Dave Shreffler

As a retired restoration ecologist, I am writing to urge Ecology to hold Rayonier responsible for complete cleanup of the Rayonier Mill site. In my professional opinion, partial cleanup and capping of contaminated sediments are not scientifically justified and will not adequately protect human health or ecosystem health.

Decades of post-remediation monitoring at five large scale sediment remediation projects in Puget Sound (Bellingham Bay, St. Paul Waterway, Eagle Harbor, Hylebos Waterway, and Sinclair Inlet) revealed mixed effectiveness at reducing risks to human and ecosystem health (Patmont and Healy 2024). https://onlinelibrary.wiley.com/doi/full/10.1002/ieam.4890

In addition, I believe Ecology is remiss in not demanding restoration of Ennis Creek in addition to the marine nearshore. Restoration of Ennis Creek and estuary is essential if there is any hope of ever recovering the ESA-listed fish species that currently use or historically used Ennis Creek. In 2009 and 2010, representatives from the Lower Elwha Klallam Tribe, Rayonier, the City of PA, and multiple other stakeholder groups spent six months developing a science-based conceptual plan for the restoration of Ennis Creek and estuary, which I have attached for your consideration. I was the facilitator of the Ennis Technical Team and the lead author of the plan.

Finally, MTCA's main purpose is "to raise sufficient funds to clean up all hazardous waste sites and to prevent the creation of future hazards due to improper disposal of toxic wastes into the state's lands and waters." (RCW 70A.305.010). Can Ecology say with certainty that it is fulfilling it's legal obligation to prevent the creation of future hazards by capping contaminated sediments at the Rayonier Mill Site?

May 18, 2010

Frances G. Charles
Chairwoman
Lower Elwha Klallam Tribe
2851 Lower Elwha Road
Port Angeles, WA 98363

Carla Yetter
Director, Environmental Affairs
Rayonier Properties LLC
50 North Laura Street, Suite 1900
Jacksonville, FL 32202

Rayonier
Value From The Ground Up.

Dear Mesdames Charles and Yetter:

Enclosed are ten (10) copies of the Ennis Creek Restoration Conceptual Plan prepared by the Ennis Technical Team ("ETT"). This conceptual plan was developed pursuant to a provision of the Cooperative Agreement between the Lower Elwha Klallam Tribe and Rayonier Properties' predecessor in interest, Rayonier Inc., dated June 21, 1999 (the "Agreement"), which stated in relevant part:

> The Company agrees to provide at its expense . . . . a conceptual plan for the restoration of Ennis Creek where it crosses the Company's property.

In developing the attached document, the ETT expanded the scope of the planning effort beyond just the boundaries of Ennis Creek on the Company's property which was above and beyond the scope of the Agreement. Restoration planning areas A through H, as shown on Figure 2 of the attached document, constitute the conceptual plan identified in the Agreement. In addition to the conceptual plan, the ETT identified suggested improvements to the estuary in planning areas I through M, some of which are located on property not owned by Rayonier. If these were implemented by present or future owners of the property, it would augment the functioning of the estuary and stream as a whole and provide additional benefits above and beyond the restoration of Ennis Creek.

The ETT recognizes that the material contained in the attached report relating to restoration planning areas A through H constitutes a conceptual plan only. Final restoration plans for Ennis Creek, if designed and implemented, may vary from this conceptual plan based on other activities and future land uses at the site.

Very truly yours,

Mike McHenry
Lower Elwha Klallam Tribe Lead

Warren Snyder
Rayonier Properties Lead

Enclosure
cc: Sonya Tetnowski, CEO (w/encl.)
Lower Elwha Klallam Tribe

Ennis Creek & Estuary Restoration Conceptual Plan:
A Synopsis of the Ennis Technical Team's Planning Efforts

1.0 The Purpose of this Report

The purpose of this report is to succinctly summarize the Ennis Technical Team's (ETT) science-based conceptual plan for restoring Ennis Creek and Estuary on property owned by Rayonier, Inc (Rayonier). The former Rayonier Mill Site is located on approximately 80 acres of land at the northern end of Ennis Creek. The site is bounded to the north by the Strait of Juan de Fuca, to the south by the Port Angeles Wastewater Treatment Facility, and to the east and west by bluffs with residential areas on top. Ennis Creek runs directly through the former mill site (Figure 1).

2.0 The Ennis Technical Team (ETT)

The Ennis Technical Team (ETT) was formed in response to a legal agreement between Rayonier and the Lower Elwha Klallam Tribe (LEKT) specifying that Rayonier agreed to provide at its expense: *(1) a survey of the elevations and location of Ennis Creek where the Creek crosses the Company's property* (See Figure 1), *and (2) a conceptual plan for the restoration of Ennis Creek where it crosses the Company's property.* Although not part of the legal agreement, there was also an understanding between Rayonier and LEKT that Ennis Creek and the estuary are functionally linked, and in order to restore the creek it will also be necessary to restore at least portions of the estuary.

The ETT was convened under the joint leadership of Warren Snyder of Rayonier and Mike McHenry of LEKT in November 2009. Shreffler Environmental was hired by Rayonier to facilitate the development of the conceptual plan between November 2009 and March 2010.

The invited participants on the ETT were:

Bill White	Lower Elwha Klallam Tribe
Byron Rot	Jamestown S'Klallam Tribe
Dave Shreffler	Shreffler Environmental (facilitator)
Joel Breems	Washington Department of Natural Resources
Julie Dieu	Rayonier
Kathryn Neal	City of Port Angeles
Larry Dunn	Lower Elwha Klallam Tribe
Matt Beirne	Lower Elwha Klallam Tribe
Michael Blanton	Washington Department of Fish and Wildlife
Mike McHenry	Lower Elwha Klallam Tribe (co-lead with Warren Snyder)
Randall McCoy	Lower Elwha Klallam Tribe
Warren Snyder	Rayonier (co-lead with Mike McHenry)

