3. SUMMARY OF INTERIM CLEANUP AND REMOVAL ACTIONS AND PREVIOUS SITE INVESITIGATIONS

This section presents a summary of interim cleanup actions, removal actions, and Site investigations completed at Rayonier Mill Site prior to the RI. Several interim cleanup and removal actions have been completed since 1991, which have involved the removal or treatment of contaminated soils, freshwater sediments, and groundwater. The post-remediation condition of the media addressed by these actions is representative of current Site conditions, and thus relevant to establishing the current nature and extent of chemicals of potential concern at the Site.

As presented in the Uplands Management Plan, substantial environmental data were collected at the Site prior to the RI (Integral 2004). The data collected in 1997/98 by the EPA as part of the ESI (E&E 1998), and data collected from recent groundwater monitoring events, comprise the largest portion of the data. In Section 5 of this report, the nature and extent of chemicals in soils and freshwater sediments are evaluated based on the data collected during the RI and previous investigations/cleanup efforts.

3.1 Interim Cleanup Actions and Removal Actions

Rayonier has conducted interim cleanup and removal actions at five different areas on the Site to address known or suspected contamination associated with various mill operations (Figure 3-1). In each case, the chemicals were identified, characterized, and addressed through various cleanup activities summarized in Table 3-1 and Figure 3-1. The following sections describe that nature of the original contamination at each area and the actions taken to address the contamination. The resultant conditions following completion of the cleanup actions are representative of current Site conditions in these areas and thus are pertinent to the evaluation of the nature and extent of chemical distributions discussed in Section 5 of this report.

3.1.1 Finishing Room – Ennis Creek Hydraulic Oil Release

An oil sheen was discovered on Ennis Creek during a chemical safety audit in May 1989. The sheen appeared to originate from riprap located on the west bank of the creek, next to the finishing room (Figure 3-2). Subsequent investigations conducted by Rayonier indicated that elevated concentrations of petroleum and polychlorinated biphenyls (PCBs) from releases of hydraulic fluid from several pulp baling presses in the finishing room were present in underlying shallow soils. Rayonier installed absorbent pads and containment structures to collect the oil leaking from the presses, oil-absorbent booms to capture oil in Ennis Creek, and extraction wells to recover oil migrating toward Ennis Creek (Foster Wheeler 1997). A Site characterization study, begun in October 1989, identified a free-phase oil plume, approximately 160 by 65 ft, under the eastern side of the finishing room and extending to Ennis Creek (Figure 3-2).

Operation of the oil recovery system was initiated in January 1991, but had limited success due to incomplete capture (i.e., oil could still migrate to Ennis Creek between the recovery wells). In response, Rayonier installed a sheet pile wall immediately west of the western bank of Ennis Creek to improve oil recovery and prevent discharge of oil to the creek (Figure 3-2). In 1993, Rayonier excavated 450 yd^3 of soil from a 160-ft-long, 8-ft-wide, and 8-ft-deep trench along the western side of the sheet pile wall (Foster Wheeler 1997). The excavated soils were treated offsite by thermal desorption, and five sumps were installed in the trench, which was backfilled with clean gravel. Impacted groundwater was pumped from the sump through an oil/water separator and the water routed through the former Rayonier Mill's waste treatment system. The recovered hydraulic oil was discharged into a holding tank for offsite disposal.

In 1998, Rayonier entered into an Agreed Order (Agreed Order DE 98SW-S288) with Ecology for cleanup of affected soils and groundwater at the finishing room site. The order included a work plan calling for removal of contaminated soils in the finishing room hydraulic area to meet MCTA Method B cleanup level requirements of 1,000 mg/kg total petroleum hydrocarbons (TPH) and 10 mg/kg PCBs. Contaminated soils in the load center transformer room area were to be removed to meet Toxic Substance Control Act (TSCA) cleanup levels for PCBs (1 mg/kg). Rayonier removed more than 8,300 tons of soil in the finishing room project area between September and December 1998. The extent of the excavated area is shown in Figure 3-2. Statistical analysis of confirmation soil sample data demonstrated compliance with the Agreed Order (SECOR 1999). It was not possible to remove soils in the stream bank at that time. The excavation was backfilled with imported clean soils consisting of sand and gravel.

