5.3 Rockpile Subbasin

5.3.1 Introduction

The Rockpile Subbasin (Calwater 2.2a 113.82 Rockpile Creek SPWS) is bounded to the north by the North Fork Subbasin and to the south by the Buckeye Subbasin. It encompasses 35 square miles of private land primarily used for timber production and grazing. This subbasin is steeper than the North Fork Subbasin and with the same zig-zag pattern to the main channel. There are 88 miles of “blue line” streams, and two major tributaries: Red Rock Creek and Horsethief Canyon (Figure 5.3-1).

Historic events and the period of record on the various data sets used in the NCWAP assessment are presented in a graphic format in Figure 5.3-2.

5.3.2 Geology

Mélange of the Franciscan Complex underlies oak savanna woodland in the eastern headwaters. Large areas of active earthflows and other forms of landsliding are abundant and contribute sediment to the streams (Figure 5.3-3). Figure 5.3-4 is the relative landslide potential map for the Rockpile Subbasin. The complete maps and explanations for both maps are on Plates 1 and 2. The steep tributaries in the upper reaches can be characterized as source (>12 percent slope) and transport (4-12 percent slope) reaches.

Over 60 percent of the subbasin has a high to very high potential for landsliding (Figure 5.3-4).

In the lower reaches of the subbasin, streams meander slightly through narrow alluviated valleys within steep valleys. The main channel is somewhat sinuous and low gradient, with a narrow floodplain and stable point bars.

5.3.3 Vegetation

The narrow Rockpile Subbasin contains high site timber ground downstream from Rockpile Peak. Upstream areas contain mixed conifer hardwood forests with grassland on ridgelines and south facing slopes. The original old growth logging was limited to the lowest reaches of the subbasin in the alluvial flat. Previous to the mid-20th-century logging boom, old growth coniferous forests occupied the middle reaches. The 1942 photos show dense mature coniferous shade canopy cover over primary streams. Only the lowest reaches near the confluence point with the South Fork is Rockpile Creek wide enough to create bank-to-bank exposure in an alluvial flood plain (Figure 5.3-5).

5.3.4 Land Use

Two eras of intensive land use characterize the Rockpile Subbasin: (1) tractor harvesting between 1952 to 1968, and (2) cable tractor harvesting throughout the Lower and Middle Rockpile Planning Watersheds (PWSs) from 1990 to the present. The original turn of the century operations were limited to the lowest reaches of the subbasin due to limited rail access from the South Fork.

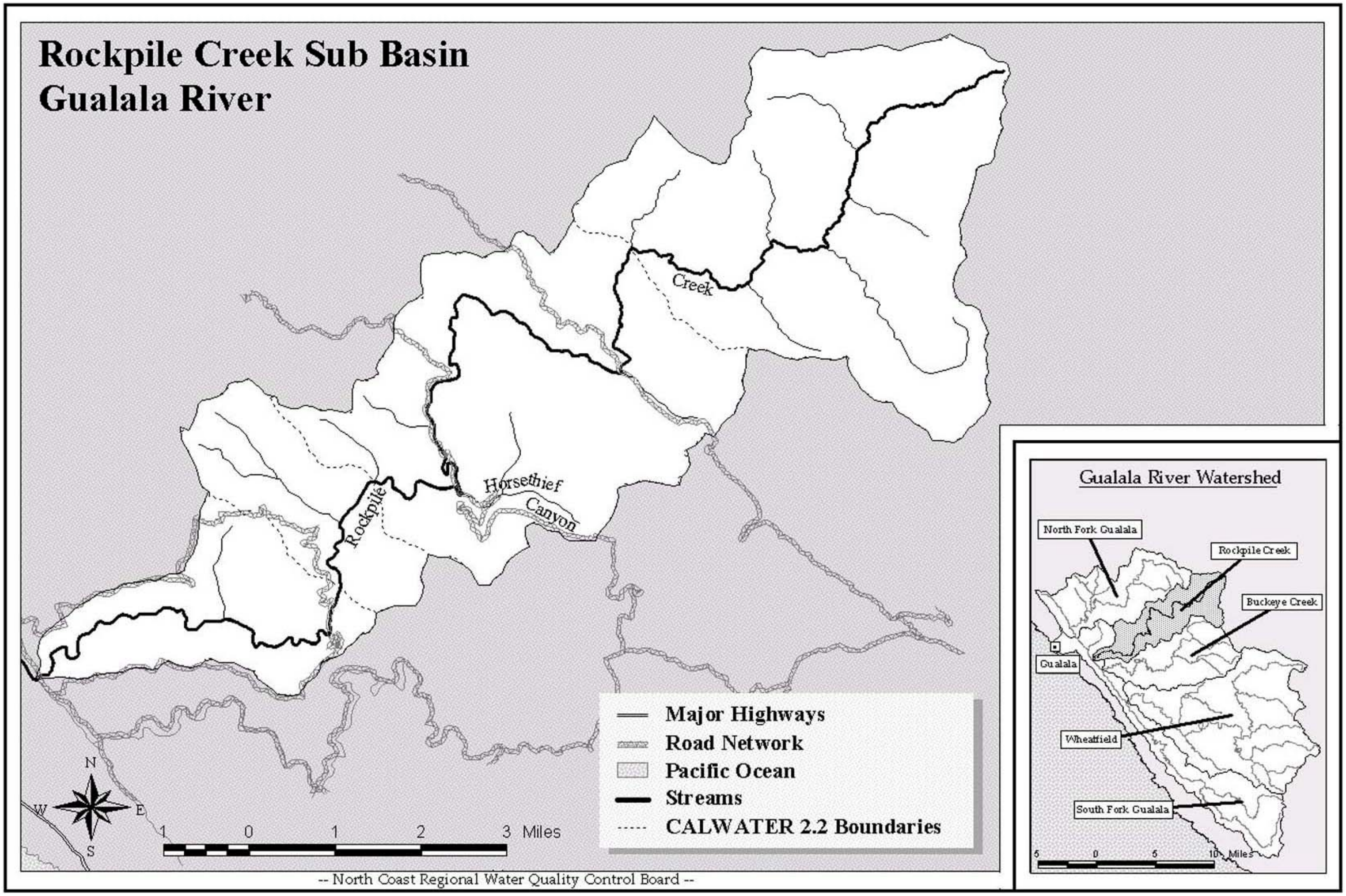


Figure 5.3-1
Rockpile Subbasin

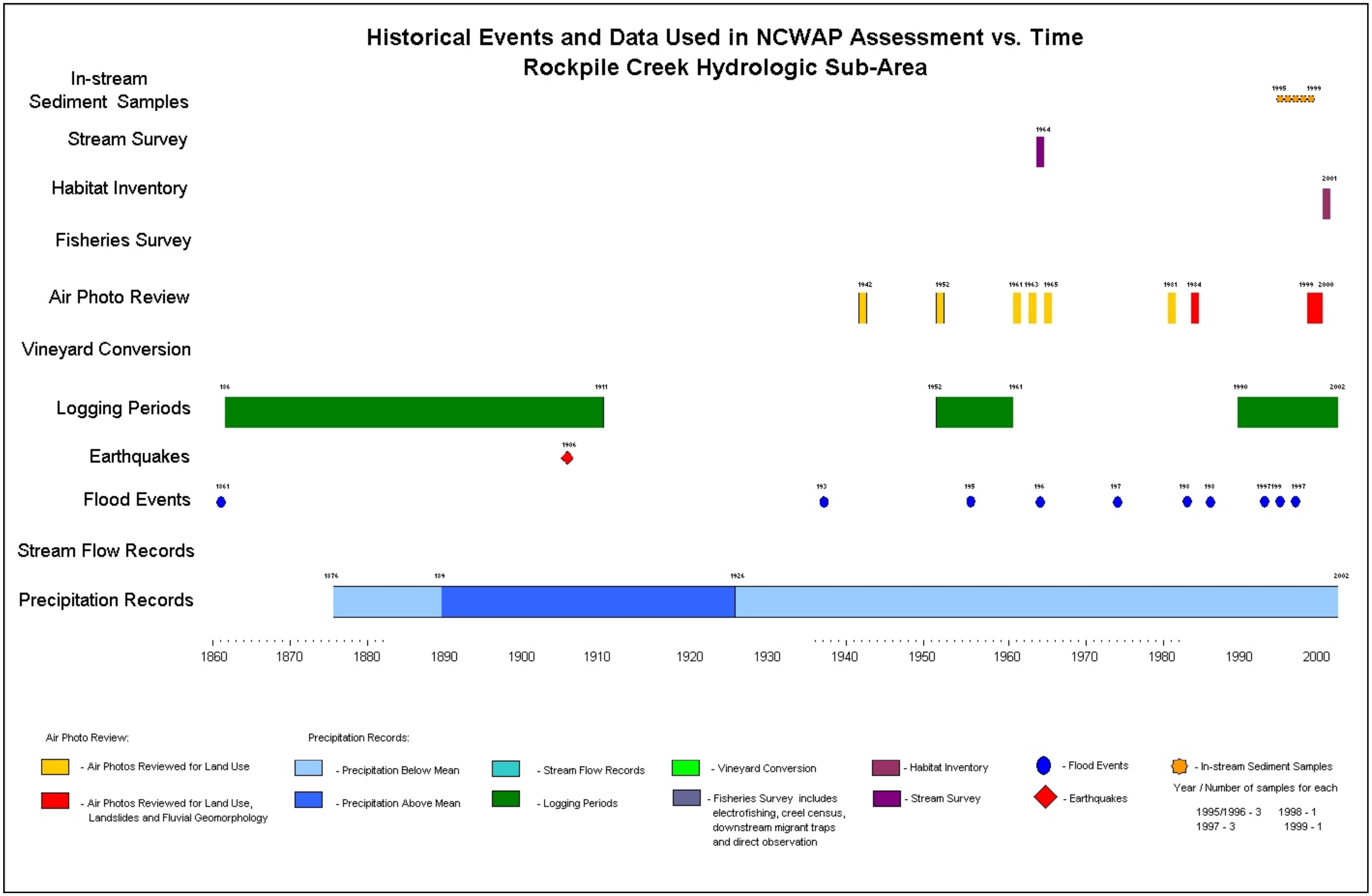


Figure 5.3-2
Historic Events and Data Used in the NCWAP Assessment for the Rockpile Subbasin