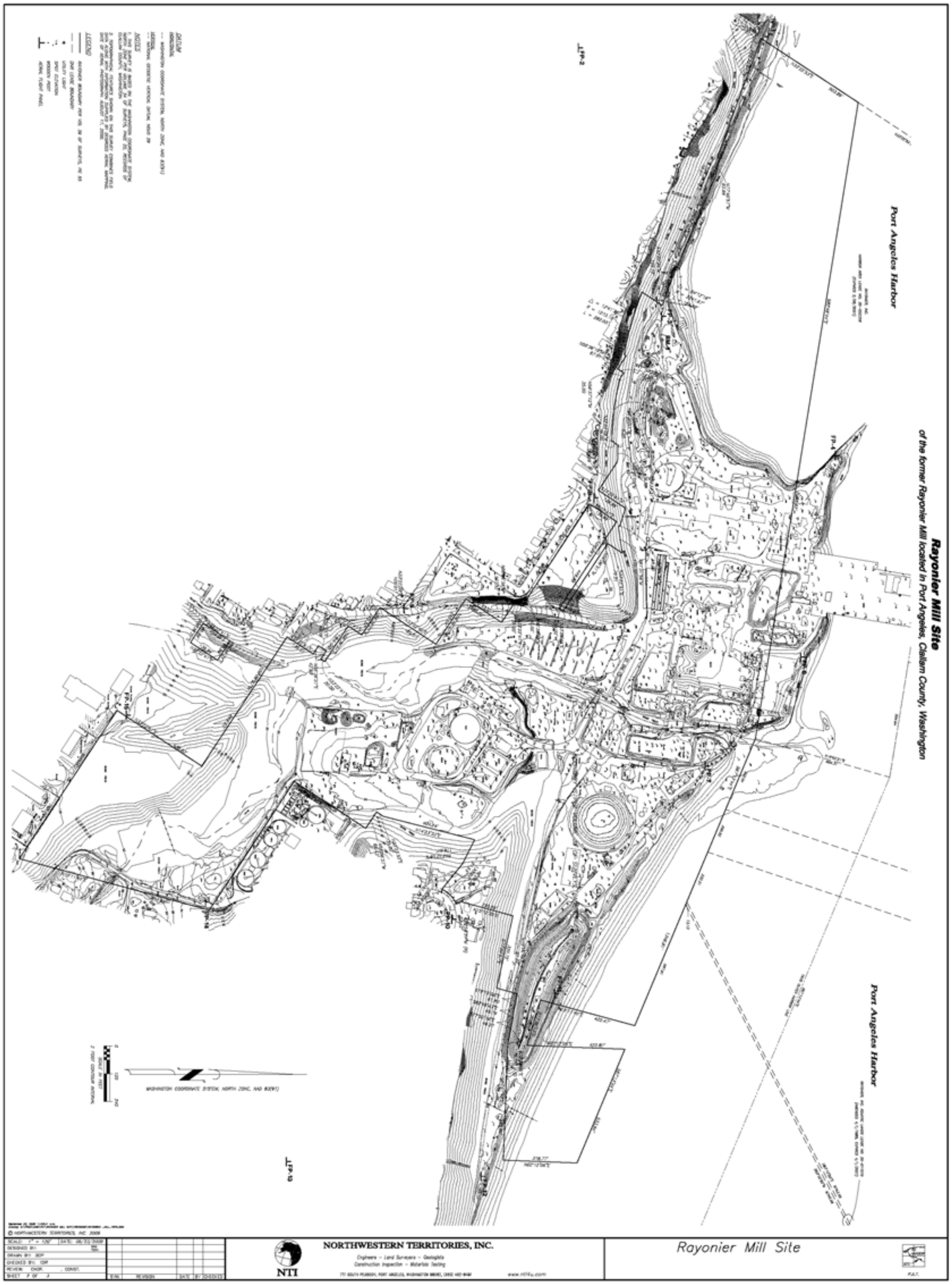

Figure 1. Boundaries of the Rayonier Mill Site.

3.0 Ennis Watershed Background

The reader already familiar with the Ennis Watershed may wish to skip directly to Section 7.0 (The Conceptual Plan for Restoring Ennis Creek and Estuary).

The following background information for Ennis Creek (WRIA #18-0234) has been extracted from the WRIA 18 Watershed Plan with some editing, modifications, and updates (**http://www.clallam.net/environment/html/wria_18_watershed_plan.htm)**. The emphasis of the below summary is on Ennis Creek where it crosses the Rayonier property, although some upper watershed information is also provided for context.

Geography

Ennis Creek is a significant watershed draining directly to the Strait of Juan de Fuca at the eastern end of Port Angeles Harbor (Haring 1999). With a length of 8.65 miles, it is the smallest snow-fed stream on the Olympic Peninsula, draining approximately 10.5 square miles (Walton 1983; Haring 1999; Port Angeles Stormwater Management Plan 1996).

Ennis Creek is generally steep and is confined within much of its length by valley side slopes (Haring 1999). Both Ennis Creek and White Creek, its major tributary, pass through forested parcels, agricultural and pasture lands, commercial, and residential communities (Economic and Engineering Services, Inc. 1996). The 4.35-mile long White Creek, which enters Ennis Creek at RM 0.3, is heavily degraded from urbanization and has little salmon production potential due to impassable culverts (Haring 1999).

The floodplain immediately downstream from the confluence of White and Ennis creeks is channelized and fully constrained by dikes, armored banks, the Rayonier Mill parking lot, and several bridges associated with the mill (Haring 1999). The mill was dismantled by 2001 and rehabilitation of the site is ongoing. Future use of the reclaimed site, especially the use of the floodplain area, will have a major effect on the long-term health of the watershed and on the prospects for successful habitat and fisheries restoration.

Fluvial Geomorphology

LWD presence is generally poor below RM 3.0 of Ennis Creek, as most of the existing riparian forest has been logged at least once. In this reach, Ennis Creek is confined within a steep wooded ravine (Economic and Engineering Services, Inc. 1996). The section between RM 0.3 and HWY 101 (RM 1.0) is dominated by long riffle sections intermixed with small lateral scour and debris pools associated with large organic debris (LOD) and other debris, such as tires and auto parts (Economic and Engineering Services, Inc. 1996).

In many areas, the low-flow channel is well incised within a narrow floodplain that exposes bedrock and other parent materials (Economic and Engineering Services, Inc. 1996). The low flow channel appears to be downcutting and vertical streambanks are common, with some measuring three to four feet. The loss of instream wood and the altered riparian composition are likely the causes of this downcutting. The substrate is dominated by small gravels and sand/silt, with riffle areas composed largely of boulders, cobbles, or larger gravels (Economic and Engineering Services, Inc. 1996).

Several landslides occurred between RM 3.0 and HWY 101 and appear to be a dominant source of sediment inputs into the creek. These slides are associated with channel scour from increased velocity of water delivery to the channel due to vegetation removal along the slope and stormwater discharge points at the top of the slope (Economic and Engineering Services, Inc. 1996).

The lower reaches of Ennis Creek through the Rayonier property lie on alluvium deposits such as sand, silt, and gravel on valley floors of main valleys and on beaches.

Hydrology

Ennis Creek is the smallest snow-fed stream on the Olympic Peninsula (Haring 1999).
The predominant peak flow occurs during the winter rains. Summer base flows are maintained by snow runoff and groundwater discharge into the upper reaches. Peak flow concerns are associated with stormwater runoff from Highway 101 and other urban development (Haring 1999).

Flow data from the Ecology gage near the mouth of Ennis Creek (RM 0.3) is available for September 2002 to present at https://fortress.wa.gov/ecy/wrx/wrx/flows/station.asp?sta=18M060. For the 2009 water year, the annual mean flow was 12.3 cfs, the minimum daily mean flow was 3.1 cfs, and the maximum daily mean flow was 86.5 cfs.

Precipitation

The climate varies greatly throughout the watershed, depending largely on changes in elevation. Snow is the dominant form of precipitation in the higher areas of the Olympic Mountains, wherever the glaciers remain. In the lower elevations, the majority of precipitation occurs in the form of rain. Temperature variations are also influenced greatly by elevation. Perry (2001) reports average annual precipitation over the watershed in a range of 25-45 inches. The mean annual temperature is approximately 49.4° F. Minimum and maximum temperature differences range from approximately 11° F for most of the year to about 71° F in summer.

