

## EXECUTIVE SUMMARY

### Watershed Analysis for Mendocino Redwood Company's Ownership in the Rockport Coastal Streams Watershed

This report presents the results of a watershed analysis performed by Mendocino Redwood Company (MRC) on their ownership<sup>1</sup> in the Rockport Coastal Streams watershed, consisting of the ownership area within the Hardy, Juan and Howard Creek Planning Watersheds. The MRC ownership in the Rockport Coastal Streams watershed is considered the Rockport Coastal Streams watershed analysis unit (WAU). This section presents a brief overview of results from the watershed analysis performed by MRC. More specific information is found in the individual modules of this report.

Rockport Coastal Streams and its tributaries support populations of steelhead trout and coho salmon, which are listed as threatened and endangered fisheries, respectively, for the Central California Coast region. For this reason MRC conducted a watershed analysis to assist in their efforts to reduce non-point source pollution, evaluate current and past land management practices and establish a baseline for monitoring of watershed conditions over time. The watershed analysis will also be used to identify needs for site-specific management planning and restoration in the watershed to reduce impacts to aquatic resources and potentially to improve fish and aquatic habitat conditions.

MRC's approach to the Rockport Coastal Streams watershed analysis was to perform resource assessments of mass wasting, surface and point source erosion (roads/skid trails), hydrology, fish habitat, amphibian distribution, riparian condition and stream channel condition. Mass wasting, riparian condition and surface and point source erosion modules address the hillslope hazards. The fish habitat, amphibian distribution, and stream channel condition modules address the vulnerability of aquatic resources. Prescriptions are developed to address the issues and processes identified in the watershed analysis. Finally, monitoring is suggested to determine the efficacy of the prescriptions to protect sensitive aquatic resources. The monitoring will provide the feedback for MRC's adaptive management approach to resource conservation.

## RESULTS

### *Mass Wasting*

A total of 412 shallow-seated landslides (debris slides, torrents, or flows) were identified and characterized in the Rockport Coastal Streams WAU. A total of 41 deep-seated landslides (rockslides and earthflows) were mapped in the Rockport Coastal Streams WAU. A considerable effort was made to field verify as many landslides as possible to insure greater confidence in the results. Approximately 21% (86/412) of the identified shallow-seated landslides were field verified. From this level of field observations, extrapolation of landslide depth and sediment delivery is assumed to be performed with a reasonable level of confidence.

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<sup>1</sup> It must be emphasized that only the Mendocino Redwood Company ownership is analyzed.

Approximately 35% (143) of the 412 shallow-seated landslides observed during aerial photograph review delivered during the 193-1978 time period. Of the 412 shallow-seated landslides in the Rockport Coastal Streams WAU, 301 are determined to be road associated (includes roads, skid trails, or landings). This is approximately 73% of the total number of shallow-seated landslides. A majority of inventoried landslides originated in convergent topography and steep streamside slopes.

The landscape was partitioned into seven Terrain Stability Units representing general areas of similar geomorphology, landslide processes, and sediment delivery potential for shallow-seated landslides (Map A-2). The TSU's with the largest estimated sediment delivery are TSU 1 and 2, which cumulatively are estimated to deliver 64% of the total sediment input for the Rockport Coastal Streams WAU. Combining all high hazard units (TSU 1, 2, and 3) would yield 96% of the estimated non-road related sediment input on approximately 25% of the MRC owned acreage.

#### ***Surface and Point Erosion (Roads/Skid Trails)***

It was determined that there are currently 129 miles of truck roads in the Rockport Coastal Streams WAU (skid trails not included). This represented an average road density of 7 miles of road per square mile. Approximately 36 miles of road contributes surface erosion to watercourses (defined as contributing road length). This represents approximately 28% of the total road length in the Rockport Coastal Streams WAU.

Roads in the Rockport Coastal Streams WAU are estimated to generate, on average, 392 tons/mi<sup>2</sup>/yr of sediment from road-associated surface and point source erosion (Table ES-1).

**Table ES-1.** Road Associated Surface and Point Source Erosion Estimates by Planning Watershed for the Rockport Coastal Streams WAU.