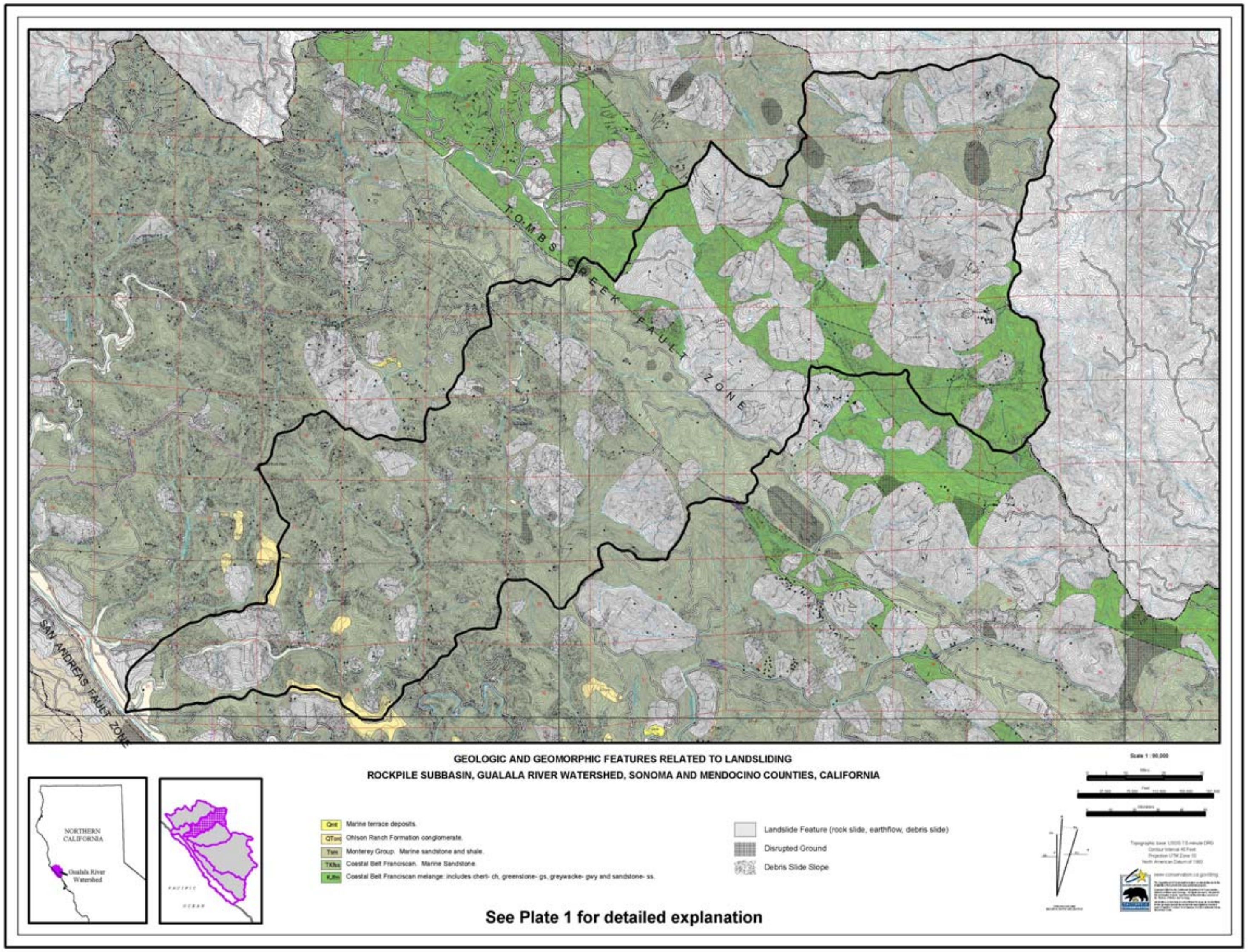


Figure 5.3-3
Geologic and Geomorphic Features Related to Landsliding - Rockpile Subbasin

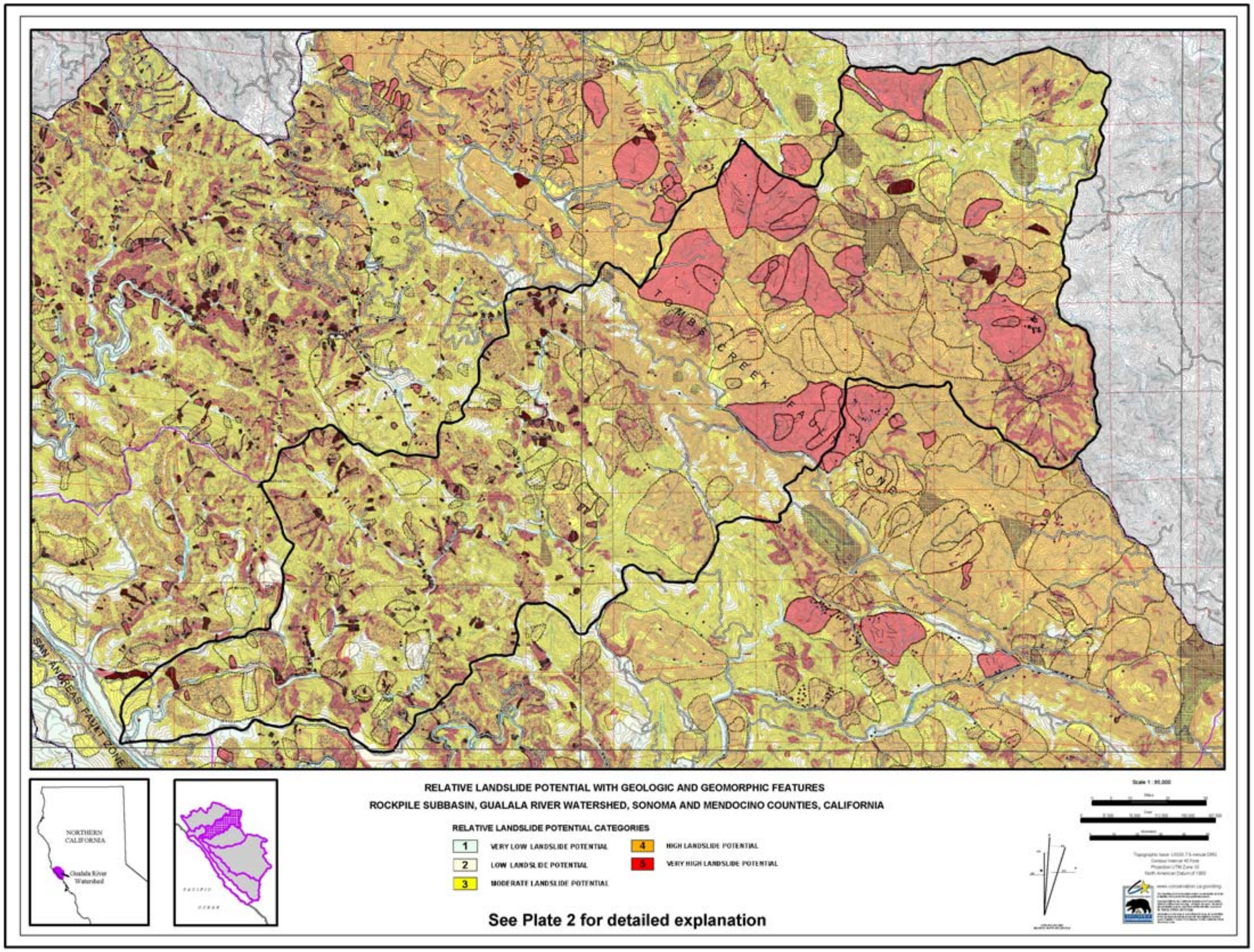


Figure 5.3-4
Relative Landslide Potential with Geologic and Geomorphic Features - Rockpile Subbasin

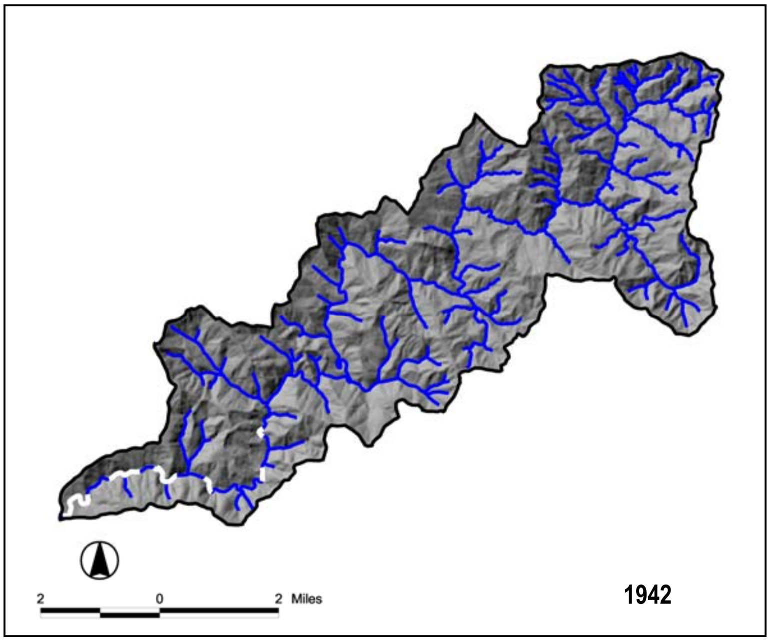
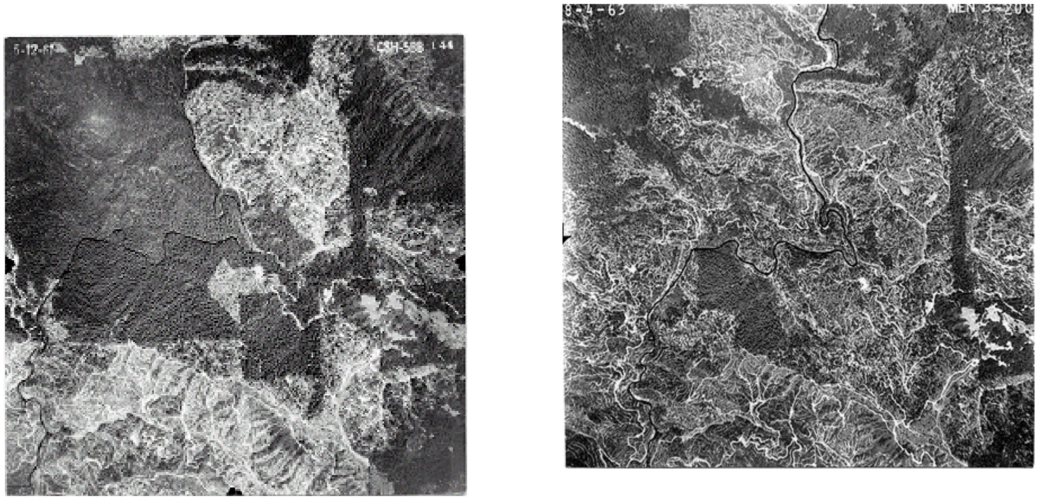


Figure 5.3-5
Bank-to-Bank Exposure (White) on Rockpile Creek in 1942
(Blue lines show partial to entire canopy cover)

Tractor logging operations in the Rockpile Subbasin accelerated in the mid-1950s, after the depression era lull. The middle reaches of Rockpile Creek downstream from Horsethief Canyon formed the central area of a large multi-basin operations unit stretching down from the upper North Fork southeast through Franchini Creek to the mainstem Buckeye Creek. By 1960, rectangular block harvest areas following straight parcel lines appear in the middle to upper reaches, comprising 9,200 acres (42 percent of the subbasin) harvested between 1952 and 1960. By 1964, each of these had enlarged to merge into one continuous harvest area (Figure 5.3-6). Due to the steep, deeply incised terrain, haul roads and landings were densely concentrated along Class I watercourses (Figure 5.3-7). The central reaches of the Rockpile Subbasin had one of the largest continuous areas in the watershed logged between 1960 and 1964, with 5,300 more acres harvested by 1964 (Table 5.3-1). Numerous road washouts, debris slides, and stream aggradations are referenced in the timber harvesting plan (THP) record attributable to this time period (see Land Use Impacts by Major Tributary, page 5.3-11). The 1961, 1963, and 1981 air photos showed road debris slides particularly concentrated in the Red Rock and Middle Rockpile PWSs.

Improvement of stream channel conditions is evident in recent times. Throughout blue line streams of the Rockpile Subbasin, California Geologic Survey (CGS) geofluvial mapping showed an overall reduction in the percentage of channel length affected by excess sediment storage or sediment sources between 1984 and 1999/2000.

Mid-20th-century logging operations removed all riparian canopy cover leaving bank-to-bank watercourse exposure throughout the entire mainstem of Rockpile Creek extending from the South Fork upstream to the Upper Rockpile Planning Watershed (see 1968 Shade Canopy Exposure Map, Figure 5.3-8).



1960 **1963**

Figure 5.3-6
Central Rockpile PWS 1960 (left) and the Same Area in 1963 (right)
Showing a Rapid Rate of Old Growth Harvesting in a Three-Year Period
(Horsethief Canyon is in the central right Note entire bank-to-bank exposure over Rockpile Creek after harvests.)