4.0 Ennis Creek Ecosystem Modifications, Functions, and Condition

The following information for Ennis Creek (WRIA #18-0234) has been extracted from the WRIA 18 Watershed Plan with some editing, modifications, and updates (**http://www.clallam.net/environment/html/wria_18_watershed_plan.htm**).

Channel

Channelization, development, culverting, and agricultural pressures have altered the Ennis Creek channel. The hydrological simplification from these practices has resulted in reduced habitat complexity. Pool habitat has been degraded from lack of large woody debris (LWD). Suitable spawning gravel is minimal due to the inundation of fine silts from landslides, downcutting, and lack of large wood.

Floodplain

The Ennis Creek floodplain downstream of White Creek is channelized and fully constrained by dikes, armored banks, the Rayonier Mill parking lot, and several bridges associated with the mill. It is constrained to the east by the Port Angeles wastewater treatment facility. Constriction of the channel and floodplain results in greater channel scour during flow events, as well as the elimination of escape cover for fish outside the active channel (EEC 1996).

Constrictions and Confinements

Constrictions include some development upstream of the Highway 101 culvert, the Highway 101 culverts, the White Creek culvert, the Ennis Creek Road culvert, the Rayonier Mill parking lot, Port Angeles wastewater treatment plant, and various bridges and pipeline crossings on the Rayonier property (Haring 1999).

Log Jam and Large Woody Debris Removal

Historically, log jams and LWD were abundant within the Ennis Creek Watershed. The reach of Ennis Creek that lies within the protection of Olympic National Park retains a high density of LWD and logjams. Below that area, the frequency of LWD and log jams decreases. LWD presence is generally poor below RM 3.0, because most of the existing riparian forest has been logged at least once. As instream wood is lost, the channel tends to downcut and eliminate gravels for spawning, isolating floodplains and off-channel habitat, resulting in a loss of pools which simplifies the system (McHenry personal communication 2002).

Substrate

Gravel is limited within the channel and deposits are confined primarily to lower reaches (Haring 1999). The channel upstream from RM 3.0 converts from gravel to cobble- and bedrock-dominated channel bed (Haring 1999). The City of Port Angeles (1996) provides details on substrate for most of the stream reaches.

Soil Erosion and Sediment Load

The combination of steep ravines and soil types of Ennis Creek leads to high erosion potential (Clallam County Critical Areas Code 2001).

Stormwater

Stormwater is a substantial concern in the Ennis and White Creek watersheds. Although there is a large area of the combined watershed that connects to the wastewater main along Front Street, much of the stormwater created in the developed areas is funneled directly to White Creek or Ennis Creek through culverts or stormwater outfalls (City of Port Angeles Mapping Data 2002). There are five direct stormwater outfalls to White Creek, seven on the lower portions of Ennis Creek, and one below the confluence of White and Ennis creeks. Polluted runoff from Highway 101 remains one of the largest stormwater concerns.

Runoff from impervious surfaces has increased with development in the watershed, and much of the existing development was constructed largely without stormwater detention and treatment facilities. Stormwater impacts resulting from altered hydrology in Ennis Creek likely include greater frequency and magnitude of peak storm flows, increased sedimentation, and rapid delivery to the streams of pollutants associated with motor vehicles, golf course maintenance, and lawn care.

Water Quality

Ennis Creek was classified as “impaired” below RM 3.0 in the State of the Waters of Clallam County, 2004. White Creek was classified as “critically impaired” below RM 1.0 and “highly impaired” between RM 1.0 and 2.0. Elevated fecal coliform levels have been reported for both

Ennis Creek and White Creek. Dissolved oxygen, turbidity, pH, temperature, nitrates, and conductivity have been measured for Ennis Creek. Little water quality data has been gathered for the White Creek watershed.

The State of the Waters report listed the following particular concerns for the Ennis Creek Watershed: impaired water quality, biological conditions, and habitat; impacts from pesticides and nutrients in golf course runoff, impacts from floodplain constrictions, encroachment, and conversion; fish passage barriers; lack of sufficient LWD; stormwater impacts; and potential leachates from old landfills.

Hazardous substances released from the Rayonier Mill Site are detailed in Section 6.0.

Noxious Weeds

Streamkeepers data note the presence of herb robert, Japanese knotweed, and reed canary grass along the lower reaches of Ennis and White creeks. The weeds are non-native species that invade ecosystems and may outcompete native vegetation.

Estuary

The lower channel and estuary have been significantly altered over time. It is thought that Ennis Creek historically emerged from the bluff over an alluvial fan before discharging into Port Angeles Harbor over broad intertidal and subtidal flats. There is no evidence that Ennis Creek flow lost an open connection to marine waters, even during summer low flows. Historic photographs indicate that Ennis Creek discharged directly to the harbor over a broad intertidal flat.

Randy Johnson, formerly of the Washington Department of Fish and Wildlife (personal communication 2001), suggests that the mill site has completely consumed the natural estuary of Ennis Creek. He references historic photographs to show that estuary conditions included about eight acres of salt marsh, with thirteen acres of sand and gravel flats. These twenty-one acres of intertidal flats associated with Ennis Creek were filled and covered over by the mill. Buildings built on pilings covered areas that were not filled. On the east bank where a building was removed, a portion of the former salt marsh is now exposed but prolific with pilings. Fill material prevents stream and tidal flow from entering this area.

The Rayonier Mill also extended into the subtidal area. Seaward of the intertidal area, the mill covered about five acres of subtidal flats. Seaward of the mill itself, the industrial pier covers another five acres. The development of the mill site has limited the natural mixing of salt and fresh water from Ennis Creek, altering hydrology and habitat.

5.0 Ennis Creek Fish Species and Status

The following information for Ennis Creek (WRIA #18-0234) has been extracted from the WRIA 18 Watershed Plan with some editing, modifications, and updates (**http://www.clallam.net/environment/html/wria_18_watershed_plan.htm**).

Ennis Creek is generally considered the healthiest of the seven small Port Angeles urban streams with respect to restoration potential for fish (Haring 1999). Salmonid stocks and historic and current status in Ennis Creek are summarized below.

Chinook salmon

Chinook salmon have not been documented in Ennis Creek. Ennis may historically have had spring Chinook salmon strays from other drainages along the Strait. In particular Elwha Chinook may have been attracted to the site when the Rayonier Mill was using 40-50 cfs of Elwha water. Up until 1997, excess Elwha water was spilled from the pipeline at the mill site.

Coho salmon

Ennis Creek continues to support a population of Morse Creek coho salmon, which does not demonstrate unique temporal or biological characteristics. Spawning is known to occur in Ennis Creek (to RM 5.0). The Lower Elwha Klallam Tribe has designated this population as "chronically depressed" (i.e. flat line and showing little sign of recovery), based on adult survey information and smolt data.

Chum salmon

Fall chum salmon were known in small runs historically, but are now thought to be extirpated.

