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January 12, 2008

Ms. Leslie Markham
California Department of Forestry and Fire Protection
135 Ridgeway Ave.
Santa Rosa, CA 95401

Re: THP 1-08-116 MEN

Dear Ms. Markham:

I have reviewed the application for Timber Harvest Permit (THP) 1-08-116 MEN on behalf of the Sierra Club Redwood Chapter, Mendocino Group. I am thoroughly familiar with the Noyo River watershed because I helped assemble a comprehensive fisheries, watershed and water quality database for the California Department of Forestry (CDF), which I will explain further below. I have read or reviewed the THP and its many sections, the consulting geologist's report (Best 2007), agency staff reports and comments (CDFG 2008, NCRWQCB 2008), responses of the Registered Professional Forester (RPF) and the submission or Attorney Paul Carroll (2008). My comments focus on the impacts of this timber harvest and the survival of coho salmon (Oncorhynchus kisutch), which is listed under both the federal Endangered Species Act (ESA) and under the California Endangered Species Act (CESA). In fact, coho salmon in the project area are in "Jeopardy" of extinction (CDFG 2008a) and this project adds to the risk of local extirpation of coho or "take."

After acknowledging that the coho salmon are a listed species and present downstream of the site, THP 01-08-116 MEN provides no substantive information on their status and trends in the region (CDFG 2002, Good et al. 2005). The THP cites the *Noyo TMDL* (U.S. EPA 1999) and acknowledges sediment and temperature pollution in the basin, but never deals with how project impacts will add to them. The THP repeatedly claims that proposed mitigations completely prevent off-site and downstream problems, when in fact these mitigations have been shown to be insufficient in preventing cumulative effects in highly disturbed watersheds like the Noyo River basin (Ligon et al, 1999; Dunne et al., 2001; Collison et al., 2003). Major issues, such as changes in hydrology associated with the THP go completely unrecognized. Only the California Department of Fish and Game (CDFG 2008) staff shows an understanding of the watershed context and potential impacts of the project.

My Qualifications

I have been a consulting fisheries biologist with an office in Arcata, California since 1989 and my specialty is salmon and steelhead restoration. I authored fisheries elements for several large northern California fisheries and watershed restoration plans (Kier Associates 1991, Pacific Watershed Associates 1994, Mendocino Resource Conservation District 1992) and co-authored the northwestern California status review of Pacific salmon species on behalf of the American Fisheries Society (Higgins et al. 1992). Since 1994 I have been working on a regional fisheries, water quality and watershed information database system, known as the Klamath Resource Information System or KRIS (www.krisweb.com). This custom program was originally devised to track restoration success in the Klamath and Trinity River basins, but has been applied to another dozen watersheds in northwestern

California. The California Department of Forestry (CDF) funded KRIS projects in six northern California watersheds as part of the North Coast Watershed Assessment Planning effort, including the Noyo River Basin (IFR 1999). I draw extensively on information in KRIS Noyo River below and all data is available on-line, including metadata.

Over the past 15 years I have reviewed dozens of timber harvest plans for private clients in the redwood region from Santa Cruz to Del Norte County. Relevant publications related to timber harvest and impacts on salmon and steelhead populations include my review of the Simpson Timber HCP (Higgins, 2002), a dissenting report on the *Pacific Lumber Company Freshwater Creek Watershed Analysis* (Higgins, 2001), and my comments on the Jackson Demonstration State Forest (JDSF) *Draft Management Plan* (Higgins, 2006). I attach the latter as Appendix A because JDSF is partially within the Noyo River basin and my comments provide useful additional background information on Noyo River cumulative watershed impacts.

Status of Coho Salmon in the Noyo River Basin and the Central California Coast ESU

CDFG (2008) verifies coho salmon presence 2000 feet downstream from the lower project boundary in the mainstem Noyo River as recently as 2003, but THP 01-08-116 MEN has only text book type information on life history requirements, run timing and habitat preferences of coho and other Pacific salmon species. Discussion of status and trends of Noyo River native populations of coho, steelhead or Chinook are wholly lacking. Under the section on whether there will be impacts to species at risk of extinction, the THP (p 36) application makes the following declaration regarding coho salmon:

> "The 'Central California Coast' Coho salmon, which is known to occur in the Noyo River watershed, is listed by both the National Oceanic and Atmospheric Administration (NOAA) and by the State as Endangered. A on-site preconsultation regarding Coho was conducted with the plan submitter, the RPF and DFG representatives on March 25, 2008. Protective measures for Coho salmon and other aquatic wildlife species have been incorporated into the silvicultural methods in Item #14, soil stabilization measures in Item #18, watercourse protection measures included in Item #26, and other provisions of the THP.

The measures listed as protective of coho actually are only those to lessen on-site impacts and will not stop contributions to cumulative watershed effects (Dunne et al. 2001, Collison et al. 2003). NMFS (1996) listed coho salmon from Santa Cruz to Punta Gorda as Threatened under the federal Endangered Species Act (ESA) and more recently upgraded their risk level to Endangered (Good et al., 2005). This population group is referred to as the Central California Coast (CCC) Evolutionarily Significant Unit (ESU) and it consists of a number of populations, such as the Noyo River coho salmon. Coho salmon were subsequently listed by the California Fish and Game Commission in 2004 under the California Endangered Species Act (CESA) as Endangered. According to the National Marine Fisheries Service (1996, 1999, Good et al. 2005), Noyo River steelhead (Oncorhynchus mykiss) are also grouped in the same CCC ESU, while (Oncorhynchus tshawyscha) salmon group with the California Coast ESU that extends south of the Klamath River. The status of both is Threatened.

Brown et al. (1994) noted that populations of coho salmon in California were at less than 5% of historic levels and that there were only seven streams with adult returns numbering in the hundreds. The RPF and those preparing the application for THP 01-08-116 MEN seem unaware that the Noyo River is one of the last rivers in northwestern California with an annual run numbering in the hundreds (Brown and Moyle 1994)(Figure 1). If these last populations are lost, then the coho recovery will not be possible. The THP also fails to reference critical information from recent coho salmon status reviews.

Figure 1. The map above shows the last populations of coho salmon in the hundreds in all of northwestern California, according Brown et al. (1994), one of which is the Noyo River population

The NMFS (2001) status review California coho salmon found that:

> "The Central California Coast ESU is presently in danger of extinction. The condition of coho salmon populations in this ESU is worse than indicated by previous reviews."

California Department of Fish and Game (CDFG, 2002):

> "Small population size along with large-scale fragmentation and collapse of range observed in data for this area indicate that metapopulation structure may be severely compromised and remaining populations may face greatly increased threats of extinction because of it. Populations in the Central Coast Coho ESU are in serious danger of extinction throughout all or a significant portion of their range."

Presence and absence of coho salmon in the CCC ESU based on CDFG surveys in the years 2000-2002 show that distribution of coho salmon is shrinking, with many smaller populations in Mendocino and Sonoma County extirpated (Figure 2). Figure 3 shows presence and absence patterns for the upper Noyo River and the region from 1988-1999 based on all available sampling data (Figure 2).

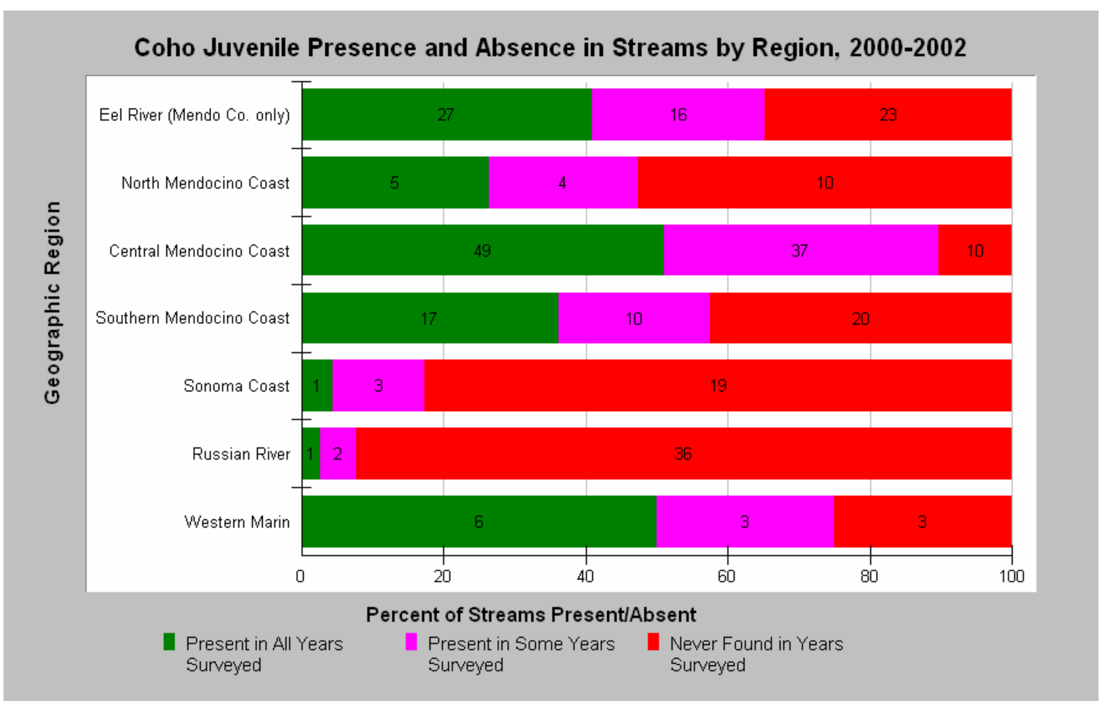

Figure 2. This chart shows a summary of the presence/absence of coho salmon juveniles in streams examined by CDFG in the years 2000-2002. The numbers shown on the chart bars indicate the number of streams in each region in which surveys always, never, or sometimes found coho.