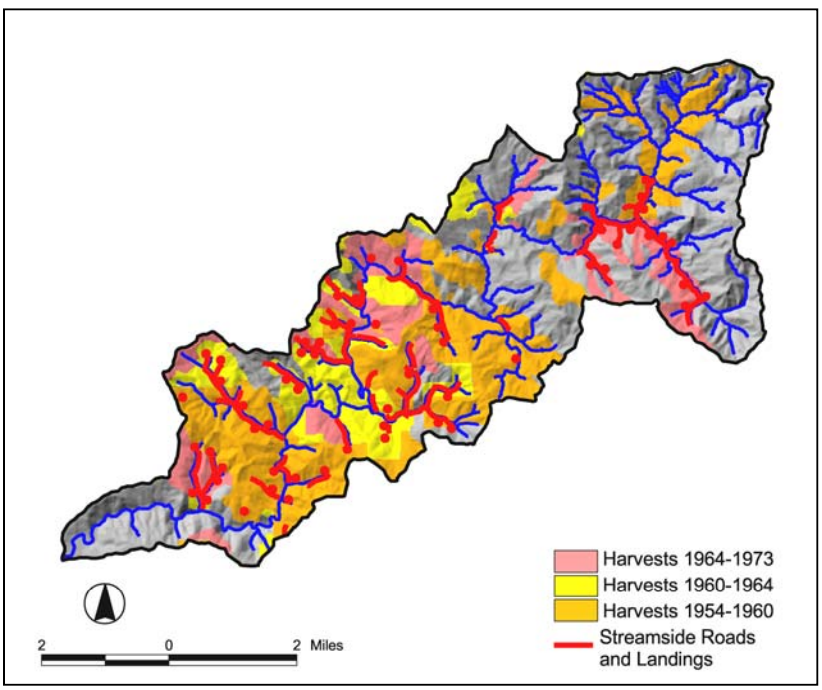
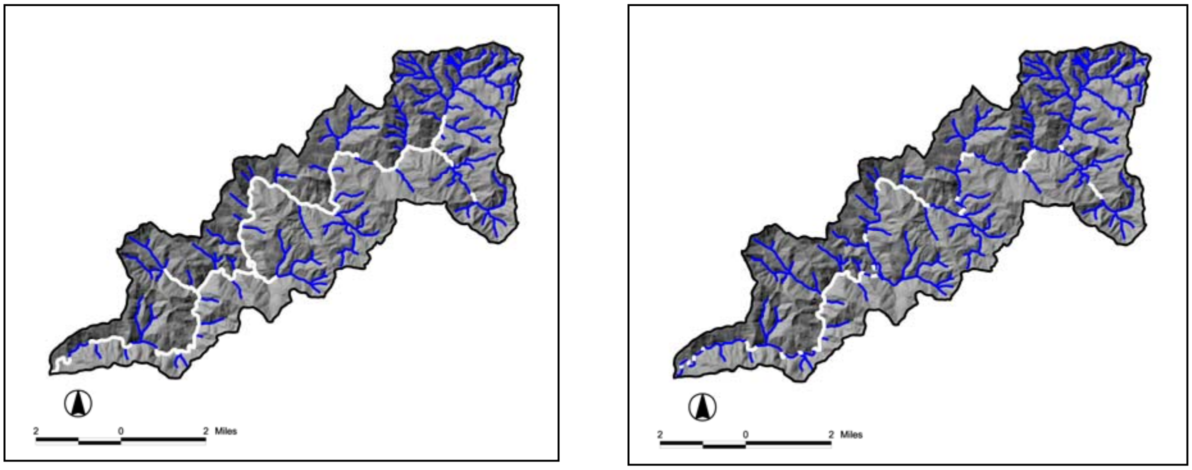


Figure 5.3-7
Mid-20th-Century Tractor Harvest Operations, and Streamside Roads and Landings (red)
(Red lines show where tractors have pushed dirt fill into the watercourse to make the road, covering the streambank.)



1968 2000

Figure 5.3-8
1968 Bank-to-Bank Exposure (Left) and 2000 (Right) in Rockpile Subbasin (white lines)
(Blue lines show partial to entire canopy cover.)

Table 5.3-1
Rockpile Subbasin Stand Replacement Operations 1942 – 1973 - Total Area = 22,390 acres

Time Period	Acres Under Operation	Type of operation	Cumulative Percent of Subbasin Under Operation Since 1942	Mean Annual Increment (acres/percent by year)
1932– 1942	0	Stand Replacement	0	0
1942 – 1952	1,200	Stand Replacement	5.3	120 (0.5)
1952 – 1960	9,200	Stand Replacement	47.0	1,150 (5.2)
1960 – 1964	5,300	Stand Replacement	65.0	1,325 (5.6)

In 1942, five percent of the blue line streams were exposed bank to bank (Figure 5.3-5), limited to alluvial openings in the lower subbasin reaches throughout generally wooded conditions. By 1968, approximately 70 percent of the blue line streams were exposed bank-to-bank by the end of the tractor-harvesting era. The bank-to-bank overstory shade canopy cover for 2000 shows improvement compared to 1968, reflecting riparian in-growth since the late 1960s. By 2000, canopy cover improved to approximately 25 percent of blue line streams exposed bank to bank (Figure 5.3-8). Streamside canopy in the middle subbasin reaches now consists primarily of 40-year-old pole to mid sized conifers. Ground surveys support these findings. Coastal Forest Lands (CFL) reported reinstatement of overstory shade canopy in numerous upper reach tributary watercourses (CFL SYP 1997). CFL no harvest Watercourse and Lake Protection Zones (WLPZs) are routinely stipulated for all THPs along Rockpile Creek and Class II tributaries to mitigate temperature impairment throughout the subbasin. Canopy cover is lacking in most areas along the mainstem Rockpile Creek, mid to higher reaches (CFL THP 1-97-475).

The 1970s were a period of relative inactivity compared to previous eras (Table 5.3-2). Partial entries and stand things were common in the alluvial flats downstream from Red Rock Creek. During the late

1980s through mid 1990s, active timber harvesting resumed. In the Middle Rockpile PWS, numerous seed tree overstory removal/dispersed harvest THPs were conducted. These covered large areas but removed scattered single trees and remnant stands left from 1960s era entries. Year 2000 air photos show these areas well vegetated. Agency review of these THPs clarified road upgrade work requirements to repair erosion conditions of pre-1973 operations. Even-aged management has been the predominant silvicultural method in the lower alluvial portion of the subbasin since the mid 1990s. Some 687 acres (3.1 percent) of grazing lands occupy the upper subbasin reaches.

Table 5.3-2
Rockpile Subbasin Timber Harvest Operations – 1974 – 2001 - Total Area = 22,390 acres

Time Period	Acres under operation	Type of operation	Cumulative percent of Subbasin Under Operation Since 1974, Some Overlap with Mid-20th-Century Areas	Mean Annual Increment (acres/ percent by year)
1974 - 1990	3,050	Stand Replacement	13.7%	191 (0.8)
1991 - 2001	11,150	THPs	63.3 (44% cable, 56% tractor)	1,014 (4.5)

5.3.5 ROADS

Historic Roads (1952 – 1968)

Built between the mid 1950s and early 1960s, streamside/instream road and landing networks spanned the natural fluvial drainage system of the Rockpile Subbasin (Figure 5.3-9). These roads dominated stream channel structure throughout the Lower and Middle Rockpile PWSs. Streamside roads and landings were densely concentrated at the base of steep ravines. Throughout Horsethief Canyon, heavy tractors cut into the steep sidebanks at the base of the streams, making the near vertical cut banks along these roads prone to failure during winter storms. The 1963 and 1981 air photos showed a high density of road debris slides accessing streams in the Central Rockpile PWS.

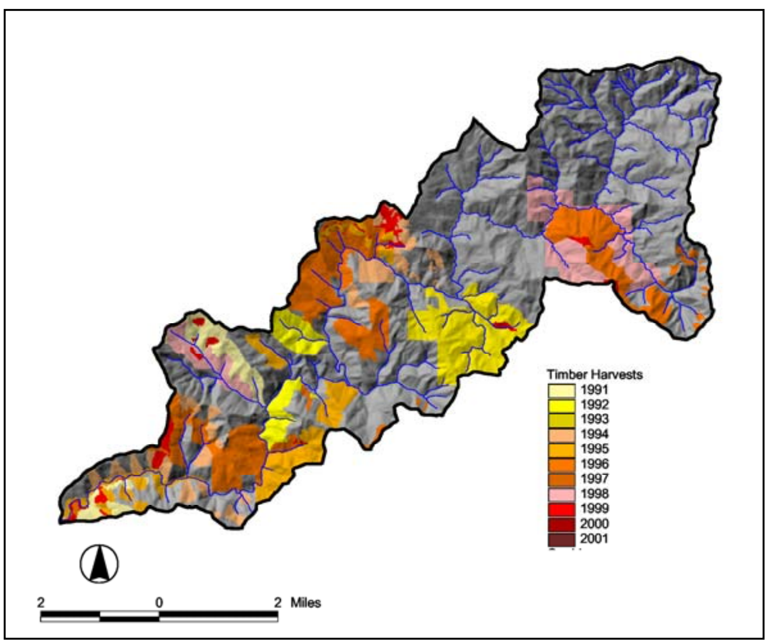


Figure 5.3-9
1991 to 2001 Timber Harvest Plans

A total of approximately 16 miles of road were build at near or equal elevation to the streambank transition line with sidecast covering the streambank leading to the creek. Tractors graded the streambank flat to one side, simplifying channel complexity and structure. More roads were located slightly upslope of streams but still near the creek (not mapped with this study). After 1968, these roads were generally unused and left abandoned. There were no to minimal erosion control facilities left with these roads. The dense network of instream/streamside roads and landings that lined blue line streams in the Central Rockpile PWS showed a high correlation with stream braiding and aggradation (over 75 percent) in 1984.

Modern Roads

Successive air photo overlays show a shift in new road construction to ridgelines and mid slope benches. The total length of the road network now consists of 168 miles of active roads, at a density of 4.8 miles/square mile. The U.C. Davis Information Center for the Environment ("ICE") developed a contemporary road map for the total maximum daily load (TMDL), which shows most of the current roads located distant from watercourses. The "ICE" roads within 50 feet of a watercourse comprise about 1.5 miles of current roads within the subbasin. Of these roads, less than a half mile total length are located in areas that may be affected by historically active landsliding and stream bank erosion.

Although the current road network shows less overall coincidence of debris slides and stream crossing failures compared to historic times, proximity to streams and steep slopes continues to locate most of the contemporary road failures. Approximately one mile of the modern roads cross steep slopes (excess of 60 percent), mostly throughout the deeply incised central subbasin reaches. Most of the historically active point slides found within 60 meters of a road occur dominantly along blue line streams in steep areas.

Substandard road networks continued to be vulnerable to large storm events. Road washouts during the 1986 and 1996 storms generally characterize contemporary land use induced sediment pulses. There are 2.3 road crossings per stream mile. With 63 percent of the Rockpile Subbasin subject to Timber Harvest Plans (THPs) since 1991, considerable road repair and upgrade work has been accomplished. More recent THPs require even higher construction/replacement standards. Remaining areas of the Rockpile Subbasin are recommended as the highest priority for restoration work in this study. The Gualala River Watershed Council (GRWC) has initially directed restoration work in the Lower Rockpile PWS only. The NCWAP restoration map targets the central and upper subbasin reaches with the highest priority for future restoration work in sediment reduction (Plate 3, Figures 5.3-18a and 5.3-18b).