Pursuant to the requirements of the Agreed Order, quarterly sampling of groundwater from compliance wells, FR-1, FR-2, FR-3, and FR-4, and surface water sampling from Ennis Creek, was conducted (Figure 3-2). Results of groundwater and surface water sampling through the fourth quarter of 1999 indicated concentrations of TPH and PCBs were no longer present above laboratory detection limits (Landau 1999).

An interim remedial action to remove the sheet pile wall, the remaining TPH- and PCB-affected soil/sediment east of the sheet pile wall, and riprap associated with the stream bank was completed in the summer of 2002 (Integral and Foster Wheeler 2003). A total of 1,248 tons of TPH- and PCB-affected soil/sediment were removed to a depth of 3 ft below the mudline from the western bank and streambed of Ennis Creek adjacent to the finishing room (Figure 3-2). The soils were disposed of in the City of Port Angeles' Sanitary Landfill. In addition, the sheet pile wall, two concrete pipe supports, four monitoring wells (FR-1 through FR-4), and protective riprap on the west bank of Ennis Creek were removed from the area. The excavation was backfilled with clean graded material, and habitat enhancements were made to the shoreline (i.e., shallow sloping shoreline to allow the creek to flow more naturally, anchored roots wads, and revegetation).

The limits of the 2002 excavation were defined based on thorough delineation sampling conducted prior to initiation of the removal action and on visual evidence of contamination during the action. Due to the high potential for cave in/sloughing, portions of the contaminated area were excavated and backfilled on a daily basis. A stream bypass was constructed prior to excavation activities to minimize surface water flow into the excavation, and pumps were used to remove water from the base of the excavation. Despite these efforts, water accumulated in the excavation, and an oily sheen was present on the surface of the water in the excavation. As a result, many of the confirmatory samples, which were collected from the walls and floor of the excavation prior to backfilling, were compromised by the presence of the sheen (Integral and Foster Wheeler 2003), with several samples showing detections of TPH. Since the confirmation samples were compromised, successful completion of the interim action was defined based on compliance with the excavation limits established prior to removal. The excavation actually proceeded beyond the limits defined by the delineation sampling.

3.1.2 Former Fuel Oil Tank No. 2

Fuel oil tank No. 2, used for storage of No. 6 Bunker C fuel oil for use in the former Rayonier Mill's boilers, was located on the west side of the mill. It was an aboveground carbon-steel tank with a capacity of 55,000 barrels. The tank was used from 1944 to 1990. Prior to tank demolition, soil and groundwater samples collected from soil borings, monitoring wells, and a test pit during Site investigations in 1989 and 1990 (Landau 1990, 1991) demonstrated that hydrocarbon contamination was present in the soil and groundwater near the tank (Figure 3-3). After the tank was dismantled in 1993, an interim action was conducted to remediate soil and groundwater beneath the former tank location. This action included excavation, treatment by thermal desorption, and replacement of approximately 1,500 yd^3 of soil. This soil was excavated from the footprint of the former tank and immediately east of the tank, near the pump sump. Figure 3-3 shows the limits of the excavation. Because of access limitations, soils in the area near the sump and associated pipe racks could not be excavated.

Groundwater was sampled in the area of the former fuel oil tank No. 2 in August and September 1997. Although groundwater from the majority of wells did not contain TPH or TPH-related compounds, a layer of free-phase petroleum product was present in well MW-11, indicating the presence of a limited amount of residual TPH contamination. In July 2001, evidence of petroleum seeps was observed at several locations along the west wall of the hog fuel pile excavation (described below), suggesting that hydrocarbon contamination from the fuel oil tank No. 2 had traveled underneath the road toward the sludge building/hog fuel pile.

In 2002, an additional interim action was undertaken to remove residual TPH-contamination associated with the former fuel oil tank No. 2. This action included removal of affected soils from two large excavations—one immediately east of the former tank and one immediately east of the southwestern end of the former hog fuel pile (Figure 3-3). The cleanup action involved excavation of soils to the groundwater table, segregation of affected soils based on visual evidence, screening of soils against criteria (500 ppm TPH), and disposal of soils above the criteria in either the TPS Technology facility in Lakewood, WA (1,793 tons) or the City of Port Angeles' Sanitary Landfill (3,344 tons). Confirmation sampling demonstrated the cleanup action had achieved the removal of the vast majority of soils containing >500 ppm TPH. The confirmation indicated that small localized pockets of TPH were left in place, but further excavation in these areas was deemed unjustified due to the extremely limited extent of this residual TPH (Integral and Foster Wheeler 2003).