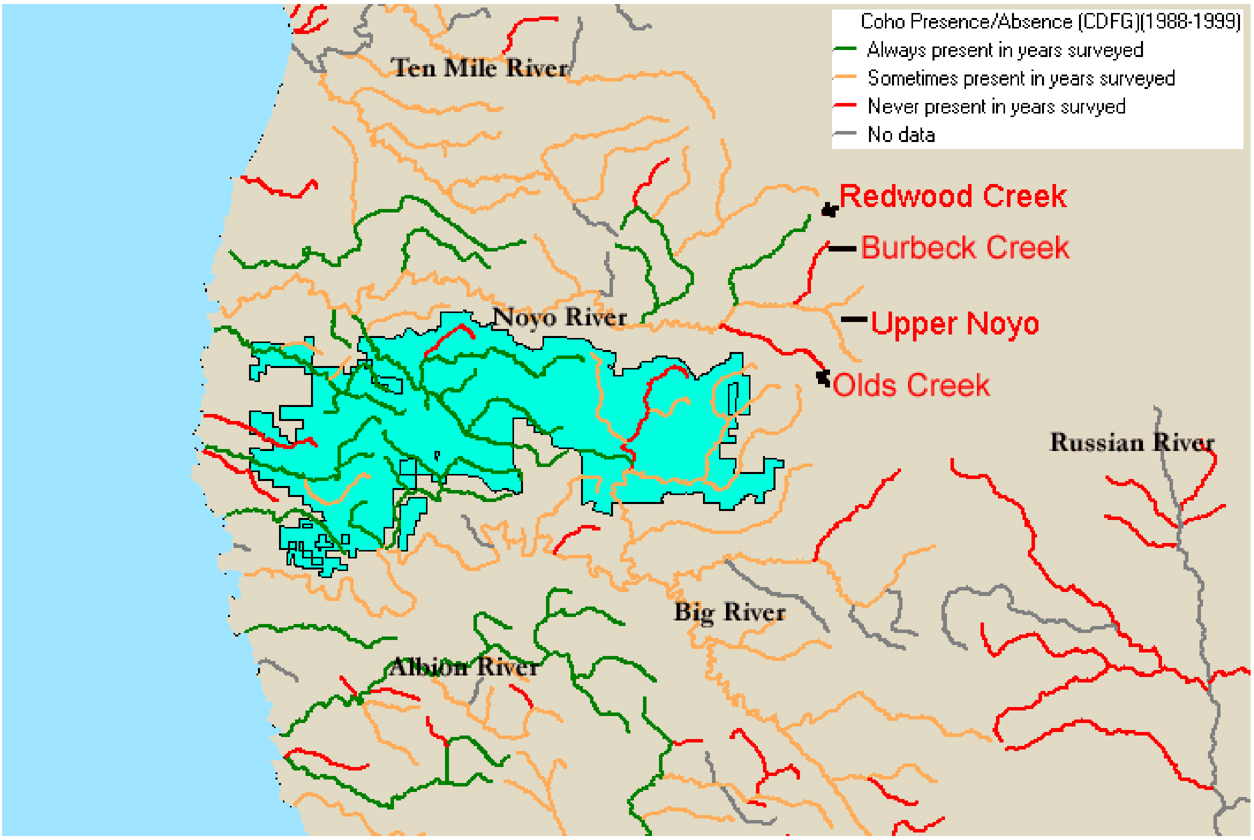

Figure 3. All survey data were pooled to study presence and absence of coho salmon between 1988 and 1999. Only Redwood Creek in the upper Noyo River area had coho salmon in all surveys, while coho were never found in Olds Creek and only in some years in Burbeck Creek and the upper Noyo. Data from KRIS Navarro Maps.

Many streams within Jackson Demonstration State Forest (JDSF) stand out as having coho every year, but those in the Upper Noyo River do not. The pattern of absence in Olds Creek and intermittent presence in the upper mainstem Noyo and adjacent Burbeck Creek show that year classes of coho salmon are missing, which means that the local population meets the criteria for jeopardy under CESA. CDFG (2008a) in the Draft Scott River Incidental Take Permit defined jeopardy as “the probable extirpation of any coho salmon cohort” and the absence of coho in many years shows cohorts that have been or on the verge of being lost. The more consistent presence in JDSF reflects better forest health due to lower rates of disturbance (Reeves et al 1995). Conversely, Upper Noyo populations are being lost because continuing waves of land use, such as THP 1-08-116 MEN, are not allowing channel recovery (Reeves et al. 1995, Frissell 1992).

Many Upper Noyo River tributaries were dominated by coho salmon when old growth forests provided shade, a cool microclimate over the stream, large wood and clean water. When CDFG (1966) seined Olds Creek before complete channel disruption related to logging, they found a fish community dominated by coho salmon juveniles, with steelhead present at only half their abundance (Figure 4). The CDFG (1966) memo also noted that "Olds Creek is an extremely important spawning ground for silver salmon and steelhead in the Noyo River system, the salmon being significantly more numerous than the steelhead." As noted above, coho have been absent from Olds Creek in recent decades. Upper Noyo River electrofishing data from all Mendocino Redwood Company (MRC) sample sites from 1994 is displayed in Figure 5 and shows that steelhead were the dominant Pacific salmon species and coho present at remnant levels, likely in upper Redwood Creek.

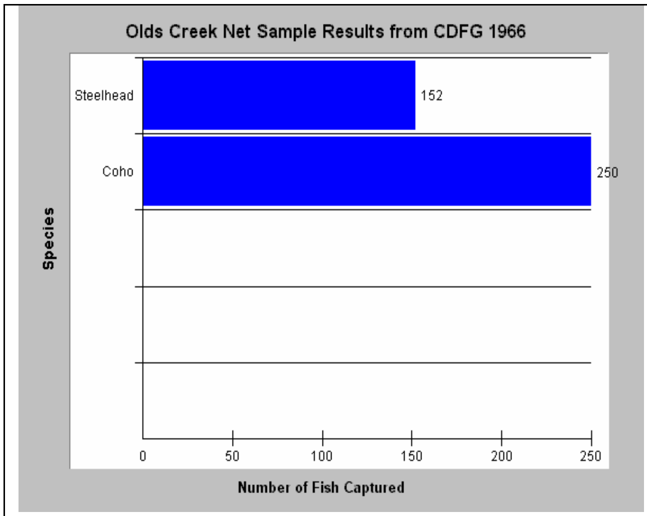

Figure 4. CDFG sampled Olds Creek on August 8, 1966 and netted 250 coho salmon juveniles and 152 steelhead trout. No other fish species were captured. From KRIS Noyo.

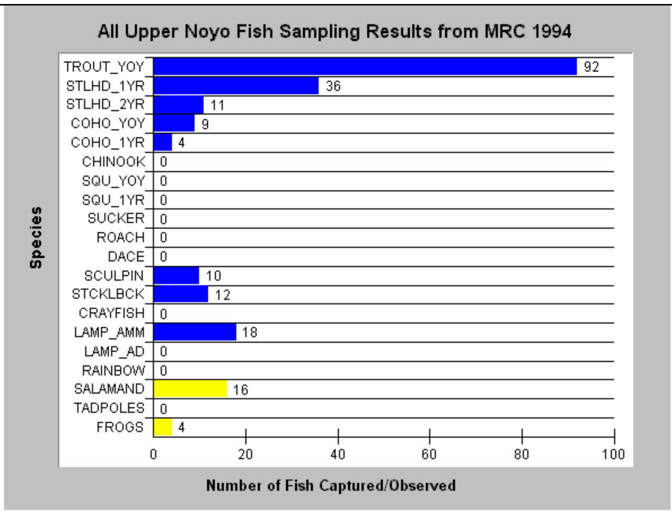

Figure 5. MRC electrofishing samples for all their Upper Noyo River basin monitoring stations indicate a community dominated by steelhead and coho present only at low levels in 1994. From KRIS Noyo.

The fragmentation of coho salmon distribution in the Upper Noyo River basin could cause a loss of diversity represented by interior populations, which should be avoided. The consistent presence in Redwood Creek of coho salmon at very low levels from 2000-2002 is no guarantee that they will persist after a major stochastic event, such as large flood, especially given its intensive recent land use (see below). Consequently, Redwood Creek should receive priority for protection and recovery (Bradbury et al. 1995), but adjacent tributaries, such as Burbeck and the Upper Noyo River itself, need to be brought back on line as producing sub-units of the population (Reeves et al. 1995).

THP 01-08-116 MEN would substantially retard recovery of the upper mainstem Noyo River, and would thus increase the already high risk of extirpation of the interior Noyo River coho salmon population. If a spawning population is too small, the survival and production of eggs or offspring may suffer because it may be difficult for spawners to find mates, or predation pressure may be too great. This condition of low productivity accelerates a decline toward extinction (Williams et al. 2007). Negative population growth is likely occurring as a result of poor habitat conditions, with loss of eggs and alevin due to high flows and sediment transport in some years, and coho juveniles running out of cold water in others. NMFS (2008) characterizes the Russian River coho population a having entered an “extinction vortex”, where recovery may not be possible. It would be wise to take some conservation measures in the Noyo River basin so that it does not similarly fall to a level where it cannot be recovered.

THP 01-08-116 MEN also fails to mention that steelhead adult populations in the entire Noyo River basin have been estimated by CDFG as 300-400 adults (Gallagher at al. 2000). This indicates that steelhead carrying capacity has greatly diminished and is in fact down by an order of magnitude from the 6000 adult steelhead estimated by CDFG in the 1960s (Taylor 1978). Steelhead survival to adulthood requires 1-3 years of freshwater residence (Barnhart 1986), with larger older age fish requiring deep complex pools for summer rearing and winter shelter during high flows. The alteration of freshwater habitat that is negatively affecting coho salmon juveniles is also restricting survival of older age steelhead juveniles, which is the bottleneck on recruitment. Elevated fine sediment transport from THP 01-08-116 MEN is also expected to decrease spawning success of Chinook salmon in the lower mainstem Noyo River. Thus, the THP will diminish survival of all listed Pacific salmon species, not just coho salmon.

Suitability of Noyo River Aquatic Habitat and Watershed Conditions for Coho Salmon

While THP 01-08-116 MEN argues that there is plenty of habitat for coho salmon in the Upper Noyo River basin, almost all data presented shows that habitat is compromised and mostly unsuitable for them. The THP application provides the following:

> "Coho are known to exist in the Noyo River, and have been documented just downstream of the plan area and up Burbeck Creek. Habitat exists within the plan area along the Class I watercourse. The watercourse protection measures stated in the plan are sufficient to protect the habitat for this species. Given the WLPZ protection measures, operations proposed as part of the THP will not result in significant adverse impacts to the Coho salmon."

The discussion below will visit different aspects of aquatic habitat quality and watershed conditions with regard to whether or not they are in "properly functioning condition" (NMFS 1996) for coho salmon.

Aquatic Habitat

<u>Pool Frequency</u>: The THP 01-08-116 MEN application cites a 1997 Georgia Pacific (GP) habitat typing report that found 35% pool frequency by length in the Upper Noyo River. This survey is more than a decade old and data may not reflect current conditions, but the data reflects impairment. Studies of Pacific Northwest undisturbed streams in old growth conifer forests find pool frequencies ranging from 37-67% (Murphy et al 1984) to as high as 80% (Grett 1985). Therefore, the 35% pool frequency is likely a substantial reduction from historic conditions. Reeves et al. (1993) found pools diminished by 10-47% in Oregon watersheds with high levels of timber harvest (>25% in 30 years) and that Pacific salmon species diversity diminished. CDFG (2008) notes problems with "habitat simplification and filling of pools from channel aggradation" both above and below the project site. Coho salmon require pools for rearing, and prefer those formed around large wood and deeper than three feet (Reeves et al. 1988). This type of pool is rare in the mainstem Upper Noyo, where as before disturbance such features would have been common. THP 01-08-116 MEN will contribute sediment and fill remaining pools instead of allowing channel recovery. The same pattern of cumulative effects from logging is known to have lead to reduction in pool frequency and depth and loss or reduction of coho salmon in other nearby basins (see Cumulative Watershed Effects).