Similar to the North Fork, stream channel morphology in the Rockpile Subbasin shows the following evolution over the last half century: (1) a high density of debris flow mounds in the active channel triggered by mid-20th-century storm events, (2) progressive abatement of the frequency of these point sources over successive decades, and (3) apparent improvement of instream channel conditions between 1984 and 2000 as evidenced by a reduction in the percentage of channel length that is affected by excess sediment storage or sediment sources. The comprehensive CGS fluvial geomorphic mapping of stream channel conditions documents that the channel has improved from 1984 to 1999/2000 throughout the Rockpile Subbasin. This period includes recent active timber harvesting in the subbasin.

Documentation of Land Use Impacts By Major Tributary

Central Rockpile Creek

- By the early 1960s, the main haul road followed directly along the central reaches of Rockpile Creek. Remnants of road and landings in Rockpile Creek continued to contribute sediment during peak flows. Shade was limited along Rockpile Creek due to large amounts of road segments and landings directly in or adjacent to upper reaches of Rockpile Creek (THP 97-510 CFL) from 30 years ago.

  Skidding and hauling in watercourses during 1950s, 1960s were noted in the central and upper reaches of Rockpile subbasin. High sedimentation and accumulations of debris were found in the stream channels. Downcutting and subsequent downstream aggregations were noted. Conditions were described in 1997 as in a stage of recovery as stream flow continued to flush sediment and organic material downstream (CFL 97 341, 97-345). In very steep areas, Class II and III watercourses were not used as skid trails.

Red Rock Creek

- This watershed was logged in 1959-1960. The main haul road was built along Red Rock Creek for nearly the entire length of the Class I watercourse, and numerous in stream landings lined Red Rock Creek.
- In the mid 1990s, extensive streambank rehabilitation work was carried out by J. Monschke.

Upper Rockpile Creek

- Seven seed tree overstory removal/dispersed harvest THPs dated 1997-98 exceeded 60 percent of the 2,700 acre Brandt tract within the Upper Rockpile Creek area. These plans directed road repair work throughout the area-wide road network. This included (1) repair of two watercourse diversions (CFL 97-371), (2) removal of a long section of seasonal road across Rockpile Creek (legacy road), and (3) repair of two other watercourse diversions, (CFL 98-091). These THPs stipulated temporary watercourse road crossing specifications as dominant among seasonal road laterals. This requires the abandonment of road crossing structures with road approaches bladed back to reestablish the original streambank configuration and treating any exposed soils with grass seed and mulch.

5.3.6 FLUVIAL GEOMORPHOLOGY

Over 60 percent of the subbasin has a high to very high potential for landsliding (Figure 5.3-4) and represents the major source area for stream sediment. Instream sediment levels, indicative of disturbance, occur along 20 of 88 miles of the blue line streams in the subbasin. This is a 38 percent reduction compared to levels in 1984. Most of the reduction occurred in the tributaries, while the lower reaches showed less change. Table 5.3-3 lists the lengths of sediment storage mapped and relative change between 1984 to 1999/2000 for the Rockpile Subbasin.

Table 5.3-3
Rockpile Subbasin Stream Characteristics Representing Sediment Sources or Storage

Planning Watershed	Year 2000		Year 1984		1984 to 2000	1:24K Streams
	Length Miles	Percent Total Stream for Subbasin	Length Miles	Percent Total Stream for Subbasin	Length Miles	Total Length Miles
Upper Rockpile Creek	6.7	15.8	8.1	19.1	-17.1	42.7
Middle Rockpile Creek	6.7	23.3	13.4	46.7	-50.0	28.7
Red Rock	2.9	39.1	4.6	62.8	-37.7	7.4
Lower Rockpile Creek	3.4	36.6	5.9	62.4	-41.4	9.4
Total	**3.4**	**22.4**	**32.0**	**36.3**	**-38.3**	**88.2**

5.3.7 WATER QUALITY

Water Temperature

Water temperature data from continuous recorders were available for five sites in the Rockpile Subbasin (Figure 5.3-10). The period of record from 1994 to 2001 yielded 22 observations for maximum weekly average temperature (MWAT) and seasonal maximum temperature (Table 5.3-4).

MWATs in the mainstem ranged from somewhat to fully unsuitable. MWATs in Horsethief Canyon were somewhat unsuitable, while MWATS in the lower tributary were fully suitable for the period of record (Table 5.3-4, Figures 5.3-11 and 5.3-12). There is evidence of slight cooling of water temperatures in the mainstem Rockpile Creek as it flows downstream toward the coast (Figure 5.3-12).

Seasonal maximum temperatures were generally below the lethal limit of 75 F, but above 71 F at the mainstem sites during the period of record. The seasonal maxima in the lower tributary were 59 F in both years.

Table 5.3-4
EMDS Ratings for Maximum Weekly Average Temperatures (MWATs) in the Rockpile Subbasin

Stream	No. of Sites	No. of Observations	Period of Record	EMDS Suitability Ratings						
				+++	++	+	0	-	--	---
Rockpile Mainstem	7	18	1994 - 2001					■	■	■
Horsethief Canyon	1	2	1997, 1998					■		
Lower Tributary	1	2	1997, 1998	■						

EMDS ratings:

+++ = fully suitable (50 - 60 F)
++ = moderately suitable (61 -62 F)
+ = somewhat suitable (63 F)
0 = undetermined (between somewhat suitable and somewhat unsuitable) (64 F)
- = somewhat unsuitable (65-66 F)
-- = moderately unsuitable (67 F)
--- = unsuitable (> 68 F)

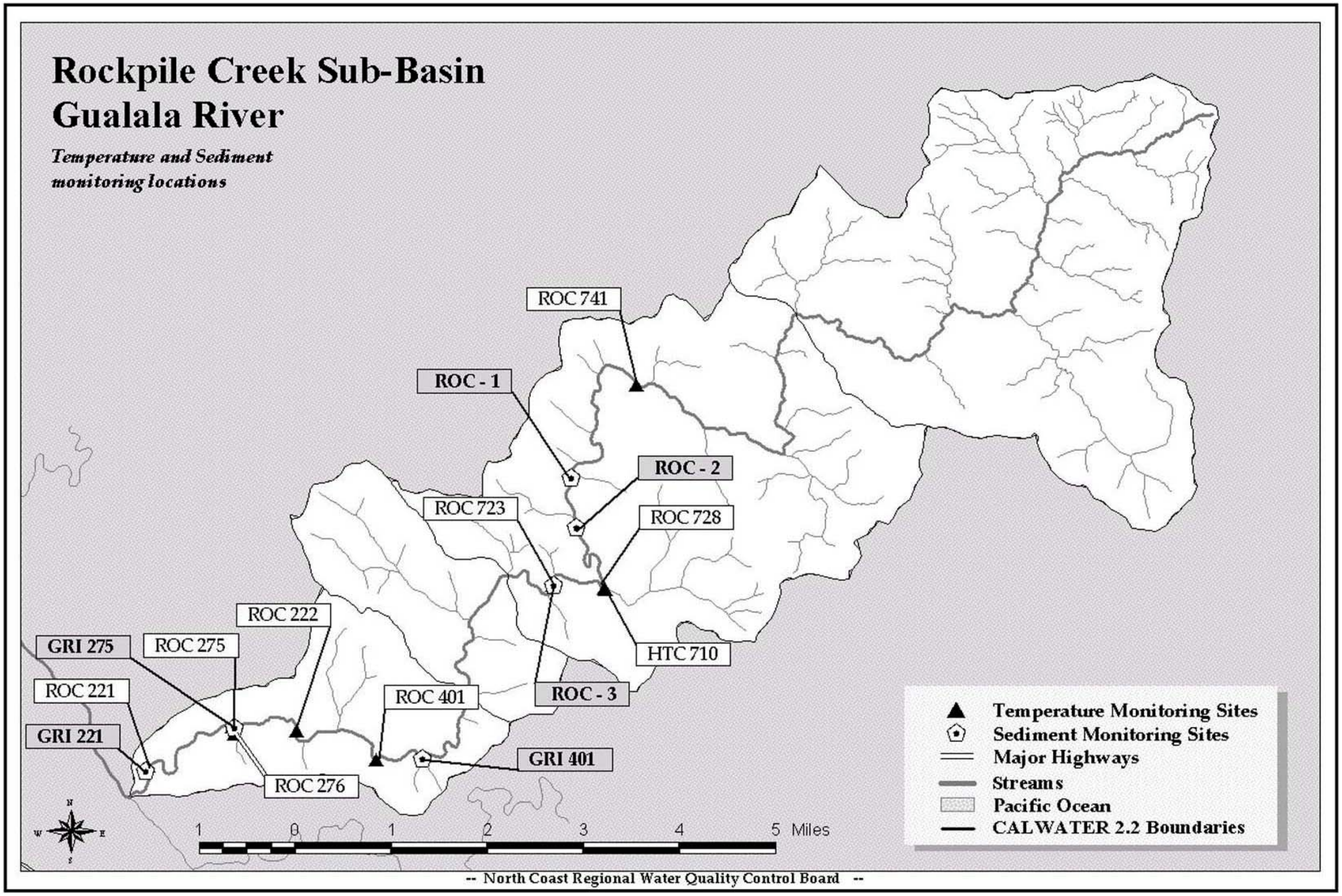


Figure 5.3-10
Instream Sediment and Temperature Sampling Sites, Rockpile Subbasin

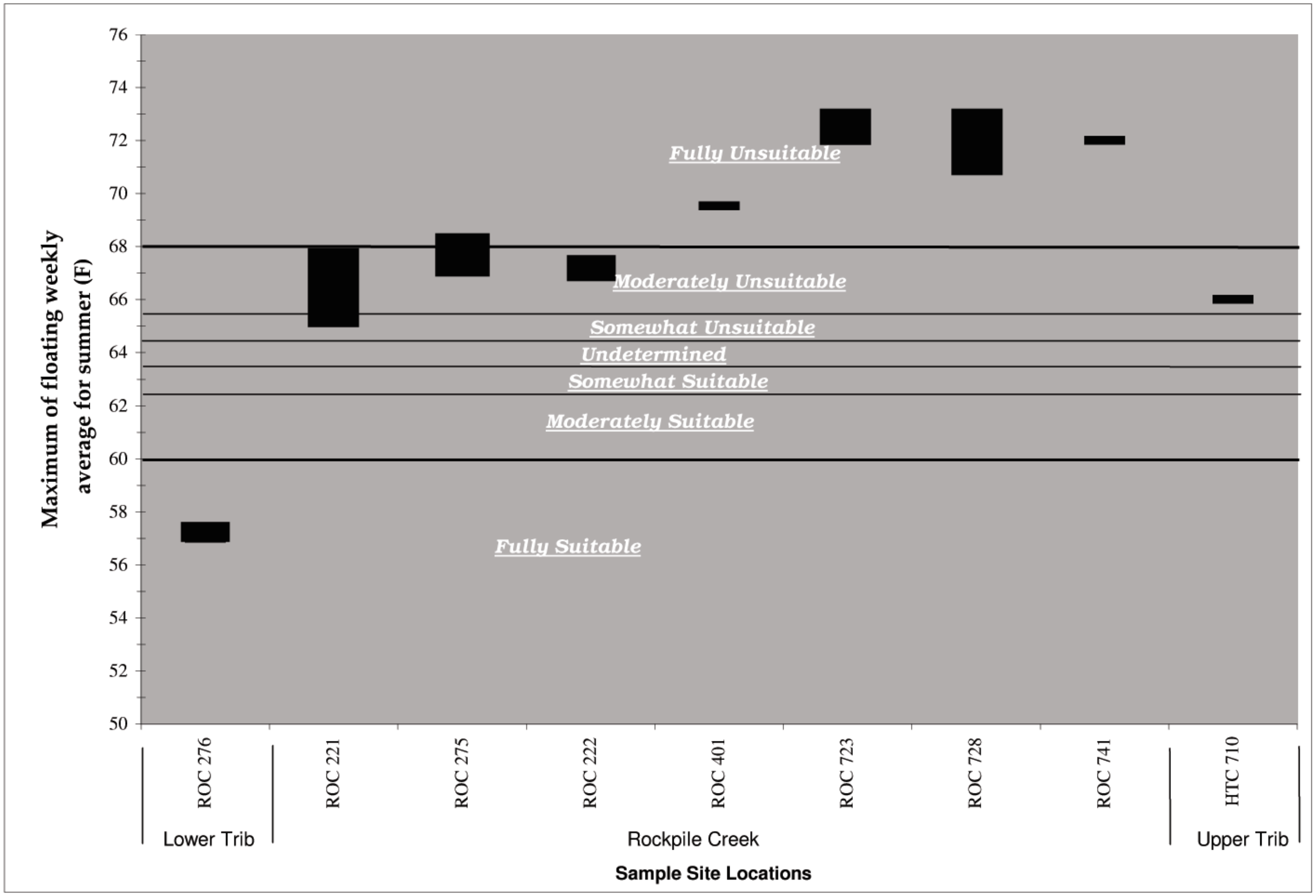


Figure 5.3-11
Maximum Weekly Average Temperature (MWAT) Ranges For The Rockpile Subbasin From 1995-2001
(Data From GRI And GRWC Continuous Monitoring Devices)