3.1.3 Hog Fuel Pile

In 1993, Rayonier conducted an investigation to evaluate a small area along the northwestern edge of the hog fuel pile that exhibited visual evidence of hydrocarbon staining. The investigation included digging test pits and sampling soil/wood chip material and groundwater. The samples were submitted for TPH analysis. The test pits showed that the ground surface was actually composed of a layer of wood chips that extended to 4.5 to 7.5 ft bgs. This layer was underlain by fill, not native soil (Landau 1993). Analysis of material taken from the test pits indicated that hydrocarbons were present in a small layer of fill underlying the wood chip layer at a depth of between 5 and 7.5 ft bgs. The analytical report also indicated the hydrocarbons were naturally degrading. Due to the relatively limited volume (approximately 90 yd^3, including fill soils and wood chip material) and low levels of TPH (concentrations were only slightly above the MCTA cleanup level of 200 mg/kg), Rayonier chose natural attenuation (via biodegradation) as the remedial alternative.

Landau and Associates (Landau 2001a,b; Rayonier 2001) conducted a supplemental evaluation of the hog fuel pile in 2001 to assess the suitability of the material for disposal at the City of Port Angeles' Sanitary Landfill. Supplemental sampling of the material consisted of collecting:

- Eight samples for toxicity characteristic leaching procedure (TCLP) analysis, including volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, herbicides, and metals
- Sixteen samples for petroleum hydrocarbons (i.e., primarily diesel-range and heavy oil-range petroleum hydrocarbons)
- One sample for VOCs.

Samples were collected throughout the footprint of the former hog fuel pile area and throughout the vertical extent of the hog fuel material (i.e., sampling depths ranged from 0 to 6 ft). Results of the TCLP analysis showed that VOCs, SVOCs, pesticides, and herbicides were not detected in any sample. Barium and cadmium were the only metals detected by TCLP analysis, and concentrations were well below those defined in the dangerous waste regulations (WAC 173-303). Total petroleum hydrocarbon concentrations ranged from approximately 400 to 17,000 ppm and were well below the City of Port Angeles' Sanitary Landfill acceptance criteria of 30,000 ppm (Parametrix 1998). Only six VOCs were detected, and concentrations were well below those defined in the dangerous waste regulations.

Following the 2001 supplemental evaluation, approximately 2,700 yd^3 of wood residue were excavated from the base of the hog fuel pile and sent to the City of Port Angeles' Sanitary Landfill for disposal (Figure 3-3). This action superseded the 1993 natural attenuation remedy implemented at the northwest edge of the hog fuel pile. During the

2002 interim action at the fuel oil tank No. 2 (see Section 3.1.2), soil was also excavated from the southwest corner of the 2001 hog fuel pile excavation (Integral and Foster Wheeler 2003). The hog fuel pile excavation was backfilled with concrete rubble stockpiled at the mill.

3.1.4 Former Machine Shop

The machine shop was located near the west end of the former Rayonier Mill property inside the engineering building (Figure 3-1). At the time the building was demolished in mid-1999, oil staining was noted both on the wooden floor and on the soils beneath the shop (Anderson 2002, pers. comm.). Following demolition of the building, samples of the wooden flooring were analyzed and found to contain diesel-range TPH. PCBs were not detected in the bottom flooring, but a wall sample and second-story floor sample both showed detections of PCBs (specifically Aroclors 1254 and 1260), as noted in the Interim Action Report (North Creek Analytical 1999).

In the summer of 2002, an interim action was completed to remove TPH-affected soils above the groundwater table in the area between the support piers under the former machine shop and to clean residual TPH from the surface of the support members (Integral and Foster Wheeler 2003). Soils were excavated over an approximate 50-ft by 75-ft area, extending to groundwater at 8 to 10 ft bgs. Figure 3-4 presents the limits of the excavation. Confirmation samples were collected from the walls and base of the excavation and screened for the presence of PCBs, Resource Conservation and Recovery Act (RCRA) metals, and solvents. With the exception of lead in one sample, all of the chemicals in the confirmation samples were below the cleanup standards for the action, as specified in Table 3-5 of the Final Interim Action Report (Integral and Foster Wheeler 2003). These standards were based primarily upon MTCA Method B soil criteria for unrestricted land use for the protection of human health.[1] The single lead exceedence in a sidewall sample was attributed to the heterogeneous nature of the soils; no further removal action was warranted.