Pink salmon

Not historically or currently present in this watershed.

Steelhead

Haring (1999) reports that Ennis Creek is known locally as supporting steelhead, but steelhead are not specifically noted in SASSI. Smolt production data collected by the Lower Elwha Klallam tribe indicates the watershed is producing small numbers of outmigrants. Spawning distribution in Ennis Creek is from approximately RM 0.2 upstream to the impassable cascade at RM 5.0 (approximately 36 redds were counted in one season in 1996 by Dick Goin).

Bull trout

While Ennis Creek does not appear to currently support a population of bull trout, there is one reported capture of a bull trout at the smolt trap site in 2000 by WDFW. However, bull trout from other adjacent drainages (Elwha and Dungeness) are at very low levels. If these populations recover, it is possible that the species will utilize habitats such as Ennis Creek. The USFWS has included Ennis Creek as a migration and rearing habitat in its definition of critical habitat in the Puget Sound Bull trout recovery plan.

Cutthroat trout

Historically and currently present in this watershed. Status is unknown.

Causes of fish declines

Possible causes of the fish stock declines in Ennis Creek include logging, channelization, urbanization, stream cleaning, estuary impacts, and fish passage problems (McHenry 1996). Randy Johnson (personal communication January 2002) reported that the estuarine and nearshore habitat modifications have impacted fish populations. Fish habitat types that have been entirely lost or severely impaired include: 1) estuarine rearing habitat for coho fry from Ennis Creek; 2) estuarine rearing habitat for juvenile Chinook and chum from nearby systems (probably Dungeness River to Elwha River); 3) estuarine foraging habitat for cutthroat and bull trout originating across the northern Olympic Peninsula; 4) healthy nearshore migration habitat for juvenile coho, Chinook, chum, pink, steelhead, cutthroat, and bull trout; and 5) spawning habitat for sand lance and surf smelt.

6.0 Ennis Watershed History & Rayonier Mill Clean-up

The following watershed history information for Ennis Creek has been extracted from the WRIA 18 Watershed Plan with some editing, modifications and updates (**http://www.clallam.net/environment/html/wria_18_watershed_plan.htm**).

A Klallam village site (Y'Innis) was located at the mouth of Ennis Creek (Haring 1999). It was one of the most productive villages for the Klallam people. In the late 19th Century, the first cooperative colony in Washington was constructed at its location (Haring 1999). A small mill operation was established in 1918 with a large pulp mill following in the 1930s and operating until 1997 when it was shut down (Haring 1999).

Human Influences/Major Projects

Dams

There are currently no dams present in the Ennis Creek watershed. Historically there was a water diversion structure at the confluence of White and Ennis creeks, as well as a water diversion structure at RM 3.5. Both structures have been removed.

Diversions

A total of 248 gallons per minute (gpm) and 0.81 cubic feet per second (cfs) are allocated out of Ennis Creek through surface and groundwater rights (Clallam County Planning Division et al. 1994).

Dikes

Ennis and White creeks are both confined by riprap, development constraints, and culverts, including the Highway 101 culverts on White and Ennis creeks and the culvert under Ennis Creek Road. Both channels have been confined for much of their length from the mouth of Ennis Creek to Highway 101 (Haring 1999).

Land Development

The floodplain of Ennis Creek is moderately confined by urban development (Haring 1999). The lower portion of Ennis Creek is constrained to the east by the City of Port Angeles wastewater treatment plant (Haring 1999). Development along the stream corridor has led to the management or removal of some riparian vegetation. These activities in turn may result in the destabilization of streambanks and increased streambank erosion. Mature deciduous trees have replaced the historic coniferous vegetation along parts of the stream. The deciduous riparian zone provides less and lower quality large woody debris to the stream and alters the streamside canopy. In addition, livestock access to the corridor has trampled streambanks, increased streambank erosion, and increased the likelihood of animal wastes and associated pollutants in the aquatic environment (Economic and Engineering Services, Inc. 1996).

City Culvert

The City culvert lies under East Ennis Creek Road. It is composed of two dual concrete pipes. The seven-foot diameter concrete box culverts are 50-feet long and placed at a 6.8 percent slope with a 0.5 foot drop at the outfall.

In a letter to Jim Mahlum of the City of Port Angeles Public Works, WDFW Fish Biologist Thomas Burns writes “the culverts have been a long-standing fish passage problem by occlusion at the inlet and the subsequent hydraulic drop. Fish can either be completely blocked or delayed by the culverts depending on stream flows and/or maintenance” (January 2002). Burns recommended a structure that fully spans the width of the channel to accommodate for fish passage and habitat connectivity, as well as to reduce flooding and improve ecosystem health. This would open 5.4 miles of currently inaccessible fish habitat (Burns personal communication February 2002).

Rayonier Mill Clean-up

Rayonier, Inc. owned and operated a dissolving sulfite pulp mill on a portion of the site from 1930 until early 1997 (see Figure 1), when Rayonier, Inc. closed the mill and dismantled the mill buildings. During its operation, the mill stacks, machinery used at the mill site, the mill wastewater outfalls, and the log storage pond released hazardous substances. Hazardous substances released to the environment include, but are not limited to, petroleum hydrocarbons (TPH), carcinogenic polycyclic aromatic hydrocarbons (cPAHs), polychlorinated biphenyls (PCBs), lead, dioxins/furans, and arsenic.

At the time of mill closure, based on the results of an Expanded Site Investigation by the Environmental Protection Agency, the site qualified for listing on the National Priorities List (NPL) as a Superfund site. EPA’s expanded site investigation (ESI) report identified areas of marine sediment, soil, and groundwater contamination that exceed applicable state criteria for the protection of human health and the environment on the site. Hazardous substances identified during the ESI at levels above applicable state criteria include dioxins/furans, cPAHs, PCBs, and metals.

In May 2000, oversight of the site cleanup was deferred to the state under a three party Deferral Agreement involving the EPA, Department of Ecology, and the Lower Elwha Klallam Tribe. The Deferral Agreement involves a cleanup process under the state Model Toxics Control Act (MTCA). The Lower Elwha Klallam Tribe has concurrence authority on all major cleanup decisions throughout this process because cleanup activities could affect its Treaty fisheries. The Tribe also has strong ties to the site, because of the known historic village site (Y’Innis) at the mouth of Ennis Creek. As a result, the Tribe is actively involved in planning activities associated with the cleanup process.

In 1992, Ecology issued MTCA Enforcement Order DE 92TCI029 requiring Rayonier, Inc. to take interim actions at the Finishing Room. The Enforcement Order required the removal of contaminated soils, control of water run-on and run-off to the Finishing Room area, and blocking of hydraulic oil migration towards Ennis Creek. In 1993, Rayonier, Inc. conducted interim actions in the area of the Finishing Room.

In 1998, following removal of the Finishing Room building, Ecology and Rayonier, Inc. entered into Agreed Order DE 98SW-S288 whereby Rayonier, Inc. agreed to undertake additional interim actions in the area of the Finishing Room. The Agreed Order required the removal of contaminated soil and groundwater monitoring. Rayonier, Inc. conducted these additional interim actions in the area of the Finishing Room.