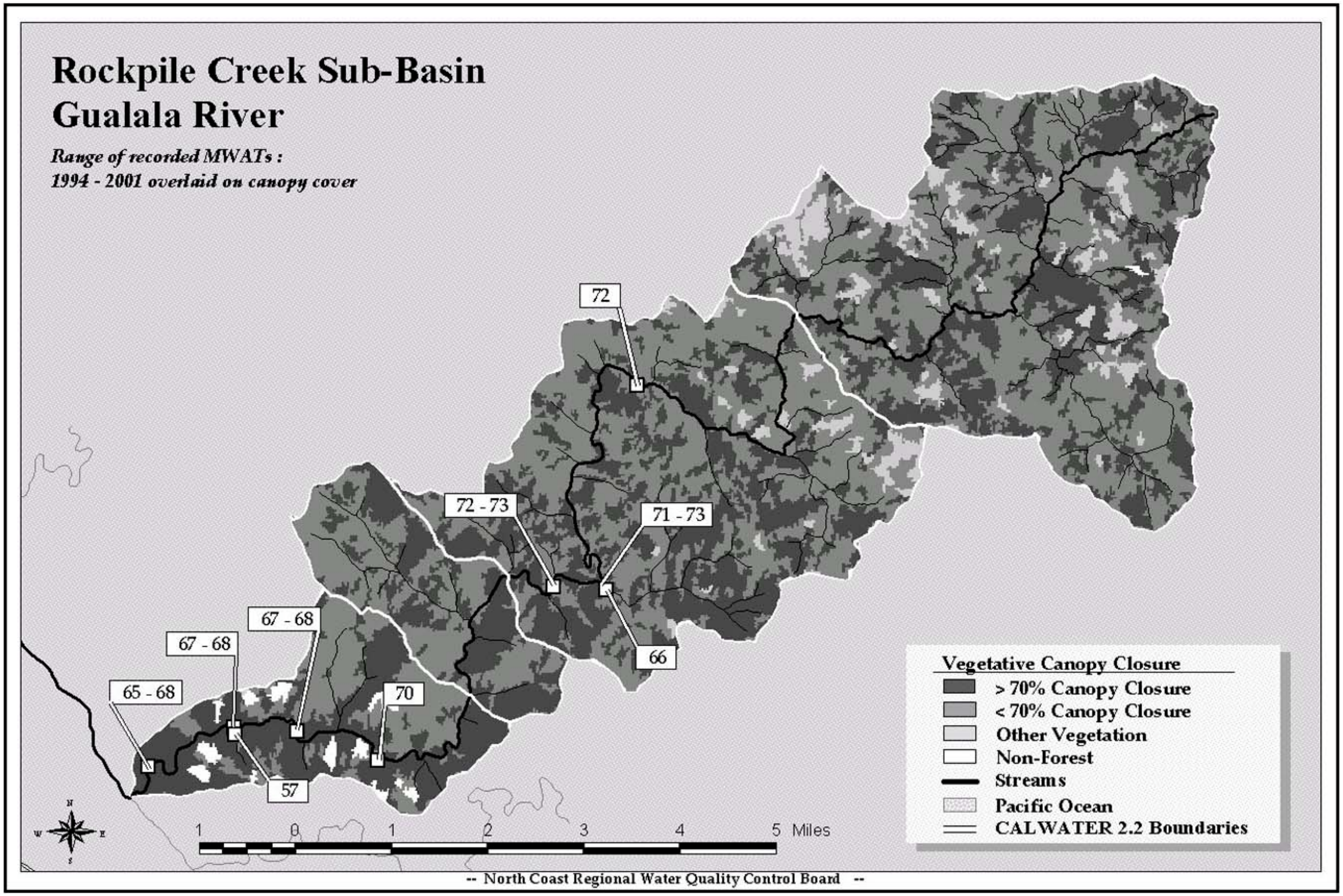


Figure 5.3-12
MWAT Temperature Ranges in the Rockpile Subbasin for the Period of Record, 1995-2001 Overlaid on the LanSat Vegetation Layer for 2000

5.3.8 Fish Habitat Relationships

Historic Habitat Conditions

No historic stream surveys were conducted.

Current (2001) Conditions

Target Values and Current Conditions from the Habitat Inventory Surveys

Beginning in 1991, habitat inventory surveys were used as a standard method to determine the quality of the stream environment in relation to conditions necessary for salmonid health and production. In the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al. 1998), target values were given for each of the individual habitat elements measured (Table 5.3-5). When habitat conditions fall below the target values, restoration projects may be recommended to meet critical habitat needs for salmonids.

Table 5.3-5
Habitat Inventory Target Values Taken From the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al 1998).

Habitat Element	Canopy Cover	Embeddedness	Primary Pool Depth/Frequency	Shelter/Cover
Range of Values	0-100%	0-100%	0-40%	Ratings range from 0-300
Target Values	>80%	>50% or more of the stream length is <50% embedded	Depth-1st and 2nd order streams >2 feet 3rd and 4th order streams >3 feet Frequency->40% of stream	>80

One habitat inventory survey was conducted in 2001on the first 44,500 feet of the mainstem Rockpile Creek with 17,332 feet skipped due to the crew's inability to physically access the stream. Data for 27,168 feet were analyzed. The canopy cover target value was not met on Rockpile Creek. The embeddedness target value was reached, indicating that some good spawning substrate conditions exist. Neither the target values for pool frequency/depth nor the shelter/cover ratings were met (Table 5.3-6).

Table 5.3-6
Summary of Current (2001) Conditions Based Upon Habitat Inventory Surveys from the Rockpile Subbasin, Gualala River Watershed, California
Condensed Tributary Reports are located in CDFG Appendix 5.

Habitat Element Stream Name	Surveyed Length (Feet)	Canopy Cover	Embeddedness	Primary Pool Depth/ Frequency	Shelter Cover Ratings
Rockpile Subbasin					
Rockpile Creek	27,168	55%	52%	22%	41

Rockpile Creek is a second order stream. The habitat inventory survey data showed habitat deficiencies related to canopy cover, pool frequency/depth, and shelter cover. Canopy cover was 55 percent in the lower five miles of Rockpile Creek with conifers contributing 15 percent and deciduous 40 percent (Figure 5.3-13). Fifty-two percent of pool tails surveyed in Rockpile Creek were category 1 or 2 embeddedness (Figure 5.3-14). Twenty-two percent of the survey length consisted of primary pools (Figure 5.3-15). Shelter/cover received a rating of 41 (Figure 5.3-16), and most of the cover was provided by undercut banks, large woody debris, and root masses (Figure 5.3-17).

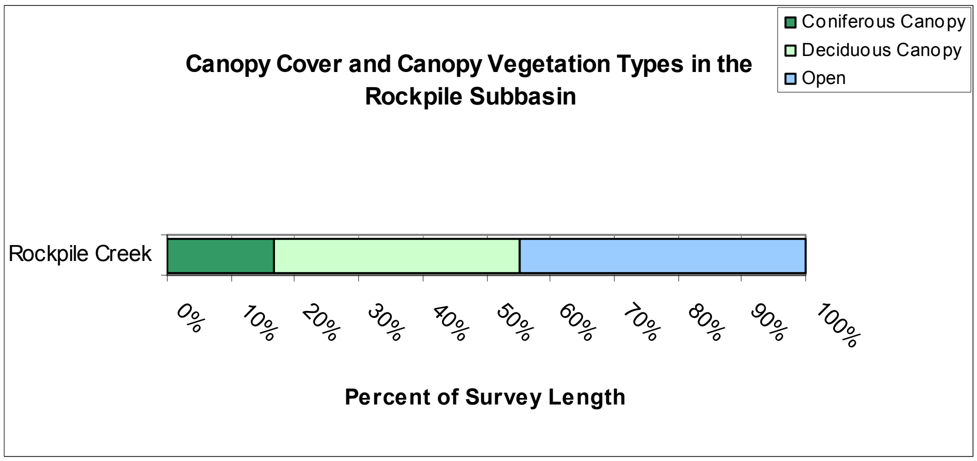


Figure 5.3-13
Canopy Cover and Canopy Vegetation Types by Percent Survey Length in Rockpile Creek, Rockpile Subbasin 2001, Gualala River Watershed, California

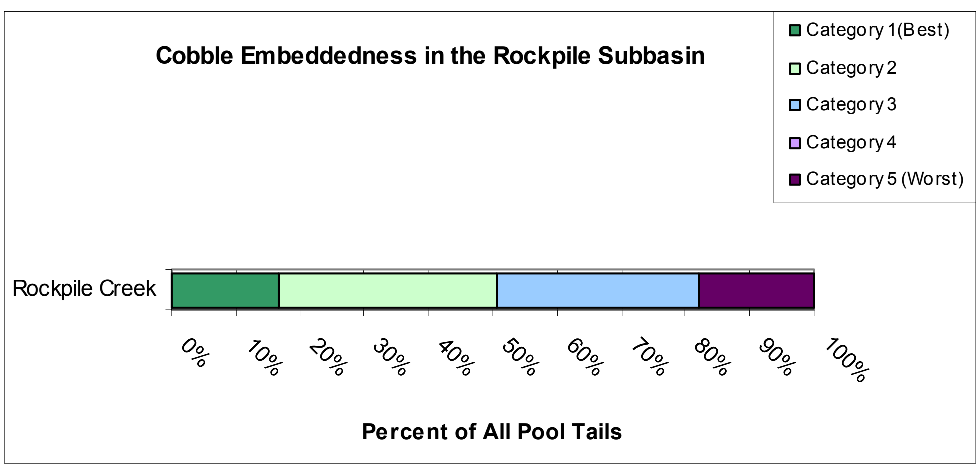


Figure 5.3-14
Cobble Embeddedness in the Rockpile Subbasin 2001, Gualala River Watershed, California