3.1.5 Spent Sulfite Liquor Lagoon

The SSL lagoon was located along the shoreline on the eastern portion of the Site. During the mill's operations, SSL was produced during the pulping process and recycled as a fuel to power the plant operations. As part of the recovery process, SSL was temporarily pumped to and stored in the SSL lagoon prior to burning in the recovery boiler. The SSL lagoon was constructed in 1974 with a 1- to 2-ft, 10^{-5} cm/sec permeability clay liner and a 60-mil HDPE floating cover.

In 1997, Landau Associates collected 13 samples from the clay liner, the berm, and the residual material in the SSL lagoon and analyzed the samples for metals, SVOCs, and polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (collectively, PCDD/Fs; Landau 1998c). Results of these analyses demonstrated that no chemicals were

[1] The standard for arsenic was based upon the Method A cleanup level for industrial sites, the standard for lead was based upon the EPA Region 9 Preliminary Remediation Goal (400 mg), and the TPH DRO and TPH RRO were based upon MTCA residual saturation screening levels.

detected above the MTCA Method B soil criteria for unrestricted land use (WAC 173-160-171), or in the case of arsenic, above the 90^{th} percentile of the natural background level (Ecology 1994).

The SSL lagoon was closed in the summer of 2001. The clay liner and associated stained soil located above the groundwater table were excavated and sent to Rayonier's Mt. Pleasant Landfill for use as subgrade fill material below the synthetic membrane for the final cover (Landau 2003b). It is estimated that approximately 3,000 yd^3 of clay material were removed from the base of the SSL lagoon. The SSL lagoon excavation was backfilled with clean soil from the upper portion of the berm, and the soil was compacted. Excess berm soil was also sent to the Mt. Pleasant Landfill.

3.2 Site Investigations Prior to the Remedial Investigation

Several Site investigations characterizing the nature and extent of chemicals at the former Rayonier Mill property were completed prior to the initiation of the 2003 field investigations associated with the RI. These prior studies were identified and reviewed in the preparation of the Uplands Management Plan (Integral 2004) as part of an initial evaluation of chemicals at the Site. This section summarizes available information on the investigations conducted at the Site prior to the RI.

An ESI of the Site prior to the RI was conducted in November/December 1997 by EPA (E&E 1998). The ESI investigation included collection of soil, groundwater, Ennis Creek surface water and sediment, sump and drainage ditch samples, marine sediment, and marine biota samples from the Port Angeles Harbor. In addition to the ESI, Rayonier conducted several soil and groundwater investigations during the 1990s, both as part of interim cleanup actions (described above) under Ecology oversight and as part of independent groundwater quality surveys.

The following sections provide a media-specific summary (i.e., soils, groundwater, surface water, and offsite soils) of the primary investigations conducted at the Site prior to the RI.

3.2.1 Soils

Based on historical mill processes, waste handling practices, and the potential presence of elevated chemical concentrations, the EPA targeted the following areas as potential chemical sources during the ESI (E&E 1998):

- ***Log Yard***—The log yard was used to store logs and stockpile boiler and fly ash before offsite disposal. The area consists of both paved and unpaved areas and is mostly underlain by fill material.
- ***Hog Fuel Pile***—The hog fuel pile was the storage area for hog fuel, which consisted of wood waste and bark. The area was unpaved, and wood chip material was underlain by native soils.

- ***Bone Yard***—The bone yard is an unpaved area east of the secondary treatment system where used equipment, including electrical transformers, was stored before offsite disposal or reuse.
- ***Facility Buildings***—The facility buildings include many of the buildings within the main process area that were located in the central portion of the Site. Most of the buildings were built on fill material and were pile-supported. During the ESI, soil borings were collected adjacent to the following buildings: the recovery boiler room, acid plant, digester building, blowpits, screening room, bleach plant, machine room, finishing room, laboratory, chip surge bin, and pre-fab shop.
- ***Pre-fab Area/ Chlorine Dioxide Generator*—**The pre-fab area, which was also known as the contractor parking lot, is located to the northwest of the wastewater treatment plant. It is an unpaved area that was used for new equipment storage before installation. The chlorine dioxide generator was placed on a paved area and located north across a paved road from the pre-fab area. The chlorine dioxide generator is hydraulically downgradient of the pre-fab area and at one time produced chlorine dioxide for the pulp bleaching process.