In 2002, Ecology and Rayonier, Inc. entered into Agreed Order DE 02SWFAPST-4571 whereby Rayonier, Inc. agreed to undertake additional interim actions in the area of the Finishing Room, Former Fuel Oil Tank No. 2, and the Former Machine Shop. The Agreed Order required: (1) removal of contaminated soil and sediment along the west bank of Ennis Creek (in the area of the Finishing Room) and to restore the area with an inundation area; and, (2) removal of contaminated soil to a depth of six to eight feet below the ground surface in the area of the Former Fuel Oil Tank No. 2 and the Former Machine Shop. Rayonier, Inc. conducted the interim actions in the area of the Finishing Room, Former Fuel Oil Tank No. 2, and the Former Machine Shop. Rayonier, Inc. submitted the *Interim Action Report, Ennis Creek-Finishing Room, Fuel Oil Tank No. 2, Machine Shop, Former Rayonier Mill Site, Port Angeles, Washington,* prepared by Integral Consulting, Inc., Foster Wheeler Environmental Corporation, Seattle, Washington, Final — March 2003.

7.0 The Conceptual Plan for Restoring Ennis Creek and Estuary

Rayonier and the Lower Elwha Klallam Tribe (LEKT) assembled the ETT to create a science-based conceptual plan consisting of graphics and accompanying narrative depicting a potential ecological restoration scenario for Ennis Creek and Estuary.

Definition of a Conceptual Plan

One of the first tasks of the ETT was defining what was meant by a “conceptual plan.” The ETT established that their conceptual plan would depict an ecological restoration scenario for Ennis Creek and Estuary that achieves all of the identified restoration goals (listed below), while allowing for one bridge crossing to accommodate the City of Port Angeles’ combined sewer outfall (CSO) connection to an existing industrial tank on the east side of Ennis Creek.

In developing the conceptual plan, the ETT was asked to assess to the best of its ability:

- ecological benefit;
- acreages of different land uses;
- constraints/challenges;
- data gaps/questions; and
- contaminant concerns.

Definition of Restoration

The ETT adopted the following definition of “restoration:”

> *The return of an ecosystem to a close approximation of its condition prior to disturbance…The goal is to emulate a natural, functioning, self-regulating system that is integrated with the ecological landscape in which it occurs (National Research Council 1992)*[1].

[1.] National Research Council (NRC). 1992. *Restoration of Aquatic Ecosystems*. National Academy Press. Washington, D.C.

According to the Society for Ecological Restoration, a leading professional organization for restoration practitioners, the mission of every ecological restoration project is:

> *To reestablish a functional ecosystem of a designated type that contains sufficient biodiversity to continue its maturation by natural processes and to evolve over longer time spans in response to changing environmental conditions. The two attributes of biodiversity that are most readily attained by restoration are species richness and community structure. The restoration ecologist must assure adequate species composition and species abundance to allow the development of suitable community structure and to initiate characteristic ecosystem processes. Concomitantly, the restorationist must provide physical conditions to sustain these species (Clewell et al. 2000)*[2].

Restoration Goals

To guide planning efforts, the ETT established the following restoration goals:

1. Restore habitat forming processes (e.g. hydrology; sediment transport; geomorphology);
2. Remove, to the extent possible, anthropogenic stressors to the ecosystem;
3. Remove, to the extent possible, invasive plant species;
4. Restore habitat for fish, invertebrates, birds, and wildlife.

Embedded in these goals was our understanding that natural **processes** create the **structure** of habitats, which support ecological **functions** for species and people.[3]

Restoration Planning Units

To facilitate discussions of how to achieve the identified restoration goals, the ETT decided to break the planning area (i.e., the former Rayonier Mill Site shown in Figure 1) into logical "planning units" as depicted in Figure 2.

The potential restoration actions for each planning unit are summarized in Table 1, along with corresponding ecological benefits derived from implementing these restoration actions, acreages of different land uses, constraints/challenges, data gaps/questions to be addressed later in an engineering feasibility assessment, and contaminant concerns. It is vital to note that this table of potential restoration actions should <u>not</u> be viewed as an a la carte menu. The science of ecological restoration necessitates an understanding of the critical linkages between different restoration actions.

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[2] Clewell, A., J. Rieger, and J. Munro. 2000. *Guidelines for Developing and Managing Ecological Restoration Projects*. Published June 24, 2000 by the Society for Ecological Restoration, Madison, Wisconsin.

[3] This principle is well established in the literature, see for example: Fresh, K., C. Simenstad, J. Brennan, M. Dethier, G. Gelfenbaum, F. Goetz, M. Logsdon, D. Myers, T. Mumford, J. Newton, H. Shipman, C. Tanner. 2004. Guidance for protection and restoration of the nearshore ecosystems of Puget Sound. Puget Sound Nearshore Partnership Report No. 2004-02. Published by WashingtonSea Grant Program, University of Washington, Seattle, Washington. Available at *http://pugetsoundnearshore.org*.

Ennis Creek and Estuary Restoration (Rayonier Mill Site)

Summary of the Conceptual Plan

Between November 2009 and March 2010, the Estuary Technical Team met four times and conducted two site visits while developing the conceptual plan. The ETT came to the consensus that it would focus solely on the ecological restoration of Ennis Creek and Estuary. Thus, the ETT did not take into account uncertain and unknowable potential future land uses or re-development scenarios with the exception of the known bridge crossing required for the City's combined sewer overflow (CSO) pipelines, which was already in engineering design phase at the time the ETT was formed.

The ETT also recognized that ecosystems evolve through time, even in the absence of human stressors and habitat alterations. A great deal of discussion revolved around understanding the existing dysfunctional condition of the creek and estuary, as well as analyzing the historic condition using aerial photos, maps, optical remote sensing technology (LIDAR), and quantitative data. The ETT made full use of the various areas of expertise represented around the table, including cultural resources, restoration ecology, fisheries biology, hydrology, geomorphology, engineering, water quality, and geographic information systems (GIS), as well as city, state and federal natural resources regulations. In the end, the ETT did not propose returning the Ennis ecosystem to any one particular historic condition (e.g. 1892), but rather focused on restoring ecological processes that would foster improved habitat conditions in the Creek and Estuary.[4]

Implementation of all the potential restoration actions identified in Table 1 would result in a restored Ennis Creek and Estuary as depicted in Figure 3 (waiting on graphic from Randall). This restored ecosystem addresses all of the identified restoration goals and would result in ~59 acres of restored aquatic habitat.

The overall ecological benefits of the restored ecosystem depicted in Figure 3 include improved fish passage, direct benefit to salmonid feeding/rearing/spawning, improved hydrology and sediment transport, increased abundance and diversity of native plant species, improved water quality, restored connection between Ennis Creek and its floodplain, restored channel migration zone, increased tidal prism, and improved habitat for fish/invertebrates/birds/wildlife.