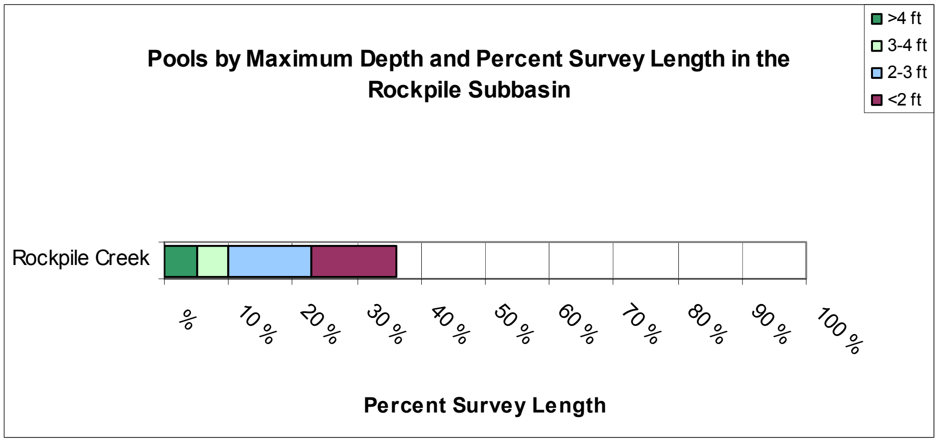


Figure 5.3-15
Pools by Maximum Depth and Percent Survey Length in the Rockpile Subbasin 2001, Gualala River Watershed, California

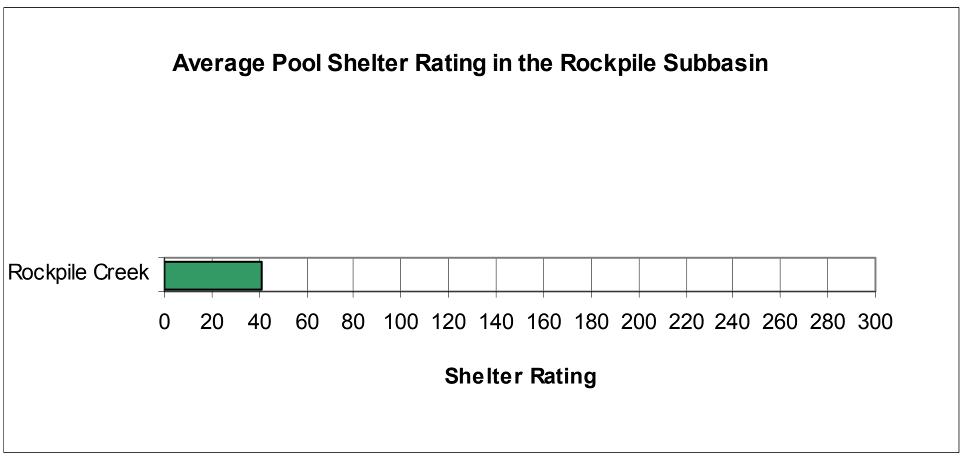


Figure 5.3-16
Average Pool Shelter Ratings in the Rockpile Subbasin 2001, Gualala River Watershed, California

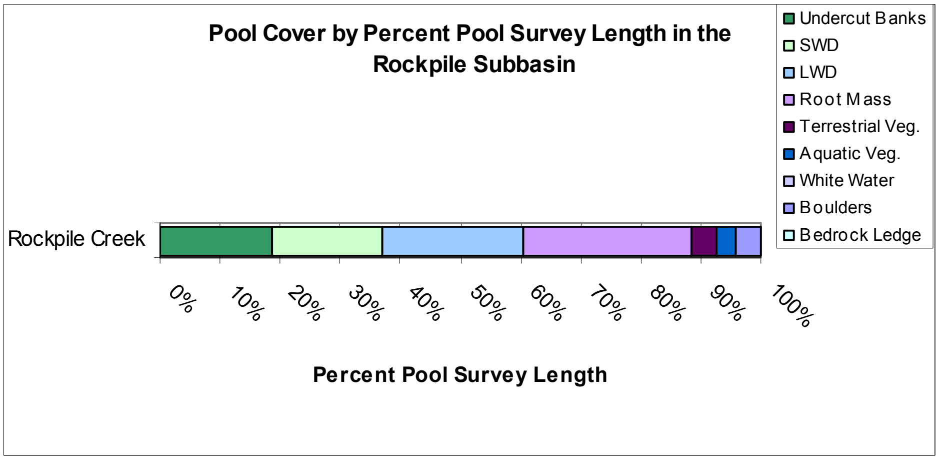


Figure 5.3-17
Pool Cover by Percent of Pool Survey Length in the Rockpile Subbasin 2001, Gualala River Watershed, California

Large Woody Debris Data

Large woody debris data were provided by the Gualala River Watershed Council's Cooperative Monitoring Program. Most large wood was cleared from the streams during the 1950s, 1960s and 1970s. A target value of 130 pieces of large wood > 8 inches per 1,000 feet is recommended in the literature (Beechie and Sibley 1997, Martin 1999). The monitoring surveys demonstrate that large wood is deficient in the section of Rockpile Creek surveyed. This finding is supported by the habitat inventory survey data for 2001 and the EMDS reach model analysis.

Large woody debris surveys conducted by the Watershed Cooperative Monitoring Program in 1998 and 1999 at a site in lower Rockpile Creek (#221) found 18 and 33 pieces per 1,000 feet of stream channel with a volume of 1,291 and 2,520 cubic feet, respectively (Table 5.3-7).

To augment the natural recruitment process of LWD, an ongoing cooperative large wood placement project in the watershed has placed an additional 2,909 cubic feet (18 pieces) of large woody debris into Rockpile Creek, not included in Table 5.3-7.

Table 5.3-7
Watershed Cooperative Monitoring Program Large Woody Debris Survey, Rockpile Subbasin (1998-2001)

Tributary	Site Number	Watershed Size (acres)	Volume in CuFt/1000'	Number of Pieces/1000'
Rockpile Creek	221	22,373	2,412	23

*Watershed size is calculated as the area above the monitoring site.

Changes in Habitat Conditions from 1964 to 2001

No comparison data were available for the Rockpile Subbasin.

Ecological Management Decision Support (EMDS) Reach Model

Although the EMDS Reach Model scores are based upon the habitat inventory survey data, the analysis differed. The habitat inventory data were divided into reaches based upon Rosgen Channel type and then converted to a weighted average. Each weighted average reach was compared to a set of habitat reference conditions which were determined from empirical studies of naturally functioning channels, expert opinion, and peer reviewed literature. EMDS rates each habitat component with a suitability score between -1 and +1, where suitability is a function of salmonid health and productivity. The reference curve breakpoints for these habitat parameters are presented in Table 4-1.

An EMDS score for the subbasin could not be calculated due to limited data. Only one stream equal to 39 percent of all the blue line streams was habitat inventoried. Data from five habitat categories and one temperature site in 2001 were evaluated in EMDS (Table 5.3-8)

Table 5.3-8
Ecological Management Decision Support (EMDS) Reach Model Scores on salmonid heath and productivity suitability for the Rockpile Subbasin, CA., based upon habitat inventory surveys conducted in 1999 and 2001

Subbasin Stream Name	Canopy Cover Score	Embeddednes s Score	Pool Depth Score	Pool Shelter Score	Pool Quality Score	2001 MWAT Water Temperature Score
Rockpile Subbasin Score	n/a	n/a	n/a	n/a	n/a	n/a
Rockpile Creek	- -	-	- - -	- -	- -	-

The 2001 water temperature data was provided by GRI and the GRWC.
+++ = Fully Suitable
++ = Moderately Suitable
+ = Somewhat Suitable
- = Somewhat Unsuitable
- - = Moderately Unsuitable
- - - = Fully Unsuitable

Limiting Factors Analysis

The Gualala River Watershed Limiting Factors Analysis (LFA) was developed for assessing coarse scale stream habitat components. Habitat inventory data, EMDS reach model scores, and the biologist's professional judgment were incorporated into both the identification of LFAs and their ranking.

The LFAs for the subbasin could not be calculated due to limited data. Only one stream equal to 39 percent of all the blue line streams was habitat inventoried. Pool depth related to summer conditions was the predominant limiting factor for salmonid health and productivity on Rockpile Creek. Pool shelter/cover was second, canopy cover was third and embeddedness was the fourth limiting factor (Table 5.3-9).

Table 5.3-9
Limiting Factors for the Rockpile Subbasin Affecting Salmonid Health and Production Based Upon Habitat Inventory Surveys Conducted in 1999 and 2001 and EMDS scores in the Gualala River Watershed, California (*Rank 1 is the most limiting factor*)

Subbasin Stream Name	Canopy Cover Related to Stream Shading	Embeddedness Related to Spawning Suitability	Pool Depth Related to Summer Conditions	Pool Shelter Related to Escape and Cover
Rockpile Subbasin Score	n/a	n/a	n/a	n/a
Rockpile Creek	3	4	1	2

Figure 5.3-18a illustrates the limiting factors as determined by CDFG and various sediment sites identified by CGS as potential restoration targets. Figure5.3-18b is the map explanation. General recommendations are made for each limiting factor and type of sediment site. The map is a reduced image of Plate 3, *Potential Restoration Sites and Habitat Limiting Factors for the Gualala River Watershed* (See Plate 3 to view details at a higher scale [1:48,000]).

Restoration Recommendations

The proposed restoration recommendations were based upon the habitat inventory surveys, limiting factors analysis, landowner and local expertise, and the biologist's professional judgment (Table 5.3-10).

Restoration recommendations for the subbasin overall could not be calculated due to limited data. Only one stream equal to 39 percent of all the blue line streams was habitat inventoried. The addition of instream structures is the highest restoration priority targeted to enhance pool development, increase depth, and provide improved pool shelter cover. The second priority is to increase the riparian canopy to provide more shade over the stream, reduce water temperatures, and provide potential large woody debris. The third priority is to stabilize stream banks. To reduce sediment and improve spawning substrate on the lower reaches, road repair or removal is the fourth restoration priority. Livestock/feral pig exclusion and barrier removal were not identified as restoration needs.

Table 5.3-10
Priorities for Restoration for the Rockpile Subbasin from the 2001 Habitat Inventory Data
Rank 1 indicates highest priority.

Stream Name	Bank Stabilization	Roads Repair or Removal	Riparian Canopy Development	Instream Structure Enhancement	Livestock or Feral Pig Exclusion	Barrier Removal
Rockpile Subbasin	n/a	n/a	n/a	n/a	n/a	n/a
Rockpile Creek	3	4	2	1		