<u>Embeddedness</u>: This is a measure of the degree to which spawning gravels are partially buried by fine sediment. Less than 25% is rated as suitable for salmonid spawning (CDFG 2004) and other classes of embeddedness recognized in habitat typing reports are 25-50%, 50-75% and greater than 75%. Although quantitative measures of sediment such as bulk gravel samples (McNeil and Ahnell 1964) or pool volume measurements (Hilton and Lisle 1993) are more quantitative, embeddedness is a tool for understanding sediment impacts to salmonids. Figure 6 is taken from the JDSF (2005) Draft Management Plan and shows embeddedness ratings from an Ecosystem Management Decision Support (EMDS) model that shows suitable conditions for salmonid spawning (dark green = <25%) only in one tributary of Olds Creek. The entire mainstem of the Noyo River, up to and including the channel adjacent to and within the project site, has the highest embeddedness score, indicating very adverse conditions for spawning coho salmon, Chinook salmon and steelhead. The obvious potential for increases in fine sediment from operation of heavy equipment on earthflows and in wetlands and effects on embeddedness and coho salmon just downstream are not discussed in THP 01-08-116 MEN.

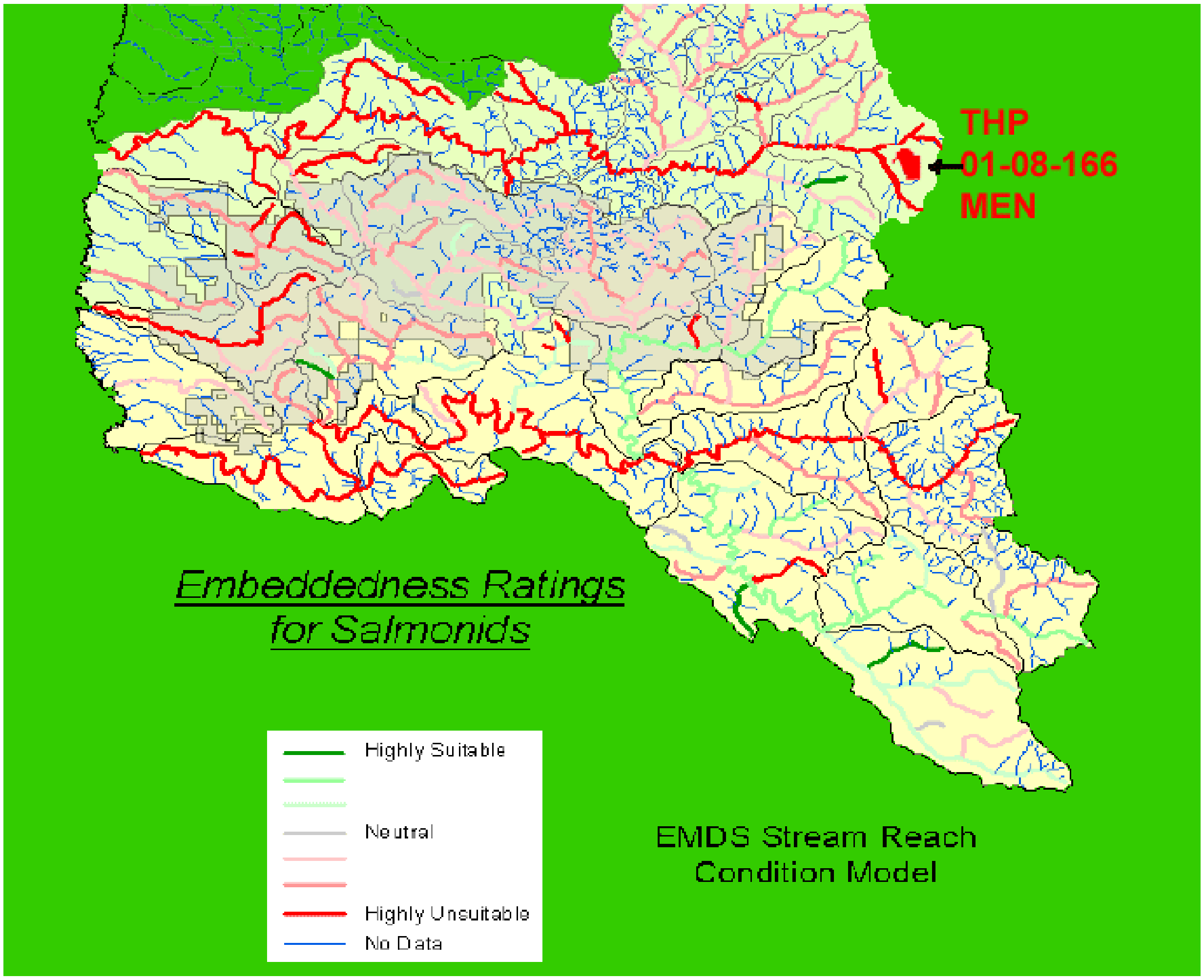

Figure 6. EMDS model output showing impaired spawning gravel conditions based on embeddedness data from CDFG habitat typing. From JDSF Draft Management Plan (2005).

Embeddedness also may restrict intra-gravel water flow and surface and groundwater connections as described by the *Draft Rogue River TMDL* (ODEQ 2008):

> "In the absence of human disturbance, many low elevation streams were likely warmer at times than is optimal for salmonids which may not have occupied these waters during the peak heat of the summer period. Channel complexity, cool water inflows, and hyporheic exchange are thought to provide local but important thermal refuges in these inhospitable environments during the warmest months of the year."

This aptly describes the Upper Noyo River, with its Central Franciscan Terrain grassy knobs and natural tendency to warm. Thus, sediment coming from THP 01-08-116 MEN will not only contribute to degraded spawning conditions but also thermal pollution through blocking hyporheic connections.

Large Woody Debris (LWD): THP 01-08-116 MEN has a lot of information on the role of large wood debris (LWD), including its role in forcing the formation of pools that are ideal habitat for coho salmon (Reeves et al. 1988). Despite admission that LWD is in short supply in stream channels on and near the project, large conifers that could otherwise recruit to stream channels are slated for harvest (see Riparian Conditions). Pool and Berman (2000) point out that large wood that falls into streams can force down-welling connections between surface and groundwater, thus, sometimes providing a cooling influence. Therefore, as THP 01-08-116 MEN reduces large wood recruitment it deprives the Upper Noyo and Claire Mill Creek of this additional avenue for cooling. The THP blames log jam removal projects in the 1960s for large wood depletion, but channel processes in highly disturbed watersheds like the Noyo River basin tend to flush large wood downstream and greatly reduce its availability (Frissell 1992, Reeves et al. 1993).

Channel Conditions: Elevated sediment transport and peak flow associated with intensive land management have caused the low pool frequency at the same time they have increased the stream's width to depth ratio. This facilitates warming and deprives fish the cover provided by depth as the channel fills in. Decreased median particle size (D50) associated with intensive land use and aggradation (Knapp 1993) leads to shifting bedload conditions that threaten egg and alevin survival (Nada and Frissell 1993). Shallow featureless pools in the mainstem offer little refuge or chance of winter survival for coho or steelhead juveniles, when the Noyo River is high and turbid for months during winter. Streamside roads and the railroad bed act as dikes constricting the Noyo River channel, increasing its velocity and reducing quiet side waters needed by coho salmon and older age steelhead trout for over-wintering. Cumulative effects from THP 01-08-116 MEN will contribute to continuing waves of disturbance that will not allow channel recovery (Reeves et al. 1995)(see Cumulative Effects).

Water Temperature: CDFG (2008) notes that water temperature below the proposed THP in the upper mainstem Noyo River was 17^{o} C MWAT in August 1998 and 18^{o} C maximum floating weekly average water (MWAT) in September 1998. Both values that are known to exceed tolerances for coho suitability (Welsh et al. 2001) and the maximum water temperatures in the mainstem downstream above the North Fork (Figure 7) exceed 20^{o} C (68^{o} F), which is stressful to all salmonids (McCullough 1999) and in the range known to retard steelhead growth (Sullivan et al. 2001). Due to its near stream tree removal and sediment discharge, THP 01-08-116 MEN will negatively effect water temperatures and coho salmon downstream in this reach that is already not meeting cold water beneficial uses.

Although the headwaters of the Noyo River may have tended to warm slightly due to headwater vegetation patterns in Central Belt Mélange Terrain, every tributary from the cool redwood forest would have cooled it as it approached the Pacific Ocean, which itself exerts a moderating influence on temperature. These tributaries are fed by groundwater that is 11 C (52 F), water transit time to the mainstem is brief and topographic shading reduces solar radiation. When huge ancient redwoods towered over these canyons, the ambient air temperatures over the stream probably had a substantial moderating influence. Temperature ranges would have been in the optimal scope for salmonids of 10-15 C before disturbance as they met the Noyo River. The MWAT of Redwood Creek (Figure 9) shows the profound change in temperature regimes associated with widespread timber harvest. Not surprisingly, the Noyo River remains too warm for coho from the project site to the mouth (Figure 10).

The U.S. Environmental Protection Agency (2003) points out the importance of protection of cold water sources when a large river is temperature impaired. Much more detailed water temperature data should be available in THP 1-08-116 MEN to help determine to what degree Clair Mill Creek might be providing a refugia in the upper Noyo River.