The vision of the ETT is *a natural, functioning, self-regulating system that is integrated with the ecological landscape in which it occurs*, including:

- A creek with more meanders, a wider floodplain, a forested riparian corridor comprised of native plant species, more pools/log jams/spawning gravel for declining salmon, trout, and steelhead populations, one bridge crossing to accommodate the City's CSO pipelines and the Olympic Discovery Trail, and all other unneeded infrastructure (e.g., culverts, rip rap, concrete, rubble, pipelines, pilings, bridges, roads, parking lots, etc.) and human waste/garbage removed;

[4] Much of the ground south of Planning Units J and K is fill. The ETT is assuming that leaving this fill to the southern edge of Planning Units J and K will not impact shoreline physical processes. This assumption is based upon untested observations of how the site should respond to, and how it will be affected by, longshore drift. It is possible that these remaining fill areas may be vulnerable to erosion if we do not remove the entire fill south to the historic 1892 beach.

- An estuary that is functionally linked with the creek, contains native plant communities in restored marsh, dune, beach, and eelgrass habitats, supports improved nearshore sediment transport, provides more natural nearshore migration corridors for juvenile salmonids, and within which the Rayonier Pier, jetty, concrete slabs, creosote pilings and all other unneeded infrastructure is removed; and

- Improved opportunities for public shoreline access and recreation.

The ETT recognized that interim cleanup actions of chemical contaminants will be required prior to implementation of some of the proposed restoration actions, but it did not identify what specific cleanup actions are required as this was beyond the scope of this team.

Before any restoration could proceed, an engineering feasibility assessment would need to be conducted to: address the data gaps and questions identified by the ETT, calculate volumes of material to be removed, identify restoration constraints, and calculate estimated costs for each potential restoration action identified in Table 1.

Planning Unit	Problems identified & Restoration Opportunities	Proposed Restoration Actions	Ecological Benefits[1]	Acreage	Constraints/Challenges	Data gaps/questions	Contaminant Concerns[2]
A: Ennis Creek Culvert	This City-owned culvert is a known barrier to fish passage. Restoration opportunities include either: 1) replacing the culvert with a bridge or 2) removing it completely. Either of these restoration actions would: improve stream fish passage (by opening ~5.4 miles of currently inaccessible fish habitat); provide direct benefit to salmonid feeding, rearing, spawning; improve hydrology and sediment transport; and restore habitat for fish, invertebrates, birds, and wildlife.	1. Replace culvert w/ bridge; or	A, B, C, J	0.5	Where would funding come from? Who's responsibility is this culvert: City and/or Rayonier?	What are the dimensions of the existing culvert? What span of bridge is required?	No contamination from prior on-site industrial activities suspected or confirmed.
		2. Remove culvert	A, B, C, J		Requires re-route of wastewater treatment access road	What easements & property acquisition might be required to re-route the road (keeping it entirely on the east side of Ennis Creek)?	
B: Ennis Creek; downstream end of Ennis Creek Culvert to top of top of parking lot on west side of Ennis mainstem, also including White Creek downstream of Planning Unit C	Within this planning unit invasive, plant species on both banks are preventing the growth of native plants. Streamkeepers has reported herb robert, Japanese knotweed, and reed canary grass are the primary problems. The ETT during a November 2009 site visit also noted extensive Himalayan blackberries growing in dense thickets that outcompete any native species. Restoration opportunities include: restoring the riparian zone by removing invasives and planting native species (especially conifers).	Restore riparian zone by removing invasives & planting native plant species (especially conifers)	D, E	16.0		What native species would be best to plant?	No contamination from prior on-site industrial activities suspected or confirmed.
	This stream reach also lacks LWD and spawning gravel. The restoration opportunity is to place engineered log jams to scour pools and create habitat complexity.	Place engineered log jams to scour pools and create habitat complexity	B, C, J		Could affect DOE gage site; need to check w/ DOE	Source of lwd? Might need to provide spawning gravel for salmon? Specs for spawning gravel are species dependant.	
	Garbage, refuse, and human waste have historically (currently, too?) been dumpe into Ennis Creek. Restoration opportunities include complete removal of all this material and posting of "no-dumping" signs as potential restoration actions.	Remove all and post "no-dumping" signs	F			How frequently does this occur?	fecal coliform from human waste i floodplain
	The configuration of the unused parking lot on the east side of Ennis Creek confines the channel and floodplain. Restoration opportunities include removing the 90-degree bend of fill out of the parking lot to ensure that the Creek has a target width of 200 to 250 ft of unobstructed floodplain.	Remove the 90 degree bend of fill out of the parking lot	C, G, H		Need to ensure this action doesn't result in increased landslide potential	Volume of material that needs to be removed?	
C: White Creek; from southern boundary of Rayonier Property to top of Planning Unit B	Really wet riparian soils in this planning unit may preclude survival of conifers, the preferred species to have within the riparian corridor. Water parsley, an indigenous indicator not just of wetland soils but specifically of perennially wet soils, suggests that restoring this part of the riparian corridor may be problematic. Restoration opportunities include: removing invasives (if present) and planting native plant species to restore the riparian corridor to the extent possible.	Remove invasives (if present) & plant native plant species; restore riparian zone to extent possible	D, E	4.1	Unclear what native species will work in these perennially wet soils; conifers may not grow on all of these soils, but should still be planted on side slopes where water parsley is not present.	What native species would be best to plant?	No contamination from prior on-site industrial activities suspected or confirmed.
	This stream reach also lacks LWD and spawning gravel. Sediment supply to this reach has been interrupted by the culverts upstream. At the culvert inlet, sedimen are periodically dredged and hauled away by the City. Restoration opportunities include: placing engineered log jams to scour pools and create habitat complexity, as well as placing spawning gravel in the stream bed and/or below th White Creek culvert outlet to be redistributed downstream through natural processes.	Place engineered log jams to scour pools and create habitat complexity	B, C, J			Source of lwd? Might need to provide spawning gravel for salmon? Specs for spawning gravel are species dependant.	
	Garbage, refuse, and human waste have historically (currently, too?) been dumpe into White Creek. Restoration opportunities include complete removal of all this material and posting of "no-dumping" signs as potential restoration actions.	Remove all and post "no-dumping" signs	F			Need to post no dumping signs?	fecal coliform from upstream septic drain fields & human waste in floodplain
D. Gully	No problems identified.	Protect this intact habitat.	O	4.2			No contamination from prior on-site industrial activities suspected or confirmed.
E1: Upper Alder St (former Rayonier Truck Route)	The ETT is concerned about the moderate to high potential for failure of this road and a landslide event(s) that would contribute unwanted sediment to the stream. Because this road is no longer needed by either the City or Rayonier, restoration opportunities include: completely removing the road and planting native vegetation to stabilize slopes and restore the riparian corridor.	Remove road completely and plant native vegetation to stabilize slopes and restore riparian corridor	C, D, E, G, H	2.0	Archeologist may need to be present during any digging	Stability of existing hill slope? How should road removal be done to decrease the potential for landslides?	No contamination from prior on-site industrial activities suspected or confirmed.
E2: Lower Alder St (former Rayonier Truck Route)	The lower portion of this road (south of the existing parking lot on the west side of Ennis Creek) confines Ennis Creek and prevents access to its former floodplai Because this road is no longer needed by either the City or Rayonier, restoration opportunities include: completely removing the road and planting native vegetation to stabilize slopes and restore the riparian corridor.	Remove road completely and plant native vegetation to stabilize slopes and restore riparian corridor	C, D, E, G, H	3.1	Archeologist may need to be present during any digging	Likelihood of cultural resources under road bed?	No contamination from prior on-site industrial activities suspected or confirmed.