The ESI also identified areas that may have received chemicals from these potential source areas, including the following:

- ***Wastewater Treatment Collection System*—**The pumping stations, drainage ditches, storm drains, and sumps received runoff from the potential source areas, and sediments had accumulated in many of them. During dismantling of the mill equipment and tanks, the sediments present in the sumps and drains were removed.
- ***Ennis Creek*—**The hydraulic oil leaks in the finishing room affected soils and sediments along the west bank of Ennis Creek. Pumping station and sump overflows were also known to have reached the creek.
- ***Nearby Residences and Businesses*—**Surficial soils at these offsite locations may have been impacted by the deposition of airborne particulates.

A total of 144 samples were collected to characterize soils at the Site (E&E 1998). A Geoprobe® direct-push drill rig was used to collect samples from the log yard, hog fuel pile, bone yard, pre-fab area/chlorine dioxide generator, and from the area of the facility buildings. A total of 39 Geoprobe® borings were completed, with samples typically collected at depth intervals of 0 – 2 ft bgs (39 samples) and 2 – 4 ft bgs (30 samples). An additional 20 samples were collected at 2-ft intervals extending to groundwater at nine locations. Thus, there were a total of 89 Geoprobe® soil samples. In addition to the Geoprobe® samples, 54 surface samples were collected at various locations on the Site property where sampling was constrained, such as under and adjacent to structures.

The 144 soil samples were analyzed for the presence of the full suite of priority pollutants as follows: all but 4 samples were analyzed for priority metals by EPA’s Contract Laboratory Program (CLP) Statement of Work (SOW) for Inorganics (ver. OLM04.0); all but 4 samples were analyzed for VOCs and SVOCs by EPA’s CLP SOW for Organics (ver. OLM03.2); all were analyzed for pesticides/PCBs by EPA's CLP SOW for Organics (ver. OLM03.2), 100 samples were screened for PCDD/Fs using P450 reporter gene system; and 34 samples were subsequently analyzed by EPA Method 8290 for PCDD/Fs. Sample locations as reported in the ESI are shown in Figure 3-5. In addition to the onsite soil samples, surface soil samples were collected from a total of 21 locations in neighborhood residences adjacent to the Site.

The ESI reported analytical results and compared them to study-specific criteria. For purposes of this investigation, significant concentrations in source samples were defined as:

- Equal to or greater than the sample's Contract Required Quantitation/Detection Limit (CRQL/CRDL)
- Equal to or greater than the background sample's CRQL/CRDL or DL, as appropriate, when the background concentration is below detection limits
- At least 3 times greater than the background concentration when the background concentration equals or exceeds the DL.

Using these criteria as a basis, EPA evaluated various samples collected from five pre-determined potential source areas identified as:

- Log yard
- Hog fuel pile
- Bone yard
- Soil under facility buildings
- Chlorine dioxide generator/pre-fab area.

EPA concluded the log yard exhibited elevated levels of metals, VOCs, SVOCs, pesticides and PCDD/Fs. The hog fuel pile contained significant concentrations of metals, VOCs, SVOCs, and PCDD/Fs. The bone yard contained significant concentrations of metals, VOCs, SVOCs, and pesticides, but no PCBs or PCDD/Fs. The soil beneath the buildings from various site subareas contained metals, VOCs, SVOCs, pesticides, PCBs, and PCDD/Fs. The chlorine dioxide generator and pre-fab area had significant levels of metals, SVOCs, and two pesticides (E&E 1998).

EPA's ESI designation for significant concentrations relies on the validity of the single background sampling station. Field crews working for E&E initially located the background station at an unspecified location presumably off the main mill process area. After reviewing the sample results, EPA directed their contractor (E&E) not to use the data from this location because, as noted in the report, EPA believed that the chemical concentrations of PCDD/Fs from this location were higher than some of those collected onsite (E&E 1998). Thus, after sampling data had been collected and reviewed, a sampling station originally collected to characterize the pre-fab source area was selected as the background station because it had the lowest dioxin concentrations noted in all of the samples. Further, as the surface sample and most of the subsurface samples at this location were not analyzed for PCDD/Fs, the 2- to 4-ft depth interval was used as the background for all other samples from the Site regardless of depth.

By using a methodology that selects the lowest concentrations of all samples collected onsite, and then comparing that station to all others to determine if a range of concentrations is greater, the methodology biases the results to always result in greater concentrations being found onsite than in the designated "background sample."