<b>Planning Watershed</b>	<b>MRC Owned (sq mi)</b>	<b>Surface Erosion (tons/sq mi/yr)</b>	<b>Point Source Erosion (tons/sq mi/yr)</b>	<b>Total (surface +point source) (tons/sq mi/yr)</b>
Hardy Creek	4.7	17	120	137
Juan Creek	7.3	16	284	300
Howard Creek	3.7	6	93	99
<b><i>Rockport Coastal Streams WAU</i></b>	<b><i>15.7</i></b>	<b><i>14<sup>+</sup></i></b>	<b><i>168<sup>+</sup></i></b>	<b><i>392<sup>+</sup></i></b>

<sup>+</sup>Area-weighted average

The future potential for point source erosion was evaluated in the Rockport Coastal Streams WAU. This potential erosion or controllable erosion was identified during the road inventory during 2008. A total of 20,709 cubic yards of controllable erosion (Table ES-2) is currently on the road network in the Rockport Coastal Streams WAU. Since 1998, when the company was formed, 3,820 cubic yards of erosion from the road network has been controlled.

Table ES-2. Controllable Erosion by Treatment Immediacy for the Rockport Coastal Streams WAU.

Road Feature	Controllable Erosion Treatment Immediacy (yd <sup>3</sup> )			
	High	Moderate	Low	None
Culverts	4,685	2,190	7,385	0
Crossings	0	1,745	360	2
Landings	0	300	385	0
Erosion Features	0	0	117	0
Road slides	3,000	200	340	0
<b>Total</b>	<b>7,685</b>	<b>4,435</b>	<b>8,587</b>	<b>2</b>

The Rockport Coastal Streams WAU was evaluated for skid trail sediment delivery from the 1940s to 2010. The greatest sediment delivery from skid trails occurred during the 1960s and the 1970s (roughly 790 tons/mi<sup>2</sup>/yr) with the majority of activity occurring in the Juan Creek planning watershed.

### ***Hydrology***

Using the peak flow record from 1965-2003, the flood of record was in December 1964 (78,700 cfs) calculated to be almost a 100 year event for the South Fork Eel River near Leggett. This suggests that the Rockport Coastal Streams WAU has been subjected to stressful hydrologic conditions, possibly creating a greater incidence of landslides, road failures or surface erosion.

### ***Riparian Function***

The riparian function assessment is divided into two groups: 1) the potential of the riparian stand to recruit large woody debris (LWD) to the stream channel along with the level of concern about current LWD conditions in the stream, and 2) a canopy closure and stream temperature assessment.

Our analysis showed a need for large woody debris in most (85%) of the channel segments of the Rockport Coastal Streams WAU due to low instream LWD and low riparian recruitment potentials. Channel segments with LWD levels that are well below targets will need to be a priority for future recruitment and restoration work. Riparian LWD recruitment potential in the Rockport Coastal Streams WAU is moderate to low. The majority of the LWD in Rockport Coastal Streams consists of older redwood logs.

The Rockport Coastal Streams WAU generally has favorable stream shade conditions. These conditions are typical of the coastal streams that have cool stream temperatures as well as adequate canopy cover. Topographical shading from the steep, dissected terrain in the Rockport Coastal Streams WAU also plays a large role maintaining desired stream temperatures.

Stream temperatures in the Rockport Coastal Streams WAU are within the range preferred by steelhead trout and coho salmon (maximum weekly average temperatures below 15C°).

### ***Stream Channel Condition***

Baseline information on the stream channels of the Rockport Coastal Streams WAU was collected and reported (see Module E Stream Channel Condition module). Individual channel segments were categorized into geomorphic units using the baseline stream channel information, topography the channel segments are found in, position in the drainage network, and gradient/confinement classes. Four stream geomorphic units were established to represent the range of channel conditions and sensitivities to input factors of coarse and fine sediment and LWD (Table ES-3). Long term channel monitoring observations

have been collected on one monitoring segment in the Rockport Coastal Streams WAU in 2006. The results for these observations are presented in the Stream Channel Condition module.

Table ES-3. Stream Geomorphic Units and Sensitivities for the Rockport Coastal Streams WAU.

Stream Geomorphic Unit	Channel Sensitivity		
	Coarse Sediment	Fine Sediment	LWD
Geomorphic Unit I. Confined Low Gradient Channels.	Moderate	Moderate	High
Geomorphic Unit II. Low Gradient Confined to Moderately Confined Transport Channels.	Moderate	Moderate	High
Geomorphic Unit III. Moderate Gradient Confined Transport Channels	Moderate	Moderate	Moderate
Geomorphic Unit IV. High Gradient Transport Channels.	Low	Low	Low

### ***Fish Habitat Assessment***

The anadromous fish species inhabiting the Rockport Coastal Stream WAU are steelhead trout (*Oncorhynchus mykiss*) and coho salmon (*O. kisutch*). Steelhead trout are present in all three planning watersheds while coho salmon have only been observed in the Hardy Creek and Howard Creek planning watersheds (note: there has only been one recent detection of coho salmon in Howard Creek which may have been erroneous). Other fish species include prickly sculpin (*Cottus asper*) and coastrange sculpin (*C. aleuticus*).

