U.S. Environmental Protection Agency
Region IX

Trinity River
Total Maximum Daily Load
for Sediment

Approved by:

/s/ 20 December 2001

Alexis Strauss Date
Director, Water Division

Table of Contents

List of Tables ii

List of Figures ii

TMDL SUMMARY iii

CHAPTER 1: INTRODUCTION 1
- 1.1. Watershed Characteristics 2
- 1.2. Information Sources 3
- 1.3. Organization 4

CHAPTER 2: PROBLEM STATEMENT 10
- 2.1. Water Quality Standards 10
- 2.2. Decline of Fish Populations 13
- 2.3. Salmonid Life Cycle and Habitat Requirements 19
- 2.4. Habitat Conditions in the Trinity River Watershed 20

CHAPTER 3: STREAM HABITAT INDICATORS 28
- 3.1. Upper Middle Mainstem Geomorphic Indicators and Targets 29
- 3.2. Basin-wide Sediment Indicators 31
- 3.3. Watershed Indicators 38

CHAPTER 4: SEDIMENT SOURCE ANALYSIS AND BUDGET 43
- 4.1. Source Analysis Methods 43
- 4.2. Summary of Sediment Source Inputs 48
- 4.3. Development of Sediment Budget 52

CHAPTER 5: TMDL AND ALLOCATIONS 55
- 5.1. Approach 55
- 5.2. Loading Capacity (TMDL) and Allocation Calculations 57
- 5.3. Margin of Safety 64
- 5.4. Seasonal Variation and Critical Conditions 65

CHAPTER 6: IMPLEMENTATION AND MONITORING RECOMMENDATIONS 66

CHAPTER 7: PUBLIC PARTICIPATION 69

References 70

Glossary 75

List of Tables

1-1. List of Assessment Areas, Subareas and Subwatersheds in the Trinity River Basin 2
2-1. Trinity River Beneficial Uses by Hydrologic Area (source: Regional Water Board 1996) 11
2-2. Water Quality Objectives Addressed in the Trinity River TMDL 12
2-3. Comparison of TRRP Inriver Spawner Escapement Goals to Average Numbers of Naturally Produced Fish (Updated from Table 3-13, U.S. FWS 1999) 14
3-1. Geomorphic Indicators, Targets and Beneficial Use Relationship for the Upper Middle Mainstem (adapted from TRMFR EIS, Table 3-1 (U.S. FWS 1999)) 30
3-2. Comparison of D_{50} Values from 1992 to 2000 indicating Declining Spawning Gravel Quality (GMA 2001a) 31
3-3. Sediment Indicators and Targets 32
3-4. Summary of Selected Road Hazard Indicators from Lowest Composite Rating Hazard Potential to Highest (Adapted from De la Fuente et al. 2000) 39
3-5. Timber Harvest Area (acres) by Decade within Each Assessment Area (GMA 2001b). 42
4-1. Sediment Source Summary by Category and Assessment Area 48
4-2. Sediment Source Summary by Category and Subareas within the Upper Assessment Area (GMA 2001b). 50
4-3. Sediment Source Summary by Category and Subareas within Upper Middle Assessment Area (GMA 2001b) 50
4-4. Sediment Source Summary by Category and Subareas with the Lower Middle Assessment Area (GMA 2001b). 51
4-5. Sediment Source Summary by Category and Subareas within the Lower Assessment Area (GMA 2001b). 51
4-6. Comparison of Tributary Sediment Inputs and Outputs in the Upper Middle Trinity Assessment Area, 1980-2000. 53
4-7. Comparison of Sediment Transport Values for Mainstem Trinity River and Tributary Sites between Historic Flows (1981-2000) and Projected ROD Flows (source: GMA 2001b) 54
5-1. Summary of Reference Watersheds and Supporting Information 56
5-2. TMDL and Allocations by Source Category for Upper Area. 60
5-3. TMDL and Allocations by Source Category for Upper Middle Area 61
5-4. TMDL and Allocations by Source Category for Lower Middle Assessment Area 62
5-5. TMDL and Allocations by Source Category for Lower Assessment Area 63
5-6. Uncertainties in Trinity River TMDL. 64
6-1. Summary of Implementation Recommendations for the Trinity River Basin. 67

List of Figures

1-1. Map of the Trinity River Basin 5
1-2 Subareas of the Upper Assessment Area 6
1-3 Subareas of the Upper Middle Assessment Area 7
1-4 Map of Lower Middle Assessment Area 8
1-5 Subareas of the Lower Assessment Area 9
2-1. Fall Chinook Spawner Escapement in the Trinity River upstream of Willow Creek, 1982-1999 (source: CDFG and USFWS) 14
2-2. Coho Spawner Escapement in the Trinity River above Willow Creek, 1991-1999 (source: CDFG and USFWS) 15
2-3. Juvenile Chinook Estimates in the Trinity River at Willow Creek (1991-1998). (source: CDFG and USFWS) 17
3-1. Mean Permeability vs. Approximate River Mile (Adapted from GMA 2001a) 36
4-1. Percent Sediment Input by Source Category within Each Assessment Area 49

Trinity River TMDL Summary

Watershed Setting: Trinity River Basin area covered by TMDL is approximately 2,000 square miles. Major tributary to the Klamath River. Terrain is predominantly mountainous and forested. Elevations from 9,000 to 300 feet. Hydrologic Code: 18010211.

Major Features: Trinity and Lewiston Reservoirs. Significant water exports from the Trinity to the Sacramento River since early 1960's.
Wild and Scenic River Designation

Ownership: US Forest Service (67% of which 32% is Wilderness)
Private Industrial Forest (15%), Small Private (8%)
Tribal (6%), Not included in TMDL.
Bureau of Land Management (4%)

Water Quality Standard of Concern: Sediment, turbidity, suspended material, settleable material
Added to the Clean Water Act Section 303(d) list in 1992.

Beneficial Use Affected: Primarily cold water fish habitat for spawning, rearing and migration

Environmental Indicators: Spawning gravel quality and permeability, turbidity, pool depth and several geomorphic indicators of a healthy alluvial river.
Watershed indicators include: road location, stream crossings with diversion potential, road drainage, road maintenance, activities in unstable areas.

Major Source(s) of impairment: Roads, timber harvesting, mining and natural sources.

Loading Capacity: Based on sediment delivery rates in reference subwatersheds, EPA determined the total percentage of background sediment delivery that could occur and still meet water quality objectives. This percent (125% of background) was applied to subareas throughout the basin to determine the loading capacity or TMDL.

Wasteload Allocation (WLA): WLAs for point sources are identical to LAs for nonpoint sources according to subarea.

Load Allocation (LA): LAs for nonpoint sources apportioned between background and management-related sources on a subarea basis. Percent reduction needed in management sources also identified (Tables 5-2,3,4 and 5)

Margin of Safety: Incorporated into TMDL through conservative assumptions

Implementation Recommendations: 1. Reduce sediment production from roads and timber harvest in sediment-impaired subwatersheds at levels identified on a subarea basis; 2. Continued sediment prevention for reference (“properly functioning”) watersheds through timely implementation of existing programs; 3. Implement the flow schedule, restoration measures and adaptive management program called for in Trinity River Mainstem Fishery Restoration Record of Decision (ROD) to the extent permitted by court order.

CHAPTER 1

INTRODUCTION

The Trinity River Total Maximum Daily Load (TMDL) for Sediment is being established in accordance with Section 303(d) of the Clean Water Act, because the State of California has determined that the water quality standards for the Trinity River are exceeded due to excessive sediment. In accordance with Section 303(d), the State of California periodically identifies "those waters within its boundaries for which the effluent limitations . . . are not stringent enough to implement any water quality standard applicable to such waters." In 1992, EPA added the Trinity River to California's 303(d) impaired water list due to elevated sedimentation. The North Coast Regional Water Quality Control Board (Regional Water Board) has continued to identify the Trinity River as impaired in subsequent listing cycles, the latest in 1998.

In accordance with a consent decree (*Pacific Coast Federation of Fishermen's Associations, et al. v. Marcus*, No. 95-4474 MHP, 11 March 1997), December 2001 is the deadline for establishment of this TMDL. Because the State of California will not complete adoption of a TMDL for the Trinity River by this deadline, EPA is establishing this TMDL, with assistance from Regional Water Board staff.

The primary adverse impacts associated with excessive sediment in the Trinity River pertain to anadromous salmonid fish habitat. The populations of several anadromous salmonid species present in the Trinity River and its tributaries are in severe decline. The population of coho salmon (*Oncorhynchus kisutch*) is listed as threatened under the federal Endangered Species Act.

The purpose of the Trinity River TMDL is to identify the total load of sediment that can be delivered to the Trinity River and its tributaries without causing exceedence of water quality standards, and to allocate the total load among the sources of sediment in the watershed. Although factors other than excessive sediment in the watershed may be affecting salmonid populations (e.g., ocean rearing conditions), this TMDL focuses on sediment, the pollutant for which the Trinity River is listed under Section 303(d). EPA expects the Regional Water Board to develop implementation measures which will result in implementation of the TMDL in accordance with the requirements of 40 CFR 130.6. The allocations, when implemented, are expected to result in the attainment of the applicable water quality standards for sediment for the Trinity River and its tributaries.

This TMDL applies to the portions of the Trinity River watershed governed by California water quality standards. It does not apply to lands under tribal jurisdiction. Nor does this TMDL apply to the South Fork Trinity River where EPA adopted a sediment TMDL in 1998 (US EPA 1998).

1.1. Watershed Characteristics

The Trinity River is the largest tributary to the Klamath River, draining an area of approximately 3,000 square miles, about 2000 of which are covered by this TMDL. The Trinity River has historically been recognized as a major producer of chinook and coho salmon and steelhead trout. The terrain is predominately mountainous and forested, with elevations ranging from 9,000 feet above sea level in the headwater areas, to less than 300 feet at the confluence with the Klamath River. The majority of the basin (approximately 70%) is under public ownership, including the Trinity Alps Wilderness areas, the Shasta-Trinity National Forest, Six Rivers National Forest, Bureau of Land Management, Bureau of Reclamation, and various state and county entities. The Hoopa Valley Tribe occupies 144 square miles of the lower basin, while industrial timber companies and other private landowners make up the remaining portions of the basin.

Several geologic strata transect the basin including the Eastern Klamath Subprovince, Central Metamorphic Subprovince, Hayfork Terrain, Galice Formation, and others. Land use activities in the Trinity include mining, timber harvesting, road construction, recreation and a limited degree of residential development in certain locations. The construction of Trinity and Lewiston dams in the early 1960's had and continues to have a major impact on the flow, function and use of the Trinity River.

Based on distinct physical and biological characteristics with the Trinity River Basin, EPA stratified the Basin into three scales (from large to small): Assessment Areas, Subareas and Subwatersheds. The TMDL assessment and companion sediment source analysis by GMA (2001b) are generally organized according this stratification. Table 1-1 identifies name and size of each area. Figure 1-1 on the following page is a map of the whole basin with assessment areas identified. More detailed maps of each assessment area including subwatersheds are included in Figures 1-2, 3, 4, 5.

Table 1-1. List of Assessment Areas, Subareas and Subwatersheds in the Trinity River Basin.

Subareas	Subwatersheds	Approximate Size (mi^2)
Upper Assessment Area		692
Reference	Stuarts Fork, Swift Creek, Coffee Creek	235
Westside Tributaries	Stuart Arm Area, Stoney Creek, Mule Creek, East Fork Stuarts Fork, West Side Trinity Lake, Hatchet Creek, Buckeye Creek	93
Upper Trinity	Upper Mainstem, Tangle Blue, Sunflower Creek, Graves Creek, Bear Creek, Upper Mainstem Area, Ramshorn Creek, Ripple Creek, Eagle Creek, Minnehaha Creek, Snowslide Gulch Area, Scorpion Creek	161
East Fork Tributaries	East Fork Trinity, Cedar Creek, Squirrel Gulch Area	115
East Side Tributaries	East Side Tributaries, Trinity Lake	89
Upper Middle Assessment Area		321
Weaver and Rush Creeks	Weaver and Rush Creek	72

Deadwood Creek, Hoadley Gulch and Poker Bar Area	Deadwood Creek, Hoadley Gulch and Poker Bar Area	47
Lewiston Lake Area	Lewiston Lake Area	25
Grass Valley Creek	Grass Valley Creek	37
Indian Creek	Indian Creek	34
Reading and Browns Creek	Reading and Browns Creek	104
Lower Middle Assessment Area		720
Reference	New River, Big French, Manzanita, North Fork, East Fork North Fork	434
Canyon Creek	Canyon Creek	64
Upper Tributaries	Dutch Creek, Soldier Creek, Oregon Gulch, Conner Creek Area	72
Middle Tributaries	Big Bar Area, Prairie Creek, Little French Creek	54
Lower Tributaries	Swede Creek, Italian Creek, Canadian Creek, Cedar Flat Creek, Mill Creek, McDonald Creek, Hennessy Creek, Quinby Creek Area, Hawkins Creek, Sharber Creek	96
Lower Assessment Area *(Hoopa Valley Tribe not included)*		189
Reference Subwatershed	Horse Linto Creek	64
Mill Creek and Tish Tang	Mill Creek and Tish Tang Creek	39
Willow Creek	Willow Creek	43
Campbell Creek	Campbell Creek	11
Lower Mainstem Area	Lower Mainstem Area and Coon Creek	32

1.2. Information Sources

The Trinity River TMDL is based on the best available information and data from several existing studies and reports including but not limited to:

* Trinity River Mainstem Fishery Restoration Environmental Impact Statement (US FWS 1999)
* Gravel Quality Monitoring in the Mainstem Trinity River (GMA 2001a)
* Trinity River Sediment Source Analysis (GMA 2001b);
* Trinity River Flow Evaluation Final Report (US FWS and HVT 1999);
* Trinity River Maintenance Flow Study Final Report (McBain and Trush 1997);
* Watershed Condition Assessment, Beta-test Results of Northern Province (De la Fuente et al 2000)
* Several habitat assessment reports and environmental assessment by the US Forest Service;
* Additional information sources as cited.

These information sources range from highly quantitative studies to general qualitative descriptions of aquatic habitat or watershed condition. The Klamath River Information System (KRIS) is a database program containing fisheries, water quality and watershed information. EPA utilized the KRIS CD to access some of the Trinity River information. In addition, the EPA wishes to acknowledge the contribution of local expertise and knowledge supplied by numerous individuals from the following organizations: Trinity County Resource Conservation District, US Forest Service, California Department of Fish and Game (CDFG) Members of the Trinity River Task Force and associated subcommittees, Natural Resource Advisory Committee of Trinity County, Hoopa Valley Tribe, landowners, Humboldt State University, and many others.

EPA has initiated informal consultation with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (US FWS) on this action, under Section 7(a)(2) of the Endangered Species Act. Section 7(a)(2) states that each federal agency shall ensure that its actions are not likely to jeopardize the continued existence of any federally-listed endangered or threatened species.

EPA's consultation with the Services has not yet been completed. EPA believes that it is unlikely that the Services will conclude that the Total Maximum Daily Load (TMDL) that EPA is establishing violates Section 7(a)(2) since the TMDL and allocations are calculated in order to meet water quality standards, and water quality standards are expressly designed to "protect the public health or welfare, enhance the quality of water and serve the purposes" of the Clean Water Act, which are to "restore and maintain the chemical, physical, and biological integrity of the Nation's water." Additionally, this action will improve existing conditions. However, EPA retains the discretion to revise this action if the consultation identifies deficiencies in the TMDL or allocations.

1.4. Organization

This report is divided into chapters. Chapter 2 (Problem Statement) describes the nature of the environmental problem addressed by the TMDL. Chapter 3 (Stream Habitat Indicators) identifies specific stream and watershed characteristics to be used to evaluate whether the Trinity River is attaining water quality standards. Chapter 4 (Source Analysis) describes what is currently understood about the sources of sediment in the watershed. Chapter 5 (TMDL and Allocations) identifies the total load of sediment that can be delivered to the Trinity River and its tributaries without causing exceedence of water quality standards, and describes how EPA is apportioning the total load among the sediment sources. Chapter 6 (Implementation and Monitoring Recommendations) contains recommendations to the State regarding implementation and monitoring of the TMDL. Chapter 7 (Public Participation) describes public participation in the development of the TMDL.

