

SECTION H CASUAL MECHANISMS AND PRESCRIPTIONS

INTRODUCTION

The following Causal Mechanism Reports and Prescriptions were specifically prepared for use in the Noyo Watershed Analysis Unit (WAU). These prescriptions are updates to the prescriptions developed in December, 2000 and supercede those prescriptions. The prescriptions were updated to reflect new company policies.

These prescriptions are meant to help address issues to aid in the stewardship of aquatic resources of the Mendocino Redwood Company ownership in the Noyo 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 current policies or regulations.

The land management prescriptions presented here are the protections that Mendocino Redwood Company will pursue to provide protection of aquatic resources. In addition to these prescriptions Mendocino Redwood Company will build and maintain all of its roads at high design standards such as presented in the Handbook for Forest and Ranch Roads (Weaver and Hagans, 1994).

The causal mechanism reports present the situations where watershed conditions have a likelihood of affecting a vulnerable resource. By addressing each of these situations with an appropriate prescription the situations that could impact sensitive resources will either be removed or their impact significantly lessened. This is to attempt to provide protection to watershed values from receiving significant or cumulative impacts from future management actions.

Monitoring will be conducted in the Noyo WAU to ensure that these prescriptions are providing necessary protection to aquatic resources (see Section I, Noyo WAU Monitoring Plan). This monitoring is part of an adaptive management approach that tests the hypothesized protections the prescriptions are developed to meet. If it is found that the prescriptions are not providing the appropriate protections, then they will be updated and improved.

CAUSAL MECHANISMS AND PRESCRIPTION REPORTS

Each Causal Mechanism Report and Prescription has specific headings to provide background on the watershed situation and prescription. The following is the description of these headings.

Resource Sensitive Area: the area or topic encompassed by the prescription.

Input Variable and Process: this briefly states what is the source variable or input to a vulnerable resource.

Situation Sentence: presents the situation that will be addressed by the prescription.

Prescriptions: specific land management actions or recommendation for the proposed causal mechanism.

Causal Mechanism Report and Prescription #1

Resource Sensitive Area: Terrain Stability Unit (TSU) 1

Input Variable and Process: Coarse and fine sediment from mass wasting

Situation Sentence:

Small shallow seated landslides are common within the over-steepened slopes or inner gorge topography. The immediate proximity of watercourses to these landslides provides direct delivery of fine and coarse sediment. The sediments delivered to the river channels are necessary to provide channel substrate needed for fish spawning and rearing habitat. However, if erosion is increased from management disturbances, then sediments delivered to the river channels could be deleterious to fish habitat. Changes to fish habitat from high sediment levels can be created by pool filling, increased channel scour, fine sediments smothering spawning gravels and loss of river channel complexity.

Prescriptions:

The general location of terrain stability units are mapped in Map A-1 but final determination of the unit existence and boundaries will be determined from field observations.

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 Registered 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 Registered Geologist.

TSU 1 Timber Harvest:

- TSU 1 will receive no harvest on inner gorge slopes unless approved by a California Registered Geologist.
- On steep streamside slopes within TSU 1 timber harvest must retain a minimum of 50% canopy¹ dispersed evenly across the slopes above AMZ.

¹ Only trees greater than 30 feet in height count towards canopy measurement.

Causal Mechanism Report and Prescription #2

Resource Sensitive Area: Terrain Stability Unit (TSU) 2

Input Variable and Process: Coarse and fine sediment from mass wasting.

Situation Sentence:

Shallow seated and deep seated landslides are frequently initiated on the streamside slopes or inner gorge of TSU 2. The immediate proximity of watercourses to these landslides provides direct delivery of fine and coarse sediment. The sediments delivered to the river channels are necessary to provide channel substrate needed for fish spawning and rearing habitat. However, if landslide frequency is increased from management disturbances, then sediments delivered to the river channels could be deleterious to fish habitat. Changes to fish habitat from high sediment levels can be created by pool filling, increased channel scour, fine sediments smothering spawning gravels and loss of river channel complexity.

Prescriptions:

The general location of terrain stability units are mapped in Map A-1 but final determination of the unit existence and boundaries will be determined from field observations.

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 Registered 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 gorge 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 Registered Geologist.