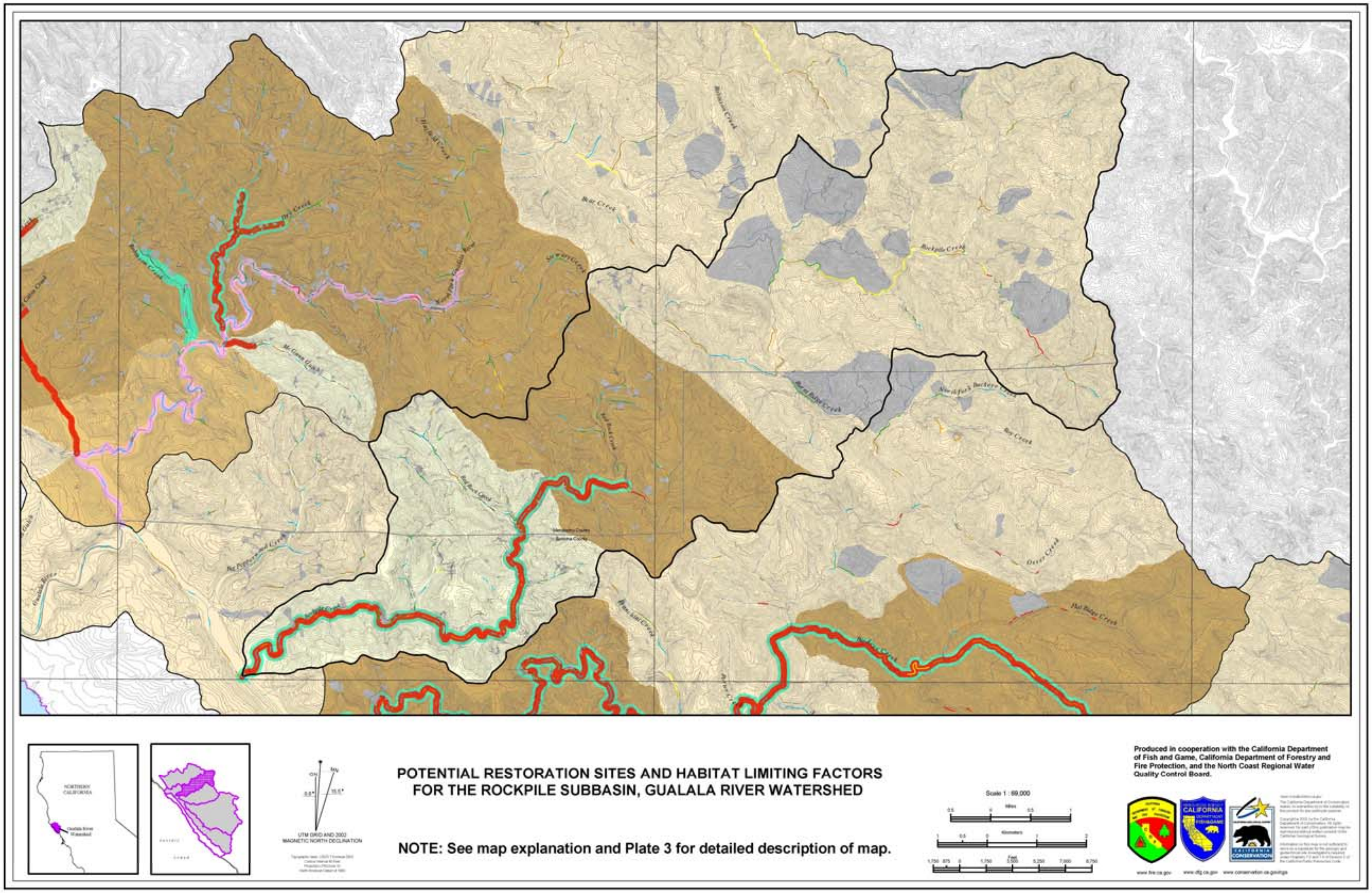


Figure 5.3-18a
Potential Restoration Sites and Habitat Limiting Factors for the Rockpile Subbasin, Gualala River Watershed

Explanation

- Roads
- Streams
- Watershed boundary
- Sub-basin boundary
- Historically Active Landslides (mapped as a point if too small to delineate at the scale of this map)

I SPATIALLY ASSOCIATED FACTORS DERIVED FROM AERIAL PHOTO INTERPRETATION OF LANDSLIDING AND SEDIMENT CONDITIONS

A *HISTORIC IN-STREAM ROADS POSSIBLY RELATED TO FLUVIAL SEDIMENT*

- Stream reaches with persistent aggrading or braiding in both 1984 and 2000 photos that may be associated with historic in-stream roads or landings. See recommendation #5.

B *ROADS POSSIBLY RELATED TO LANDSLIDES AND/OR ERODING BANKS*

- Road segments that may be affected by historically active landsliding and bank erosion. See recommendation #6.
- Road segments that may be affected by historically active landsliding. See recommendation #7.

C *FLUVIAL SEDIMENT CONDITIONS POSSIBLY RELATED TO LANDSLIDES*

- Stream reaches with potentially adverse sediment accumulations that may be affected by historically active landslides and lack any apparent association with the modern road network or the historic in-stream roads or landings. See recommendation #8.
- Stream reaches with potentially adverse sediment accumulations that may be affected by erosion from adjacent dormant landslide terrain that lack any apparent association with historically active landsliding, the modern road network, and historic in-stream roads or landings. See recommendation #9.

D *POTENTIALLY UNRELATED FLUVIAL SEDIMENT CONDITIONS*

- Stream reaches with potentially adverse sediment accumulations that lack any of the above associations. See recommendation #9.

II LIMITING FACTORS DERIVED FROM GROUND BASED HABITAT SURVEYS (SEE DFG APPENDIX)

A *CANOPY AND POOLS AS LIMITING FACTORS* (All stream reaches surveyed by DFG in 2001 are highlighted as follows. Reaches that were not surveyed in 2001 are not highlighted on the map.)

- Stream reaches with inadaquate canopy cover as the limiting factor. See recommendation #2.
- Stream reaches with inadequate pool depths as the limiting factor. See recommendation #4.
- Stream reaches with inadequate pool shelter as the limiting factor. See recommendation #3.
- Stream reaches with both inadaquate pool depths and shelter as limiting factors. See recommendations #3 and #4.

B *EMBEDDEDNESS AS A LIMITING FACTOR*

- Areas draining into where embededdness conditions are unknown.
- Areas draining into reaches where embeddedness is not limiting.
- Areas draining into reaches where embeddedness is marginal but not limiting.
- Areas draining into reaches where embeddedness is somewhat limiting. See recommendation #1.
- Areas draining into reaches where embeddedness is significantly limiting. See recommendation #1.

RECOMMENDATIONS BASED ON LIMITING FACTORS

(1) Reduce production of fine sediment throughout the contributing area. Evaluate contribution from roads and upgrade roads as appropriate. Evaluate contribution from soil disturbance and control erosion as appropriate (see recommendations 5-10). Evaluate contribution from soil disturbance and control erosion as appropriate. Consider the additive effect of the short-term increases in erosion due to mitigation activities. Distribute individual activities both spatially and temporally as appropriate to avoid additive sediment impacts. Institute best management practices in erodible areas; such as, areas shown on the CGS Relative Landslide Potential Map (Plate Two), and National Resources Conservation Service soil maps.

(2) Enhance current riparian vegetation by planting additional trees, and stabilize stream banks as needed. Also, consider both downstream and upstream effects.

(3) Enhance pool shelter by adding submerged or partially submerged structures. Consider both upstream and downstream effects due to operation and possible failure.

(4) Install in-stream structures to produce hydraulic variability and to scour pools. Consider both downstream and upstream effects due to operations and possible failure.

RECOMMENDATIONS BASED ON SPATIAL ASSOCIATIONS

(5) Evaluate relationship on-site. Consider channel restoration and drainage improvements for the road and landing. Consider engineered abandonment.

(6) Evaluate relationship on-site. Consider road drainage improvements to prevent saturation of slide area. Consider abandonment or realignment where feasible. Consider stream bank stabilization where feasible.

(7) Evaluate relationship on-site. Consider road drainage improvements to prevent saturation of slide area. Consider abandonment or realignment where feasible.

(8) Evaluate on-site whether these represent natural background conditions. If mitigation is desired, road construction may be needed for equipment access.

(9) No recommendation because potentially associated active sediment sources have not been identified.

EXPLANATION FOR POTENTIAL RESTORATION SITES AND HABITAT LIMITING FACTORS FOR THE GUALALA RIVER WATERSHED MAP

NOTE: See Plate 3 for complete description of map.

Produced in cooperation with the California Department of Fish and Game, California Department of Forestry and Fire Protection, and the North Coast Regional Water Quality Control Board.

www.fire.ca.gov www.dfg.ca.gov www.conservation.ca.gov/cgs

Figure 5.3-18b

Explanation for Potential Restoration Sites and Habitat Limiting Factors for the Gualala River Watershed Map

Potential Refugia

No potential refugia were identified based upon 2001 data.

5.3.9 FISH HISTORY AND STATUS

Historic fish data don't exist or were unavailable from the 1950s through 2000.

- **2000s -** Young of the year and older steelhead trout were observed during habitat inventory surveys in 2001. Gradient is suitable for coho salmon in the mainstem of lower Rockpile up through the Middle Rockpile Subbasin, although tributaries to lower Rockpile are mainly too steep for the species.

5.3.10 ROCKPILE SUBBASIN PUBLIC ISSUES, SYNTHESIS, AND RECOMMENDATIONS

After conducting public scoping meetings and workshops, the NCWAP team compiled a preliminary list of general issues based upon public input and initial analyses of the available data. Some issues were suggested by watershed analysis experts, and some by Gualala River Watershed residents and constituents. The following general concerns were expressed as potential factors affecting the Rockpile Subbasin and its fisheries, but do not necessarily reflect the findings of the assessment. Some have been disproved by the assessment findings.

- Abandoned roads, new road construction, and road maintenance related to landsliding and sediment input need to be addressed. Without appropriate maintenance or storm proofing, existing roads, both active and abandoned, may contribute sediment.
- Subdivision development is not an issue at this time. However, Pioneer Ltd owns a larger portion of the upper subbasin and is in escrow.
- Grazing is occurring in the upper portion of this subbasin.
- Water temperatures may exceed suitable conditions for coho salmon and steelhead throughout much of this subbasin.
- Low canopy coverage are effecting water temperatures and large wood recruitment.
- Timber harvest and associated road building have increased erosion, increased landsliding, and negative impacts to the riparian zones.
- Best management practices required by current forest practice rules are reducing forestry impacts to insignificance.
- Sediment as a limiting factor for salmonids due to pool filling, aggradation, and small-sized spawning substrate.
- Water temperature and instream sediment monitoring sites are needed.
- Invasive plant species occur in this subbasin.

Working Hypotheses

The primary purpose of these hypotheses is to elucidate in a succinct format the judgment of the Team regarding watershed conditions relative to anadromous salmonids. As such, they are responsive to the assessment questions presented on page 1-1 and 1-2. The findings supporting the hypothesis are presented, along with recommendations for watershed improvements along with recommendations, and to further investigate the hypotheses. As such, they are not intended to be the final word, but are the best judgment based on the information at hand.

Recommendations for watershed improvements and further study are presented at the end of the section, as single recommendations apply in many cases to more than one hypothesis.

The working hypotheses are:

1. Stream conditions in the Rockpile Subbasin provide unsuitable habitat for salmonids.
2. Depleted shade canopy cover along the mainstem of Rockpile Creek and tributaries from past timber harvest activities continues to contribute to elevated water temperatures that are unsuitable for salmonids.
3. A lack of instream large woody debris contributes to simplified riparian habitat structure (e.g., lack of large, deep pools).
4. Instream and near stream conditions are improving in the Rockpile Subbasin.
5. Land management activities, especially road building adjacent to stream channels or across debris slide slopes and/or steep terrain have contributed sediment to streams.

Working Hypothesis 1

Stream conditions in the Rockpile Subbasin provide unsuitable habitat for salmonids.

<u>Supporting Findings</u>

- Water temperatures from 1994 to 2001 in the lower 11 miles of the mainstem and in Horsethief Canyon range from somewhat to fully unsuitable for summertime rearing of salmonids (Table 5.3-4, Figure 5.3-11).
- Canopy cover, pool frequency/depth and pool shelter/cover target values were not met on Rockpile Creek, the only tributary habitat inventory surveyed by CDFG in the Rockpile Subbasin.
- Canopy cover, pool shelter and pool quality EMDS scores were moderately unsuitable on Rockpile Creek. Embeddedness was somewhat unsuitable. Rockpile Creek is a second order stream and the pool depth was fully unsuitable. The Maximum Weekly Average Temperature at the only site sampled in 2001 on Rockpile Creek was somewhat unsuitable (Table 5.3.8).
- The Watershed Cooperative Monitoring Program found large woody debris to be deficient at the one monitored site in lower Rockpile (#221) in 1998 and 1999 (Table 5.3-7).
- Approximately 16 miles of historic logging and ranchland roads built in or along the streambed simplified pool structure and complexity throughout the major tributary streams of the Rockpile Subbasin. The residual effects of channel aggradation from streamside road system failures are noted in timber harvest plan records (see Land Use Section), particularly in many of the unnamed tributaries of the central Rockpile PWS. where the channel continues to downcut to pre-logging levels in many areas (Section 5.3.4 and 5.3.5).