FIGURE 1-1

TRINITY RIVER WATERSHED

Assessment Areas of the Trinity River Watershed

Basemap Data Source: U. S. Forest Service

Presented By
Enviromental Protection Agency

Prepared By
Trinity County Resource Conservation District

Scale: 1 = 640,000

October 11, 2001

KDS

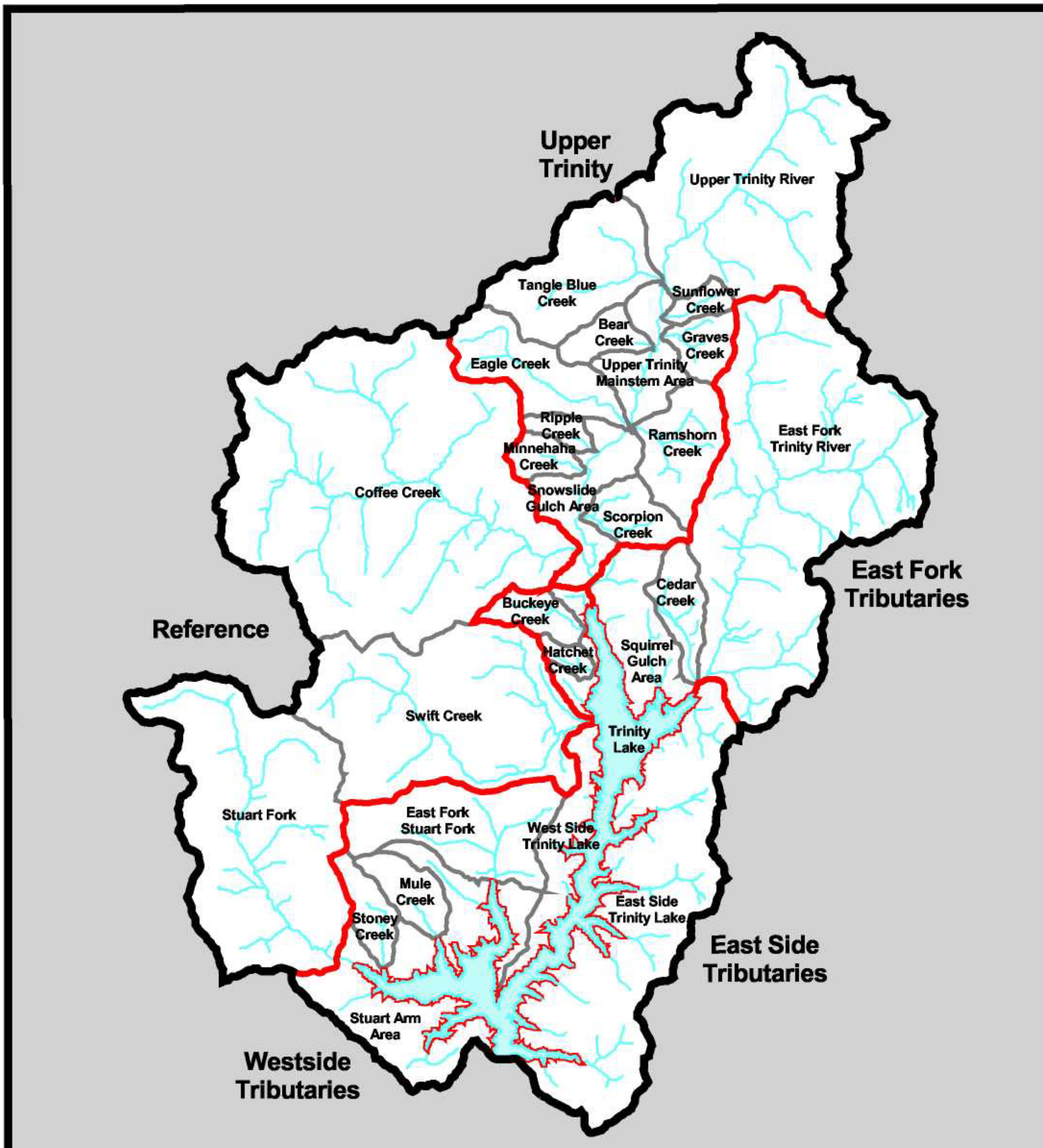


FIGURE 1-2

TRINITY RIVER WATERSHED

Subareas of the Upper Trinity River Assessment Area

Assessment Area
Subareas
Sub-Watersheds
Streams

Basemap Data Source: U. S. Forest Service

Assessment Area Location

N W E S

Presented By
Enviromental Protection Agency

Prepared By
Trinity County Resource Conservation District

October 11, 2001

Scale: 1 = 350,000

0 1 2 3 4 5 6 7 8 Miles

0 1 2 3 4 5 6 7 8 9 10 Kilometers

K D S

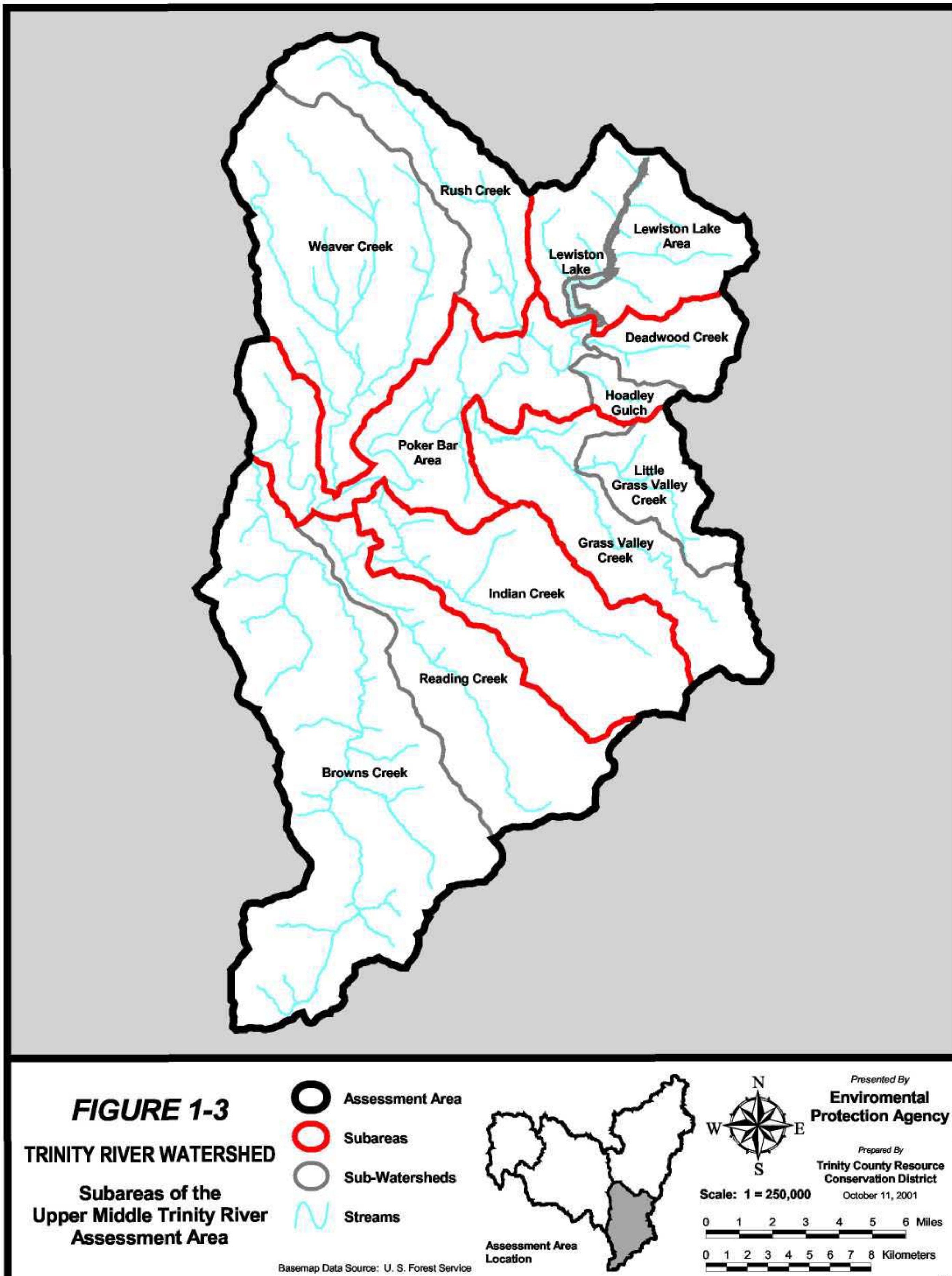


FIGURE 1-3

TRINITY RIVER WATERSHED

Subareas of the Upper Middle Trinity River Assessment Area

FIGURE 1-4

TRINITY RIVER WATERSHED

Subareas of the Lower Middle Trinity River Assessment Area

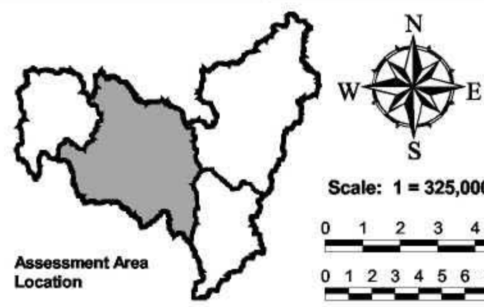
Assessment Area

Subareas

Sub-Watersheds

Streams

Basemap Data Source: U. S. Forest Service



Presented By
Enviromental Protection Agency

Prepared By
Trinity County Resource Conservation District

October 11, 2001

Scale: 1 = 325,000

0 1 2 3 4 5 6 7 8 Miles

0 1 2 3 4 5 6 7 8 9 10 11 Kilometers

KDS

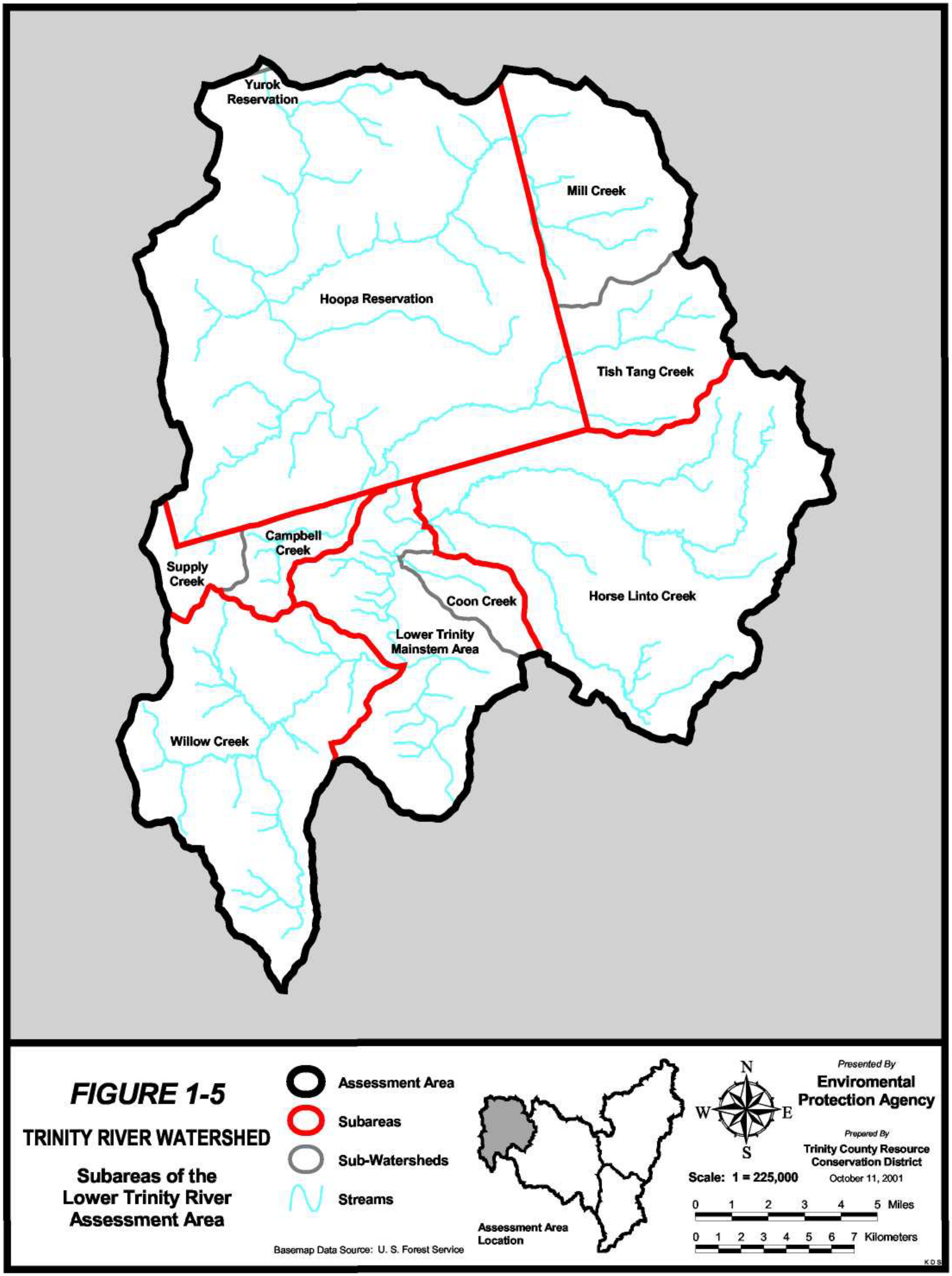


FIGURE 1-5

TRINITY RIVER WATERSHED

Subareas of the Lower Trinity River Assessment Area

CHAPTER 2

PROBLEM STATEMENT

The beneficial uses associated with cold water fish habitat are currently impaired in the Trinity River Basin. Conditions in portions of the Trinity River and its tributaries have degraded and are not adequate to support the beneficial uses. Disturbance is a natural part of stream ecosystems, and salmonid populations naturally fluctuate in response to disturbances, but human activities can result in increased severity and frequency of disturbances. Habitat degradation, exacerbated by human activites, has contributed to a dramatic decline in the populations of coho, chinook, and steelhead from historical levels.

This chapter summarizes how and where sediment is affecting the beneficial uses of the Trinity River and its tributaries associated with the decline of cold water fish habitat. The water quality standards section (2.1) describes the beneficial uses and sediment-related water quality objectives (i.e., suspended material, settleable material, turbidity, etc.) that apply to the Trinity River Basin. Section 2.2 summarizes the distribution and abundance of fish populations based on various estimates by state, federal and tribal entities. The salmonid life cycle and habitat requirements are described in Section 2.3. Finally, Section 2.4 provides a qualitative assessment of existing instream and watershed conditions in the Trinity River basin, including both healthy and degraded areas of the Trinity River Basin.

2.1. Water Quality Standards

In accordance with the Clean Water Act, TMDLs are set at levels necessary to implement the applicable water quality standards. Under the Clean Water Act, water quality standards consist of designated uses, water quality criteria to protect the uses, and an antidegradation policy. The State of California uses slightly different language (i.e., beneficial uses, water quality objectives, and a non-degradation policy). This section describes the State water quality standards applicable to the Trinity River TMDL using the State’s terminology. The remainder of the document simply refers to water quality standards.

The beneficial uses and water quality objectives for the Trinity River are contained in the *Water Quality Control Plan for the North Coast Region* (Basin Plan) as amended in 1996 (Regional Water Board 1996). The beneficial uses pertinent to the Trinity River are listed in Table 2-1.

Table 2-1. Trinity River Beneficial Uses by Hydrologic Area (Regional Water Board 1996)

Beneficial Water Use	Upper Trinity Hydrologic Area		Lower Trinity Hydrologic Area (Trinity River below Lewiston Reservoir)
	Trinity Lake and Lewiston Reservoir	Trinity River above Trinity Lake	
Municipal and Domestic Supply (MUN*)	E	E	E
Agricultural Supply (AGR*)	E	E	E
Industrial Service Supply (IND*)	E	E	P
Industrial Process Supply (PROC*)	E	P	P
Groundwater Recharge (GWR)	E	E	E
Freshwater Replenishment (FRSH)	E	E	E
Hydropower Generation (POW)	E		
Water Contact Recreation (REC-1)	E	E	E
Non-contact Water Recreation (REC-2)	E	E	E
Commercial and Sport Fishing (COMM)	E	E	E
Warm Freshwater Habitat (WARM)	E		
Cold Freshwater Habitat (COLD)	E	E	E
Wildlife Habitat (WILD)	E	E	E
Migration of Aquatic Organisms (MIGR)		E	E
Spawning, Reproduction and/or Early Development of fish (SPWN)	E	E	E
Aquaculture (AQUA)	E	E	P

* Groundwater or surface water
E = Existing
P = Potential

As defined in the Basin Plan (Regional Water Board 1996), the beneficial uses impaired by excessive sediment in the Trinity River are primarily those associated with supporting high quality habitat for fish, specifically: Commercial or Sport Fishing (COMM), Cold Freshwater Habitat (COLD), Migration of Aquatic Organisms (MIGR), and Spawning, Reproduction, and/or Early Development (SPWN). In addition, the Regional Water Board is in the process of updating the Beneficial Uses chapter of the Basin Plan and will likely include Rare, Threatened, or Endangered Species (RARE) beneficial use for the Trinity River basin as a result of the listing of coho salmon as threatened under the Federal ESA. (pers. comm David Leland). See Section 2.2 for further discussion of salmonid fish populations and habitat needs.

Recreation is another important beneficial use potentially impacted by sedimentation. The two existing recreational beneficial uses described in the Basin Plan (Regional Water Board 1996) that apply to the Trinity River Basin are water contact recreation (REC-1) and non-contact water recreation (REC-2). The

Trinity River Basin, including designated wilderness areas (Trinity Wilderness Area, the Chanchelulla Wilderness Area, and the Trinity Alps Wilderness), the river itself and the two reservoirs (Lewiston and Trinity) support an abundance of recreational opportunities including: boating, fishing, camping, swimming, sight-seeing, hiking, etc. The USFS quantifies the amount of recreational activity in a particular area in terms of "recreational visitor days." In 1995, an estimated 214,000 recreational visitor days were spent on the Trinity River (US FWS 1999, p.3-263). The net economic value to persons who recreated along the Trinity River in 1995 is estimated to be $9.9 million.

The entire mainstem of the Trinity River was designated a National Wild and Scenic River by the Secretary of the Interior in 1981. Approximately 97.5 miles of the river are classified as recreational under the National Wild and Scenic River Act. The mainstem Trinity River is also classified as recreational and scenic under the California Wild and Scenic Rivers Act.

The USFS manages the Shasta-Trinity National Recreation Area which includes Trinity and Lewiston Reservoirs. Trinity Reservoir features 4 marinas, 10 boat launches, 20 campgrounds, and 2 swimming areas. Recreation opportunities in the vicinity of Trinity reservoir include powerboating, sailing, houseboating, swimming, water-skiing, camping, hunting, fishing, hiking and sight-seeing. Recreational facilities at Lewiston Reservoir, include campgrounds, a picnic area, boat ramp, and marina. Low water temperatures generally make this reservoir unsuitable for water-contact activities (e.g., swimming) (US FWS, p. 3-279.)

The Basin Plan (Regional Water Board 1996) identifies both numeric and narrative water quality objectives for the Trinity River. Those pertinent to the Trinity River TMDL are listed in Table 2-2.

Table 2-2. Water Quality Objectives Addressed in the Trinity River TMDL

Parameter	**Water Quality Objective**
Suspended Material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Settleable Material	Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.
Sediment	The suspended sediment load and suspended sediment discharge rate of surface water shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
Turbidity	Turbidity shall not be increased more than 20 percent above naturally occurring background levels. Allowable zones of dilution with which higher percentages can be tolerated may be defined for specific discharges upon the issuance of discharge permits or waiver thereof.

In addition to water quality objectives, the Basin Plan (Regional Water Board 1996) includes two prohibitions specifically applicable to logging, construction, and other associated nonpoint source activities:

- the discharge of soil, silt, bark, sawdust, or other organic and earthen material from any logging, construction, or associated activity of whatever nature into any stream or watercourse in the basin in quantities deleterious to fish, wildlife, or other beneficial uses is prohibited; and

- the placing or disposal of soil, silt, bark, slash, sawdust, or other organic and earthen material from any logging, construction, or associated activity of whatever nature at locations where such material could pass into any stream or watercourse in the basin in quantities which could be deleterious to fish, wildlife, or other beneficial uses is prohibited.

2.2. Decline of Fish Populations

This section describes how the populations of anadromous salmonids have declined in the Trinity River. It also briefly discusses other fish species of interest in the watershed. Anadromous salmonids have declined throughout their range in California over the last several decades. For example, CDFG (1994a) reported that "coho salmon in California, including hatchery stocks, could be less than 6 percent of their abundance during the 1940's, and have experienced at least a 70 percent decline in numbers since the 1960's." NMFS (1995) concluded that natural coho populations within the Southern Oregon/northern California coasts evolutionary significant unit (ESU) are not self-sustaining and are presently threatened, i.e., are likely to become in danger of extinction in the foreseeable future if present trends continue.

Abundance of native anadromous fish populations in the Trinity River Basin has changed dramatically from historic levels and is presently well below the goals set by the Trinity River Restoration Program (TRRP). For example, estimates of fall chinook salmon escapement (i.e., return from the ocean to spawn) prior to dam construction in the early 1960's averaged 45,600 compared with an average of 11,932 from 1982-2000 (US FWS 1999). Distribution of salmonid populations within the basin also changed significantly due, primarily, to the construction of the Trinity River Division (TRD) dams which blocked access to approximately 109 miles of steelhead habitat and 59 miles (50%) of chinook habitat (US FWS 1999). The Trinity River fishery has been a cultural and subsistence mainstay of the Hoopa people for several thousand years (HVT 2000).

Following the dramatic decline in fish populations after dam construction, the 1983 Environmental Impact Statement (EIS) on the Trinity River Basin Fish and Wildlife Management Program (US FWS 1983) established inriver spawner escapement goals that could be met once restoration was complete. "Inriver spawner escapement" refers to the number of returning fish that physically spawn in the river. Based on adult escapement estimates since the early 1980's, the US FWS (1999) have found that naturally produced anadromous salmonid populations are, on average, well-below the restoration goals. However, certain tributaries (e.g., North Fork, New River, Horse Linto) appear to be supporting stable or recovering populations of salmonids. The relatively low returns of naturally produced fish in the mainstem, compared to hatchery produced, are likely indicative of low survival rates of young freshwater life stages (eggs, fry and/or juvenile fish).

Table 2-3 provides a comparison between the TRRP inriver spawner escapement goals with the average inriver escapement of naturally produced fish. The TRRP makes a clear distinction between "naturally produced" spawners and "hatchery produced" spawners. Naturally produced fish refers to the progeny of fish that physically spawned in the river or its tributaries, without human intervention (i.e., hatchery raised). Hatchery produced fish refers to the progeny of fish that were spawned and raised at the hatchery. (US FWS 1999, p. B-3) Achievement of the TRRP natural escapement goals would indicate that fish populations are self-sustaining rather than dependent on artificial hatchery production. (US FWS 1999, B-3) The data indicate that current/recent levels of naturally produced fish are far below the goals.