TSU 2 Timber Harvest:

- TSU 2 will receive no harvest on inner gorge slopes unless approved by a California Registered Geologist.
- On steep streamside slopes within TSU 2 timber harvest must retain a minimum of 50% canopy² dispersed evenly across the slopes above AMZ.

² Only trees greater than 30 feet in height count towards canopy measurement.

Causal Mechanism Report and Prescription #3

Resource Sensitive Area: Terrain Stability Unit (TSU) 3

Input Variable and Process: Coarse and fine sediment from mass wasting

Situation Sentence:

Steep and/or convergent slopes of TSU 3 can have shallow seated landslides associated with them. These landslides can travel moderate distances across hill slopes to reach streams where sediment delivery and sometimes debris torrents or flows occur. When sediment delivery occurs with these landslides, sediments will travel down the watercourses and are delivered to river and stream channels. If the frequency and amount of shallow seated landslides are increased from management actions in TSU 3 this can contribute to poor instream habitat, downstream aggradation or high stream turbidity.

Prescriptions:

The general location of terrain stability units are mapped in Map A-1 but final determination of the unit existence and boundaries will be determined from field observations.

TSU 3 Road construction:

- No new road construction across TSU 3 unless field reviewed and approved by a California Registered Geologist unless it is the best road alternative³.

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 trails⁴.

TSU 3 Skid Trail Construction or Reconstruction:

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

TSU 3 Timber Harvest:

- Retain 50% canopy (see footnote 1, page H-2) 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 Registered Geologist.

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

⁴ 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.

Causal Mechanism Report and Prescription #4

Resource Sensitive Area: Rockslides

Input Variable(s): Coarse and fine sediment from mass wasting.

Situation Sentence:

Rockslides are deep-seated landslides within the Hollow Tree WAU. These features can be active, dormant or have sections of the landslide active with other sections of the landslide dormant. Increases in sub-surface water from loss of evapo-transpiration or concentrated water from road drainage can activate or accelerate movement and sediment delivery from these features. The increased sediment delivery could contribute to adverse fish habitat by pool filling, increased channel scour, fine sediments smothering spawning gravel and loss of stream channel complexity.

Prescriptions:

The general location of rockslides is mapped in Map A-1 but final determination of the existence and/or activity will be determined by field observations.

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

Causal Mechanism Report and Prescription #5

Resource Sensitive Area: River Road (R Line)

Situation Sentence:

The River road (R line) is the main haul road in the Noyo WAU. The majority of truck and log haul traffic in the Noyo WAU passes across some portion of this road. The high amount of truck and log haul traffic makes this road particularly vulnerable to fine sediment production due to continual break down of the road surface. The R line has areas of long watercourse contributing road lengths that increase the amount of fine sediment delivery. The R line has many areas without a rock surface (native surface) that makes the road surface a fine sediment source. Isolated areas of the R line are within the Aquatic Management Zone (AMZ) of watercourses in the Noyo WAU. The R line crosses numerous other watercourses on its route through the Noyo WAU. The fine sediments delivered to the watercourse could be deleterious to fish spawning habitat or create high turbidity. High fine sediment levels can degrade fish spawning habitat by creating less permeable egg pockets and reducing egg emergence survival. High turbidity during storm flows can affect fish physiology, reduce feeding or in the worst cases increase mortality.

Prescriptions:

The long un-drained road tread approaches to watercourse crossings on this road section will be treated with one or a combination of several of these options:

- 1) Ditch relief culverts can be installed to drain water and sediments concentrated in inside ditches. The ditch relief culverts would be placed such that the majority of long un-drained tread approaches to watercourse crossings of the road would be relieved prior to the watercourse crossing. The discharges of water and sediment from the ditch relief culverts would drain on to the adjacent hillslope such that no additional erosion would occur.
- 2) Rocked rolling dips or rolling dips can be installed in the road prism. The rolling dips would be placed such that the majority of long un-drained tread approaches to watercourse crossings of the road would be relieved prior to the watercourse crossing. The discharges of water and sediment from the rolling dips would drain on to the adjacent hillslope such that no additional erosion would occur.
- 3) Long tread approaches to watercourse crossings can have the road prism re-shaped such that the tread is outsloped toward its outside edge. This out-sloped road would be done so that it allows continuous drainage of the road surface away from the watercourse crossings.