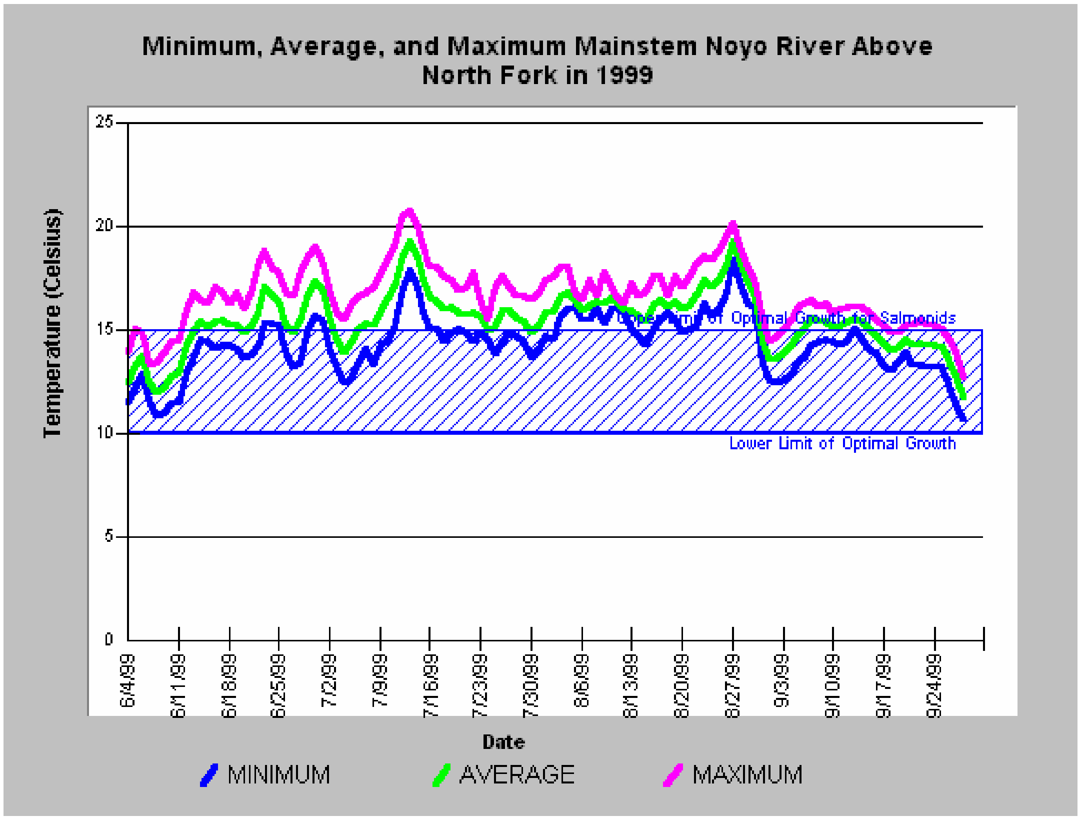

Figure 7. Maximum, average and minimum daily water temperatures show that the mainstem Noyo River above the North Fork remains above optimal salmonid temperatures even nocturnally, allowing for no recovery from temperature stress for species like coho salmon. Chart from KRIS Noyo.

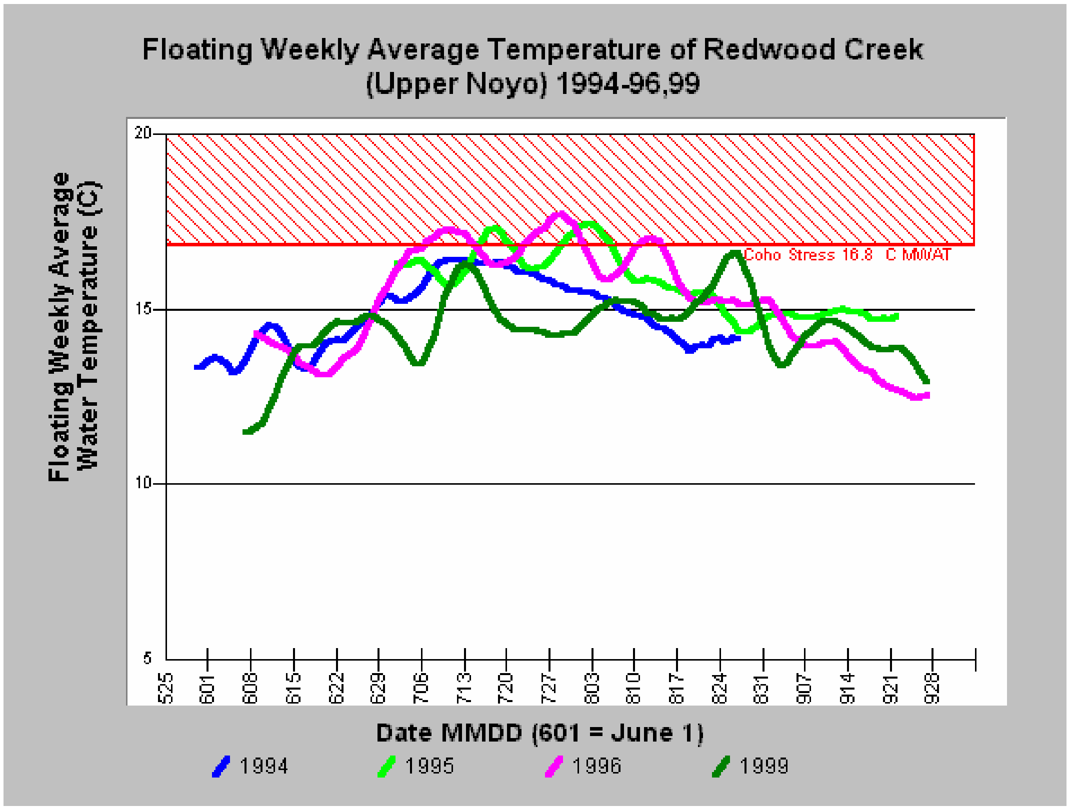

Figure 8. The maximum floating average water temperature (MWAT) of Redwood Creek at its convergence with the Noyo River for 1994,1995,1996 and 1999 shows that coho salmon suitability is exceeded in some years and but not in others. Reference of 16.8^{o} C MWAT suitability is from Welsh et al. (2001). Chart from KRIS Noyo.

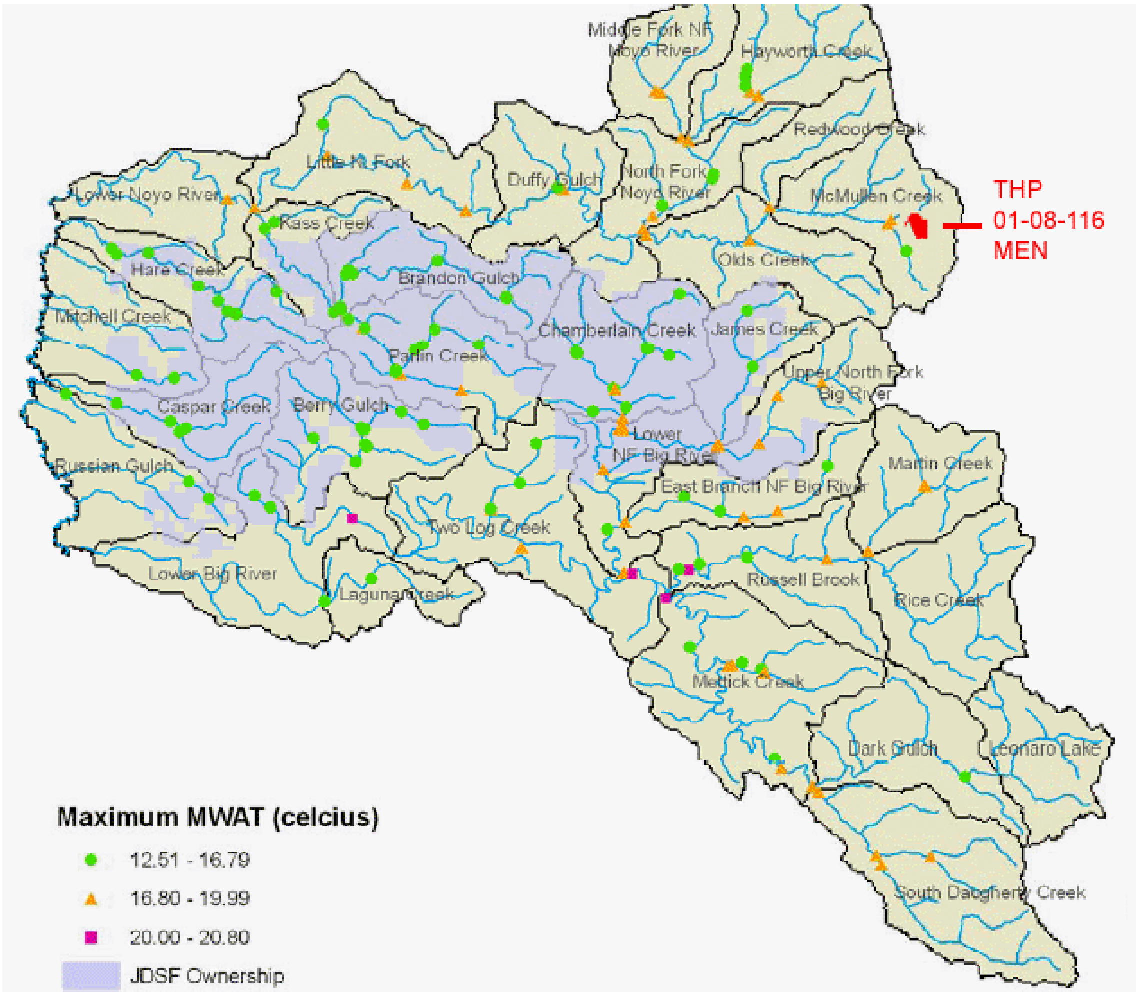

Figure 9. Maximum floating average water temperatures relative to coho suitability are shown here in map taken from JDSF (2005). Green dots are coho suitable and other symbols show non-functional temperatures.

The JDSF (2004) *Draft Management Plan* compendium of temperature data in Figure 9 shows a number of tributaries near the project site that were formerly coho salmon habitat but currently have unsuitable water temperatures, including Olds and Hayworth Creeks and lower North Fork, Middle Fork North Fork and upper mainstem Noyo River. Temperatures are also similarly elevated in the mainstem Big River and many of its tributaries. Water temperatures on JDSF, where forests are more mature, are predominantly coho suitable.

Riparian Conditions: THP 01-08-116 MEN does not discuss functional riparian distances generally recognized as protective of Pacific salmon species and instead continually refers to canopy. A functional riparian zone extends further from the stream than shade trees (FEMAT, 1993) and has several other important functions, such as large wood supply, temperature buffering and filtration of sediment or non-point source pollutants. Spence et al. (1996) recognized the distance equal to the potential height of riparian trees (one site potential tree height) as a minimum buffer for Pacific salmon streams, which they estimated as 200-220 feet in redwood forests. FEMAT (1993) extended that zone of influence to two site potential tree heights or to the top of any inner gorge areas on federal forest lands. The THP provides little data on real riparian health and instead notes that canopy in 1997 was 72% with 58% conifer with current "estimates" indicating it has increased to 90%. This amounts to opinion with no basis, is not quantitative or scientific and shows problems with lack of current data regarding habitat conditions in THP 01-08-116 MEN.

THP 01-08-116 MEN instead invokes the authority of the California Forest Practice Rules (FPR) for the right to harvest large riparian redwoods in Class II streams: “enforceable standards for shade canopy retention” require only that 50% of total canopy be left and the “residual over-story shall be composed of 25% conifers.” If only 50% canopy is retained and only 25% of that needs to be coniferous, therefore, only 12.5% of conifers may remain. The project applicant instead needs to meet CDFG’s (2008) requirement that no large redwoods be removed from Class II riparian zones because of the Department’s authority under CESA.