Habitat typing data indicated that spawning habitat was generally fair to good throughout most of the Rockport Coastal WAU. However, substrate sampling indicated gravels with lower than desirable permeability levels: Mean permeability measurements were at the low end of the marginal range and resulting survivability index was below 50% for the single reach that was sampled. Fine sediment deposition in pools (V\*), however, was not indicative of highly disturbed systems. Reduction of erosion rates should increase the quality of spawning gravel in the Rockport Coastal WAU. Throughout most of the Rockport Coastal WAU, summer rearing and over-wintering habitat were rated as poor to fair. Land management activities that promote woody debris recruitment and sediment reduction should directly increase the quality of rearing habitat in the Rockport Coastal WAU.

### ***Amphibian Distribution***

The amphibian species detected in the Rockport Coastal Streams WAU represent three of the four species having geographical ranges in the area. The three detected amphibian ‘Species of Special Concern’ (as designated by the State of California) are coastal tailed frogs (*Ascaphus truei*), northern red-legged frogs (*Rana aurora*), and southern torrent salamanders (*Rhyacotriton variegatus*). Aquatic habitat types have remained functional in the Rockport Coastal Streams WAU to support the tailed frogs and southern torrent salamanders. During surveys for southern torrent salamanders, tailed frog adults were observed within seeps at five sampling locations. Based upon this evidence it appears as if seeps adjacent to larger watercourses may be an important habitat for tailed frogs; whether for foraging habitat or reproductive habitat. Insufficient breeding habitat for the other ‘Species of Special Concern’ may explain the absence of foothill yellow-legged frogs (*Rana boylei*) and the low density of red-legged frogs in the Rockport Coastal Streams WAU.

**Synthesis**

The habitat quality ratings and sediment input summaries show that large woody debris and road associated sediment have the most significant need for improvement. Stream temperature conditions in Rockport Coastal Streams are at a desirable level for steelhead and coho as well as having favorable canopy conditions. Currently MRC has made good strides toward controlling road sediment in Rockport Coastal Streams, but a significant amount of controllable sediment remains to be controlled. Long-term monitoring data in the Rockport Coastal Streams is in its infancy since 2006 was the first year that this type of monitoring was conducted, but initial data suggests that large woody debris levels are low, pool depths and frequencies are very low and fine sediment deposition levels are acceptable.

**Land Management Prescriptions**

The following prescriptions were specifically prepared for use in the Rockport Coastal Streams WAU. These prescriptions are meant to help address issues to aid in the stewardship of aquatic resources of the Mendocino Redwood Company ownership in the Rockport Coastal Streams WAU. The prescriptions are meant to be used in addition to the current California Forest Practice Rules and company policies. At the time of the publication of this watershed analysis MRC's forest management policies are governed by interim guidelines prior to the issuance of a Habitat Conservation Plan and Natural Community Conservation Plan (HCP/NCCP). Once the HCP/NCCP is approved, the conservation strategies set forth in these documents will become the company policies. A prescription is only presented if it deviates from or adds clarification to these policies.

**Mass Wasting***Terrain stability unit 1 – Inner gorge or steep streamside slopes adjacent to low gradient watercourses*

Where there is inner gorge within TSU 1 protections will extend from the edge of the watercourse transition line up to the break in slope of the inner gorge and 25 feet of additional slope distance after the break in slope of the inner gorge.

**TSU 1 Road construction:**

- No new road or landing construction unless field reviewed and approved by a California Professional Geologist.

**TSU 1 Existing Roads:**

- Roads or landings shall be maintained at the design standards that lower risk of mass wasting sediment delivery. Existing roads and landings within TSU 1 should be considered for abandonment if no longer needed.

**TSU 1 Tractor Yarding:**

- Equipment exclusion zones on inner gorge slopes. Equipment exclusion zones on steep streamside slopes (non-inner gorge) except for existing roads or where alternative yarding method creates potential for greater sediment delivery.