Table 2-3. Comparison of TRRP Inriver Spawner Escapement Goals to Average Numbers of Naturally Produced Fish (Updated from US FWS 1999, Table 3-13)

Species	TRRP Inriver Spawner Escapement Goals	Average Inriver Escapement of Naturally Produced Fish	Years of Available Data	Percent of TRRP Goal Met
Fall chinook salmon	62,000	11,932	1982-2000	19
Spring chinook salmon	6,000	2,370	1982-1999	40
Coho salmon	1,400	390	1991-1995, 1998,1999	28
Steelhead	40,000	1870	1992-1996	5

The in river spawning escapement estimates of all the anadromous species have varied tremendously each year. Figures 2-1 and 2-2 illustrate the high variability in escapement estimates year-to-year as well as the relatively low percentage of naturally produced fish that return to spawn for Fall Chinook and Coho salmon, respectively. During the period of the 1990's, each of the species experienced at least two or more extremely low escapement years.

Figure 2-1. Fall Chinook Spawner Escapement in the Trinity River above Willow Creek, 1982-1999. (Source: CDFG 2001a, US FWS 1999)

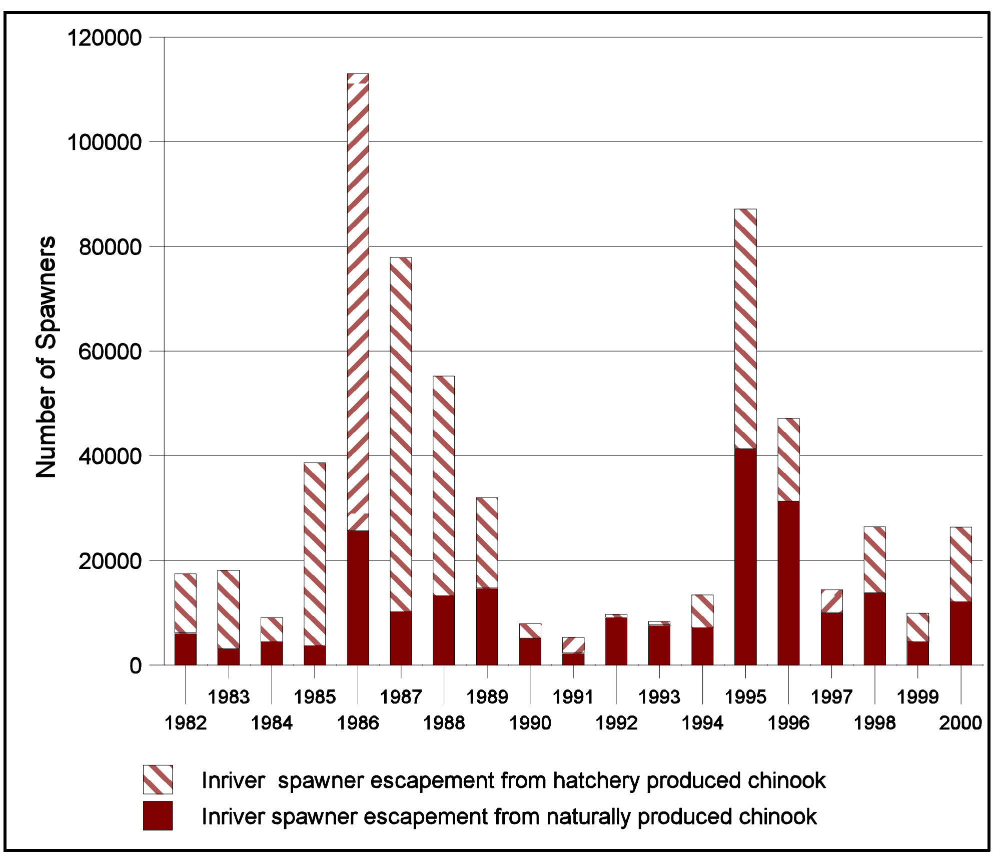
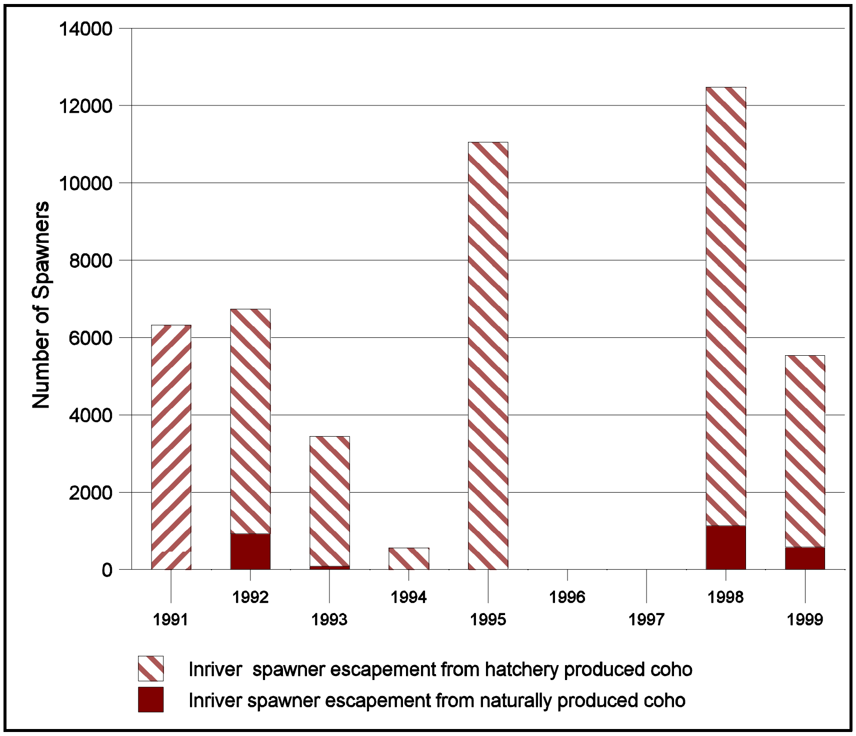


Figure 2-2. Coho spawner escapement in the Trinity river above Willow Creek, 1991-1999, data not available '96, '97. (Source: CDFG 2001, US FWS 1999)



Coho

USFWS and CDFG (1956) estimated that 5,000 coho salmon were spawning above Lewiston prior to dam construction. Accurate estimates of coho populations below Lewiston prior to dam construction were not available. Coho inriver escapement estimates for the decade of the 1990's (excluding 1996, 1997 when data were not available) averaged 390 naturally produced fish above Willow Creek compared with the TRRP goal of 1,400. Data for the proportion of hatchery-produced coho salmon during this period indicate that the coho population is predominantly of hatchery origin. Captures of [yearling] coho salmon in recent years during USFWS outmigrant trapping efforts have been consistent, but numbers have been very low (Glase 1994).

With regard to coho usage of the tributaries within the Upper Middle Assessment Area, the USBLM (1995) reported that: "...it is likely that coho utilized accessible tributaries in years when returning adult numbers were high. Salmon carcass surveys in 1995 (unpub. data. USFWS 1995) indicate substantial usage in many of the tributaries from the North Fork upstream to Deadwood Creek. Surveys in the 1980's (Ebasco Environmental 1989, 1990; USFS 1988) revealed coho in some tributaries." The USBLM (1995) also identified migration barriers and potential habitat limiting factors for coho and other anadromous salmonids. The USFS (2000a) reported that coho salmon are "rarely found" in the New River.

In the Lower Assessment Area, the USFS (2001a) identified Sharber/Peckham Creek, compared with other lower basin tributaries, as supporting the highest number of spawning coho salmon based on redd and carcasses surveys conducted from 1996 to 2000. The USFS estimated that 110 coho salmon spawned in Sharber/Peckham Creek in 1998, however only one coho carcass and two live coho were observed in the 2000 survey. Coho salmon also inhabit the lower portions of Mill Creek (within the Hoopa Valley Tribal lands) and Horse Linto Creek. However, the Six Rivers National Forest indicated that populations in these areas are extremely low, particularly in Horse Linto Creek since 1995 (USFS 2001b, p. G-21) . Based on fish population studies conducted by the Hoopa Valley Tribal Fisheries Department, coho salmon is the least abundant of the three anadromous salmonid species in Mill Creek.

The Six Rivers National Forest and Hoopa Tribal Fisheries Department have operated downstream migrant traps in Horse Linto Creek, Supply Creek, Tish Tang Creeks and Mill Creeks in the Lower Basin to estimate juvenile anadromous fish populations. Very few juvenile coho have been trapped in these tributaries, compared with chinook and steelhead, during the years in which data were collected throughout the 1990's (see KRIS for reporting of data).

Fall and Spring Chinook

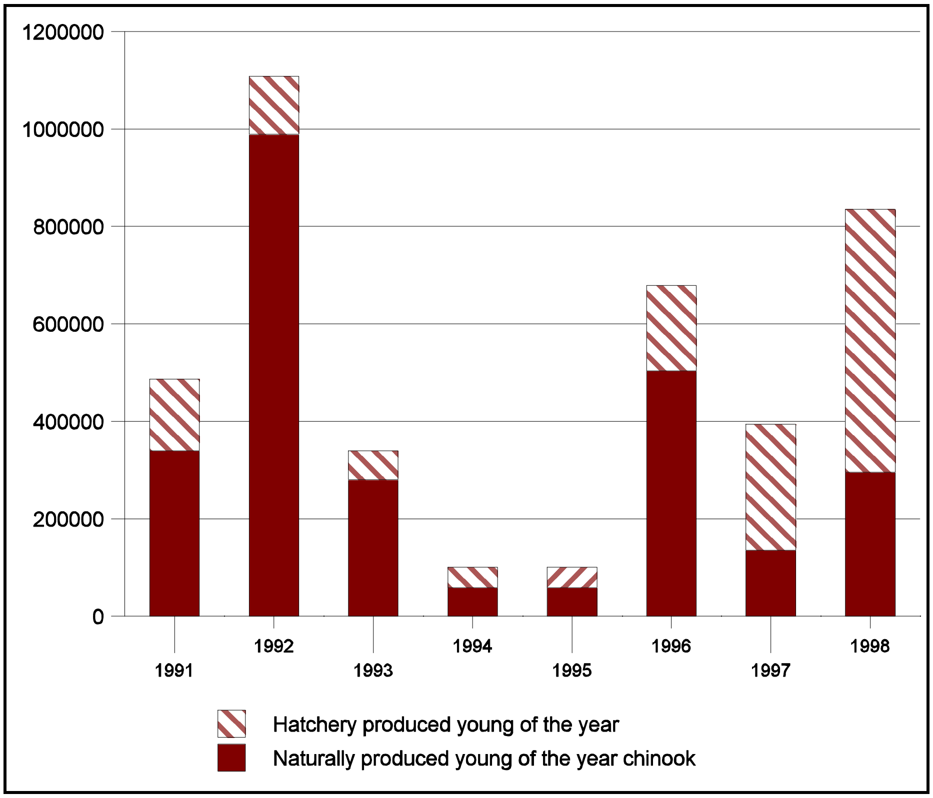
The annual pre-dam estimates of fall chinook escapement averaged 45,600 based on a few studies conducted between 1944 and 1963. Based on yearly estimates from 1982 through 2000, the CDFG estimated that the river below Lewiston produced an average of 11,932 fall chinook salmon which is 19 percent of the TRRP goal of 62,000 naturally produced fall chinook salmon (US FWS 1999, p. 3-159) and much less than historic estimates for this reach of the river (22,600 adults and jacks). The CDFG estimated that naturally produced spring chinook averaged 2,370 or 40 percent of the TRRP goal of 6,000, between 1982 and 1999 (excluding 1983 and 1995 when surveys were not conducted).

Adult spawning chinook make limited use of the tributaries compared to the mainstem above the Junction City Weir, based on CDFG surveys of carcass and redd counts. (CDFG 1996, Table 6, Appendix 5, CDFG 1994a). For example, CDFG found only 29 carcasses in the tributaries out of a total of 690 (including mainstem) during spawner surveys in 1991. Between the North Fork confluence to Cedar Flat (39 Km), the US FWS (1999) surveyed chinook salmon redd distribution and abundance from 1996 to 1998. They found: 602 redds in 1996, 928 redds in 1997 and 187 redds in 1998. Redd numbers were highest between Big Bar Creek and Big French Creek. Interestingly, they also found 72 redds (4%) on or near the tailings from suction dredge mining operations. Due to the instability of tailings during high flows, however, redds constructed therein face a high risk of scouring (Harvey and Lisle 1998).

In the Lower Trinity tributaries, adult spawner populations have varied widely from year to year during the 1990's, however they appear to be strongest in Horse Linto Creek. The USFS in cooperation with several other agencies, organizations, the Hoopa Valley tribe and Humboldt State University, developed a small chinook production facility in 1981, designed to increase returning chinook spawners to a level that would no longer require augmentation (USFS 2000b, p. 3-170). The USFS has continued to monitor redds, carcasses and juvenile production since 1994 to evaluate the viability of the population. The USFS (2001b) observed close to 400 redds in 1997 and less than 100 redds in 1998 and considers the “hatchbox” project a success due to the comparatively strong population estimates. Old Campbell Creek and Willow Creek, other tributaries in the lower Trinity, have continued to support chinook, however the USFS (2001a) has counted precariously low numbers of redds and carcasses in some years during the 1990s.

Juvenile chinook abundance above the Willow Creek weir has varied from 77,230 in 1991 to almost 2,000,000 in 1998 based on US Fish and Wildlife Service estimates (reported in KRIS database). More than 50% of the 1998 estimate were hatchery fish. The US Forest Service (1988) estimated that juvenile chinook salmon density in Canyon Creek was lower than densities obtained from other researchers working in Idaho, Oregon and Northern California. Whereas in the North Fork Trinity, they found juvenile chinook salmon density higher than in other Northern California streams. Juvenile chinook estimates from outmigrant traps in tributaries to the Lower Trinity have ranged widely during several years the traps were operation during the 1990' s (see KRIS for data results).

Figure 2-3. Juvenile Chinook Estimates in the Trinity River at Willow Creek Weir, 1991-1998. (Source: US FWS)



Winter and Summer Steelhead:

Prior to the construction of the dam, CDFG and US FWS (1956) estimated winter steelhead spawner escapements above Lewiston ranged from 6,900 to 24,000 while summer steelhead averaged 8,000. From 1980 through 1999 (excluding a few years when no estimates were made) CDFG estimated an average of 4,400 naturally produced steelhead spawning escapement which represents approximately 11 percent of the TRRP goal of 40,000. Of all the anadromous species, steelhead extend the furthest up tributary streams. Summer steelhead hold over during the summer months then spawn in the following late winter or early spring. Agencies have focused population surveys of summer steelhead in the following tributaries: North Fork, South Fork, Canyon Creek, and the New River. The USFS (2000a) reported that the summer steelhead counts in the New River over the last decade range from 307 to 804 making it one of the larger populations in California. Populations of summer steelhead on tributaries other than the New River and North Fork Trinity are significantly low (USFS 2000a).

Juvenile steelhead production in most of the lower tributaries has varied widely during the 1990's based on outmigrant trapping data collected by the USFS (reported in KRIS). However, the USFS (2001b, p. g-22) reports that Steelhead populations in Horse Linto Creek appear to be stable including well balanced year-class distributions for juvenile steelhead.

For a more complete discussion of anadromous fish population estimates see the Trinity River Mainstem Fishery Restoration EIS/R, particularly Appendix B, and CDFG Reports, generally available via KRIS database.

Other Fish Species

The Trinity and Klamath River Basins contain the largest spawning population of green sturgeon in California. Green sturgeon was recently petitioned for listing on the federal endangered species list due to declining populations (reported in Times-Standard 2001). Green sturgeon generally begin migrating into the Klamath Basin in late February and spawn in spring and early summer. Sturgeon require deep pool habitat and suitable substrate quality for spawning. Excessive fine sediment can limit sturgeon production by decreasing the adhesiveness of eggs to channel substrate following spawning.

Population estimates of Pacific lamprey are limited, however, anecdotal evidence suggests the population has dramatically declined over the last few decades (Bias 2001).

Although anadromous fish no longer exist above Lewiston dam, the reservoir and associated tributaries support a broad range of fish species and other beneficial uses which can be affected by sediment. Trinity Reservoir supports a trophy smallmouth bass fishery and provides sport fishing for largemouth bass, trout, kokanee salmon, landlocked chinook salmon, and other gamefish. Cool water and the high percentage of gravel-rubble bottom in Trinity Reservoir create ideal forage and habitat conditions for smallmouth bass. The species requires clean sand, gravel, or debris-littered bottoms to spawn, at depths of 103 feet up to 23 feet. Spawning begins in April.

Kokanee salmon are a “land-locked” form of sockeye salmon. They were introduced and have become well established in both Trinity and Lewiston Reservoirs. The species makes its spawning migration into streams between early August and February (US FWS 1999, p. 3-185). The CDFG has determined that the size of kokanee salmon are stunted (7"-8") due to overproduction and are consequently not a highly sought after sport fishery (B. Aguilar personal communication). CDFG has begun planting chinook salmon to control the kokanee population and potentially produce additional sport fishing opportunities.

Rainbow trout are the most abundant salmonid found in the Trinity and Lewiston reservoirs. They spawn in the spring in streams flowing into the reservoirs. Juvenile trout enter the reservoir to forage and mature where the cold, deep water provides suitable habitat. (US FWS 1999, p. 3-185). The CDFG (letter dated June 7) identifed Stuart Fork, Coffee Creek, Upper Trinity River, Mule Creek and Swift Creek as key trout streams providing refugia and major recreational opportunities.

In summary, naturally produced anadromous salmonid populations are clearly below historic levels and the goals set by the TRRP. Certain subwatersheds (i.e. North Fork, New River, Horse Linto) appear to be supporting stable or recovering populations of salmonids. Population estimates for adult salmonid escapement and juvenile outmigration have varied widely over the past 20 years. The relatively low returns of naturally produced fish, compared to hatchery produced, are likely indicative of low survival rates of young freshwater life stages (eggs, fry and/or juvenile fish).

2.3. Salmonid Life Cycle and Water Quality Requirements

This section describes the life cycle of anadromous salmonids and the habitat conditions that are crucial for the survival of each life stage. Salmonid populations are affected by a number of factors including: operation of the Trinity River Salmon and Steelhead Hatchery with regard to species competition, predation, dilution of native genetic stock and transmission of disease organisms; commercial and sport harvest; operation of TRD; food production; and factors which occur outside of the watershed (e.g., ocean rearing conditions). This TMDL focuses on achievement of water quality standards related to sediment, which will facilitate, but not guarantee, population recovery.

Salmonids have a five-stage life cycle. First, adult salmonids lay their eggs in clean stream or lake gravels to incubate. Second, the eggs hatch and young fish seek shelter in the pools and adjacent wetlands. Third, juvenile fish leave the stream or lake, migrate downriver, and reside in the estuary to feed and adjust to saltwater for up to a year before continuing onto the ocean. Fourth, juvenile fish mature in the ocean. And fifth, adult fish return to their home stream or lake to spawn. This cycle from spawning area to the ocean and back defines Pacific salmonids as "anadromous." Most Pacific salmonids die after spawning: their total energies are devoted to producing the next generation, and their bodies help enrich the stream for that generation.

Salmonids have a variety of requirements related to sediment. Salmonids have different water quality and habitat requirements at different life stages. Sediment of appropriate quality and quantity is needed for redd (i.e., salmon nest) construction, spawning, and embryo development. However, excessive amounts of sediment or changes in size distribution (e.g., increased fine sediment) can adversely affect salmonid development and habitat.