The THP application fails to give a proper assessment of riparian conditions despite many tools being available for analysis, such as classified Landsat imagery available from the USFS Spatial Analysis Lab in Sacramento (Warbington et al. 1998) and change scene detection using Landsat that compares ground cover in 1994 and 1998 (Fischer 2003). Figure 10 shows tree size classes in average diameter at breast height (dbh) for buffer strips that span 90 meters (297 feet) of each side of the stream center line or one site potential tree height at this location (FEMAT 1993). Giant trees (>50 “ dbh) would have dominated the Upper Noyo watershed but today there aren’t enough trees in this size class to register using the 1 hectare scale of Landsat anywhere nearby. The dark and medium dark greens of Very Large trees (40-50” dbh), Large (30-40” dbh) and Medium/Large (20-30” dbh) dominate the upper mainstem Noyo River riparian zone except in headwaters coming off prairies. However, the rest of riparian zones on the mainstem downstream, Olds Creek and portions of tributaries have extremely early seral conditions and even Non Forest (hot pink), which means that there are extensive areas of grass, bare soil or brush species that have colonized the riparian zone. Change scene detection (Fischer 2003) is overlain in Figure 10 to show where canopy changed in nearby tributaries in the North Fork Noyo River indicating extremely active riparian timber harvests from 1994-1998 (40-70% canopy loss = orange-red). These recent impacts to nearby riparian zones are exactly the cumulative effects that CEQA requires be examined, since THP 01-08-116 MEN will be also harvesting riparian trees.

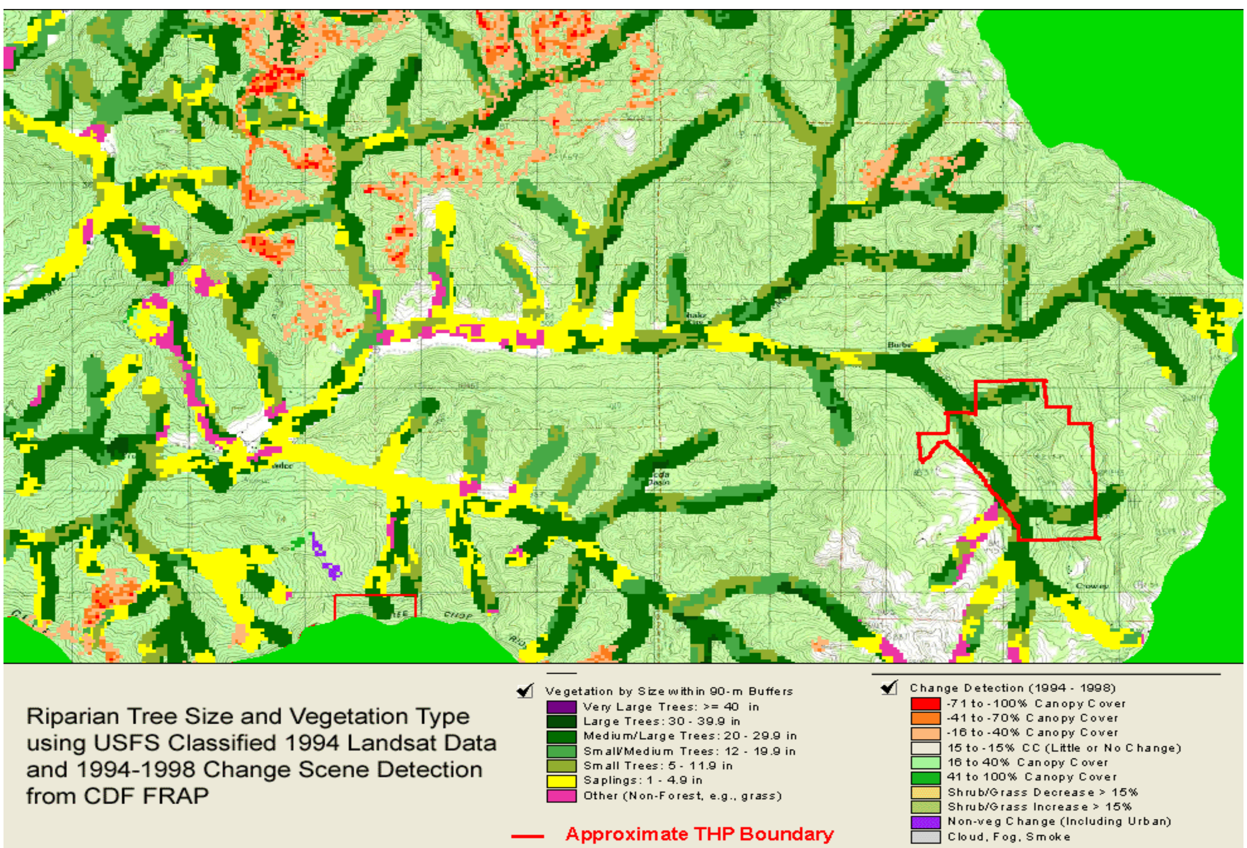

Figure 10. Vegetation and tree size based on 1994 Landsat is displayed for 90 m riparian buffer with 1994-1998 change scene detection also showing riparian logging. Data from USFS and CDF.

Keithley (1999) provides analysis of riparian and upland vegetation conditions for both the Big River and Noyo River basins (Figure 11). The entire McMullen Creek Calwater Planning Watershed, which includes the Upper Noyo River, has average tree diameters of 10-20 inches in uplands and similar tree size in riparian zones. This is more evidence of widespread riparian degradation on industrial timber lands that are contributing to stream warming and to loss of coho salmon.

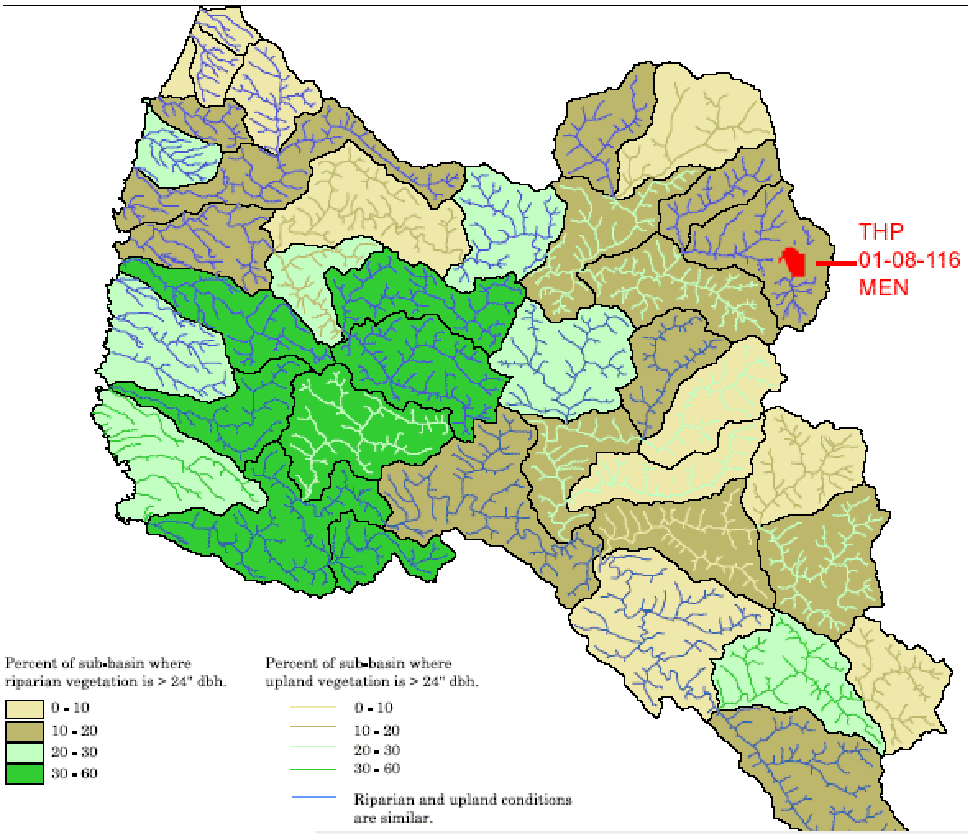

Figure 11. Average upland tree diameter is shown here with riparian tree diameter for the Noyo and Big River basins as calculated by CDF FRAP. Pre-disturbance diameters in these watersheds would have been >60". From Keithley (1999).

Upland Conditions

Noyo River watershed conditions far exceed prudent risk thresholds for disturbance related to road densities, near stream roads, road stream crossings and timber harvest. Each of the stresses or threats to coho salmon habitat act to degrade habitat individually, but synergistic effects cause downstream channel damage that is greater than the expected from each of the factors operating independently (see Cumulative Watershed Effects).

Road Densities: Graham Matthews and Associates (GMA 1999) performed the technical analysis for the Noyo River TMDL (U.S. EPA 1999) and found that road networks were a major contributor to sediment pollution. Roads can contribute sediment through chronic surface erosion, but mass wasting triggered by roads is a much greater source. Hagans et al. (1986) estimated that 50 to 80% of the sediment that enters northwestern California streams stems from road-related erosion. THP 01-08-116 MEN does not deal credibly with road related cumulative effects potential, with no mention of prudent risk limits on road density to maintain hydrologic integrity. Cedarholm et. al. (1981) found that road densities greater 4.2 miles of road per square mile (mi^2) of watershed yielded sediment levels 260% to 430% higher and increased fine sediment in salmon spawning gravels by 2.6 - 4.3 times over background levels. U.S. Forest Service (1996) studies in the interior Columbia River basin found that bull trout were not found in basins with road densities greater than 1.7 mi/mi2. They ranked the risk of road density of greater than 4.7 mi/mi^2 as extremely high (Figure 12). National Marine Fisheries

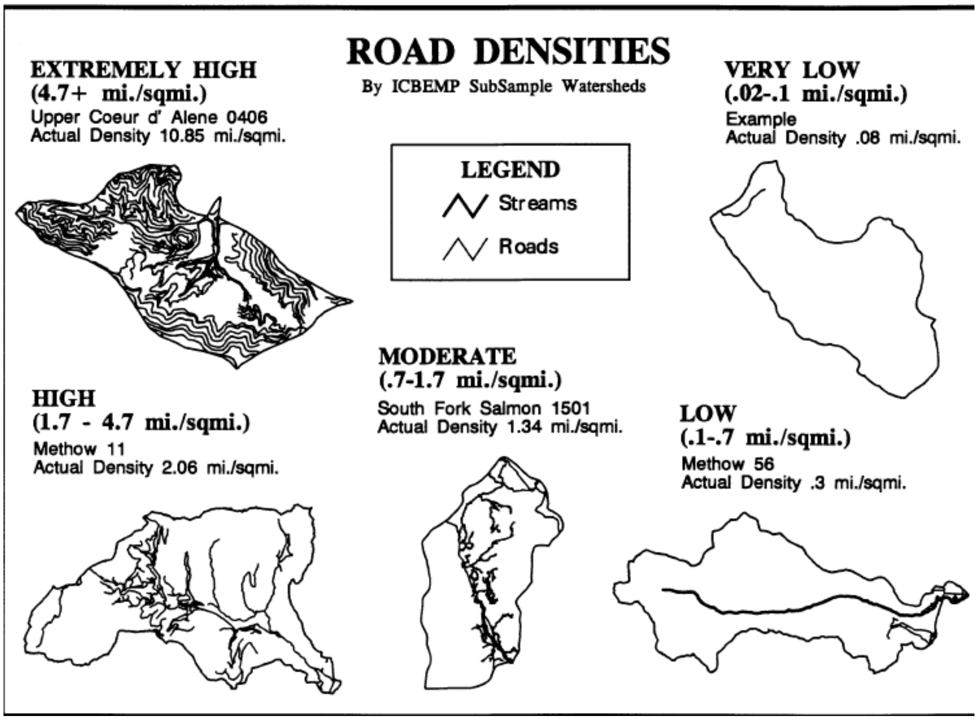

Figure 12. The USFS (1996) Interior Columbia River basin criterion for ecological and hydraulic risk from road densities is displayed here. The Noyo River watershed falls into the Extremely High category over all (6.78 mi/mi^2.) as do the Redwood Creek (7.5 mi/mi^2) and McMullen (5.1 mi/mi^2) Calwater Planning Watersheds. The THP is within the McMullen Calwater basin.