Furthermore, as noted in the *EPA Guidance for Performing Site Inspections Under CERCLA* (USEPA 1992a), the general criterion for background samples for an ESI is the collection and analysis of two background samples for every three release (i.e., source) samples. The application of a single background sample from one location to this large investigation does not follow agency guidance or appropriate scientific method, and while the analytical data appear accurate and are well documented, the ESI conclusions are methodologically biased for heterogeneous chemicals. In Section 5 of this report, soil data from the ESI investigation are used to augment, where the data are appropriate for use, the soil data collected during the 2003 RI field sampling

3.2.2 Groundwater

Since 1989, fifty-one groundwater monitoring wells and piezometers have been installed to assess groundwater conditions in the shallow water-bearing zone beneath the Site and/or to monitor the effectiveness of interim remedial actions. Table 3-2 summarizes monitoring well installation and abandonment dates, ground and casing elevations, screened intervals, and soil types across the screened intervals. Figure 3-6 shows the locations of the wells.

Several groundwater investigations have been conducted since 1989 as part of interim cleanup actions under Ecology oversight, as well as independent groundwater quality surveys. The previous groundwater investigations are briefly summarized in the following sections.

3.2.2.1 Groundwater Investigations Associated with the Finishing Room Interim Cleanup Actions

Section 3.1.1 describes the release of oil originating from beneath the finishing room building in the northeast area of the Site and associated interim cleanup. Pursuant to the requirements of an Agreed Order with Ecology, Rayonier conducted quarterly sampling of groundwater from compliance wells FR-1, FR-2, FR-3, and FR-4, installed downgradient of the area, and surface water sampling from Ennis Creek in 1999. Results of four quarters of groundwater and surface water sampling (summarized in Table 3-3) showed that concentrations of TPH and PCBs (the chemicals of concern) were not detected. Detection limits were below cleanup action level criteria from the consent order (Landau 1999).

3.2.2.2 Groundwater Investigations Associated with Former Fuel Oil Tank No. 2 Interim Cleanup Actions

As discussed in Section 3.1.2, 28 subsurface soils borings and 13 groundwater monitoring wells were investigated near fuel oil tank No. 2. prior to demolition of the tank (Landau

1990, 1991). These investigations revealed petroleum constituents in the soil and groundwater beneath the footprint of the former tank and in an adjacent pump sump area immediately east of the tank. Free-phase petroleum product, apparently up to 2 ft thick, accumulated in wells MW-7 and MW-16 located in the pump sump area (Landau 1990, 1991). In an interim cleanup action conducted in 1993, approximately 1,500 yd^3 of impacted soils were excavated, treated, and replaced. This soil was excavated from the footprint of the former tank and immediately east of the tank, near the sump pump. Because of access limitations, soils in the area near the sump and associated pipe racks could not be excavated.

Groundwater samples were collected in 1991 prior to the interim cleanup action from wells MW-7, MW-11, MW-13, MW-16, MW-19, MW-20, MW-23, MW-26, MW-27, MW-28, and MW-29 (Landau 1991; Table 3-4). The majority of the samples were analyzed for VOCs, and select wells were analyzed for TPH and PAHs. PAHs were not detected in the two wells sampled—MW-11 and MW-13. TPH concentrations ranged from below detection in wells MW-20 and MW-23 to 3.8 mg/L in well MW-11. VOCs were not detected in the majority of the samples and at low concentrations for the few chemicals that were detected. Wells MW-7 and MW-16 had free-phase oil present. A groundwater sample was not obtained at MW-7 because of the presence of the oil; however, a groundwater sample was obtained at MW-16 and analyzed for VOCs.

As part of Site monitoring in 1997, four wells in the vicinity of the fuel oil tank No. 2 (MW-11, MW-20, MW-23, and MW-29) were sampled. Samples were submitted for VOCs, SVOCs, PAHs, TPH, metals, and PCB analysis (Appendix A). No exceedences above MTCA Method A criteria (WAC 173-340-900) were found in samples submitted for analysis from wells MW-20, MW-23, and MW-29. A layer of free-phase petroleum product was found in well MW-11 during the 1997sampling event. Due to the presence of free-phase product, a separate-phase groundwater sample could not be collected from well MW-11; however, petroleum product was collected and analyzed for the presence of PCBs. No PCBs were found to be present above the method detection limits (MDLs).