Excessive fine sediment can reduce egg and embryo survival and juvenile salmonid development. Tappel and Bjornn (1983) found that embryo survival decreases as the amount of fine sediment increases. Excess fine sediment can prevent adequate water flow through salmon redds, which is critical for maintaining adequate oxygen levels and removing metabolic wastes. Deposits of these finer sediments can also prevent the hatching fry from emerging from the redds, resulting in smothering. Excess fine sediment can also cause gravels in the waterbody to become embedded (i.e., the fine sediment surrounds and packs-in against the gravels), which effectively cements them into the channel bottom. Embeddedness can prevent the spawning salmon from building their redds.

An imbalance of fine or coarse sediment supply or transport rate can also adversely affect the quality and availability of salmonid habitat by changing the morphology of the stream. It can reduce overall stream depth and the availability of shelter, and it can reduce the frequency, volume, and depth of pools. CDFG habitat data indicate that coho in Northern California tend to be found in streams that have as much as 40% of their total habitat in primary pools (Flosi et al. 1998). Pools in first and second order streams are considered primary pools when they are at least as long as the low-flow channel width, occupy at least half the width of the low-flow channel, and are two feet or more in depth. Primary pools in third order and larger channels are defined similarly, except that pool depth must be three feet or more. Pools provide salmon with protection from predators, a food source, and resting location.

Excessive sediment can affect other factors important to salmonids. Stream temperatures can increase as a result of stream widening and pool filling. The abundance of invertebrates, a primary food source for juvenile salmonids, can be reduced by excessive fine sediment. Large woody debris, which provides shelter, can be buried. Increased sediment delivery can also result in elevated turbidity, which is highly correlated with increased suspended sediment concentrations. Increases in turbidity or suspended sediment can impair growth by reducing availability or visibility of food sources, and the suspended sediment can cause direct damage to the fish by clogging gills.

2.4. Habitat Conditions in the Trinity River Watershed

This section describes the existing habitat conditions in the Trinity River basin. First, an approach is described for assessing qualitatively the health of watersheds, then habitat conditions are described for subwatersheds in each of the four main assessment areas of the Trinity River addressed in this TMDL. In each of the four main assessment areas, some subwatersheds appear healthy and properly functioning with regard to physical watershed processes affecting beneficial uses and some are impaired and not supporting beneficial uses. Habitat conditions in the impaired subwatersheds are described in this chapter because they demonstrate the nature of the sediment problems in the Trinity River watershed. Habitat conditions in the healthy subwatersheds are described because this information was used to help select reference streams (reference streams are used in Chapter 5 as the basis for determining the appropriate loading capacity or TMDL for all the subareas).

Subwatershed Assessment Approach

EPA has utilized all available, relevant instream habitat and watershed condition information to determine whether subwatersheds within the Trinity basin are presently healthy or impaired. Much of the information available has been developed by the USFS.

Using the approach in Rating Watershed Condition: Reconnaissance Level Assessment for the National Forests of the Pacific Southwest Region ("Watershed Condition Assessment") (USFS 2000c), De la Fuente et al. (2000) assessed the condition of watersheds on USFS land in Northern California including the Trinity River basin. Each watershed received a rating of its ***hazard*** of impairment to watershed resources (i.e., disturbance prone to accelerate future sediment delivery to streams) and its ***expression*** of watershed condition (i.e., water quality). The ratings were based on several quantitative and qualitative indicators. For example, the USFS assigned a value (1=properly functioning; 2=functioning, at-risk; 3=impaired) based on best professional judgment to the following indicators that reflect the expression of watershed condition: floodplain connectivety, water quality, water quantity, riparian vegetation, channel stability and aquatic integrity. The resulting values were added together for an overall expression rating. The hazard and expression ratings were then used to classify the overall condition of the watershed into one of three categories.

Healthy (Reference) watersheds (Category I): ***Watersheds that are currently exhibiting high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and exhibit a stable drainage network. Physical and biological conditions suggest that aquatic and riparian systems***

are predominantly functional in terms of supporting dependent species and beneficial uses of water. The risks of management induced disturbance have not been expressed or resulted in significant alteration of geomorphic, hydrologic, and biotic processes.

Moderate watersheds (Category II): ***Watersheds that are currently exhibiting moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and portions of these watersheds exhibit an unstable drainage network. Physical and biological conditions suggest that aquatic and riparian systems are at risk in being able to support dependent species and retain beneficial uses of water. The risks of management induced disturbance are variable and effects have partially been expressed or have resulted in localized alteration of geomorphic, hydrologic, and biotic processes***.

Impaired watersheds (Category III): ***Watersheds that are currently exhibiting low geomorphic hydrologic, and biotic integrity relative to their natural potential condition and a majority of the drainage network is unstable. Physical and biological conditions suggest that riparian and aquatic systems do not support dependent species nor beneficial uses of water. The risks of management induced disturbance are high; they have been fully expressed and/or have resulted in deterioration of geomorphic, hdyrologic, and/or biotic processes.***

Another assessment by the USFS (1997) identified specific watersheds as "Focal" watersheds which they define as: "...critical areas supporting a mosaic of high-quality habitats that sustain a diverse or unusually productive complement of native species. Most typically, they are relatively undisturbed headwater watersheds that foster spawning and rearing habitat for remnant populations of sensitive fishes and other organisms." EPA considered the focal watershed designation when assessing watershed conditions.

The Aquatic Conservation Strategy (ACS) of the Northwest Forest Plan (USDA and USDI 1994) identified "Key Watersheds" throughout the range of the Northern Spotted Owl. Tier 1 Key Watersheds are intended to provide refugia that are crucial to at-risk fish species and stocks and provide high quality water. The Trinity River basin contains the following Tier 1 Key Watersheds: Horse Linto Creek, New River, North Fork Trinity and Canyon Creek.

EPA combined the USFS information for the Trinity with other available information regarding stream and watershed condition. This remainder of this section describes both the healthy and degraded subwatershed areas existing in each of the four assessment areas. EPA is using the healthy streams as "reference" streams for comparing the degree of sediment impairment in the other streams in the area. Figures 1-2,3,4, and 5 identify the reference subwatersheds throughout the basin.

Habitat Conditions in Upper Trinity Assessment Area

Healthy subwatersheds:
Based on the results of a regional watershed condition assessment, De la Fuente et al. (2000) classified Coffee Creek and Stuart Fork watersheds, including Swift Creek, as Category I watersheds. Also, USFS (1997) has identified Middle Fork Coffee Creek, North Fork Swift Creek and Stuart Fork as "Focal" watersheds. CDFG (2001b) confirms that several of these west-side tributaries are important for spawning of kokanee salmon and resident trout. Although recent stream condition data is limited for most upper basin tributaries, CDFG surveys from the 1970's document the relatively good habitat conditions in portions of Coffee Creek despite the impact of historic hydraulic mining that occurred until 1939. These streams have long been tourist destinations for recreation, sport fishing and scenic attributes, particularly in the Trinity Alps Wilderness.

Impaired Areas:
Several tributaries to Trinity and Lewiston Reservoirs are currently exhibiting low (watershed condition Category II or III) geomorphic and biotic integrity relative to their natural potential condition; specifically, portions of the upper Trinity River mainstem, East Fork and Eastside tributaries to the Trinity reservoir (De la Fuente et al. 2000). The Upper Trinity mainstem and the East Fork each received values indicating an "at risk" condition.

A USFS channel survey of the upper mainstem of the Trinity River from 1991 reveals moderate to fair habitat conditions and a high degree of disturbance in the form of historic or active mine tailings, mass wasting features, and bank erosion (USFS 1991). Certain tributaries are discharging excessive levels of suspended sediment, affecting the beneficial uses in the tributaries themselves and in the reservoir and posing a risk to beneficial uses downstream of the dams. Discharge from the reservoirs has had high levels of turbidity and suspended sediment for extended periods during and following high flow years (e.g., 1974, 1983, 1997) (GMA 1997).

Habitat Conditions in Upper Middle Assessment Area

The condition of aquatic habitat in the Upper Middle Assessment Area is of particular importance for two reasons: (1) biologically, it is utilized more extensively for anadromous fish spawning and rearing than other basins, and (2) the tributaries and mainstem of the Middle Basin have been subjected to a high level of habitat modification, due to the TRD and land management in the tributaries, including mining, timber extraction and road building. Due to the magnitude of impairment in the mainstem and level of disturbance throughout the tributaries, EPA was unable to identify completely healthy subwatersheds in the Upper Middle Assessment Area. The sediment related problems are described below.

Mainstem impairment:
The reduction in quantity and variability of mainstem flows following dam construction, coupled with an accellerated rate of sediment delivery due to intensive management practices in the tributaries, resulted in an inbalance in the sediment budget and a reshaped channel (McBain and Trush 1997). The once diverse channel was converted into a structurally uniform channel, in some places choked with sediment and a few places deprived of sediment, thereby eliminating or modifying critical habitat elements for anadromous salmonids. Each sediment-related change and relation to biological values is briefly characterized below.

1) Loss of coarse sediment supply from the upper basin (due to blockage by the dams) resulted in a reduction of spawning gravels and cobble channel margins in the mainstem below Lewiston Dam to the confluence with Rush Creek.

> High-quality spawning habitat for anadromous salmonids requires frequent mobilization and replenishment of gravel. Gravel deposits in the tails of pools and runs, often preferred spawning habitat, are subject to frequent scour during high flow events. Lewiston and Trinity Dams completely cut-off the upstream source of coarse bed material to replace bed material transported downstream. The mainstem immediately below Lewiston Dam (to confluence with Rush Creek approximately) has responded with slight down-cutting and significant channel bed coarsening (US FWS and HVT 1999). Despite supplementation of spawning gravels immediately below the Dam in 1998, the U.S. FWS and HVT (1999) determined that the channel had degraded a depth of 2 feet. They recommended supplementing 10,000 yds^3 of properly graded gravel material on the short term to the reach immediately below the Dam to offset gravel export and presumably enhance spawning capacity.

2) The mainstem channelbed has not been adequately mobilized resulting in sediment accumulation at the deltas of tributaries and loss of habitat characteristics associated with alternate bar sequence.

Healthy alluvial river systems require frequent (1-3 years) mobilization of the channelbed for several reasons: 1) facilitate the transport of bedload; 2) discourage riparian vegetation from colonizing and fossilizing alluvial features; 3) clean spawning gravel deposits; and 4) facilitate the formation of alternate bars (McBain and Trush 1997). The gravels delivered by the mainstem tributaries below the dam have not been effectively mobilized and dispersed due to inadequate flood flows. Below the confluence with Rush Creek the annual coarse sediment supply from downstream tributaries has continued at rates equal to or slightly higher than before TRD but lower instream flows reduce mainstem transport capacity (US FWS and HVT 1999). Using tracer rock movement studies among diverse alluvial features (i.e. pool tail deposits edges of point bars, long riffles, etc.), McBain and Trush (1997) document the inability of the regulated flows to adequately mobilize the coarse bedload. Inadequate bedload mobility results in a decrease in substrate complexity thereby reducing macroinvertebrate production and reducing pool depths needed for adult fish cover and holding. GMA (2001b) identified a 12 foot increase in channel bed elevation at a cross-section just below the confluence of Indian Creek.

3) Sediment has filled in mainstem pools thereby eliminating deep pool habitat important for adult salmonids holding over the summer.

After access to the upper basin was eliminated due to dam construction, spring chinook had to "summer-over" in any available deep pools below the dam until spawning began in Fall. Since many of these pools were historically occupied by summer-run steelhead, chinook and steelhead were forced to compete for pool habitat below the dam. Deep pools provide thermal refuge during warm summer months as well as potential refuge from predators. However, flows below Lewiston dam have not been sufficient to move sediment, delivered from tributaries, out of mainstem pools. Thus, pools have filled, and the lack of deep pools now restricts adult salmonid holding habitat.

4) Excessive levels of fine sediment in the stream channel have limited anadromous salmonid habitat by: 1) infiltrating spawning gravel which can increase egg and alevin mortality; 2) depositing on exposed cobble bars which can impact salmonid fry and over-wintering rearing habitat; and 3) filling pools, in some cases, and limiting adult holding habitat.

GMA (2001a) determined that spawning gravel quality generally declines in a downstream direction from the spawning area just below Lewiston dam (river mile 111.5) through the study sites below each of the major tributaries (to river mile 80.3). The Poker Bar site (river mile 102.7), just below the confluence of Grass Valley Creek, contained the poorest gravel quality of all the study sites as indicated by increased percentages of fines, decreased D_{84} to D_{16} values (the sizes at which 84% and 16% of the sample, respectively, are finer) and decreased geometric mean diameter. Mean site permeability shows the same general trend of decreasing in a downstream direction. Sand size particles (<2mm) appear to be limiting emergence of alevins from redds by blocking interstitial space in spawning size gravel, particularly below Grass Valley Creek.

5) Sediment has deposited and accumulated around riparian vegetation contributing to the creation of "fossilized" berms along the channel resulting in the loss of open, shallow, low-velocity gravel bar habitats for rearing salmonid fry.

Riparian vegetation along the low-water channel margin has grown and matured at unnaturally high densities due to consistent year-round low flow releases (150-300 cfs), in the absence of high scouring flows. These riparian berms trap sediment which further contributes to the size of the berm. The berms and associated dense vegetation serve to restrict access of emerging fry into important shallow, low velocity stream margin habitat. In addition, much of the sediment deposited in the berm no longer has access to the floodplain where, under less disturbed conditions, the sediment deposit and contribute to certain ecological functions on the floodplain.

6) Geomorphology: The pre-dam riffle-pool sequences associated with point bars were replaced with monotypic runs, which reduced the quantity, quality, and diversity of aquatic habitats (US FWS and HVT 1999, p. 3-25, Figure 3-6).

Changes in sediment transport and storage, in combination with the reduction in mainstem flow following construction of the TRD, altered the channel geomorphology thereby reducing the number and quality of alternate bar sequences. Important fish habitat characteristics impacted by the loss of alternate bar sequences includes: pools that provide cover from predators and cool resting places for juveniles and adults; gravelly riffles where adults typically spawn; open gravel/cobble bars that create shallow, low-velocity zones important for emerging fry; and slack water habitats for rearing juveniles.((US FWS and HVT 1999, App. B-12) The Trinity River does not approach a pre-dam channel geomorphology until the confluence with the North Fork

Although this TMDL does not directly address temperature, there is a direct link between sediment storage in the pools and thermal impacts on anadromous fish. Moffett and Smith (1950) documented that the deepest levels of pools, prior to the TRD, were as much as 7 degrees Fahrenheit cooler than the shallow levels. The cooler temperatures at the bottom of pools provided thermal refugia for migrating adult and rearing juvenile salmonids. The change in channel geomorphology due to the altered flow regime decreased or eliminated the temperature stratification in pools, particularly in the summer and early fall months.

In addition, changes in channel structure and substrate quality have reduced total habitat areas suitable for the production of food organisms, primarily benthic macroinvertebrates (insects). Production of benthic macroinvertebrates takes place on the submerged portions of a streambed (Frederiksen, Kamine, and Associates 1980). Substrate quality and particle size within the streambed can greatly influence the production of benthic macroinvertebrates. Boles (1980) documented an increase in productivity, biomass, and diversity of benthic organisms following the “flushing” of granitic sand from a riffle in the Junction City reach of the Trinity River. However, the EIS noted that based on investigations of macroinvertebrate production in the Trinity compared with other basins, benthic food production does not appear to be a major factor in limiting fish production in the mainstem Trinity at the current time (US FWS and HVT 1999, App. B-13)

Tributary impairment:
Many of the middle basin tributaries presently or historically contain salmonid habitat, particularly in the lower gradient reaches. As discussed in the fisheries section (2.2), steelhead are the most abundant of the salmonids in the tributaries followed by chinook then coho. LaFaunce (1965) reported spawning chinook salmon in Rush, Reading, Brown’s and Canyon Creeks in the Middle Basin. Most of these tributaries have been subjected to some form of habitat modification, including historic hydraulic mining, water diversion, road construction and timber harvesting continuing through the present. Unfortunately, aquatic habitat conditions and potential limiting factors in the tributaries are not nearly as well studied as in the mainstem.

De la Fuente et al. (2000) determined that Weaver and Rush Creeks are impaired (Category III) based on an analysis of the stream and watershed condition indicators.   The water quality and channel conditions in Weaver and Rush Creeks were rated as functioning at risk and the watershed hazard condition was high. The same assessment determined that Brown's Creek was in a moderate (Category II) condition. In other words, physical and biological conditions suggest that aquatic and riparian systems are at risk in being able to support dependent species and retain beneficial uses of water.

Numerous studies have identified and evaluated sediment sources and delivery from Grass Valley Creek (GVC) which is considered to be the primary producer of sand-size sediment to the mainstem. As a result, the TRRP supported the development of an extensive erosion control program including: 1) Construction of the Buckhorn Debris Dam in 1990 to trap sediment; 2) Construction of Hamilton Ponds in 1984, 1988-89 to trap sediment close to the mouth of the GVC before entering the mainstem; 3) Bureau of Land Management aquired 17,000 acres of highly eroded private timberland for restoration purposes; and 4) extensive erosion control program largely implemented by the Trinity County Resource Conservation District and the Natural Resource Conservation Service that continues today.

Based on a survey initiated by Pacific Watershed Associates (2000) in 1992, stream channel conditions in GVC appeared to be improving (pools were more common, larger and deeper; substrate was more coarse; and channel complexity increased). Since GVC is a transport dominated system (PWA 2000), most of the sediment produced from GVC is transported to the mainstem, aside from what is trapped in the sediment retention basins. Even though sediment production has decreased (perhaps by as much as one fifth of estimates made prior to Buckhorn dam construction (PWA 2000)), GVC appears to continue discharging sand-size sediment in quantities that are impacting the mainstem. GMA (2001a) found that substrate samples taken at Poker Bar, below the confluence of GVC with the mainstem, contained excessive levels of sand-size particles (64% <5.6mm) compared to other mainstem sampling sites.

GMA (2001a) found that permeability levels in several of the Tributaries were quite low (98cm/hr in Reading Creek; 258 cm/hr in Indian Creek; 363 cm/hr in Rush Creek; 521 cm/hr in Canyon Creek) indicative of low survival rates of salmonids.

Habitat Conditions in Lower Middle Assessment Area

The lower middle assessment area generally consists of relatively steep gradient (i.e. sediment transport) stream reaches and rugged terrain, much of which lies within the Trinity Wilderness area. Although land management disturbance is minimized in much of the area due to the Wilderness designation, a large wildfire, termed the Big Bar Complex, burned close to 80,000 acres (53%) of the New River watershed in August, 1999. Thus far, the fire has not resulted in a significant impact to the aquatic ecosystem, in part due to mild winters since the fire. Fortunately, the majority of the acres burned (72%) were categorized in the low to moderate range of intensity whereby perennial plants with thicker bark generally survive. However, the burned area does create significant future risk to the existing good health of the New River should a major storm event occur while the landscape is not fully revegetated and is susceptible to erosion.

Healthy Subwatersheds:
The New River, North Fork Trinity, East Fork North Fork, Big French Creek and Manzanita Creek, all major tributaries to the lower-middle mainstem, are presently considered "properly functioning" with regard to aquatic habitat and watershed conditions (De la Fuente 2000). The North Fork and New River are identified as tier one "Key Watersheds" according to the Aquatic Conservation Plan contained in the Northwest Forest Plan (USDA and USDI 1994). Key watersheds are intended to provide refugia that are crusial to at-risk fish species and stocks and provide high quality water. One key indicator of healthy aquatic conditions in these tributaries is the relatively strong trend in summer steelhead populations in the New River and North Fork Trinity since the 1970's. As discussed in the fisheries section above,

summer steelhead populations ranging between 300 and 800 in the New River make it one of the larger populations in California (USFS 2000a, p.4-11). The USFS estimates similar population sizes for the North Fork Trinity through the decade of the 1990s.