**TSU 1 Skid Trail Construction or Reconstruction:**

- No new tractor trail construction unless field reviewed and approved by a California Professional Geologist.

**TSU 1 Timber Harvest:**

- TSU 1 will receive no harvest on inner gorge slopes unless approved by a California Professional Geologist. On steep streamside slopes within TSU 1, in addition to the riparian protections set as company policy, timber harvest must retain a minimum of 50% canopy<sup>2</sup> dispersed evenly across the slopes.

*Terrain stability unit 2 – Inner gorge or steep streamside slopes adjacent to moderate to high gradient watercourses*

Where there is inner gorge within TSU 2 protections will extend from the edge of the watercourse transition line up to the break in slope of the inner gorge and 25 feet of additional slope distance after the break in slope of the inner gorge.

TSU 2 Road construction:

- If inner gorge topography, no new road or landing construction unless field reviewed and approved by a California Professional Geologist. If steep streamside slope topography, road construction shall be minimized. If road construction must occur, the road must utilize the highest design standards to lower risk of mass wasting sediment delivery.

TSU 2 Existing Roads:

- Roads or landings shall be maintained at the design standards that lower risk of mass wasting sediment delivery. Existing roads and landings within TSU 2 should be considered for abandonment if no longer needed.

TSU 2 Tractor Yarding:

- Equipment exclusion zones on inner gorge slopes. Equipment exclusion zones on steep streamside slopes except for existing roads or where alternative yarding method creates potential for greater sediment delivery.

TSU 2 Skid Trail Construction or Reconstruction:

- No new tractor trail construction unless field reviewed and approved by a California Professional Geologist.

TSU 2 Timber Harvest:

- No harvest on inner gorge slopes unless approved by a California Professional Geologist. On steep streamside slopes within TSU 2, in addition to the riparian protections set as company policy, timber harvest must retain a minimum of 50% canopy (see footnote 2) dispersed evenly across the slopes.

*Terrain stability unit 3 – Steep dissected terrain*

This area is characterized primarily by 1) steep convergent and dissected topography located within steep gradient colluvial hollows or headwall swales and small high gradient watercourses, and 2) locally steep planar slopes where there is strong evidence of past landsliding. Please see the mass wasting module for the full definition.

TSU 3 Road construction:

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<sup>2</sup> Only trees greater than 30 feet in height count towards canopy measurement.

- No new road construction across TSU 3 unless field reviewed and approved by a California Professional Geologist unless it is the best road alternative<sup>3</sup>.

#### TSU 3 Existing Roads:

- Roads or landings shall be maintained at the design standards that lower risk of mass wasting sediment delivery. Existing roads and landings within TSU 3 should be considered for abandonment if no longer needed.

#### TSU 3 Tractor Yarding:

- Equipment limited to existing roads or stable trails<sup>4</sup>.

#### TSU 3 Skid Trail Construction or Reconstruction:

- No new tractor trail construction or reconstruction unless field reviewed and approved by a California Professional Geologist.

#### TSU 3 Timber Harvest:

- Retain 50% canopy (see footnote 2, page v) with trees dispersed evenly across slope. Tree retention shall be emphasized in the axis of headwall swales. Deviations from this default must be field reviewed and approved by a California Professional Geologist.

#### *Rockslides*

No harvest or new road construction will occur on active portions of rockslides with a risk for sediment delivery unless approved by a California Professional Geologist.

#### Roads

##### *High and Moderate Erosion Hazard Roads*

The roads with a high erosion hazard rating should be given special attention for maintenance or erosion control. These roads should be considered high priority roads for rock surface, improved and increased road drainage relief, design upgrades or decommissioning.

The moderate erosion hazard roads should be given similar attention, but not as high a priority as the high erosion hazard roads.

##### *High and moderate treatment immediacy sites for roads in the Rockport Coastal Streams WAU*

The high treatment immediacy controllable erosion sites will be the highest priority for erosion control, upgrade, or modifications to existing design. These sites will be scheduled for repair based on operational considerations of harvest scheduling, proximity and availability of equipment, magnitude of the problem, and accessibility to the site.

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<sup>3</sup> Best road alternative – the placement has a lower potential for sediment production and greater cost effectiveness.

<sup>4</sup> Stable trail – skid trail that has >85% of trail's tread intact, fill cracks or settling can have occurred provided the trail is still 85% intact and can have corrective action such that the trail presents little risk of future sediment delivery after use. Cut bank slumps can occur on stable trails, however, the slump cannot be removed if it buttresses failure of upslope soils.