Fuel oil tank No. 2 monitoring wells, MW-19 and MW-23, were sampled as part of the February and August 2001 monitoring events, and samples were submitted for analysis of VOCs, SVOCs, PAHs, TPH, and metals. Well MW-23 was also sampled for pesticide analysis in August 2001. None of the constituents tested exceeded state and federal ambient water quality criteria (see Section 3.2.2.5). Well MW-11 was also sampled in August 2001 for diesel-range hydrocarbons. Diesel was detected at an estimated value of 12 ppb.

As described in Section 3.1.2, an additional interim cleanup action was completed in the former fuel oil tank No. 2 area in 2002 (Integral and Foster Wheeler 2003). The interim action included excavation of 3,344 tons of soil exceeding TPH concentrations of 500 mg/kg. The 2002 excavation also resulted in the abandonment of several wells. The wells currently existing in this area include MW-23, MW-28, and MW-29. MW-28 is an observation well that has never been sampled.

Monitoring well MW-23 was sampled as part of the December 2002 monitoring event, and samples were submitted for analysis of VOCs, SVOCs, PAHs, TPH, metals, and pesticides. With the exception of pentachlorophenol, none of the constituents tested exceeded state and federal ambient water quality criteria (see Section 3.2.2.5).

3.2.2.3 Field Investigation Report, ITT Quantitative Environmental Survey Program

The objective of this 1993 study was to assess the stratigraphic and hydrogeologic conditions at the Site (HLA 1993). The study included installing 12 piezometers (PZ-1 through PZ-7, and PZ-9 through PZ-13), measuring water elevations and assessing the magnitude of any tidal influence on groundwater. No analytical samples were collected during the study. Groundwater was found in a shallow water-bearing zone between 3.2 and 14.9 ft bgs under unconfined conditions. Groundwater flow directions were determined to be north toward Port Angeles Harbor. Water levels were measured 4 times during a 24-hour period to assess tidal influence. Changes in water levels due to tides were measured in wells near the shoreline.

3.2.2.4 ESI Investigation

The ESI included the collection of groundwater samples from the shallow water-bearing unit underlying/downgradient of potential source areas and areas potentially impacted through chemical migration (e.g., the wastewater treatment collection system) (E&E 1998). Onsite groundwater was sampled from seven piezometers, five monitoring wells (all in the finishing room area), and seven in situ grab samples (using a Geoprobe®). The sampling locations are shown in Figure 3-6. Groundwater samples were analyzed for VOCs, SVOCs, PCBs, Washington TPH-diesel (WTPH-D) extended, dissolved priority pollutant metals, and pesticides.

The ESI report defined a potential contaminant to be present at an elevated concentration if analytical results met one or a combination of the following criteria:

- The analytical result is equal to or greater than the contract-required CRQL/CRDL.
- The analytical result is greater than or equal to the background CRQL/CRDL.
- The analytical result is at least 3 times greater than the background concentration when the background concentration exceeds the detection limit.

Based on these criteria, the following compounds were deemed to be present at elevated concentrations in groundwater collected from at least one sampling location during the ESI investigation:

- **Inorganics**—Arsenic, barium, chromium, copper, manganese, vanadium, and zinc.
- **SVOCs**—Acenaphthene and bis(2-ethylhexyl)phthalate.
- **PCBs**—Aroclor 1260.

3.2.2.5 Mill Site Groundwater Monitoring

In consultation with Ecology, Rayonier began Site groundwater monitoring in 1997 after mill closure and as Site demolition began. Initially, the monitoring well network included all of the wells that were present at the Site in 1997, with the exception of the finishing room wells (designated as “FR” and “FA” wells). These wells included PZ-2 through PZ-7, PZ-9 through PZ-13, MW-20, MW-23, and MW-29. The network was expanded when wells MW-51, MW-52, MW-53 through MW-56, and MW-57 through MW-59 were installed between 1998 and 2002 (Figure 3-6). Groundwater monitoring wells were sampled in September and October 1997, February and August 2001, and December 2002, and the analytical results are summarized in Appendix A.

Landau (1997) compared the 1997 groundwater monitoring data to MTCA Method A groundwater criteria (WAC 173-340) to evaluate analytical results. Samples were analyzed for VOCs, SVOCs, PCBs, WTPH-D extended, priority pollutant metals, turbidity, asbestos, and indicator parameters identified in the minimum functional standards for solid waste handling (WAC 173-304-490). Results showed no exceedences of screening criteria in any wells except PZ-9. PZ-9 showed exceedences of Method A levels for arsenic and chromium.