Aquatic habitat surveys conducted sporadically since the 1970's and 1980's generally characterize instream and riparian habitat in the New River as good to excellent, despite the high level of historic mining activity (USFS 2000a, p.4-12). Following the 1999 Big Bar fire, the USFS (2000d) found that stream conditions in reaches influenced by the fire are not significantly different than reference streams with regard to pebble counts, large woody debris, width to depth ratios, entrenchment ratios, pools and shade, based on surveys conducting using the Stream Condition Inventory protocol (USFS 1998). In addition, De la Fuente et al. (2000) classified both the New River and North Fork as properly functioning with regard to the "expression" indicators as part of the watershed condition assessment.

Big French Creek and Manzanita Creek are also considered to be in a properly functioning condition (De la Fuente 2000). As a relatively undisturbed, wilderness watershed, the USFS (1989) recommended that Big French Creek serve as an index steelhead stream and not be subject to any habitat modification projects for comparison purposes with more intensively managed streams.

<u>Impaired areas</u>:
Canyon Creek: According to De la Fuente et al. (2000), Canyon Creek is at risk with regard to several aquatic habitat indicators including water quality, stream vegetation, channel stability and aquatic integrity. The present unstable channel conditions in Canyon Creek are largely due to intensive historic mining activity and other land use activities for several miles along the lower mainstem which is easily accessible via a primary road (pers. comm. Loren Everest). Conversely, other tributaries in the lower-middle area are relatively difficult to access and have not experienced the same level of disturbance as in Canyon Creek. In a habitat typing report, the USFS (1989) identified spawning gravel degradation due to fine sediments, particularly within the lower two reaches, and specific incidents of suspended sediments resulting from dredging activities.

Lower-Middle mainstem area: Quihillalt (1999) indicated that suction dredge mining pressure in high-density redd habitats could impact the survival of incubating chinook salmon eggs particularly between Big Bar Creek and Little Swede Creek. Suction dredging activity may affect the viability of spawning redds on the Trinity river by altering the stability of spawning gravels. Although dredge tailings may be attractive sites for redd construction because they provide loose, appropriately sized gravel near riffle crests where fish frequently spawn, embryos in tailings may suffer high mortality due to scouring during high flows (Harvey et al. 1998).

Habitat condition data in many of the smaller tributaries in the Lower Middle Area were not available. However, the sediment source analysis (chapter 4) indicates that some of these tributaries have high percentages of legacy or management-related sediment delivery, compared to background, and consequently may be exhibiting a high risk of watershed disturbance.

Habitat Conditions in Lower Assessment Area:

The lowest area includes the tributary watersheds and mainstem Trinity outside of the Hoopa Valley Tribal reservation.

<u>Healthy Subwatersheds</u>:
Horse Linto Creek is a designated Tier-1 Key watershed, according to the Northwest Forest Plan, which is intended to serve as refugia for maintaining and recovering habitat for at-risk stocks of anadromous

salmonids (USDA and USDI 1994). The USFS (2000b, p.3-175) characterized the health of the Horse Linto watershed as properly functioning, according to the methodology to determine environmental baseline conditions (NMFS 1996). This methodology considers several variables including: water quality, habitat access, habitat elements, channel condition and dynamics, flow/hydrology and watershed conditions. Horse Linto Creek has been in a gradual state of recovery since the 1964 flood severely impacted channel conditions. The USFS has contributed to the recovery effort by establishing instream habitat structures, operating a chinook rearing “hatchbox” facility, and decommissioning high impact roads (USFS 2000b). Recent sediment and habitat monitoring (e.g., V*, turbidity) data from the USFS indicate relatively healthy habitat conditions that can serve as a “reference” watershed for the Trinity Basin.

It is not clear to what degree the Meagram fire that occurred in 1999 will affect anadromous fish and associated aquatic habitat. Two mild winters since the fire has had a minimal effect on aquatic habitat condition. However, one can expect increased erosion and change in the hydrology of the watershed due to the changes in vegetation caused by the fire. The full effect of the impact to environmental baseline conditions may not be evident for several years depending on the severity of storm events and natural recovery processes in the future.

Impaired areas:
Both Campbell Creek and Willow Creek have experienced more intensive land management than Horse Linto Creek in recent decades which has impacted aquatic habitat conditions. The USFS has designated Campbell Creek as “not properly functioning” with regard to sediment/turbidity, disturbance history and riparian reserves, according to an assessment of environmental baseline conditions required under Endangered Species Act consultations (matrix from USFS, no date). Similarly, the USFS determined that Willow Creek is at risk for several indicators including sediment/turbidity, substrate and watershed conditions.

Mill Creek and Tish Tang Creek, lower basin tributaries that flow for the most part through the Hoopa Valley tribal reservation, are also considered more heavily impacted by sediment than Horse Linto Creek. Although all three of the tributaries were heavily impacted by the 1964 flood, Mill Creek and Tish Tang Creek have not recovered as rapidly as Horse Linto due, in part, to subsequent road building and timber harvesting (USFS 2000b).

CHAPTER 3

STREAM HABITAT INDICATORS

This chapter identifies freshwater habitat indicators that are more specific to the Trinity River and generally more quantifiable than the water quality standards for sediment contained in the Basin Plan (see section 2.1). They are interpretations of the water quality standards expressed in terms of instream and watershed conditions. For each indicator, a numeric or qualitative target value is identified to define the desired condition for that indicator. EPA expects that these indicators, and their associated target values, will provide a useful reference in determining the effectiveness of the TMDL in attaining water quality standards, although they are not directly enforceable by EPA.

No single indicator adequately describes water quality related to sediment, so a suite of instream and watershed indicators is identified. Because of the inherent variability associated with stream channel conditions, and because no single indicator applies in all situations, attainment of the targets is intended to be evaluated using a weight-of-evidence approach. When considered together, the indicators are expected to provide good evidence of the condition of the stream and attainment of water quality standards.

In addition to instream indicators, we are including watershed indicators in this TMDL because watershed indicators focus on imminent threats to water quality that can be detected and located before the sediment is actually delivered to the stream, and because watershed indicators are often easier to measure than instream indicators. These watershed indicators are established to identify conditions in the watershed needed to protect water quality. They are set at levels associated with well-functioning watersheds.

Watershed indicators assist with the identification of threats to water quality for both temporal and spatial reasons. Watershed indicators reflect conditions in the watershed at the time of measurement, whereas instream indicators can take years or decades to respond to changes in the watershed, because linkages between hillslope sediment production and instream sediment delivery are complicated by time lags from production to delivery, instream storage, and transport through the system. Also, watershed indicators tend to reflect local conditions, whereas instream indicators often reflect upstream watershed conditions as well as local conditions. Thus, watershed indicators help to identify more prospectively conditions in the watershed needed to protect water quality.

The indicators and associated targets for the Trinity River TMDL are divided between geomorphology-related targets that apply to the upper middle mainstem reach, based largely on the TRFE, and other sediment-related targets that apply throughout the Trinity River network, including tributaries.

3.1. Upper Middle Mainstem Geomorphic Indicators and Targets:

EPA is establishing distinct indicators and targets for the upper middle mainstem for several reasons: (1) the geomorphology of the middle mainstem functions as an alluvial floodplain as opposed to steeper gradient, transport reaches in many of the tributaries; (2) the middle mainstem channel is highly altered due to the operation of the TRD; (3) the middle mainstem is more extensively studied than other areas of the basin; and (4) the Trinity Management Council (TMC) is developing a unique suite of hypotheses for the middle mainstem as part of the Adaptive Management Program component of the ROD for the TRRP. These hypotheses for sediment-related features such as geomorphology, substrate quality and mobility, can serve as TMDL indicators and targets for middle mainstem.

The establishment of TMDL target conditions for the mainstem alluvial reach below Lewiston is based largely on the attributes of a healthy alluvial river developed by McBain and Trush (1997) and later incorporated into the Trinity River Mainstem Fishery Restoration EIS/EIR (US FWS and HVT 1999). The ten attributes, which were developed specifically for the Trinity River, describe the geomorphic environment and processes of a healthy alluvial river. The attributes were developed based on a comparison of pre- and post-dam conditions using aerial photographs and examining sediment budgets, riparian community, and channel characteristics in the basin. Table 3-1 on the following page identifies the sediment related indicators, target condition, and relationship to beneficial use for the middle mainstem.

The Trinity Management Council (TMC) and associated subcommittees are in the process of developing specific hypotheses and thresholds for each indicator through the Trinity River Adaptive Environmental Assessment and Management (AEAM) program. The AEAM program consists of the following components: “(1) defines goals and objectives in measurable terms; (2) develops hypotheses, builds models, compares alternatives, and designs system manipulations and monitoring programs for promising alternatives; (3) proposes modifications to operations that protect, conserve and enhance the resources; and (4) implements monitoring and research programs to examine how selected management actions meet resource management objectives. The intention of the AEAM program is to provide a process for cooperative integration of water-control operations, resource protection, monitoring, management, and research.” (US FWS and HVT 1999,N-2).

Because the hypotheses and thresholds are still under development, EPA is identifying the broader characteristics of alluvial rivers in Table 3-1 as the indicators and targets for the TMDL. However, a workgroup of the TMC has drafted a list of potential hypotheses some of which correspond very well with sediment-related numeric targets within the TMDL context for the middle mainstem. EPA endorses testing of specific hypotheses through the AEAM process, the results of which can serve to refine the indicators and targets for the middle mainstem reach of the Trinity River.

The existing condition of the middle mainstem relative to these targets is summarized in 2.4. Habitat Conditions in the Trinity River Watershed. For more quantitative analysis of the conditions, refer to McBain and Trush (1997), US FWS and HVT (1999), and/or US FWS (1999) .

Table 3-1. Geomorphic Indicators, Targets and Beneficial Use Relationship for the Upper Middle Mainstem (adapted from TRMFR EIS table 3-1, US FWS (1999)

Indicator	Target Condition	Beneficial use relationship
Spatially complex channel geomorphology (Attribute #1): The sum of channel segments provides high-quality habitat for all life stages of native species.	- Restore alluvial channel (self-forming bed particle and bank dimensions). - Create and/or maintain structural complexity of alternate bar sequences. - Create and maintain functional floodplains - Increase diversity of channelbed particle size. - Greater topographic complexity in side channels.	Diverse salmonid habitat available for all life stages over a wide range of flows.
Frequently mobilized channelbed surface (Attribute #3): Channelbed framework particles of coarse alluvial surfaces are mobilized by the bankfull discharge, which on average occurs every 1-2 years.	- Achieve incipient motion for most of channelbed surface (riffles, face of point bars). Flow: >6,000 cfs every 2 or 3 years; - Exceed incipient motion for mobile active channel alluvial features (median bars, pool tails, spawning gravel deposits). Flow: > 3,000 cfs every 2 or 3 years. - Exceed threshold for transporting sand through most pools. Flow: > 3,000 cfs every 2 or 3 years.	Higher egg and alevin survival due to reduced fine sediment in redds. Greater substrate complexity, increasing macroinvertebrate production, and creating deeper pool depths for adult fish cover and holding.
Periodic channelbed scour and fill (Attribute #4): Alternate bars are scoured deeper than the coarse surface layer by floods exceeding 3-5 year annual maximum flood recurrences.	- Scour/redeposit faces of alternate bars (at least to D_{84}). Flow: > 8,500 cfs every 3-5 years. - Maintain scour channels on alternate bar surfaces. Flow: > 8,500 cfs every 3-5 years. - Scour/redeposit spawning gravel deposits (at least to D_{84}). Flow: >6,000 cfs every 2-3 years. - Deposit fine sediment onto upper alternate bar and floodplain surfaces. Flow: > 6,000 cfs.	Anadromous spawning and rearing habitat. Channel-wide habitat complexity. Lower rates of riparian encroachment on alternate bars.
Balanced fine and coarse sediment budgets (attribute#5): River reaches export fine and coarse sediment at rates approximately equal to sediment inputs.	- Reduce fine sediment storage in mainstem, particularly sand size particles (<2mm) which may prevent emergence of alevins. Flow: Qualitative based on fine sediment budget. - Maintain coarse sediment budget in the mainstem. Flow: Qualitative based on coarse sediment budget. - Route mobilized D_{84} through alternate bar sequence. Flow: 6,000 cfs every 2-3 years. - Prevent excessive aggradation of tributary-derived material in mainstem. Flow: 6,000-14,000 cfs every 2-3 years.	Improved spawning, rearing and overwintering habitat. Reduced riparian fossilization. Maintenance of habitat complexity
Periodic channel migration (Attribute #6): The channel migrates at variable rates and establishes wavelengths consistent with regional rives with similar conditions.	- Create channel avulsions every 10 years. Flow: 30,000 cfs every 10 years. - Channel migrates in alluvial reaches. Flow: 6,000cfs - Maintain channel geometry as channel migrates. Flow: 6,000cfs.	Improved habitat for developing salmon. Refugia from high-flow and high-temperature conditions.

3.2. Basin-wide Sediment Indicators and Targets

This section describes several additional sediment indicators for the Trinity River TMDL, including target values, relationship to beneficial uses, scientific references and a summary of existing conditions where available. In several cases, targets are expressed as improving trends, since thresholds specific to the Trinity River have not been developed. Table 3.3 on the following page summarizes the indicators, targets, description and purpose.

Spawning Gravel Quality

Streambed gravels naturally consist of a range of particle sizes from finer clay and sand to coarser cobbles and boulders. Kondolf (2000) described how various gravel sizes and mixtures can influence different salmonid life stages including redd construction, egg incubation and alevin emergence. In addition, interstitial spaces in clean cobble provide important cover for salmonid and other fry at a critical and vulnerable time in their life history. A variety of indicators are necessary to express the overall substrate quality relative to salmonid life stage requirements. Each indicator, target threshold and available Trinity River data are described below.

Target: Improving trend (increase) in particle size distribution as measured by median particle diameter (D_{50}) and geometric mean (Dg).

Median particle diameter (D_{50}) and geometric mean (Dg) are measures of the central tendency of the substrate sample and relate to the ability of salmonids to move the gravel and construct a redd. A precise target threshold is difficult to express at this point due to lack of long-term data set from the Trinity River and lack of literature relating specific thresholds to survival estimates for salmonids. However, EPA expects to D_{50} and Dg values to increase (improve) over time from baseline levels as fine sediment input is reduced, coarse gravel inputs increase, and flows increase in the Upper Middle Mainstem.

Trinity River Data: GMA (2001a) collected bulk samples of gravel substrate on several mainstem and tributary sites in the Upper Middle Assessment Area (where spawning was likely but had not yet occurred) using a 2' diameter sampler in 2000. Results of this study indicate that spawning gravel quality generally declines in a downstream direction from the mainstem spawning area just below Lewiston dam (river mile 111.5) through the study sites below each of the major tributaries (to river mile 80.3). The median particle diameter (D_{50}) and geometric mean (Dg) were lowest (3.24mm and 4.33 respectively) at the Poker Bar site followed by the Evans bar site (12.66 and 10.23 respectively). These samples contained relatively high proportion of finer grain material, likely delivered from upstream tributaries (Grass Valley Creek and Reading Creek), which is indicative of poor spawning gravel quality. The highest, better quality D_{50} and Dg values are observed at the Lewiston site where essentially all fine sediment inputs are eliminated due to the dam located immediately upstream of the sampling site and due to the mechanical introduction of spawning size gravel as part of mainstem restoration efforts.

GMA (2001a) also documented a decline in spawning gravel quality by comparing year 2000 D_{50} data with year 1992 D_{50} values from samples taken by Wilcock et al. (1995). The study indicated that D_{50} values degraded from 35 mm in 1992 to 19.9 mm in 2000 at one sample site (Table 3-2). At another sample site, the D_{50} values declined from 33 mm to 22.6 mm during the same time period. This suggests that fine sediment has increased during this period and/or flows have not been adequate to "flush" the existing sediment load, at least at the Steelbridge site, and spawning gravel quality has correspondingly declined.

Table 3-2. Comparison of D_{50} values from 1992 to 2000 indicating declining quality (GMA 2001a)

	D_{50} Values 1992 (Wilcock et al 1995)	D_{50} Values 2000 (Matthews 2001a)
Steelbridge Sample #1	35 mm	19.9 mm
Steelbridge Sample #2	33 mm	22.6 mm

Table 3-3. Sediment Indicators and Targets

INDICATOR	TARGET	DESCRIPTION	PURPOSE
Instream			
Spawning Gravel Quality	Improving Trend: D_{50}, Dg ≤10% < 0.85 mm ≤15% < 2.0 mm ≤30% < 6.4 mm;	Bulk sample dry weight) during low-flow period, at riffles heads in potential spawning reaches. Methods on the mainstem should be consistent with Matthews (2001a). Discussion of indicators and targets by Kondolf (2000), Chapman (1988).	Indirect measure of fine sediment content relative to incubation and fry emergence from the redd. Indirect measure of ability of salmonids to construct redds
Permeability of spawning gravel	Improving trends (increase cm/hr)	Permeability standpipe driven into potential spawning gravel to a depth of approximately 35 cm below the bed surface (Matthews 2001a)	Measure of oxygenated water supply directly affecting salmon egg survival
Turbidity and Suspended Sediment	Turbidity ≤ 20% above naturally occurring background (Basin Plan)	Measured upstream and downstream of sediment discharging activity or between "paired" watersheds.	Indirect measure of fish feeding/growth ability related to sediment, and impacts from management activities
	Decreasing trend in days of turbidity threshold exceedance	Develop turbidity rating curve and relate to biological effects (Newcombe and Jenson 1996)	Indirect measure of chronic suspended sediment affects on fish feeding, growth, etc.
Riffle Embeddedness	≤25% or improving (decreasing) trend	Estimated visually at riffle heads where spawning is likely, during low-flow period (Flosi et al 1998)	Indirect measure of spawning support; improved quality & size distribution of spawning gravel
V*	≤0.21 (Franciscan) or <0.10 (other)	Residual pool volume. Measure during low-flow period. (Lisle and Hilton 1992)	Estimate of sediment filling of pools from disturbance
Aquatic Insect Production	Improving trends	EPT, Richness & % Dominant Taxa indices. Methods should follow CDFG-WPCL (1996).	Estimate of salmonid food availability, indirect estimate of sediment quality.
Thalweg profile	Increasing variation from the mean	Measured in deposition reaches during low-flow period.	Estimate of improving habitat complexity & availability
pool/riffle distribution & depth of pools	increasing trend toward >40% in primary pools	Trend or greater than % (by length) of primary pools, measured low-flow period.	Estimates improving habitat availability
Large Woody Debris (LWD)	increasing distribution, volume & of key pieces	Increasing number & volume of key pieces or increasing distribution of LWD-formed habitat.	Estimates improving habitat availability
Watershed Indicators			
Diversion potential & stream crossing failure potential	≤1% crossings in 100 yr storm	Conduct road inventory to identify and fix stream crossing problems (Weaver and Hagans 1994). See USDA (1999) Roads Analysis for assessing road network.	Estimates potential for reduced risk of sediment delivery from hillslope sources to the watercourse
Hydrologic connectivity of roads	Decreasing length of road	Conduct road inventory to identify and fix road drainage problems (Weaver and Hagans 1994).	Estimates potential for reduced risk of sediment delivery from hillslope sources to the watercourse
Annual road inspection & correction	Increased mileage inspected and corrected	Roads inspected and maintained, or decommissioned or hydrologically closed prior to winter- No migration barriers.	Estimates potential for reduced risk of sediment delivery from hillslope sources to the watercourse
Road location, surfacing, sidecast	Reduce density next to stream, increased % outsloped and hard surfaced roads	see text	minimized sediment delivery
Activities in unstable areas	avoid and/or /eliminate	Subject to geological/geotechnical assessment to minimize delivery and/or show that no increased delivery would result	minimized sediment delivery from management activities
Disturbed Area	Decrease in impaired subareas	Disturbed area is area covered by roads, landings, skid trails, agriculture, etc.	Correlated with suspended sediment (Lewis 1998)

Percent Fines < 0.85 mm: <10%

The percent fines <0.85 mm is defined as the percentage of subsurface fine material in pool tail-outs < 0.85 mm in diameter. This indicator and target represent adequate spawning, incubation, and emergence conditions relative to substrate composition. Excess fine sediment can decrease water flow through salmon redds. Sufficient water flow is critical for maintaining adequate oxygen levels and removing metabolic wastes. Deposits of these finer sediments can also prevent the recently hatched fry from emerging from the redds, resulting in entrapment. Monitoring should be conducted by bulk sampling during low-flow periods at the heads of riffles, in potential spawning reaches. The numeric target for this parameter is 10% based on the following: (1) 10% is generally within the range that supports high levels of survival to emergence of salmonids (Chapman 1988); (2) 10% is achievable based on recent data collected by GMA (2001a) indicating the geologic and hydrologic conditions in the Trinity are generally capable of producing relatively small percentages of finer grain material than other Northcoastal rivers.