Service (1996) guidelines for salmon habitat characterize watersheds with road densities greater than 3 mi/mi^2 as "not properly functioning" while "properly functioning condition" was defined as less than or equal to 2 mi/mi^2 with no or few streamside roads. GMA (1999) found that all sub basins within the Noyo River watershed were over this level of impacts, with some road densities as high as 10 mi./mi. ^{2} (Figure 13). Ironically, the lower road density in the Upper Noyo River is likely because of the prevalence of earthflows. The overall road density for Noyo River watershed as a whole is extremely high with 6.71 mi./sq. mi.^{2} and that figure is very conservative because it does not include temporary haul roads and skid trails.

GMA (1999) digitized all roads from aerial photos chronicling construction over nearly 60 years (Figure 15) and found that road construction in the Noyo River basin has accelerated and that “seasonal (dirt) roads were 83.7% of the total, followed by rocked road at 13.2%, paved at 1.9%, and highway at 1.2%.” While the quality of road construction has improved substantially from earlier periods and the amount of mass wasting events triggered by them has decreased, the huge increase in unsurfaced road miles has lead to continuing elevation of sediment (Figure 16). This is similar to the findings of GMA (2001) in the Ten Mile River basin (see Cumulative Effects). THP 01-08-116 MEN involves new road construction, reactivation of streamside roads, and increasing road-stream crossings and all add to the likelihood of channel disturbance downstream and negative impacts to coho salmon. Jones and Grant (1996) point out that watershed hydrology can recovery rather quickly from timber effects, but that hydrologic perturbations from road networks can persist for decades. High road densities act to extend stream networks and intercept ground water flows (Jones and Grant, 1996), resulting in increased peak flows and decreased base flows (Montgomery and Buffington, 1993), factors ignored by THP 01-08-116 MEN (see Cumulative Watershed Effects).

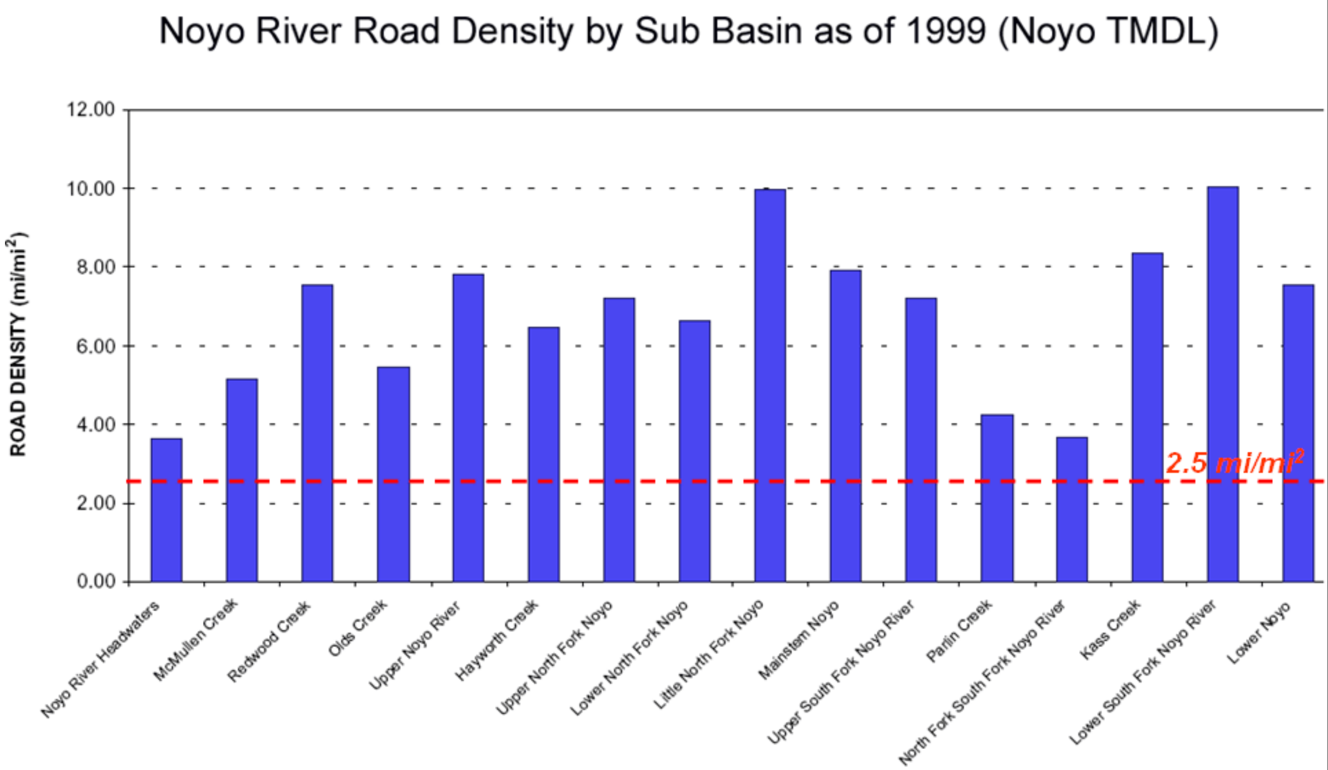

Figure 13. Road densities in various Noyo River watersheds as calculated by Graham Matthews & Associates (1999) and are over levels recommended for Properly Functioning watershed condition (2.5 mi/sq mi) for Pacific salmon (NMFS, 1996).

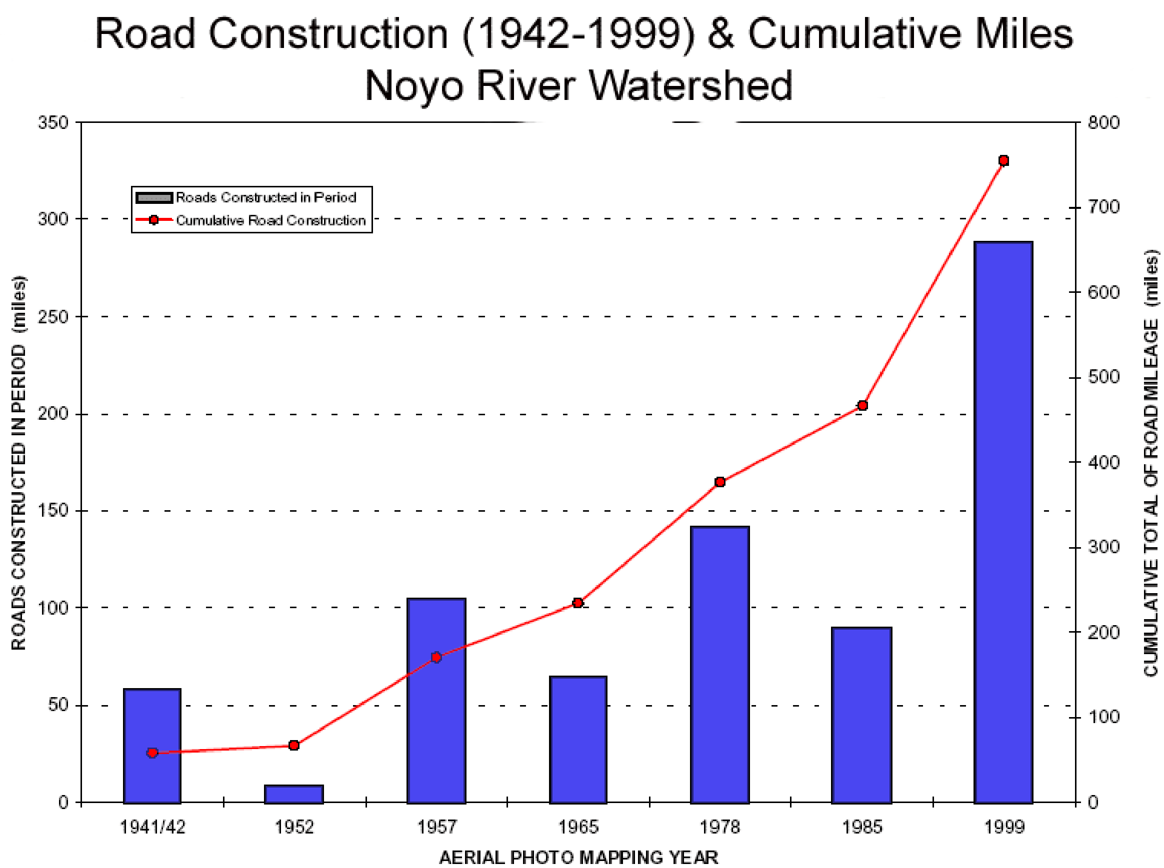

Figure 14. Road construction history of the Noyo River basin shows that the greatest increase in road construction in the last 60 years was between 1985 and 1999. The red line is the cumulative miles of road, which is over 750 miles.