A screening evaluation of existing groundwater data was conducted in 2000 to evaluate chemicals of concern (Foster Wheeler 2000). Table 3-5 provides a summary of the well sampling events included in the evaluation. The screening criteria used for the evaluation were state and federal ambient water quality standards that are protective of human health exposure from fish consumption and protective of fresh water and marine aquatic organisms from acute and chronic exposures to chemicals. Where more than one numerical criterion is available for a chemical, the most stringent criteria were used for the comparison. As summarized in Table 3-6, of the 196 constituents tested, 38 were found above detectable levels in at least one onsite groundwater sample. No pesticides, PCBs, or VOCs were found above any of the screening criteria. Five metals (arsenic, chromium, copper, nickel, and selenium) and one SVOC [bis(2-ethylhexyl)phthalate] were found at levels above the screening criteria. Of the 158 chemicals that were not detected in groundwater, 48 had analytical detection limits that were above the screening criteria. While these chemicals were not detected in onsite groundwater, no conclusions could be made regarding their concentrations compared to the screening criteria due to detection limit issues.

The data presented in Appendix A were also compared to state and federal marine surface water quality standards, with one exception. The screening value for arsenic is the Method A value for groundwater. This value is identified as the natural background levels for the state of Washington (MTCA Table 720-1, Footnote b). The specific criteria are listed in the footnotes of the table. As noted above, the Appendix A data include sampling results collected by Rayonier from September and October 1997, February and August 2001, and December 2002. Sample duplicates were not included in the comparison.

As shown in Table 3-7, the results of this comparison are similar to the comparison presented in the Work Plan. Of the 151 constituents evaluated, 54 were found above detectable levels in at least one sample and 14 constituents had detections higher than screening levels. No VOCs or pesticides were found above screening criteria. Five dissolved metals (arsenic, chromium, copper, nickel, and selenium), five SVOCs [bis(2-ethylhexyl)phthalate, pentachlorophenol, benzo(a)anthracene, chrysene, and benzo(a)pyrene)], diesel- and motor oil-range petroleum hydrocarbons (Method A criteria), Aroclor 1260, and un-ionized ammonia were also found at levels above the screening criteria. Of the 97 chemicals that were not detected in groundwater, 32 had analytical detection limits in at least one sample that were above the screening criteria. Additional discussion of this comparison is presented in Section 6.

3.2.3 Surface Water and Sediment – Ennis Creek

Ennis Creek, which runs through the mill complex, is the primary area of freshwater and freshwater sediment within the Site boundary. White Creek converges with Ennis Creek near the southern boundary of the Site. Ennis Creek is a snowmelt creek and exhibits variable flows throughout the year. The mouth of Ennis Creek is tidally influenced, and the creek discharges directly into Port Angeles Harbor on the Strait of Juan de Fuca. Surface water elevation variations occur daily at the mouth of Ennis Creek as a result of tidal changes. The section of Ennis Creek that flows through the Site is confined to a manmade channel, the majority of which is lined with large riprap rock, creating a relatively fast-flowing stream during high rainfall events.

As discussed in Section 3.1.1, an area extending from the finishing room to the west side of Ennis Creek near its outlet to Port Angeles Harbor was impacted by releases of hydraulic oil containing low levels of PCBs. Oil was suspected to have discharged to Ennis Creek, as evidenced by an oil-sheen present on the creek's surface. Various interim containment and cleanup actions were conducted following the discovery of the oil sheen, ultimately resulting in the removal of contaminated soils and riprap from the impacted area and habitat restoration along the creek from the finishing room area to the creek outlet in Port Angeles Harbor (Integral and Foster Wheeler 2003).

During the ESI (E&E 1998), eight co-located surface water and freshwater sediment samples were collected throughout Ennis Creek—with the majority targeting the vicinity of the finishing room as an area of potential concern (Figure 3-7). Three of the samples were collected south of the Rayonier facility and identified as background samples by EPA (E&E 1998). The remaining five samples were collected along the creek closer to the former mill processes facilities—one west of the wastewater treatment plant and four adjacent to the finishing room. Results of this effort and of the 2003 RI field sampling effort are described in Section 5.3 of this report.

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