Trinity data: Most of the samples taken by GMA (2001a) in both the mainstem and tributaries, demonstrate that percent fines <0.85 are below threshold levels indicating that this size class may not presently be a limiting factor for salmonid production in the Upper Middle Area. Data not available for other areas of the basin.

Percent Fines 15% <2.0 mm; 30%<6.4 mm :

After hatching, alevins live within the intragravel pore space in the redd then migrate upward toward the surface. The presence of excessive sand size particles can result in the "capping" of the redd and prevent emergence of alevins (Phillips et al. 1975). EPA has selected sand sized particles (approximately 2.0mm), which is particularly representative of the decomposed granitic terrain in the Upper Middle Assessment Area, and fine sediment (6.4 mm) as additional surrogate measurements of spawning gravel quality. The target thresholds of 15% for particles less than 2.0mm and 30% for particles less than 6.4mm sizes are based on literature relating size classes survival to emergence (summarized in Chapman 1988, and Kondolf 2000) and were shown to be achievable at many of the GMA (2001a) sampling sites.

Trinity Data: The Poker Bar site (river mile 102.7), just below the confluence of Grass Valley Creek, contained high levels (30%) of sand size particles (<2.0 mm) and approximately 65% of size class 5.6 mm (GMA 2001a). These values indicate a relatively low chance of survival to emergence under these excessive fine sediment conditions in this reach. In addition, this suggests that erosion control efforts are still necessary in Grass Valley Creek to reduce the supply of sand-sized sediment. Most of the other mainstem sampling sites (besides Lewiston which was significantly below) were very close to the 30% threshold, indicating that this size class is potentially a limiting factor salmonid production throughout the middle mainstem.

Riffle Embeddedness

Target: <25% or improving (decreasing) trend

Embeddedness is a measure of fine sediment that surrounds and packs-in gravels. A heavily embedded riffle section may limit the ability of an adult female to construct a redd. When constructing its redd, generally at a pool tail-out (or the head of the riffle), the spawning fish essentially slaps its tail against the channel bottom, which lifts unembedded gravels and removes some of the fine sediment. This process results in a pile of cleaner and more permeable gravel, which is more suited to nurturing of the eggs. Embedded gravels do not generally lift easily, which prevents spawning fish from building their redds. Flosi et al. (1998) suggest that gravels that are less than 25% embedded are preferred for spawning. This target should be estimated during the low-flow period, generally at riffle heads, in potential spawning reaches.

Trinity Data: The USFS has collected embeddedness data in various tributaries throughout the Trinity Basin following the Stream Condition Inventory methodology (USFS 1998) which is different than the methodology used by the CDFG. The USFS conducts a modified Wolman pebble count to determine a percentage of the gravel and cobble that are considered embedded (defined as >50% covered in fine material)(USFS 2000d). Alternatively, the CDFG (1998) samples five small cobbles at pool tail-outs and estimates the amount (percent) of the stone buried in the sediment to determine an average cobble embeddednes rating. Due to these differences, data are not comparable. Since the USFS manages the majority of land in the Trinity Basin, it may be advisable to determine an embeddedness threshold based on the USFS monitoring protocol, which presently is not available.

The Forest Service found a range of 5 to 44 percent of the gravel or cobble in the New River, including tributaries, were embedded more than 50%. Recent samples from Manzanita Creek, North Fork Trinity, Canyon Creek, Eagle Creek and Halls Creek all show seemingly low percentages of embeddedness (USFS data sheets 2001).

V*

Target: <0.21 (Franciscan geology) or <0.10 (stable geology)
V* is a measure of the fraction of a pool's volume that is filled by fine sediment, and represents the in-channel supply of mobile bedload sediment (Lisle and Hilton 1992). It reflects the quality of pool habitat, since a lower filled pool volume reflects deeper, cooler pools offering protection from predators, a food source, and resting location. Lisle and Hilton (1992) also describe methods for monitoring, which should be conducted in low-flow periods. V* is not appropriate for large rivers, but in large river systems it is appropriate for tributaries. The target of V* values less than .21 (Franciscan geology) is based on Knopp (1993).

Trinity Data: Lisle and Hilton (1992) measured residual pool volumes in the Big French, Horse Linto, Three Creeks and Grass Valley Creek watersheds. The study reach in each creek consisted of between 13 and 21 pools. Big French Creek and Horse Linto Creek, both reference streams, had a average V* value of 0.04 and 0.12 respectively, indicative of very low sediment yields. Grass Valley Creek had an average V* of 0.50, indicative of high yields.

Aquatic Insect Production

Target: improving trends in EPT, % dominant taxa and species richness indices
Benthic macroinvertebrate populations are greatly influenced by water quality and are often adversely affected by excess fine sediment. This TMDL recommends several indices be calculated, following the CDFG Water Pollution Control Laboratory Stream Bioassessment Procedures (1996).

1) EPT Index. The EPT Index is the number of species within the orders Ephemeroptera, Plecoptera, and Trichoptera (EPT), more commonly known as mayflies, stoneflies and caddisflies. These organisms require higher levels of water quality and respond rapidly to improving or degrading conditions.
2) Percent Dominant Taxa. This index is calculated by dividing the number of organisms in the most abundant taxa by the total number of organisms in the sample. Collections dominated by one taxa generally represent a disturbed ecosystem.
3) Richness Index. This is the total number of taxa represented in the sample. Higher diversity can indicate better water quality.

Trinity Data: Boles (1980) documented an increase in productivity, biomass, and diversity of benthic organisms following the "flushing" of granitic sand from a riffle in the Junction City reach of the Trinity River. However, the TRMFR EIS noted that based on investigations of macroinvertebrate production in the Trinity compared with other basins, benthic food production does not appear to be a major factor in limiting fish production in the mainstem Trinity at the current time (US FWS 1999, App B-13).

Turbidity and Suspended Sediment

Target: <20% above naturally occurring background levels; and Decreasing trend in number of days in which a turbidity threshold is exceeded

Turbidity is a measure of the ability of light to shine through water (with greater turbidity indicating more material in the water blocking the light). Although turbidity levels can be elevated by both sediment and organic material, in California's North Coast stream turbidity levels tend to be highly correlated with suspended sediment. High turbidity in the stream affects fish by reducing visibility, which may result in reduced feeding and growth. Elevated suspended sediment, particularly over a long period, may also result in direct physical harm, for example, by clogging gills. The deleterious effects on salmonids were found not only to be a function of concentration of fine particles but also a function of duration of exposure. Chronic turbidity can also reduce productivity by impeding photosynthesis.

Sigler et al (1984) found that as little as 25 NTUs of turbidity caused a reduction in fish growth. The North Coast Basin Plan presently stipulates that turbidity shall not be increased more than 20 percent above naturally occurring background levels by an individual activity. This indicator should be measured during and following winter storm flows, and upstream and downstream of a management activity to compare changes in the turbidity levels that are likely attributable to that activity. Information should include both magnitude and duration of elevated turbidity levels.

The number of days per year in which a turbidity threshold is exceeded is another important expression of the effects of turbidity on salmonids. For a stream where suspended sediment or turbidity monitoring has taken place, a rating curve that relates suspended sediment or turbidity to an exceedance probability can be developed based on the relationship developed between suspended sediment or turbidity to stream flowrate. This rating curve shows the likelihood of the exceedance of a given suspended sediment concentration or turbidity for a given site specific data set. Turbidity and/or suspended sediment rating curves should be developed and maintained to establish temporal trends for suspended sediment and/or turbidity concentrations. Present turbidity levels and exceedance durations should be established for the Trinity River before an exceedance threshold is defined.

Trinity Data: GMA (2001b) collected turbidity and suspended sediment data from various tributaries (with a focus on the Upper Middle Area) during WY2000 and 2001. This data was used to determine calculate the amount of total suspended sediment transported from certain tributaries as part of the sediment budget development (Section 4.3). GMA (2001b) reported maximum turbidity values (NTU) by sampling stations according to various ranges of turbidities (e.g., <10, 10-50,...,>500). According to GMA (2001b), no sites that are considered to have little disturbance upstream were found to have NTU values exceeding 100, and most were lower than 50 during the storms in WY2000 and 2001 when data were collected. In contrast, in watersheds with high disturbance, values were typically in excess of 100 NTU, and sometimes higher. Values in excess of 500 NTU were found at Indian, Reading and Browns Creeks as well as a small creek draining the Diener Mine, southwest of Trinity Center.

The USFS (2000b, 3-149,) reports that turbidity measurements in Horse Linto Creek since the Meagram fire are mostly in the 5 to 10 NTUs with occasional spikes of 40 to 80 NTUs during high flows (and one peak of 200-300 NTUs in January, 2000). These low values provide support the consideration of Horse Linto Creek as a reference watershed.

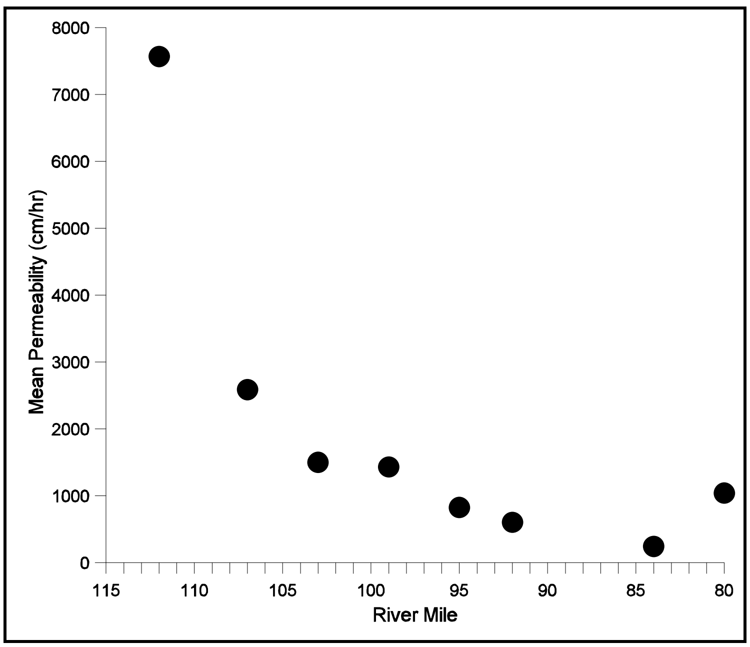
Permeability:

Improving trend (increasing cm/hr):

Permeability is a measure of the ease with which water can pass through gravel, thereby supplying dissolved oxygen directly to salmon eggs and facilitating the removal of metabolic waste from the egg pocket. The higher the permeability, the greater the supply of oxygenated water that can reach the salmon eggs (Terhune 1958, in McBain and Trush 2000). Fine sediment intrusion into gravel reduces permeability. Permeability is potentially an important indicator for TMDL purposes because: 1) it measures factors that directly affect salmonid egg incubations, and 2) new techniques to measure permeability are more cost- and time-effective than other measures of spawning gravel quality (e.g., bulk samples). Since few studies have related permeability to egg survival-to-emergence (even though it is possible to design research around this question), the TMDL target for permeability at this point is an improving trend over time.

Trinity data: Similar to substrate quality, GMA (2001a) found that permeability values generally declined in a downstream direction from the Lewiston monitoring site to Junction City on the mainstem in the UMT (Figure 3-1). GMA (2001a) utilized equations presented by McBain and Trush (2000) and McCuddin (1977) to estimate chinook survival to emergence using mean site permeability. This suggests a much lower suvival percentage than suggested by the gravel distribution indexes. GMA (2001a) reports that, "permeability index drops in steps below Rush Creek, Grass Valley Creek, and to 0% survival at the Evans Bar site, suggesting deteriorating conditions due to increased fines contributed by tributaries."

Figure 3-1. Mean permeability vs. River Mile (source: GMA 2001a)



Thalweg Profile

Target: Increasing variation of elevation around the mean slope
Variety and complexity in habitat is needed to support fish at different times in the year or in their life cycle. Both pools and riffles are used through spawning, incubation of eggs, and emergence of the fry. Once fry emerge, they rest in pools and other slower-moving water, darting into faster riffle sections to feed where insects are abundant. Deeper pools, overhanging banks, or logs provide cover from predators. Measuring the thalweg profile is an indicator of habitat complexity.

The thalweg is the deepest part of the stream channel at a given cross section. The thalweg profile is a plot of the elevation of the thalweg as surveyed in a series of cross sections. Harrelson et al. (1994) provide a practical guide for performing thalweg profiles and cross sections. The profile appears as a jagged but descending line, relatively flat at pool areas, and descending sharply at cascades. The comparison between the mean slope (i.e., the overall trend of the descending stream) and the details of the slope is a measure of the complexity of stream habitats. More variability in the profile indicates more complexity in stream habitat. Inadequate availability of pool-forming features, such as bedrock or large wood debris, can be revealed by this indicator of channel structure. Because the change in the profile will occur relatively slowly, and because not enough is yet known about channel structure to establish a specific number that reflects a satisfactory degree of variation, the target is simply an increasing trend in variation from the mean thalweg profile slope. This indicator should be measured during the low-flow period every 5-10 years, after large storm seasons.

Trinity Data: The US FWS and HVT (1999) thoroughly describes the change in middle mainstem from an alternatve bar morphology which provided velocity, substrate and topographical diversity to monotypic channel lacking such diversity. EPA refers the reader to the Trinity River Flow Study (McBain and Trush 1997) and the Trinity River Flow Evaluation Final Report (US FWS and HVT 1999) for more detail.

Pool Distribution and Depth

Target: increasing inventory of reaches which are >40% pools
Pools generally account for more than 40% of stream length in streams with good salmonid habitat (Flosi et al. 1998). Frequent pools are important for providing feeding stations and shelter, and may also serve locally as refugia. This indicator should be measured during the low-flow period every 5-10 years, after large storm seasons. Information should include length and depth of pools, and should report the number of primary pools, usually defined as pools greater than two feet in depth in 1st and 2nd order streams, and greater than three feet in depth in 3rd and 4th order streams. Backwater pools are used by salmonids as overwintering habitats (Flosi et al. 1998). In particular, they provide shelter from high storm flows. Lateral scour pools (i.e., pools formed near either bank) tend to be heavily used by fish for cover and refugia.

Trinity Data: McBain and Trush (1997) documented the change in fine sediment storage in five mainstem Trinity River pools between 1993 and 1997. Four of the five pools increased in fill material ranging from 670yds^3 to 4,050 yds^3 during this time period (p.164). The TRFE thoroughly describes the change in middle mainstem from an alternative bar morphology which provided velocity, substrate and topographical diversity to monotypic channel lacking such diversity (US FWS and HVT 1999). EPA refers the reader to the TRFE and TRMFR EIS for more detail than was provided in the description of habitat conditions (Section 2.4).

With regard to tributary pool conditions, the Shasta/Trinity National Forest has recently initiated stream condition inventories in several tributaries throughout the basin from which to establish baseline conditions for determining future trends. In addition, the USFS conducted habitat surveys in the late 1980's in some tributaries. However, EPA determined that this data was not recent enough to indicate current conditions relative to beneficial uses support.

Large Woody Debris (LWD)

Target: increasing distribution, volume and number of key pieces
California coastal streams are especially dependent on the presence of large woody debris to provide ecological functions, such as sediment metering, sediment grading, pool formation, and shelter. Large pieces of woody debris in streams influence the physical form of the channel, the movement of sediment, the retention of organic matter and the composition of the biological community (Bilby and Ward 1989). Debris can be instrumental in forming and stabilizing gravel bars (Bilby and Ward 1989, Lisle 1986, in US EPA 1999), or in accumulating fine sediment (and thereby keep it from clogging spawning areas) (Zimmerman et al. 1967, Megahan 1982, in Bilby and Ward 1989). LWD can also form pools by directing or concentrating flow in the stream in such a way that the bank or bed is scoured, or by impounding water upstream from the obstruction (Lisle and Kelsey 1982, in US EPA 1999). LWD and key pieces are found by lineal stream reach and are related to the piece diameter and length, channel gradient, and channel

width (Montgomery and Buffington 1993). LWD plays a more significant role in routing sediment in small streams than in large ones (Bilby and Ward 1989). However, it also plays a role on floodplains and in off channel wetted areas of larger streams. This indicator should be measured during the low-flow period, and should report the number and volume of key pieces or the distribution of LWD-formed habitat.

Trinity Data: The US Forest Service has begun gathering LWD data (number of pieces, size classes, lengths) following the SCI protocol (USFS 1998) in survey reaches of the North Fork and New River to determine trends following the Big Bar Fire Complex. Trends can only be determined after several more years of data collection are complete.

3.3. Watershed Indicators

Stream Crossings with Diversion Potential or Significant Failure Potential

Target: <1% of all stream crossings divert or fail as a result of a 100-year or smaller flood
Most roads, including skid roads and railroads, cross ephemeral or perennial streams. Crossings are built to capture the stream flow and safely convey it through, under, or around the roadbed. However, stream crossings can fail, adding sediment from the crossing structure (i.e., fill) or from the road bed directly into the stream. Stream crossings with diversion potential or significant failure potential are high risks for sediment delivery to streams. Stream crossing failures are generally related to undersized, poorly placed, plugged, or partially plugged culverts. When a crossing fails, the total sediment volume delivered to the stream usually includes both the volume of road fill associated with the crossing and sediment from collateral failures such as debris torrents that scour the channel and stream banks. Diversion potential is the potential for a road to divert water from its intended drainage system across or through the road fill, thereby delivering road-related sediment to a watercourse. The potential to deliver sediment to the stream can be eliminated from almost all stream crossings by eliminating inboard ditches, outsloping roads, or installing rolling dips (US EPA 1998). Less than 1% of stream crossings have conditions where modification is inappropriate because it would endanger travelers or where modification is impractical because of physical constraints.