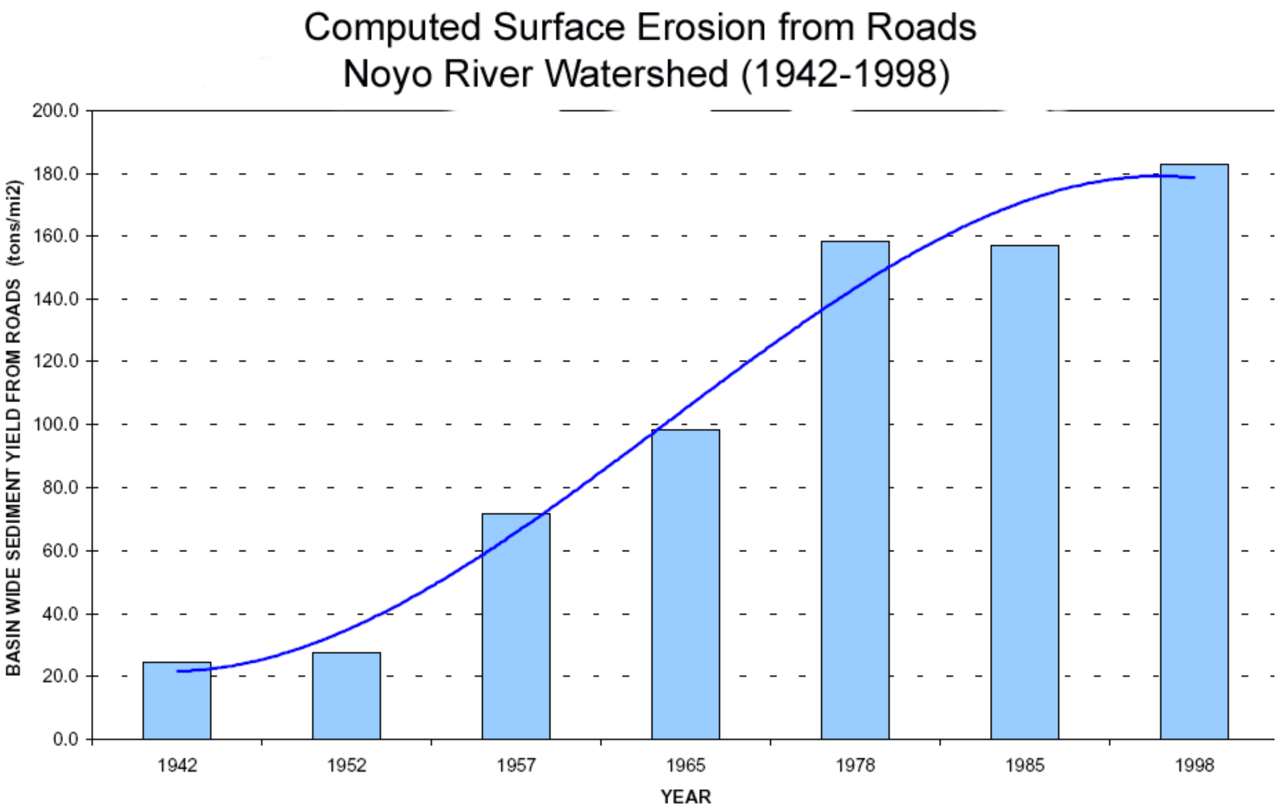

Figure 15. Surface erosion from Noyo River roads has increased over time and remains high according to GMA (1999).

<u>Near-Stream Roads and Road-Stream Crossings</u>: Roads constructed near streams are recognized as chronically contributing high amounts of fine sediment to streams (Cedarholm et al. 1981). These fines can infiltrate gravels and smother coho salmon eggs in the gravel and reduce the aquatic invertebrate production that is a major source of food for juvenile salmonids. THP 01-08-116 MEN calls for 8,086 feet of new road to be constructed or stream side road to be reactivated all across earthflow terrain. The hydrologic effects of this type of activity cannot be mitigated (see Hydrologic Change). CDFG (2008) points out that there will be 51 road-stream crossings either constructed or reactivated and some would remain permanently. Armentrout et al. (1999) point out that multiple high numbers of road crossings substantially elevate risk of sediment yield and recommend that road-stream crossings be reduced to two per mile or less. THP 01-08-166 MEN exceeds this levels and the new or reopened crossings substantially add to cumulative effects risk, especially in light of described gullying and increased erosion already extant at crossings that will be reactivated (CDFG 2008). An aerial photo of Redwood Creek not far downstream from the proposed project shows typical road layouts in the Noyo River basin with roads paralleling streams for much of their length (Figure 16). In order to recover riparian and hydrologic function to allow coho recovery, streamside roads in the Noyo River basin need to be decreased, not increased as will occur with this THP.

<u>Timber Harvest</u>: Timber harvest in more than 25% of the watershed area of Oregon Coastal basins in less than 30 years caused loss of aquatic habitat diversity and fish communities to become dominated by one Pacific salmon species (Reeves et al. 1993). The Noyo River basin has been timber harvested at a 75% rate since 1986 and the changes recognized by Reeves et al. (1993) are apparent in the Noyo River. Pool frequency and depth are low, large wood has been depleted, coho salmon have been virtually eliminated and the community is dominated by one salmonid species; steelhead. Figure 17 is from the JDSF (2004) Draft Management Plan and shows timber harvests between 1986 and 2004. JDSF has had a lesser rate of timber harvest than the Noyo River basin overall for most of that period, but harvests increased from 1994-1998 (Figure 18). This needs discussion in THP 01-08-116 MEN

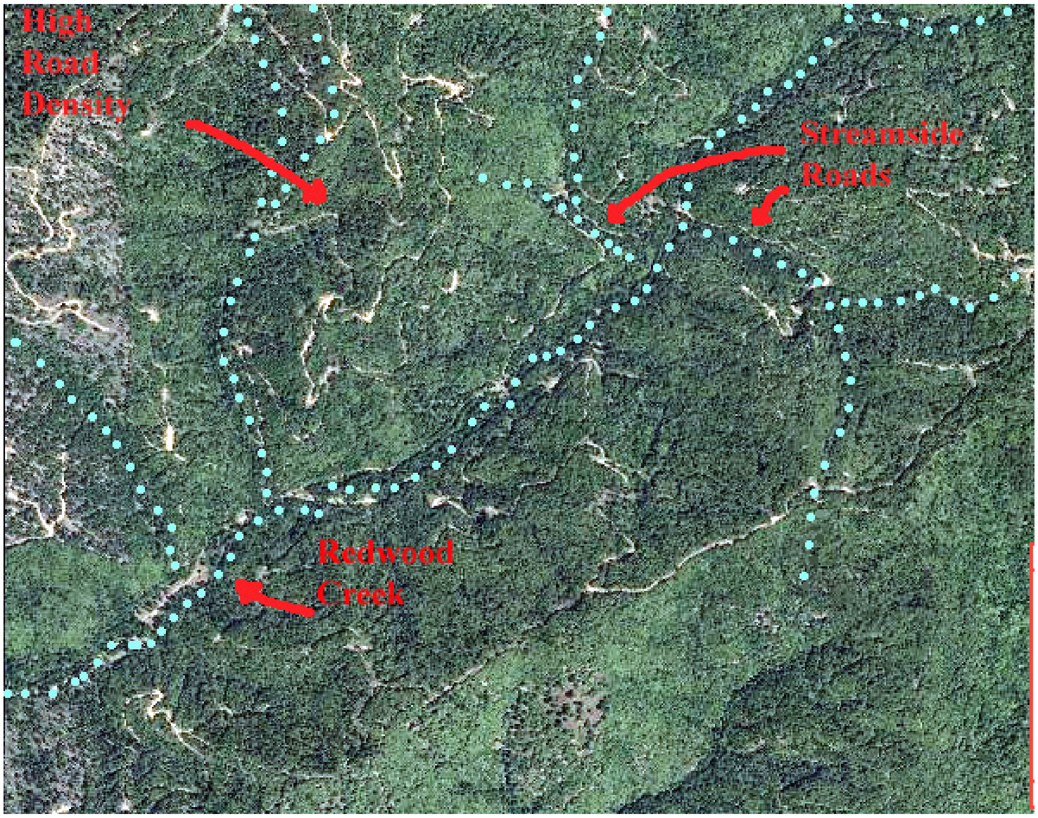

Figure 16. Redwood Creek in the Upper Noyo River basin is shown in blue dots from USGS 1:24000 streams and roads paralleling the streams are obvious and road densities extremely high. Photo from June 2005.

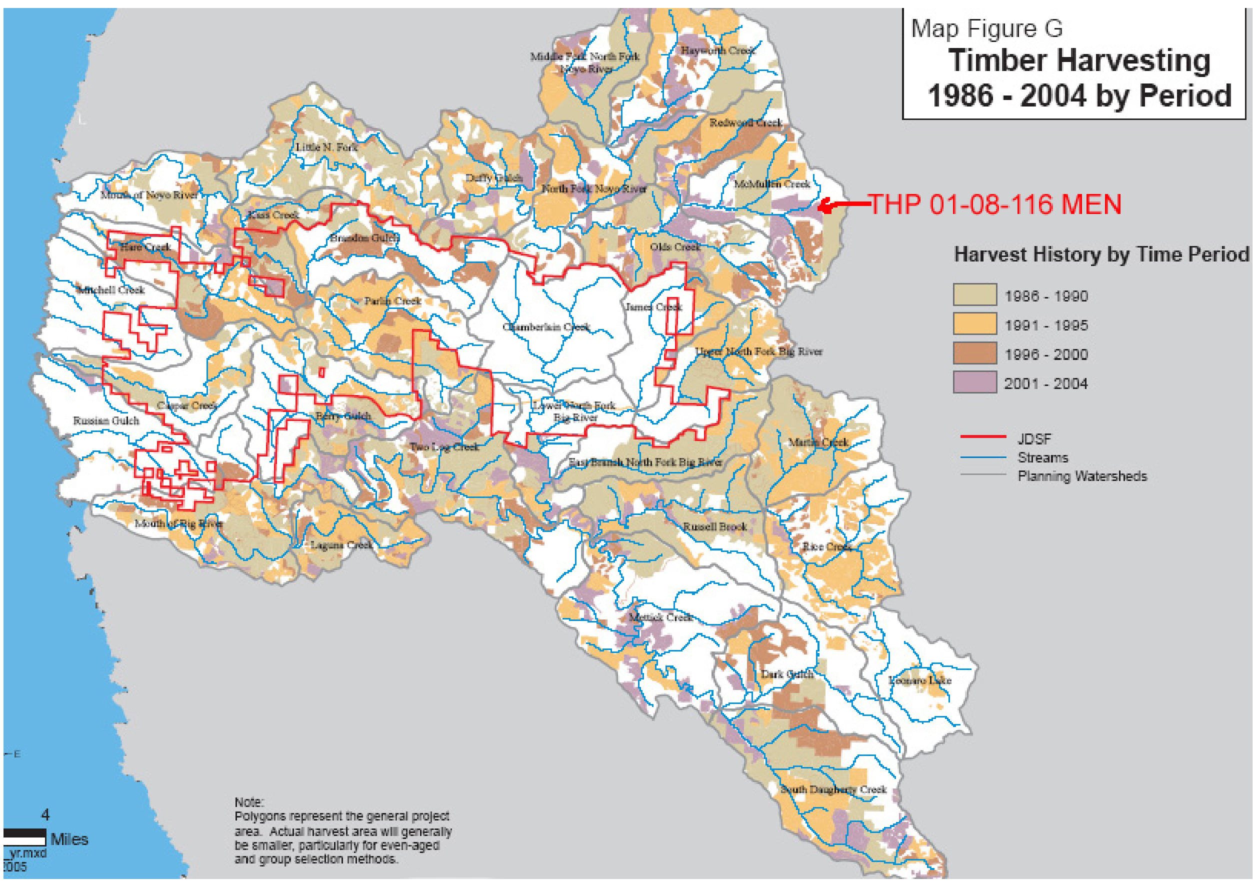

Figure 17. Timber harvest map of the Noyo River basin from 1986-2004 shows that more than 75% of the basin was harvested in this period, which poses extreme cumulative effects risk. From JDSF (2004).