- At least 80 per cent of the channel along the mainstem Rockpile Creek in the Middle Rockpile PWS contained sediment accumulations indicative of channel disturbance in 1984 aerial images. In Horsethief Canyon, where streamside roads and landings were densely concentrated, 75 percent of the channels were disturbed in 1984 (Appendix 2).

<u>Contrary Findings</u>

- Embeddedness target values were reached on Rockpile Creek indicating that some good spawning substrate conditions exist in the 8.5 miles surveyed.
- Water temperatures were fully suitable for the two years sampled in a tributary about one and a half miles from the mouth.
- By 1999/2000 the main channel appeared to have shown some improvement with 50 percent of the channel reach appearing disturbed. In-channel disturbance in Horsethief Canyon improved to 25 percent in 1999/2000 (Table 5.3-3).

<u>Limitations</u>

- Water temperature data were limited to the lower 11 miles of the mainstem.
- Habitat inventory surveys were conducted only on 39 percent of stream miles in the Rockpile Subbasin.

<u>Conclusion</u>

- The hypothesis is supported.

Working Hypothesis 2

Depleted shade canopy cover along the mainstem of Rockpile Creek and tributaries from past timber harvest activities continues to contribute to elevated water temperatures that are unsuitable for salmonids.

<u>Supporting Findings</u>

- Temperatures in the lower 11 miles of mainstem Rockpile Creek were unsuitable for summer rearing of salmonids (Table 5.3-4, Figure 5.3-11).
- The CDFG canopy cover target value was not met on Rockpile Creek, the only tributary surveyed in the Rockpile Subbasin. (Table 5.3-6, Figure 5.3-13).
- Canopy cover EMDS scores were moderately unsuitable on Rockpile Creek (Table 5.3-8)
- Post World War II construction of roads, landings, and skid trails in riparian zones by crawler tractors eliminated overstory shade canopy cover over most of the blue line streams in the middle subbasin reaches. Twenty-five percent of the blue line streams still had exposed banks in 2000 photos compared with five percent in the 1942 pre-harvest photos (Figure 5.3-8 and discussion).

<u>Contrary Findings</u>

- Stream bank canopy cover has improved on Red Rock Creek, Horsethief Canyon, and unnamed tributaries downstream of Rockpile Peak, and has increased overall from 70 percent exposure in 1968 photos (Section 5.3.4).

<u>*Limitations*</u>

- Water temperature data were available for the lower 11 miles of the subbasin.
- Only 39 percent of the subbasin was habitat inventory surveyed.

<u>*Conclusion*</u>

- The hypothesis is supported.

Working Hypothesis 3

A lack of instream large woody debris contributes to simplified riparian habitat structure (e.g., lack of large, deep pools).

<u>*Supporting Findings*</u>

- The pool frequency/depth and pool shelter/cover CDFG target values were not met on Rockpile Creek, the only tributary surveyed in the Rockpile Subbasin. Large woody debris is important as a pool-forming component (Table 5.3-6).
- Pool shelter and pool quality EMDS scores were moderately unsuitable on Rockpile Creek. Pool depth was fully unsuitable in this second order stream (Table 5.3-8).
- Construction of roads, landings, and skid trails in or adjacent to streams between 1952 and 1968 buried, removed, or dispersed LWD in the subbasin. Review of 1961 and 1963 aerial photos showed riparian areas entirely cleared of vegetation and remnant downed logs (Section 5.3.4).
- Historic and recent timber harvest in the lower and middle reaches frequently removed large conifer vegetation down to the stream bank, severely reducing the available recruitment supply of large woody debris. Dense buffers of conifers large enough to function, upon recruitment, as LWD in channel formation processes have not reestablished (Section 5.3.4).
- The Watershed Cooperative Monitoring Program found large woody debris to be deficient at the one monitored site in lower Rockpile (#221) in 1998 and 1999 (Table 5.3-7).

<u>*Contrary Findings*</u>

- In the central subbasin reaches, riparian areas are re-growing under current land management practices.

<u>*Limitations*</u>

- Habitat inventory surveys were conducted on only 39 percent of the mainstem Rockpile Creek (the lower 8.5 miles).

<u>*Conclusion*</u>

- The hypothesis is supported.

Working Hypothesis 4

Instream and near stream conditions are improving in the Rockpile Subbasin.

- Overall levels of sediment accumulations indicating channel disturbance were less in the Lower Rockpile PWS 1999/2000 photos compared to 1984. Along the mainstem Rockpile Creek, approximately 80 percent of the main channel appeared disturbed with enlarged and numerous bars and lack of riparian vegetation in 1984. By 1999/2000 the main channel appeared to have shown some improvement with 50 percent of the channel reach disturbed (Table 5.3-3).

- At least 80 percent of the channel along the mainstem Rockpile Creek in the Middle Rockpile PWS was disturbed in 1984 images. In the 1999/2000 images, there were some improvements to 50 to 75 percent disturbance (Table 5.3-3).

- In Horsethief Canyon, where streamside roads and landings were densely concentrated, 75 percent of the channels were disturbed in 1984 compared with 25 percent in 1999/2000 (Table 5.3-3).

- Visual examination of GIS layers for dominant substrate, embeddedness, adverse fluvial, and landslide potential resulted in three conclusions: (1) 70 percent of adverse fluvial characteristics in the Gualala Basin abutted high and very high landslide potential ratings, (2) adverse fluvial declined from 1984 to1999, and (3) larger streambed particles were observed in upstream compared to downstream areas.

- Stream bank canopy cover has improved on Red Rock Creek, Horsethief Canyon, and unnamed tributaries downstream of Rockpile Peak, and has increased overall from 70 percent exposure in 1968 photos (Section 5.3.4).

Contrary Findings

- No change in channel disturbance at 50 percent was observed in the Upper Rockpile PWS between 1984 and 1999/2000.

Limitations

- None noted.

Conclusion

- The hypothesis is supported.

Working Hypothesis 5

Land management activities, especially past road building adjacent to stream channels or across debris slide slopes and/or steep terrain have contributed sediment to streams.

Supporting Findings

- Approximately 16 miles of historic logging and ranchland roads built in or along the streambed impacted pool structure and complexity throughout the major tributary streams of the Rockpile Subbasin (Section 5.3.4).

- A high density of road debris slides into streams in the Red Rock and Central Rockpile PWSs was visible in the1963 and 1981 air photos (Section 5.3.4).

- Mid-20th-century roads and landings built in or near the main channel may still be contributing excess sediment, especially where channel braiding and/or aggradation are persistent as noted along the mainstem, Red Rock Creek, and Horsethief Canyon (Section 5.3.4).

- The residual effects of heavy channel aggradation from failure of streamside road systems built in the 1950s and 1960s are noted in timber harvest plan records (Section 5.3.4), particularly in many of the unnamed tributaries of the central Rockpile PWS, where the channel continues to downcut.

- Modern road segments within 60 meters of historically active landslides are numerous in the upper stream reaches and may be contributing excess sediment to streams. Debris slides and debris flows are more numerous in the central and upper reaches of the subbasin. Modern road failures were generally more numerous in high or very high potential landslide areas (105 miles, or 62 percent, of current roads in the Rockpile) (Section 5.3.4).

- Many undersized culverts and substandard road drainage facilities failed during the 1986 and 1996 storms, representing a portion of contemporary sediment pulses in the subbasin (Section 5.3.4).

- Large portions of the upper subbasin are underlain with the mélange of the Central Belt of the Franciscan Assemblage and vegetated with prairie and sparse oaks. Landsliding is especially prevalent in the mélange, and active earthflow complexes are very numerous and unavoidably crossed by many roads.

<u>Contrary Findings</u>

- Approximately one and a half miles of modern roads (out of 168 miles total) are located within 50 feet of blue line streams in the subbasin. Of these roads, less than a half mile total length are in areas that may be affected by historically active landsliding and stream bank erosion.

- Distributions of debris slides and debris flows are more numerous in the central and upper reaches of the subbasin. Major earth flows are common in the Central Belt of the Franciscan Complex mélange in the east subbasin (Plate 1 and Appendix 2, and Synthesis Graphics), potentially high in natural background sources.

<u>Limitations</u>

- Although roads are located in erosion-prone areas, the performance of those roads was not evaluated in this assessment.

- Evaluation of the relationship of site specific road failures to regional geologic conditions is beyond the scope of this assessment.

<u>Conclusions</u>

- Sediment contributions from earlier timber harvest and road building activities persist, while sources associated with existing unimproved timber and ranchland roads may still exist.

Rockpile Subbasin Recommendations

Target restoration and land use activities to the three highest priorities for restoration in the Rockpile Subbasin: (1) fish habitat improvement structures including large wood placement, (2) riparian canopy development, and (3) bank stabilization. Cost sharing grants should be pursued to off set the costs of watershed improvements.

1. Install fish habitat improvement structures including large woody debris placement

   a. Promote installation of fish habitat improvement structures as appropriate to the stream channel type and hydrologic conditions.

   b. Land managers in this subbasin should be encouraged to add more large organic debris and shelter structures in order to improve sediment metering, channel structure, channel function, habitat complexity, and habitat diversity for salmonids.

Pool shelter is the most limiting factor in Rockpile Creek, the stream surveyed in the subbasin. The natural large woody debris recruitment process should be enhanced by developing large riparian conifers with tree protection, planting, thinning from below, and other vegetation management techniques. Instream structure enhancement is the first of the top three recommendations.

2. Improve or enhance riparian zones to achieve target canopy density and increase the density and diversity of the riparian zone, including large conifers for LWD recruitment.

   a. Maintain and enhance existing riparian cover. Where current canopy is inadequate and site conditions are appropriate, initiate tree planting and other vegetation management to hasten the development of denser and more extensive riparian canopy. Riparian canopy development is the second priority recommendation. The mainstem, Red Rock Creek and Horsethief Canyon are the primary areas needing attention.

3. Address bank stabilization issues where indicated on the restoration map in Chapter 4.

   a. Encourage cooperative efforts to reduce sediment yield to streams at stream bank erosion sites. Grazing is an issue in the upper subbasin. Bank stabilization is the third of the top three recommendations.

   b. Continue efforts such as road erosion proofing, improvements, and decommissioning throughout the subbasin to reduce sediment delivery to central Rockpile Creek and Rockpile Creek tributaries. Focus efforts on areas adjacent to the streams, abandoning and vegetating historic streamside roads were feasible. Channel characteristics improved the least in the Middle and Upper Rockpile Creek PWSs.

   c. Encourage the use of cable or helicopter yarding on steep and unstable slopes to reduce soil compaction, surface disturbance, and resultant sediment yield.

   d. Consider careful planning of land uses that could exacerbate mass wasting, since the relative potential of landsliding is high to very high in 60 percent of the subbasin.

4. Expand existing monitoring efforts to both better understand relationships in the subbasin and to assist in targeting restoration activities.

   a. Expand continuous temperature monitoring efforts into the upper subbasin and tributaries

   b. Investigate the availability and quality of other temperature and canopy data for the eastern area, and reevaluate the relationship of canopy to actual stream temperatures.

   c. Collect data to evaluate and possibly model the relationship among water temperature, canopy levels, and other factors where canopy is still recovering to establish reasonable recovery targets.

   d. Encourage more stream habitat inventories and biological surveys of tributaries, as only 39 percent has been completed.

e. Survey for salmonids, using consistent methods, to estimate population numbers for comparison with recovery targets to be set by NMFS.

f. Conduct both instream and hillslope monitoring to determine whether land use practices are allowing for recovery and protection of the salmonid habitat in the subbasin. Use GRWC methods for instream monitoring.