Trinity data: A recent road inventory conducted as part of the Five County Salmon Conservation Program (“Five County Program”) identified 787 stream crossings, out of a total of 1195 sites, as potential sediment delivery sites from county roads throughout Trinity County (PWA 2001). Several of the stream crossing sites are located on key tributary streams including Canyon Creek Road (49 sites), Coffee Creek Road (42 sites), Indian Creek Road (52 sites), Deadwood Creek Road (34 sites), Rush Creek Road (40 sites). The total potential sediment yield from the Trinity County road sites is approximately 650,963 (PWA 2001).

As part of the USFS watershed condition assessment, De la Fuente et al. (2000) calculated several road related values which illustrate which subwatershed areas represent higher road hazard potential with regard to sediment delivery. Table 3-4 contains the several road-related indicators and associated values including the composite rating of road hazard potential. Although the data do not reflect the quality of stream crossings (i.e., number of diversion potentials), it does illustrate that certain watershed areas consist of relatively high numbers and densities of stream crossings which generally correlates with a higher sediment delivery risk. The subwatersheds in Table 3-4 are listed from lowest to highest based on their composite rating of road hazard potential.

Table 3-4. Summary of Selected Road Hazard Indicators from Lowest Composite Rating Hazard Potential to Highest (Adapted from De la Fuente 2000)

Subwatershed Area	**Road miles on steep slopes (slopes >45%)**	**Stream Buffer Road Density (mi/mi^2)**	**Density of road/stream intersects (# per mi^2)**	**Composite rating of road hazard potential**
North Fork	16	0.15	0.38	12
Coffee Creek	6	0.26	0.62	19
New River	36	0.26	0.76	20
Lower Trinity	42	0.55	1.39	39
Trinity - SF to Tish Tang	78	0.48	1.00	41
Brown's Creek	16	0.83	1.61	56
Stuart Fork	8	0.88	2.00	57
Canyon Creek	33	0.82	2.22	59
Trinity - New River to South Fork	22	0.77	1.66	63
Mainstem Trinity	39	0.84	1.61	65
East Fork	30	0.96	1.95	75
Trinity Reservoir	33	1.34	3.78	91
Weaver-Rush	13	1.65	3.61	104

Hydrologic Connectivity

Target: decreasing length
A road is hydrologically connected to a stream when the road drains water directly to the stream. A hydrologically connected road increases the intensity, frequency, and magnitude of flood flows and suspended sediment loads in the adjacent stream, which can result in destabilization of the stream channel. This can have a devastating effect on salmonid redds and growing embryos (Lisle 1989). The connectivity can be reduced by outsloping roads, creating road drainage that mimics natural drainage as much as possible, and other factors (USDA 1999, Weaver and Hagans 1994).

The reduction of road densities and the reconstruction of roads to reduce the use of inboard ditches, for example, can reduce the amount of water that is directly delivered to watercourses, including any associated sediment load. Current research appears insufficient to identify a specific target, so this TMDL calls for a reduction in the hydrologic connectivity of roads to watercourses.

Trinity Data: The USFS has assessed the potential for an altered hydrologic regime (changes in timing, magnitude, duration and spatial distribution of runoff flows) and stream diversion associated with roads as part of the Road Hazard Potential indicator in their Watershed Condition Assessment. Specifically, they examined the road network in relation to slope position, slope gradient, proximity to stream channels, number of stream crossings and density within watershed assessment areas. The composite rating of road hazard potential for each watershed is displayed in Table 3-4 above. The higher rating represents a higher potential hazard for hydrologic change associated with roads.

As part of the Five County Program, PWA (2001) estimated that approximately 95,087 yds^3 of sediment represent "persistent surface erosion" from all the county road sites identified.

Annual Road Inspection and Correction

Target: decreasing road length next to streams, increasing proportion outsloped or hard surfaced roads
EPA's analysis indicates that in watersheds with road networks that have not experienced excessive road-related sedimentation, roads are either (1) regularly inspected and maintained; (2) hydrologically maintenance free (i.e., they do not alter the natural hydrology of the stream); or (3) decommissioned or hydrologically closed (i.e., fills and culverts have been removed and the natural hydrology of the hillslope has largely been restored). If not, they are potentially large sources of sediment (D. Hagans, pers. comm., 1998, in EPA 1998). In general, road inspection should be undertaken annually, and could in most cases be accomplished with a windshield survey. The areas with the greatest potential for sediment delivery should be corrected prior to the onset of winter conditions. This target calls for an increase in the proportion of roads that are either (1) inspected annually and maintained prior to winter, (2) hydrologically maintenance free, or (3) decommissioned or hydrologically closed, until all roads in the Trinity River watershed fall into one of these categories.

Trinity Data: The US Forest Service has acknowledged that funding for road inspection and maintenance is well below the demand on the expansive federal forest road network nationwide. The Six Rivers National Forest has conducted extensive road inventories throughout the Lower Assessment Area. A transportation strategy was developed for Horse Linto Creek, Mill Creek and Tish Tang Creek in 1997. 23 miles (19%) of the road network in Horse Linto Creek has been decommissioned or placed in a hydrologically maintenance free condition (USFS 2000b). EPA was not able to ascertain the degree to which other federal and non-federal roads throughout the Trinity Basin are inspected and maintained. However, based on the road-related sediment problems identified by GMA (2001b) and the Five County Program (PWA 2001), it appears that annual road inspections on both federal and non-federal land are lacking in many areas.

Road Location, Surfacing, Sidecast

Target: prevent sediment delivery
This indicator is intended to address the highest risk sediment delivery from roads not covered in other indicators. Roads located in inner gorges and headwall areas are more likely to fail than roads located in other topographic locations. Other than ephemeral watercourses, roads should be removed from inner gorge and potentially unstable headwall areas, except where alternative road locations are unavailable and the road is clearly needed. Road surfacing and use intensity directly influences sediment delivery from roads. Rock surfacing or paving is appropriate for frequently used roads. Sidecast on steep slopes can trigger earth movements, potentially resulting in sediment delivery to watercourses. These factors reflect the highest risk of sediment delivery from roads, and should be the highest priorities for correction (C. Cook, M. Furniss, M. Madej, R. Klein, G. Bundros, pers. comm., 1998, in EPA 1998).

This target calls for several things: (1) all roads alongside inner gorge areas or in potentially unstable headwall areas are removed unless alternative road locations are unavailable and the need for the road is clearly justified; (2) road surfacing, drainage methods, and maintenance are appropriate to their use patterns and intensities; and (3) sidecast or fill on steep (i.e., greater than 50%) or potentially unstable slopes, that could delivery sediment to a watercourse, are pulled back or stabilized.

Trinity Data: De la Fuente (2000) evaluated the number of miles of roads located on steep slopes (>45%) within each sub-basin as part of the watershed condition assessment (Table 3-4). Roads located in these sensitive areas should be prioritized for further evaluation to determine degree of sediment delivery risk.

Activity in Unstable Areas

Target: avoid or eliminate, unless detailed geologic assessment by a certified engineering geologist concludes there is no additional potential for increased sediment loading

Unstable areas are those areas that have a high risk of landsliding, including steep slopes, inner gorges, headwall swales, stream banks, existing landslides, and other locations identified in the field. Any activity that might trigger a landslide in these areas (e.g., road building, harvesting, yarding, terracing for vineyards) should be avoided, unless a detailed geologic assessment by a certified engineering geologist concludes there is no additional potential for increased sediment loading. An analysis of chronic landsliding in the Noyo River basin indicated that landslides observed on aerial photographs largely coincide with predicted chronic risk areas, including steep slopes, inner gorges and headwall swales (Dietrich et al. 1998). Several other studies have shown that landslides are larger or more common in some harvest areas, particularly in inner gorges (US EPA 2000). Weaver and Hagans (1994) also suggest methods for eliminating or decreasing the potential for road-related sediment delivery.

Disturbed Area

Target: decrease

Studies in Caspar Creek indicate that more disturbed areas have higher suspended sediment discharge rates (Lewis 1998). In addition, studies in Caspar Creek indicate that clearcutting causes greater increases in peak flows (and, by extension, increased suspended sediment loads) than does selective harvest (Ziemer 1998). As with the "hydrologic connectivity" target, increases in peak flows, annual flows, and suspended sediment discharge rates negatively affect the potential survivability of ova in redds (Lisle 1989).

Available information is insufficient to identify a threshold below which effects on the Trinity River watershed would be insignificant. Accordingly, the target calls for a reduction in the amount of disturbed area. In this context, "disturbed area" is defined as the area covered by management-related facilities of any sort, including: roads, landings, skid trails, firelines, harvest areas, animal holding pens, and agricultural fields (e.g., pastures, vineyards, orchards, row crops, etc.). The definition of disturbed area is intentionally broad to include managed agricultural areas, such as pastures and harvest areas, where the management activity (e.g., logging or grazing) results in removal of vegetation sufficient to reduce significantly important rainfall interception and soil protection functions. Agricultural fields or harvest areas in which adequate vegetation is retained to perform these ecological functions can be excluded from consideration as disturbed areas. Dramatic reductions in the amount of disturbed area, then, can be made by reducing road densities, skid trail densities, clearcut areas, and other management-induced bare areas.

Trinity Data:

GMA (2001b) determined the amount of timber harvest area by decade by each assessment area which is an indicator of the level of disturbance that has occurred between these area (summarized in Table 3-5). Of course, timber harvest is just one indicator of disturbance in addition to road construction, mining, etc. The sediment source analysis (chapter 4) provides a quantitative evaluation of the sediment delivery rates associated with the various management-related and background sources.

Table 3-5. Timber Harvest Area (acres) by Decade within each Assessment Area (source: GMA 2001b).

Harvest Area by Decade	Upper Trinity		Upper Middle Trinity		Lower Middle Trinity		Lower Trinity	
	acres	percent	acres	percent	acres	percent	acres	percent
1940	9,331	6%	351	0.2%	103	0.2%	1,035	30%
1950	24,019	15%	39,302	29%	6,069	10%	16,269	30%
1960	34,626	22%	15,094	11%	13,905	24%	23,407	43%
1970	56,917	36%	18,673	14%	29,643	50%	11,433	21%
1980	13,885	9%	25,693	19%	4,086	7%	0	0
1990	17,816	11%	34,465	26%	5,157	9%	1,875	4%
Total	**156,595**	**35%**	**133,577**	**65%**	**58,963**	**13%**	**54,020**	**28%**

CHAPTER 4

SEDIMENT SOURCE ANALYSIS and BUDGET

The purpose of the sediment source analysis is to identify the various sediment delivery processes and sources in the watershed and to estimate the sediment yield from those sources. A sediment budget is an accounting of the sources as well as the storage and transport of sediment out of a drainage basin. This chapter summarizes the methodology (section 4.1) and results (section 4.2) of the sediment source analysis and sediment budget calculations (section 4.3), based largely data compiled by GMA (2001b). The results of the sediment source analysis (expressed in tons per square mile per year (t/mi2/yr)), including the amount of sediment delivered from each management-related source category (e.g., roads, timber harvest, legacy mining) and background source categories are summarized in Tables 4-2, 4-3, 4-4, 4-5 according to subareas within each assessment area.

4.1 Sediment Source Analysis Methods

The sediment source analysis consisted of the following components to quantify the rates of sediment yield from management and background source categories that have occurred in the recent past: landslide mapping, field plot inventory, surface and gully erosion estimates, legacy (i.e., abandoned roads and historic mining activity) erosion estimates, and bank erosion estimates.

Landslide Mapping

The relative importance and contribution of landslide-generated sediment was estimated based on air photo and field estimates of volumes of sediment introduced into streams by landslides over the duration of the air photo record (1944 to 2000). Measurements made during the landslide inventory were used to estimate the sediment contribution of both management (primarily timber harvesting and road building) and non-management or natural sources that appear to be associated with landslide activity. The landslide inventory documents the location, timing, classification (e.g., rotational, earthflow, debris torrent, etc.) and relative size of landslides in the watershed.

GMA (2001b) field verified about 15% of the landslides mapped, which was considered a representative sample of landslides in the watershed, to evaluate air photo interpretation limitations and help resolve major uncertainties. The sample size was primarily a function of access (i.e. permission, distance from road access, etc.), with most emphasis on verification in the Upper Middle Assessment Area. The factors assessed during the field inventory included the following: landslide area/volume, land use association, initiation factors, delivery to streams, etc.

The landslide database and landslide inventory maps were linked through the project GIS. Each slide mapped onto the overlays was digitized as a polygon and linked to the database. Slides judged questionable and/or non-delivering were discarded from further analysis. The remaining dataset was queried by landslide type, year, number of slides and area, geology, and the locations were separated into sub-watershed areas for evaluation at that level. Summary tables for the assessment areas and each sub-watershed were prepared for use in interpreting the data and performing volume calculations. The volume of delivering landslides in each accounting unit (watershed and/or sub-watershed) was computed based on delivery percentage multiplied by slide area times slide thickness. Selection of an average slide thickness by type was based on literature review and field verification. Slide volumes were converted from cubic yards to tons based on soil bulk density data. This allows comparison of sediment inputs to sediment transport values, which are usually computed in term of tons.

Field Plot Inventory

In order to assess the relative contribution of smaller slide features, GMA (2001b) conducted detailed mapping in the watershed study. Within the Upper Middle Assessment Area sites were randomly selected. Depending on access limitations, certain selected sites had to be rejected and another site randomly chosen. The size of each site was approximately 40 acres, which provided a manageable size and often has easily determined boundaries due to the subdivision of sections (40 acres being 1/16th of a square mile (640 acres per section)). A total of 40 detailed sample plots were mapped, with almost all of these sites in the Upper Middle. All of these sites were located on public land (due to access permission), thus the effects of management activities on private lands could not be ascertained by this method.

Once a sample plot was selected, field personnel mapped all erosional features within the boundaries of the plot by walking its entire area. Each feature had the following data recorded: (1) type of sediment source, (2) any apparent land use or management associations, (3) area, thickness and volume of erosion, (4) estimate of the percentage of sediment delivered to the stream, (5) estimate of the feature's age, and (6) specific location characteristics such as geomorphic form, hillslope steepness, dominant vegetation, and canopy cover. All data was entered on a data form that was then input into the project database.

Data analysis included evaluation of sediment delivery by process (slides, gullies, rill erosion, bank erosion) and by land use association (non-management, harvest-related, road related). Data collected allowed differentiation between system roads (currently in use) and abandoned or legacy roads. Volumes were computed and rates computed after selecting a typical time period for which the observed features were determined to be representative.

Surface and Gully Erosion

<u>Road Surface Erosion</u>
Unlike surface erosion from exposed hillslopes where revegetation usually occurs within a few years, road surfaces can continue to erode as long as the road is used. The road cut slopes and fill slopes tend to revegetate, reducing erosion from those sources over time. However, road-running surfaces continue to provide fine-grained sediments over the life of the road. The purpose of this part of the sediment source analysis was to identify portions of the road network that deliver sediment to streams and therefore affect aquatic habitat or water quality. This analysis develops an understanding of the overall effects of the road system on sediment yield by roughly quantifying the amount of sediment delivered to streams from roads in a sub-basin for use in comparing that amount to the estimated sediment input rates for background and

other land management activities.

The approach for estimating sediment production was to examine road segments for characteristics of the road prism, drainage system, and traffic as they influence the delivery of sediment to the stream system, and calculate sediment yield based on them. Factors were applied for differing conditions of the road tread, cut- and fill-slopes, and traffic use that increase or decrease the estimated sediment yield of that segment. The result is an estimate of sediment yield for each road segment. The estimate was further modified according to the estimated delivery of sediment to streams along that segment.

Road segment groups were analyzed to produce estimates of sediment delivery for each road segment type. That rate was applied to all of the segments of that type in each sub-basin, resulting in an estimate of sediment delivery from roads for each sub-basin. The amount of sediment delivered to the stream from each road segment type was estimated by apportioning the inherent erosion rate among the road prism components. Each component rate was modified by factors based on road prism characteristics and the percentage of the road delivering sediment into the stream system. The final product is the rate of sediment delivered to streams from road segment types. The rate multiplied by the length of each segment type in each sub-basin provides the total sediment from roads for each sub-basin.

Field Inventory was used to verify traffic and surfacing information, to verify segment types and grouping, to check average road attributes (tread, ditch, cut slope, fill slope) and prism dimensions, to collect information on cover percentage on cut- and fill-slopes, to review localized problem areas, and to determine potential delivery to streams. Prior to field inventory, GMA (2001b) performed GIS analyses to identify those portions of the road network within the standard 200 foot buffer from a Class I, II, or III watercourse (i.e. riparian roads). Because of the much greater delivery from riparian roads, these areas were prioritized. During field surveys, information on road sediment delivery was also collected for each segment. At each drainage site, the potential for sediment delivery to the stream was determined.

Gully Erosion On Roads

Gully erosion on roads can occur when surface runoff is concentrated along the tread or ditch for long distances. The most common causes of gully erosion are plugged culverts, undersized culverts, or steep un-surfaced roads (over 10% grade). Gully erosion is not included in estimates of surface erosion using the Washington Department of Natural Resources (1997) method, and so must be analyzed separately. Because gully erosion is often episodic (e.g., in response to a blocked culvert that causes a stream to flow down or across the road tread) it is difficult to obtain a good quantitative estimate of gully erosion. Instead, a qualitative estimate of how severe the problem is in different areas of the basin or on different road slopes was made during road field-verification. When gullying was seen in the field, data were recorded including the location, cause, and approximate dimensions of the gully to help determine the relative amount of sediment produced by this mechanism. Separate rates for gullies were developed by road surface, hillslope position, and geology.

Road Surface Erosion Calculations by Sub-Watershed

A formula was developed in order to estimate total sediment delivered for the entire Trinity River basin. The formula used was similar to the formula used in SEDMODL, which was used in the Sediment Source Analysis for thee South Fork Trinity River (Raines 1998, in US EPA 1998). The formula developed does not, however, account for road use factors, precipitation factors, or road slope factors.

The total amount of erosion from each drainage segment was calculated as the sum of tread erosion, cutbank erosion, and other sources of erosion. Total erosion was then divided by the length of the segment and by the age of the road. The ratio of segment length to total length surveyed was then used to derive an adjusted total erosion amount recorded in tons per mile per year. Total erosion from each site was summed for each of the geology types and then sorted by both surfacing type and hillslope location. These values were then used to develop surface erosion rates (tons/mi/year) which could then be applied to data extracted from the project GIS.

Surface erosion from roads within each sub-watershed and planning watershed was computed for existing conditions by stratifying by geology, stratifying by location (riparian, mid-slope, and ridge categories), and stratifying by road surface (paved, rocked, and native categories) and then applying the appropriate rate developed from the field inventories. Slope positions were assigned using the following methodology. To determine the location of Riparian roads, all Class I and Class II streams were buffered by 200 feet on either side. All roads segments within this buffer were considered Riparian. To determine the location of Ridge roads, ridgelines were identified by creating watershed boundaries from the 10-meter DEM with a minimum area of approximately 75 acres. Next all Class I streams were buffered by 500 feet to clip the watershed boundaries away from the riparian zone. The resulting ridgeline coverage was then buffered by 100 feet on either side. All roads segments within this buffer were considered Ridge roads. All the roads segments that didn't fall into the 200 foot riparian buffer or the 100 foot ridge buffer were considered to be Mid-Slope.

<u>Surface Erosion from Harvest Areas:</u>
Surface erosion from harvested areas is most often related to various surface disturbance activities, primarily skid trails. Without access to verify rates for harvested areas (almost all recently harvested land in the watershed is privately owned), we were limited to application of a single sediment delivery rate which was obtained from the literature. 4 tons/ac/year was selected from a review of the literature and values used in the South Fork Trinity River Sediment Source Analysis (Raines 1998) for the post-1974 period after development of Forest Practice Rules regulating harvesting methods. For pre-1974 harvesting, the rate was assumed to be 12 tons/ac/year or three times as great prior to regulation. These values were applied to all harvested areas, regardless of silviculture method, by the appropriate period. Areas of harvest were determined in several ways, including: (1) Maps of timber harvesting prepared by Department of Water Resources (CDWR 1981) were digitized and input into the project GIS thus providing information from 1940 to 1978, (2) maps contained in California Department of Forestry (CDF) THP's for the period 1979-2001 were digitized and combined with USFS compartment data to arrive at harvest acreage by sub-watershed for the current period.