The moderate treatment immediacy controllable erosion sites will be the next highest priority (relative to the high treatment immediacy sites) for erosion control, upgrade, or modifications to existing design. The moderate treatment immediacy sites will typically be addressed when in close proximity to high treatment immediacy sites.

### Riparian

#### *Large woody debris recruitment*

The company policies for streamside stand retention are considered to be appropriate at this time for LWD recruitment. Monitoring of LWD recruitment will be done to determine if this is correct.

In the interim MRC will promote attempts to place LWD in stream channels to provide habitat structure. The stream locations with high instream LWD demand should be considered the highest priority for LWD placement. The moderate instream LWD demand segments would be next.

#### *Stream Shade*

The company policies for promoting streamside canopy and riparian management are considered to be appropriate at this time to improve stream canopy. Monitoring of stream temperatures and canopy will be done to determine if this is correct.

### **Monitoring**

Aquatic resources monitoring will be conducted in the Rockport Coastal Streams WAU. This monitoring is to assist Mendocino Redwood Company to assess impacts to aquatic resources associated with past or future timber harvest and related forest management activities in the Rockport Coastal Streams WAU. The monitoring suggested in this plan is monitoring that MRC does across all its lands including the Rockport Coastal Streams WAU. However, other monitoring efforts not mentioned here may be conducted by MRC in the Rockport Coastal Streams WAU. Currently a comprehensive monitoring plan is being developed for the MRC lands. Once that plan is finalized it will supercede the monitoring presented here.

#### *Monitoring Plan Goals:*

- Test the efficacy of the Rockport Coastal Streams WAU prescriptions to address impacts to aquatic resources from timber harvest and related forest management activities.
- To assess long term channel conditions. Are current and future forest management practices inhibiting, neutralizing or promoting stream channel conditions for aquatic habitat?

A monitoring report will be produced each year that monitoring is conducted in the Rockport Coastal Streams WAU. The report will cover the monitoring and analysis that has occurred up to that year; if no monitoring is conducted in a given year than no report will be produced. Table ES-4 summarizes some of the monitoring to be conducted in the Rockport Coastal Streams WAU over time.



Table ES-4. Monitoring Matrix for Mendocino Redwood Company Lands Including the Rockport Coastal Streams Watershed Analysis Unit.

Monitoring Objectives	Reasoning, Comments	Technique
1. Determine effectiveness of measures to reduce management created mass wasting.	Management created mass wasting is significant contributor of sediment delivery.	Evaluation of mass wasting after approximately 20 years.
2. Determine effectiveness of erosion control practices on high and moderate surface erosion hazard roads and landings.	Roads provide sediment delivery in the Rockport Coastal Streams WAU.	Evaluation of watercourse crossings, landings, and road lengths for erosion evaluation.
3. Determine in-stream large woody debris amounts over time.	Large woody debris is needed for stream channel and aquatic habitat improvement in the Rockport Coastal Streams WAU.	Stream LWD inventories and mapping of LWD designation areas in select stream reaches and long term channel monitoring sites.
4. Determine if stream temperatures are staying within properly functioning range for salmonids.	Stream temperature can be a limiting factor for salmonid growth and survival.	Stream temperature probes and assessment conducted in strategic locations.
5. Determine if fine sediment in stream channels is creating effects deleterious to salmonid reproduction.	Many forest practices can produce high fine sediment amounts. Need to ensure fine sediments are not impacting salmonid reproduction.	Permeability measurements on select stream reaches (bulk gravel samples if necessary).
6. Determine long-term channel morphology changes from coarse sediments.	Channel morphology can be altered from sediment increases, possibly affecting aquatic habitat.	Thalweg profiles and cross section surveys on select stream reaches.
7. Determine presence and absence of fish species in Class I watercourses.	Management practices and resource protections can affect distribution of aquatic organisms.	Electro-fishing and snorkeling observations at select locations to determine species composition and presence.



**Rockport Coastal Streams  
Watershed Analysis  
Unit**

**Base Map**

**Road Surface**

- Paved Road
- Rocked Road
- Native Road
- Jeep Trail
- Undetermined

- 200' contour interval
- 40' contour interval

- MRC Ownership
- Planning Watershed Boundary
- Rockport Coastal Streams Watershed Analysis Unit Boundary

**Flow Class**

- Class I
- Class II
- Class III