Planning Unit	Problems identified & Restoration Opportunities	Proposed Restoration Actions	Ecological Benefits[1]	Acreage	Constraints/Challenges	Data gaps/questions	Contaminant Concerns[2]
F. Parking Lot Reach	This stream reach is severely confined and rip-rapped on both banks the entire length of the planning unit. Restoration opportunities include: removing all rip-rap and one to two vertical feet of fill at the edge of existing creek channel. The restoration actions will allow natural processes to gradually carve a new floodplain and channel meanders.	Remove all rip-rap & 1-2 vertical feet of fill at edge of existing creek channel and allow mother nature to gradually carve a new floodplain and channel meanders through natural processes	B, C, G, H, I, J	4.7	Significant concerns about cultural resources that could be unearthed beneath the existing parking lot; archeologist must be present during any digging	Where would rock & fill material be disposed? There's lots of excess rock in the project area; could it be used in the channel in a beneficial way to create habitat?	No contamination from prior on-site industrial activities suspected or confirmed.
	Within this planning unit, invasive plant species on both banks may be preventing the growth of native plants. Restoration opportunities include: removing invasives (where present) and planting native plant species to restore the riparian corridor to the extent possible.	Remove invasives (if present) & plant native plant species; restore riparian zone to extent possible	D, E			What native species would be best to plant?	
	This stream reach also lacks LWD and spawning gravel. The restoration opportunity is to place engineered log jams to scour pools and create habitat complexity.	Place engineered log jams to scour pools and create habitat complexity	B, C, J			Source of lwd? Might need to provide spawning gravel for salmon? Specs for spawning gravel are species dependant.	
	The current Olympic Discovery Trail (ODT) crossing confines Ennis Creek and prevents access to its former floodplain. Restoration opportunities include: removing the existing ODT Bridge and re-routing trail traffic to the new City Bridge that will be constructed downstream.	Remove ODT bridge and re-route trail traffic to new City bridge downstream	G, H		Would need to leave existing ODT crossing in place until new City bridge is done	Could bridge be saved intact & used at another ODT stream crossing?	
G: Crossings Reach; downstream end of parking lot reach (E) to upstream limit of tidal influence	Multiple stream crossings (i.e., bridges, pipelines, catwalks) confine Ennis Creek and prevent access to its former floodplain. Restoration opportunities include: removing all crossings within Unit F except the new bridge the City is constructing, which would carry all City pipelines and also be the new ODT crossing; the crossings (from S to N) are: traffic bridge, railroad bridge, sanitary sewer force mains, traffic bridge, utility catwalk).	Remove all crossings within Unit F except the bridge required for the City CSO project. The Ennis Technical Team recommended to the City a 100-ft long, 15-ft wide bridge that would carry the City's 3 pipelines underneath and the Olympic Discovery Trail on top, as depicted in Alternative 2C by the City's contracted engineering firm Berger ABAM. The existing traffic bridge must stary in place until the new City CSO bridge is constructed. Once the City CSO bridge is in place the traffic bridge must be removed.	F, G, H	0.5	This proposed action would eliminate the existing traffic bridge, which currently allows west to east access across Ennis Creek. Any future bridge crossing would need to occur within the existing railroad bridge corridor and be 100-ft minimum span in order to accommodate the restoration of the Creek. Any future bridge crossings must keep pilings and infrastructure out of the Ennis Creek channel. The City's concrete pipeline that is currently in the bed of the creek is acting as a grade control; as soon as the City's new CSO Bridge is constructed, the pipeline will no longer be needed and must be removed.	Are any of these existing structures creosote? Need to do an inventory. What road improvements are needed on east side of Creek if the traffic bridge is removed?	Creosote in pilings and cross-beams of some structures. No other contamination from prior on-site industrial activities suspected or confirmed.
	This reach is severely confined & rip-rapped on both banks the entire length of the planning unit. Restoration opportunities include: removing all rip-rap on both banks and re-meandering the stream channel.	Remove all rip-rap and re-meander the stream channel	B, C, G, H, I, J		Archeologist must be present during any digging	Where would rock & fill material be disposed? There's lots of excess rock in the project area; could it be used in the channel in a beneficial way to create habitat? Design of channel meanders: how many, where?	
	Within this planning unit, invasive plant species are preventing the growth of native plants. Restoration opportunities include: removing invasives (where present) and planting native plant species to restore the riparian corridor to the extent possible.	Remove invasives & plant native plant species; restore riparian zone	D, E			What native species would be best to plant?	
	This stream reach also lacks LWD and spawning gravel. Restoration opportunities include: placing engineered log jams to scour pools and create habitat complexity, as well as placing spawning gravel in the stream bed.	Place engineered log jams to scour pools and create habitat complexity; place spawning gravel	B, C, J			Source of lwd? Might need to provide spawning gravel for salmon? Specs for spawning gravel are species dependant.	
H: Estuary; upstream limit of tidal influence to mouth of Ennis Creek	This reach is severely confined and rip-rapped on both banks the entire length of the planning unit. Mill rubble is acting like a dike that prevents the creek from accessing the former floodplain. Restoration opportunities include: removing all rip-rap, mill rubble, and fill, and allowing the stream channel to naturally meander.	Remove all rip-rap, mill rubble, fill, and allow the stream channel to naturally meander	B, C, G, H, I, J, N	4.4	Archeologist may need to be present during any digging	Where would rock & fill material be disposed? There's lots of excess rock in the project area; could it be used in the channel in a beneficial way to create habitat?	Metals and PAHs detected above screening levels in a few soil sample locations. Dioxins & PCBs detected above screening level in one soil sample.
	This reach also has remnant (and no longer needed) infrastructure from the Rayonier Mill, including concrete slabs, building foundations, pilings, and an unneeded creek crossing near the mouth of Ennis Creek. Restoration opportunities include: removing all pilings (~600), foundations, concrete slabs, and creek crossings.	Remove all pilings (~600), foundations, concrete slabs, and creek crossings	B, C, F, G, H, I, J, N		Archeologist may need to be present during any digging. Need to investigate whether the creosote pilings visible above ground in the former salt marsh are on concrete footings (i.e. remnant block & pier foundation) or whether they were driven deep and are creosoted their entire length.	Where would rock/concrete/pilings be disposed? There's lots of excess rock in the project area; could it be used in the channel in a beneficial way to create habitat? Are some (all?) of the estimated 600 pilings creosote?	Creosote in pilings and cross-beams of some structures. TPH detected above screening levels in soil samples near bridge at mouth of Ennis Creek.
	Within this planning unit, invasive plant species are preventing the growth of native plants. Restoration opportunities include: removing invasives (where present) and allowing native estuarine plant species to naturally colonize the former salt marsh in this area.	Remove invasives & plant native plant species and/or allow natural recolonization of estuarine plant species	D, E			What native species would be best to plant?	
	This stream reach also lacks LWD and spawning gravel. The restoration opportunity is to place engineered log jams to scour pools and create habitat complexity.	Place engineered log jams to scour pools and create habitat complexity	B, C, J			Source of lwd? Might need to provide spawning gravel for salmon? Specs for spawning gravel are species dependant.	