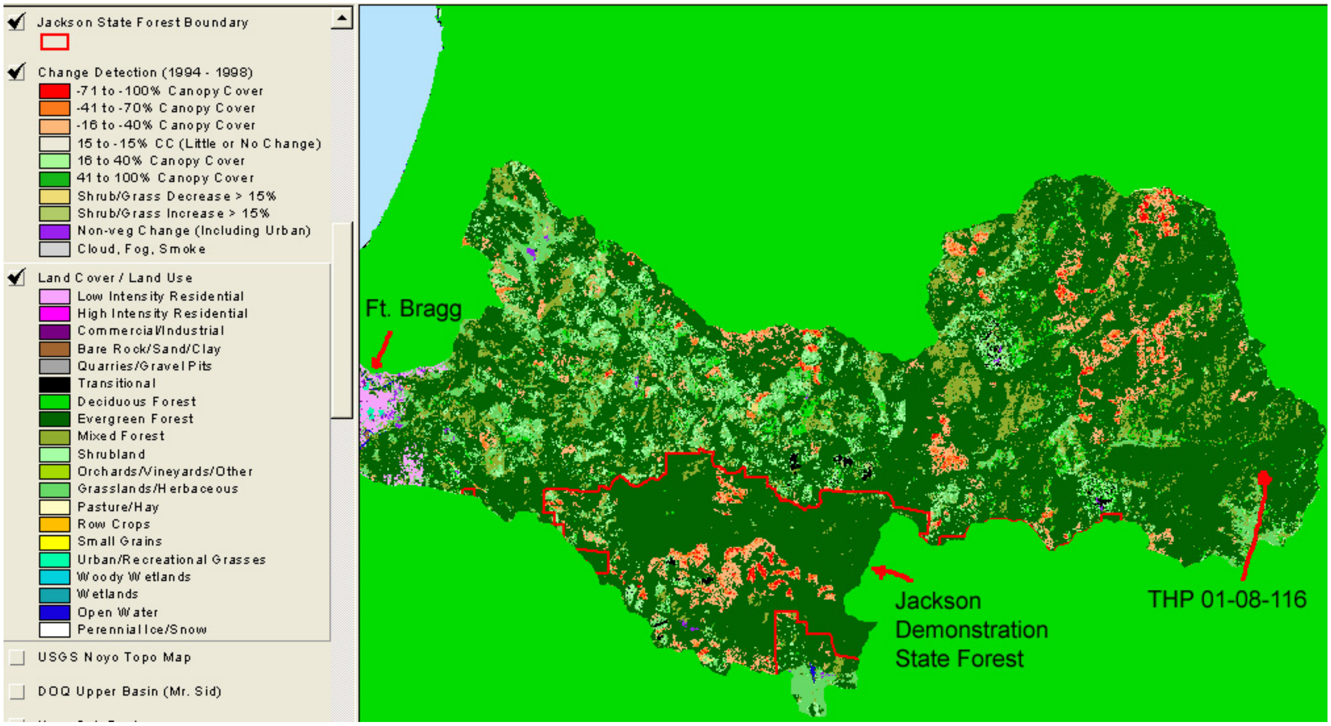

Figure 18. The Noyo River basin is shown here with classified Landsat vegetation showing widespread areas so over-cut they show hardwood not conifers and change scene detection from 1994 and 1998 Landsat images demonstrating extremely rapid vegetation change with major cumulative effects consequences. Data from U.S. EPA and CDF FRAP (Fischer 2003).

Figure 18 uses the National Landcover Data (USGS and U.S. EPA 1999) derived from a 1992 Landsat image to characterize vegetation. While this coverage does not provide tree size, the lighter shades of green indicate that many areas within the Noyo River basin have been so extensively harvested that they have been converted to hardwoods or chaparral. JDSF has been acting as a refugia of sorts for coho salmon (Reeves et al. 1995), but the harvest of nearly one third of Parlin Creek in four years (Figure 18) has reduced carrying capacity in that important South Fork Noyo River tributary (Higgins 2004).

Cumulative Watershed Effects

Numerous recent studies, such as Ligon et al. (1999), Dunne et al., (2001) and Collison et al. (2003), have explicitly pointed out that California FPRs have failed to protect Pacific salmon species because timber harvests are looked at individually and not in conjunction with all activities in a watershed. Dunne et al. (2001) described cumulative effects as follows:

> "Generally speaking, the larger the proportion of the land surface that is disturbed at any time, and the larger the proportion of the land that is sensitive to severe disturbance, the larger is the downstream impact. These land-surface and channel changes can: increase runoff, degrade water quality, and alter channel and riparian conditions to make them less favorable for a large number of species that are valued by society."

Dunne et al. (2001) warn that at risk populations can be lost, if cumulative effects are ignored and anthropogenic stressors continued:

> "The concern about cumulative effects arises because it is increasingly acknowledged that, when reviewed on one parcel of terrain at a time, land use may appear to have little impact on plant and animal resources. But a multitude of independently reviewed land transformations

> may have a combined effect, which stresses and eventually destroys a biological population in the long run."

THP 01-08-116 MEN is falling into the pattern described where it ignores the cumulative watershed damage described above and says none of its problems will leave the site. The casualty, if the plan is carried out without CDFG's (2008) "full mitigation," will certainly be coho salmon downstream.

The consulting geologist's report (Best 2008) focuses on whether THP 01-08-116 MEN will cause mass wasting, but the real problem is more likely to be persistent and irresolvable gully and surface erosion problems from operations. Gullies described at old neglected culvert outlets are evidence of what will eventually occur at every crossing again five or ten years in the future. The sheared soils associated with earthflows are perennially saturated, so the requirement of the THP that tractors operate only during dry soil conditions cannot be met. When sheared soils are compacted, their permeability is further decreased, which will lead to increased surface erosion. The road systems that will be reopened are in many cases immediately adjacent to streams; therefore, surface erosion from the compacted areas will be delivered directly to streams and to coho habitat below the ownership.

Poole and Berman (2000) and ODEQ (2008) recognize that subsurface areas beneath and adjacent to streams and streamside wetlands have water storage capacity that can be lost when compacted by heavy equipment operation associated with logging. If heavy equipment operation disrupts groundwater storage and supply, then diminished delivery during base flow periods could add to problems with water temperatures, because lesser volumes of water heat more quickly. Brosofske et al. (1997) found that logging in headwater streams caused elevated soil temperatures that translated into increased groundwater temperatures. THP 01-08-116 MEN will reduce canopy extensively in near stream areas likely to be connected to groundwater sources and may cause impacts similar to those described by Brosofske et al (1997) that could increase Noyo River water temperatures.

Although there is little discussion of the use of pesticides and herbicides associated with post-harvest activities to control competing vegetation, NMFS (2008) in a biological opinion to the U.S. Environmental Protection Agency has found that a number of substances routinely used are toxic to salmonids.

Tailed Frogs

THP 01-08-116 MEN mentions tailed frogs (p 36) in a small section but provides no information on whether they exist on the site or not nor on their status regionally. Welsh et al. (2005) found that early seral stages conditions in riparian zones were not compatible with maintaining water and air temperatures suitable for supporting tailed frogs. The Landsat vegetation map in Figure 18 shows that much of the watershed has been converted to hardwoods; therefore, tailed frogs are likely missing from much of the basin. The condition of Noyo River tailed frog populations are likely similar to those of the Mattole Basin characterized by Welsh et al. (2005):

> "The few small populations of these species now appear to be sufficiently isolated from one another by distance that they are likely nearing extinction in this watershed. These fragmented distributions are the legacy of the large-scale anthropogenic alteration of much of the watershed."

 Tailed frog larvae.	Because tailed frog larvae (left) live for up to four years in streams adhering to rocks with a sucking disc, they are extremely susceptible to being dislodged by sediment transport. High sand supply may also scour algae from rocks, thus reducing food supply for this sensitive indicator species. The area of the Willits Redwood proposed THP has larger trees than many other areas and may have a tailed frog population that is very important.

Conclusion

When discussing prospects for regional coho salmon recovery, climate and ocean cycles of productivity must be kept in mind. The Pacific Decadal Oscillation (PDO) cycle (Hare 1998, Hare et al. 1999) recognizes positive ocean cycles that coincide with wet on-land conditions in northwestern California for a period of about 25 years, then alternate with ocean conditions prone to warm El Nino conditions and periods of lesser rainfall. Positive PDO conditions prevailed from 1950-1975 and negative-ocean and dry on-land conditions prevailed between 1975-1995. We are currently in a productive ocean and wet climatic phase that provides an opportunity to recovery coho and Chinook salmon and steelhead. Collison et al. (2003) concluded that, if freshwater habitat was not recovered by the time the next switch in the PDO occurred sometime between 2015-2025, then many Pacific salmon stocks will likely go extinct. No actions taken in THP 01-08-116 MEN should be allowed that degrade fish habitat or reduce carrying capacity of the Noyo River.

Reeves et al (1995) point out that timber harvest disturbance does not mimic natural patterns caused by historic fire, where patches of habitat might be disturbed but the numerous areas of intact habitat were available for colonization by displaced populations. When timber harvest (>75%) and road networks (6.71 mi./mi.^{2}) become as widespread as they are in the Noyo River, there are no intact functional habitats that remain as population centers for species, such as coho salmon. The Upper Noyo River has lesser impacts than basins like the Little North Fork, Duffy, Kass or Hayworth Creeks and should be a priority for restoration (Bradbury et al. 1995). Reducing road densities has been demonstrated to decrease stream damage and promote salmon recovery (Harr and Nichols 1993) and such efforts should probably start in JDSF and the Upper Noyo River basin. An optimal outcome for the ecological future of the region would be for the Willits Redwood property to be managed for forest health, with thinning from below using low impact harvest methods that did not compact the sensitive soils. In order to meet CEQA requirements, THP 01-08-116 MEN needs to provide a less damaging alternative than the preferred project and it failed to do so. In fact, a forest health option using thinning from below of smaller diameter trees can produce both healthy forests and healthy profits.

If the timber harvest were to go forward as proposed with 1) extensive timber harvest, including logging large diameter trees near streams, 2) construction and re-opening of over a mile and half of roads with many near streams, 3) creating or reactivating 51 crossing and 4) building 11 quarter acre landings, all in an area that has earthflow and wetland characteristics, this project is likely to have very significant, undesirable and irreversible effects. THP 1-08-166 MEN will certainly increase the risk of extirpation of coho salmon in the interior Noyo River basin, which is already high.

Sincerely,

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