Treatment of native surface segments:

- The segment of the River road from the bridge crossing at the Noyo River, adjacent to the confluence with Redwood Creek, to Camp Four area will be a high priority for receiving a rock surface.
- The segment of the River road from the Hunter's Camp, adjacent to the confluence of Hayworth Creek and North Fork Noyo, to the intersection with the W road by the Middle Fork of the North Fork Noyo will be a medium priority for receiving a rock surface.
- The segment of the River road from the Camp Four to the Hunter's Camp will be a low priority for receiving a rock surface.

The entire River road should receive a high level of attention, maintenance and monitoring.

Causal Mechanism Report and Prescription #6

Resource Sensitive Area: High and Moderate Road Surface Erosion Hazard Rating Roads

Situation Sentence:

The majority of roads in the Noyo WAU are of moderate road surface erosion hazard, with a few roads with high erosion hazard ratings. The erosion hazard ratings suggest the likelihood and amount of future sediment delivery to be delivered from a road. The high erosion hazard roads would be considered the greatest risk, with the moderate erosion hazard roads next.

These roads commonly have areas of long un-drained road lengths, unstable fill or are directly adjacent to watercourses. These roads can create surface or point source erosion contributing both fine and coarse sediment deliveries to watercourses. If the frequency and amount of erosion is increased from management actions this can contribute to poor rearing habitat, high turbidity or decreased spawning habitat quality.

Prescriptions:

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.

Causal Mechanism Report and Prescription #7

Resource Sensitive Area: High treatment immediacy with high or moderate sediment delivery potential sites on roads in the Noyo WAU.

Input Variable and Process: Coarse and fine sediment from controllable road erosion

Situation Sentence:

Individual culverts, bridges, landings and road erosion sites were inventoried and ranked based on their priority for treatment and relative degree of likelihood of sediment delivery. In the Noyo WAU 43 sites were identified as having high treatment immediacy along with at least a moderate potential of future sediment delivery. These 43 sites are those sites with potential controllable erosion that are in need of immediate action or maintenance. All have a significant concern for a large discrete input of coarse and fine sediment to watercourses. The fine and coarse sediments delivered to the watercourse could be deleterious to fish spawning habitat, fish rearing habitat or create high turbidity. Changes to fish habitat from high sediment levels can be created by pool filling, increased channel scour, fine sediments smothering spawning gravels and loss of stream channel complexity.

Prescriptions:

These 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.

Causal Mechanism Report and Prescription #8

Resource Sensitive Area: Moderate treatment immediacy with high or moderate sediment delivery potential sites on roads in the Noyo WAU.

Input Variable and Process: Coarse and fine sediment from controllable road erosion

Situation Sentence:

Individual culverts, bridges, landings and road erosion sites were inventoried and ranked based on their priority for treatment and relative degree of likelihood of sediment delivery. In the Noyo WAU 123 sites were identified as having moderate treatment immediacy along with at least a moderate potential of future sediment delivery. These 123 sites are those sites with potential controllable erosion that are in need of action or maintenance in the near future. All have a concern for a large discrete input of coarse and fine sediment to watercourses. The fine and coarse sediments delivered to the watercourse could be deleterious to fish spawning habitat, fish rearing habitat or create high turbidity. Changes to fish habitat from high sediment levels can be created by pool filling, increased channel scour, fine sediments smothering spawning gravels and loss of stream channel complexity.

Prescriptions:

These 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. 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. It is very likely that moderate treatment immediacy sites will be addressed when in close proximity to high treatment immediacy sites.

Causal Mechanism Report and Prescription #9

Resource Sensitive Area: Diversion potential sites along roads in the Noyo WAU.

Input Variable and Process: Coarse and fine sediment from potential road erosion sites due to water diversion potential

Situation Sentence:

When roads cross watercourses the resulting crossing structure (culvert or bridge) has a potential to fail. When the crossing fails the watercourse has potential to either stay within the “natural” channel or be diverted away from the channel. Typically a diversion away from a “natural” channel in a failed crossing is due to low areas adjacent to the crossing that allows water to be routed either down the road surface or through fill material. This potential for diversion of water if a crossing failed can be a secondary erosion process that can create significant sediment inputs, sometimes greater than the actual crossing failure itself. This water diversion potential is an important concern to correct on roads. Within the Noyo WAU 157 sites have been identified as having a water diversion potential. Excess sediment inputs from road related erosion can be delivered to a watercourse and could be deleterious to fish spawning habitat, fish rearing habitat or create high turbidity. Changes to fish habitat from high sediment levels can be created by pool filling, increased channel scour, fine sediments smothering spawning gravels and loss of stream channel complexity.