Planning Unit	Problems identified & Restoration Opportunities	Proposed Restoration Actions	Ecological Benefits[1]	Acreage	Constraints/Challenges	Data gaps/questions	Contaminant Concerns[2]
I. Estuary Beach; east of Ennis Mouth to eastern boundary of Rayonier Property	This shoreline planning unit has riprap, a berm, and remnant (no longer needed) infrastructure from the Rayonier Mill. Restoration opportunities include: removing all rip-rap, the berm, and mill infrastructure.	Remove all rip-rap, the berm, and remnant infrastructure	B, C, J, K, M	4.9	Restoration actions must not disturb the City Outfall; Archeologist may need to be present during any digging	Need to inventory what remnant infrastructure exists within this unit. Is this potential forage fish spawning habitat?	Dioxin/furan detected in only one soil sample location above standards.
	Invasive plant species along the shoreline are preventing the growth of native plants. Restoration opportunities include: removing the invasive species and restoring the native plant community either by planting native species or allowing natural recolonization.	Remove invasives and allow natural recolonization of estuarine plant species and the beach dune community; if natural recolonization does not happen, planting native plants and controlling exotics may be necessary.	D, E			Natural recolonization or replant? Was there ever coastal forest at this location, between the toe of the bluff and the dune?	
J. NE Beach; west of Ennis Mouth to Rayonier Pier	Along the shoreline of this planning unit there is a remnant concrete slab on pilings built over formerly functional beach/intertidal habitat. Restoration opportunities include: removing the fill, riprap, timber seawall, pilings, concrete slab, and all other infrastructure to beach/intertidal elevations.	Remove fill, rip-rap, timber seawall, pilings, concrete slab, and all other infrastructure to beach/intertidal elevations	B, C, F, J, K, M, N	3.2	Archeologist may need to be present during any digging	Need to inventory what remnant infrastructure exists within this unit; How many of the pilings are creosote? Is this potential forage fish spawning habitat? Where did the limestone on the beach come from (there is no known limestone quarry on the Peninsula)?	Creosote in pilings. Potential for dioxin/furan, metals and cPAH in soils.
K. NW Beach; Rayonier Pier to Jetty, including shoreline along former log bay	This planning unit has rip-rap and remnant (no longer needed) infrastructure from the Rayonier Mill built over formerly functional beach/intertidal habitat. Restoration opportunities include: removing the fill, riprap, timber seawall, and all other infrastructure to beach/intertidal elevations.	Remove fill, rip-rap, timber seawall, and all other infrastructure to beach/intertidal elevations	B, C, F, J, K, M, N	5.9	Archeologist may need to be present during any digging	Need to inventory what remnant infrastructure exists within this unit; How many of the pilings are creosote? Is this potential forage fish spawning habitat?	Creosote in pilings. Potential for dioxin/furan, metals and cPAH in soils.
L. Rayonier Pier	The pier interrupts nearshore sediment transport and disrupts natural alongshore fish migration. Restoration opportunities include: complete removal of the pier and all associated infrastructure.	Complete removal of pier (~10,000 pilings) and all associated concrete, pipes, and infrastructure.	F, J, K, L, M, N	5.7	Public perception that this pier is useable in its current state. Removal cost will be the driver.	Exact number of pilings to be removed? Is this potential forage fish spawning habitat? Where did the limestone on the beach under the pier come from (there is no known limestone quarry on the Peninsula)?	Creosote in pilings. Dioxins, PCBs in sediments.
M. Jetty	The driven piling/rock crib jetty to the west of the Rayonier Pier was constructed to protect the log bay, but is no longer needed. The jetty interrupts nearshore sediment transport and disrupts natural alongshore fish migration. The restoration opportunity is complete removal of the jetty.	Complete removal of jetty; large logs trapped at base of jetty should be used in other areas of the restored site and/or stockpiled for use in nearby restoration projects.	J, K, L, M	0.2	Interim cleanup of the log bay must happen before jetty is removed.	Volume of rock to be removed? Does this rock have monetary value?	Creosote in pilings. Dioxins, PCBs in sediments.

[1] **Ecological Benefits Codes:**

A. Improves stream fish passage.
B. Provides direct benefit to salmonid feeding, rearing, and spawning.
C. Improves hydrology and sediment transport.
D. Removes non-native/invasive plant species.
E. Increases diversity and abundance of native vegetation.
F. Improves water quality.
G. Restores/partially restores historic connection between Ennis Creek and the floodplain.
H. Restores/partially restores channel migration zone.
I. Increases tidal prism.
J. Restores habitat for fish, invertebrates, birds, and wildlife
K. Restores more natural drift cell.
L. Removes shading of submerged vegetation (e.g. eelgrass
M. Restores more natural shoreline migration route for fish
N. Removes contaminated soil/sedimen
O. Protects intact habitat.

[2] **Contaminant Concerns Notes:**

The creek and buffer were not developed in the southern part of the property, and there is only sparse sampling data in that area. In the northern portion of the site, the former Finishing Room area interim action (IA) included the removal of contamination within the area adjacent to the creek. Currently, the majority of the creek area has not been identified as having contamination, with the exception of some residual TPH contamination left after the former Finishing Room IA and creosoted wood pilings in the former roll storage warehouses adjacent to the railroad bridge. Data from the Uplands RI and EPA ESI show that surface and subsurface freshwater sediment data for Ennis Creek indicated the presence of several metals (aluminum, barium, cobalt, manganese, nickel, and vanadium; some naturally occurring) exceeding freshwater and marine sediment quality levels; however, with the exception of manganese these concentrations fell within the range of results for the EPA ESI background locations (Integral 2007). A detailed review of site contamination data will be performed prior to any on-the-ground restoration activities.

[3] **Future Potential Restoration Opportunities**

Upland areas south of Planning Units I, J, and K were identified by ETT as "future potential restoration opportunities." The ETT consensus was that these upland areas were outside the essential area necessary to restore ecological processes for Ennis Creek and Estuary, and thus they were not included as part of the Conceptual Plan. However, the ETT also recognized that from a landscape ecology perspective, connectivity of habitats is essential to ecosystem function. Thus, there would be significant benefit to restoring these upland areas south of Planning Units I, J, and K to (now rare) forested marine riparian habitat to the base of the bluff.

Figure 3. Depiction of Ennis Creek and Estuary pre-restoration (left) and post-restoration (right) (graphics by Randall McCoy).