Prescriptions:

These diversion potential sites will be a high priority for correction. 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. It is very likely that these sites will be addressed when in close proximity to high treatment immediacy sites.

Causal Mechanism Report and Prescription #10

Resource Sensitive Area: Aquatic management zone (AMZ) (also known as WLPZ) roads in the Noyo WAU.

Sections of road of: K-022-03, J-024, L-034, R-043, R-043-01, R, R-103, R-101, R-112, N-032-02, M, M-013, M-014, Z-001, Z-002, B, B-031, B-033, A, A-002, H, H-002, G, G-012, G-013, G-015, G-022, W-001, W-041, E, E-002, E-002-01, E-002-01-02, P-002-02-02

Situation Sentence:

AMZ roads are road within the Noyo WAU's defined AMZ boundaries for Class I and II watercourses. These roads are directly adjacent to or in close proximity to watercourses. Because the roads are in such close proximity to watercourses surface erosion and cut and fill slope failures from this road often deliver sediment directly to the watercourse. The fine and coarse sediments delivered to the watercourse could be deleterious to fish spawning habitat, fish rearing habitat or create high turbidity. Changes to fish habitat from high sediment levels can be created by pool filling, increased channel scour, fine sediments smothering spawning gravels and loss of stream channel complexity.

Prescriptions:

Road surface and prism treatment and road management:

- Seasonal roads (gets used annually) in the AMZ will have the surface of new road construction or re-opened existing roads armored with, at a minimum, a 6 inch rock layer.
- Temporary roads (roads only used periodically, every few years or decades) in AMZ will have maintenance free road drainage prior to the winter period and the surface stabilized with grass seed, mulch or other cover product.

Causal Mechanism Report and Prescription #11

Resource Sensitive Area: Aquatic Management Zone (AMZ)

Input Variable(s): Large woody debris recruitment

Situation Sentence:

Large woody debris (LWD) is an important component of stream habitat. Large woody debris provides sediment storage in channels, creates areas of scour for pool creation, provides cover for fish habitat and adds channel roughness for habitat complexity. Historic forest management practices did not require watercourse protection measures like current California Forest Practice Rules mandate. Historic removal of LWD from the Noyo WAU has created a deficiency of LWD available for fish habitat and stream channel diversity. Historic harvesting practices have removed many of the large conifer trees which provide the current and future large woody debris recruitment needed in these areas.

This watershed analysis has presented, by stream segment, the instream LWD demand based on riparian stand recruitment potential and instream LWD conditions. The majority of streams in the Noyo WAU have a high LWD demand, suggesting lack of LWD and short term LWD recruitment potential

Prescriptions:

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.

Causal Mechanism Report and Prescription #12

Resource Sensitive Area: Aquatic Management Zone, low and moderate canopy closure areas

Input Variable(s): Canopy closure and stream temperature

Situation Sentence:

Stream temperatures in the Noyo WAU are near the maximum mean weekly average temperature (MWAT) suggested for salmonids. The Mendocino Redwood Company property in the Noyo River is toward the eastern side of the Coast Range. The farther east from the cooling effect of the Pacific Ocean the higher the air and water temperatures become, so high stream temperatures might be expected. Some of the streams in the Noyo WAU do have low stream canopy cover. Solar exposure, due to lack of stream shade is a primary reason for increased water temperatures of rivers and streams. High water temperature from lack of shade can be deleterious and even fatal to many fish and aquatic species and warrant concern.

Prescriptions:

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 conducted to determine if this is correct.

Areas with low canopy in the Noyo WAU will have the following considerations:

- Restoration harvest within the AMZ will not remove trees providing effective shade.
- Stream temperatures will be monitored to determine if temperatures fluctuate over time.
- Tree planting should be considered in streamside areas with low tree density of future canopy potential for shading a watercourse.

Literature Cited

Weaver, W. and D. Hagans. 1994. Handbook for forest and ranch roads, a guide to planning , designing, constructing, reconstructing, maintaining and closing wildland roads. Prepared for: The Mendocino Resource Conservation District, Ukiah, CA.