The only modification to the calculation of surface erosion as described above occurred in those portions of the Upper Middle Trinity underlain by the extremely erodible Shasta Bally Formation, primarily in the Grass Valley Creek sub-watershed. This area has long been known to have produced enormous sediment yields following disturbance in the 1960s and 1970s. For those portions of the basin underlain by this geologic formation, a rate of 40tons/ac/year was used.

From 1988 to present, road and harvest history was obtained from CDF's GIS coverages which had been developed by directly inputting information provided as part of submitted Timber Harvest Plans (THPs). Data from the pre-1988 mapping efforts were shown on overlays and simply record road or harvest activity during the period between years of photographs reviewed. For roads, only main roads or haul roads were generally mapped. Because of revegetation over time, probably not all haul roads were mapped. Furthermore, their importance could be misinterpreted because of lack of use, being overgrown, or being incorporated into harvest units and lost in a maze of skid trails. In tractor-logged harvest units, road and skid trail density was characterized as low, moderate, or high. Data from the overlays was digitized into the GIS database for subsequent mapping and analysis.

Legacy Road and Mining Erosion

Data from the sample plots allowed a distinction to be made between active system roads and abandoned roads (termed legacy roads). Rates for sediment delivery from legacy roads were computed assuming that observed erosion occurred over a 30-year period. Sediment volumes from legacy roads for each sub-watershed were computed on a per square mile basis, since no data were available on the extent of these abandoned roads.

The Trinity River Watershed has a long history of mining, starting with the Gold Rush in 1848. Hard rock, placer, and hydraulic mining were all extensive, with hundreds of mines operating at various times between 1948 and 1962 with an estimated production of $60,000,000-$70,000,000. One of the largest hydraulic mines in the world, the La Grange Mine near Junction City, operated for a number of years in the watershed. Although scars are still visible at a number of these historic mining sites, no acreage for these mines is available with which to compute a surface erosion rate. However, there is fairly detailed information on a mining-related feature, ditches, which have caused considerable erosion, and we developed data with which to estimate the magnitude of these impacts on sediment delivery. Ditches conveyed water from the point of diversion, often high up in a tributary watershed, to the hydraulic mine site, where with the considerable pressure obtained from the elevation difference, large hydraulic “giants” could be operated. These ditches were constructed over often steep and challenging terrain, and a number of large landslides have occurred in recent years caused by failure of some portion of the long-abandoned ditch system. GMA (2001b) walked several miles of the most well-known of the ditches (the La Grange Ditch) and mapped all landslides and gullies found along the ditch. The volume was converted into a rate per mile of ditch assuming that an 80-year period had occurred since the ditch was last maintained. The miles of ditches by Planning Watershed were obtained from California Division of Mines and Geology 1965 Trinity County Mineral Resources Report.

Bank Erosion

Most bank erosion, except large-scale changes in alluvial reaches, cannot be mapped from aerial photography. GMA (2001b) followed the following steps to estimate bank erosion. The channel network in each watershed was analyzed to compute stream order. The number of segments of each type was computed, and a stratified random sampling approach undertaken. The main channel of each significant tributary watershed was walked in its entirety, providing access was available. For smaller drainage channels, the total length of the segments in that stream order was obtained, and the random sampling scheme was applied in proportion to the percent of the total drainage network that the segments in that particular stream order represented. Approximately 10-20% of the stream network outside of the main channel was assessed.

In order to quantify the amount of sediment contributed to stream channels, selected reaches of channels were selected and inventoried for past erosion. All erosion from hillslopes and inner channel banks was summed and divided by total length of the stream reach. Stream length and site location were identified using a range finder and aerial photography mapping. Erosional features less than ten cubic yards were not recorded. Sources of erosion were from natural bank erosion from channel changes, road related feature, and hillslope debris slides. Features were given a volume, delivery percentage, and an age. The data set was limited by the amount of private land surrounding the stream channels in the Upper Middle Area, however, 27 miles of channel, all in the Upper Middle Assessment Area, were field inventoried.

Background Sediment Delivery Rates

Background sediment delivery is considered to be all sediment that is not associated with management-related causes (such as natural landslides in Wilderness areas). GMA (2001b) determined background for each subwatershed throughout the Trinity River basin by combining the non-management sediment delivery rates from the following four categories: landslides based on air photo inventory, various processes from inventoried field plots, bank erosion estimates and soil creep.

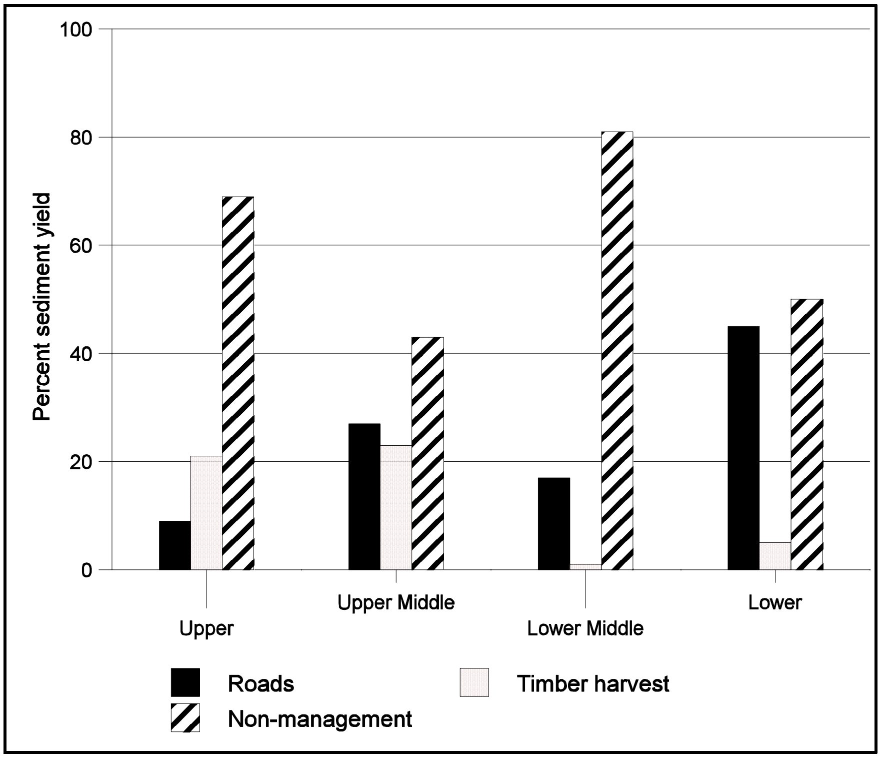
4.2. Summary of Sediment Source Inputs

The results of the sediment source analysis are summarized first by each source category and erosion process according to the four assessment areas (Table 4-1). The quantities of sediment are expressed in tons/mi2/year and the percentage by source category within each assessment area is indicated in Table 4-1. Figure 4-1 on the following page displays the percentage contribution between management, legacy and background within each assessment area.

Table 4-1. Sediment Source Summary by Category and Assessment Area

Source Category		Current Load Estimate by Assessment Area tons/mi^2/yr (%)			
		Upper	Upper Middle	Lower Middle	Lower
Management Associated Load					
Roads	Landslides	108	186	219	1307
	Cut-Bank	15	59	8	20
	Tread	17	82	9	13
	Other	14	33	6	11
	Total Roads	154 (9%)	360 (27%)	242 (17%)	1351 (45%)
Timber Harvest	Landslides	335	146		124
	Various processes (plot data)	10	18	7	15
	Surface	4	146	3	2
	Total Timber Harvest	349 (21%)	310 (23%)	10 (1%)	141 (5%)
Legacy	Roads	17	31	12	na
	Mining (slides/gullies)	1	57	6	na
Total Management-related		521 (31%)	758 (57%)	270 (19%)	1492 (50%)
Background (Non Management-associated) loads					
Landsliding		960	352	935	1280
Various Processes (plot data)		110	147	114	110
Bank Erosion		55	35	54	51
Soil Creep		30	40	30	30
Total Background		1155 (69%)	574 (43%)	1133 (81%)	1471 (50%)
Total Sediment Yield		1676	1332	1403	2963

Figure 4-1. Percent Sediment Input by Source Category within each Assessment Area.



Secondly, the results are summarized by grouping the erosional processes into four categories (background, roads, timber harvest, legacy) according to subareas within each of the assessment areas (Tables 4-2, 4-3, 4-4, 4-5). Subareas are an appropriate scale to display results because they provide a finer resolution to distinguish differences within each assessment area while at the same time combining small subwatersheds with similar characteristics. EPA uses the same subarea scale for calculating the TMDLs and allocations in the following chapter.

In addition to expressing the loading rates in terms of tons/mi^2/year, EPA has also expressed them as a percentage of the background sediment delivery rate. The percent of background indicates the magnitude of management-related sediment sources in relation to background rates for each subarea.   For example, the percent of background in the East Fork Tributaries (252%, Table 4-2) indicates a higher proportion of management-related sediment delivery than the percent of background in the Westside Tributaries (137%, Table 4-2). GMA (2001b) provides more detailed results by subwatersheds and more specific sediment input categories.

Table 4-2. Sediment Source Summary by Category and Subareas within the Upper Assessment Area

Sediment Source Categories		Current sediment delivery rates (tons/mi²/year) by subareas (GMA 2001b)				
		Reference Subwatersheds[1] (235 mi2)	Westside Tributaries[2] (93 mi2)	Upper Trinity[3] (161 mi2)	East Fork Tributaries[4] (115 mi2)	East Side Tributaries[5] (89 mi2)
Background (Non-management)		1125	421	2759	258	241
Manage ment	Roads	129	101	162	319	48
	Timber Harvest	240	31	1084	46	22
	Legacy (Roads, Mining)	7	25	21	26	26
	Total Management	376	157	1267	391	96
Total Sediment Delivery		1501	578	4026	649	337
Total as percent of background		133%	137%	146%	252%	140%

1. Stuarts Fork, Swift Creek, Coffee Creek
2. Stuart Arm Area, Stoney Creek, Mule Creek, East Fork Stuart Fork, West Side Trinity Lake, Hatchet Creek, Buckeye Creek;
3. Upper Trinity River, Tangle Blue, Sunflower, Graves, Bear Upper Trinity Mainstem Area, Ramshorn Creek, Ripple Creek, Minnehaha Creek, Snowslide Gulch Area, Scorpion Creek
4. East Fork Trinity, Cedar Creek, Squirrel Gulch Area
5. East Side Tributaries, Trinity Lake

Table 4-3. Sediment source Summary by Category and Subareas within Upper Middle Assessment Area

Sediment Delivery Categories		Current sediment delivery rates (tons/mi²/year) by subareas (GMA 2001b)					
		Weaver and Rush Creeks *(72 mi2)*	Deadwood Creek, Hoadley Gulch and Poker Bar Area *(47 mi2)*	Lewiston Lake Area (25mi2)	Grass Valley Creek [1] *(37 mi2)*	Indian Creek *(34 mi2)*	Reading and Browns Creek *(104 mi2)*
Background (non-management)		675	273	195	175	324	263
Managem ent	Roads	144	220	83	287	1570	126
	Timber Harvest	61	280	37	1136	330	204
	Legacy (Roads, Mining)	81	62	69	65	68	42
	Total Management	286	562	189	1488	1968	372
Total Sediment Delivery		961	835	384	1663	2292	635
Total as percent of background		142%	305%	197%	950%	707%	241%

1. The rates in Grass Valley Creek do not account for the amount of sediment trapped by Buckhorn Dam and Hamilton Ponds.

Table 4-4. Sediment Source Summary by Category and Subareas within the Lower Middle Assessment Area

Sediment Input Categories		Current sediment delivery rates (tons/mi^2/year) by subareas (GMA 2001b)				
		Reference Subwatersheds[1] *(434 mi2)*	Canyon Creek *(64 mi2)*	Upper Tributaries[2] *(72 mi2)*	Middle Tributaries[3] *(54 mi2)*	Lower Tributaries[4] *(96mi2)*
Background (non-management)		1568	1302	268	210	221
Manage ment	Roads	11	2482	60	37	41
	Timber Harvest	4	4	29	16	20
	Legacy (Roads ,Mining)	9	17	46	28	29
	Total Management	24	2503	135	81	90
Total Sediment Yield		1592	3805	403	291	311
Total as percent of background		102%	292%	150%	139%	141%

1. New River, Big French, Manzanita, North Fork, East Fork North Fork.
2. Dutch, Soldier, Oregon Gulch, Conner Creek Area
3. Big Bar Area, Prairie Creek, Little French Creek.
4. Swede, Italian, Canadian, Cedar Flat, Mill, McDonald, Hennessy, Quinby Creek Area, Hawkins, Sharber.

Table 4-5. Sediment Source Summary by Category and Subareas within the Lower Assessment Area

Sediment Source Categories		Current sediment delivery rates (tons/mi^2/year) by subareas, outside of the Hoopa Valley Tribe Reservation boundaries (GMA 2001b)				
		Reference Subwatershed (Horse Linto Creek: 64 mi2)	Mill Creek and Tish Tang (39 mi2)	Willow Creek (43 mi2)	Campbell Creek and Supply Creek (11 mi2)	Lower Mainstem Area and Coon Creek[1] (32mi2)
(Background (non-management)		2110	839	374	7845	252
Manage ment	Roads	483	703	854	14349	76
	Timber Harvest	87	83	201	785	15
	Legacy (Roads ,Mining)	26	26	26	26	22
	Total Management	596	812	1081	15160	113
Total Sediment Yield		2706	1651	1455	23005	365
Total as percent of background		128%	197%	389%	293%	145%

1. Since background rates for Lower Mainstem Area and Coon Creek were not available from GMA (2001b), EPA used the same rate as was calculated for the Quinby Creek Area which is immediately upstream, because Quimby Creek Area is comparable in size and underlain by the same geology type (Galice Formation).

4.3. Development of the Sediment Budget

Reid and Dunne (1996) define a sediment budget as, "an accounting of the sources and disposition of sediment as it travels from its point of origin to its eventual exit from a drainage basin." In addition to the sediment source information above, GMA (2001b) was able to estimate output (transport) components of a complete sediment budget for portions of the basin, particularly the Upper Middle Assessment Area. Output values are based on measurements of sediment transport at the gaging stations near the confluence of some tributaries as well as the mainstem in the Upper Middle Assessment Area. Unfortunately, many areas of the basin do not have sufficient record of flow and sediment transport data to support complete sediment budget construction. Moreover, information on change in storage was not available for a sufficient portion of the watershed, which further limits the analysis. A summary of the methods and results of the sediment budget by GMA (2001b) is described in this section.

Hydrology

Existing precipitation data were collected from the USFS, DWR, and the National Weather Service. Streamflow records were obtained from the USGS, USBR, DWR, and the Trinity River Restoration Program. Streamflow records have been maintained in the Trinity River basin for various periods of record. The USGS, USBR, DWR, the Hoopa Valley Tribe, and private organizations have maintained gages on the Mainstem Trinity River, North Fork Trinity River, various tributaries, and Trinity Reservoir. The quality of streamflow records range from good to excellent. Most records are available from the various agencies and/or organizations in either digital or hardcopy formats.

Since 1996, the Hoopa Valley Tribe has been installing and operating a series of mainstem and tributary streamflow stations, mostly in the Upper Middle Trinity Planning Watershed. The purpose of these stations is to provide streamflow and sediment transport data with which to develop a sediment budget for the mainstem in this reach, as part of planning efforts for implementation of the Trinity River Restoration Program.

Turbidity and Suspended Sediment Data Collection

GMA (2001b) conducted a reconnaissance assessment of relative tributary sediment yields based on collection of turbidity and suspended sediment data during storm events in the water year (WY) 2000. Sample sites were established throughout the entire watershed on sub-watersheds of all sizes and with a variety of upstream land uses. In WY2000, samples were collected at over 150 sites, with a total of 650 samples collected. Preliminary streamflow rating curves were established at over 60 sites, with a total of 230 discharge measurements made. Sample sites were stratified by geology and comparisons of sediment transport rates between basins and differing geologies were made.

In WY 2001, dataloggers were installed at 11 sites throughout the watershed. These records, combined with existing streamflow and sediment transport stations operated and maintained by the USGS or the Hoopa Valley Tribe, were used to compute continuous records of streamflow and sediment transport. In addition, many of the manual gage sites, established in Phase 1 were also operated in WY2001. Most of these sites were upgraded to contain crest stage gages and indirect peak discharge (e.g. slope-area peak) computation sites. Unfortunately, WY2001 turned out to be a critically dry year, with only a few small storms. Approximately 400 samples were collected in WY2001 in the Trinity Watershed.

Since the detailed data collection effort spanned only one winter season, GMA (2001b) assessed the relative magnitude of the winter in comparison to long-term historical records of storm intensity, duration, and frequency in order to develop a mechanism for translating data from WY 2001 into average yields (for example a 10-20 year period). GMA (2001b) used two approaches to accomplish this: (1) by comparison to gages with longer-term sediment records in the area (Grass Valley Creek) and other gages with shorter records that extend from 1997 to present (Deadwood, Rush, and Indian Creeks), and (2) by computing sediment loads from a combination of synthetic and historic mean daily discharge values at each of the streamflow sites in the Upper Middle Assessment Area. For more information on the specific collection methods, data analysis and transport calculations, refer to GMA (2001b).

Summary of Sediment Transport Results

Analysis of the sediment transport data indicates the following: (1) the estimated sediment outputs from the tributaries in the Upper Middle Assessment Area are, for the most part, very similar to the estimated inputs from the sediment source analysis, and (2) the ROD flows improve (increase) the transport capacity of the mainstem compared to the recent flow record (1980-2000), however they are still insufficient to transport the current sediment load from the tributaries and mainstem. In other words, sediment reduction from the tributaries is necessary from the tributaries even under ROD flows.

GMA (2001b) compared the tributary sediment inputs estimated from the sediment source analysis (described in sections 4.1, 4.2 above) with the calculated tributary outputs based on the analysis of gaging station data. The results (Table 4-5) indicate that the difference between the two estimates is very similar for Deadwood Creek, Grass Valley Creek, Indian Creek, Reading Creek and Browns Creek. However, the input and output estimates for Rush Creek and Weaver Creek are significantly different. One explanation for differences in Rush and Weaver Creek may be the result of excessive sediment inputs from the fairly recent 1997 storm which have not yet migrated through the channel network and out of the tributary into the mainstem.

Table 4-6. Comparison of Tributary Sediment Inputs and Outputs in the Upper Middle Trinity Assessement Area, 1980 - 2000 (GMA 2001b)

Tributary	Sediment Source Analysis Results (Inputs), 1980-2000, tons/mi^2/year	Computed Sediment Transport Near Confluence with Mainstem (Outputs), 1981-2000, tons/mi^2/year	Difference between Tributary Inputs and Outputs
Deadwood Creek	646	530	116
Rush Creek	2452	407	2045
Grass Valley Creek	1673	1303	370
Indian Creek	2319	2106	213
Weaver Creek	2459	347	2112
Reading Creek	872	817	55
Browns Creek	541	512	30

As discussed in the habitat conditions assessment (Section 2.4) sediment accumulation in the upper middle mainstem (below the dam) is a problem, particularly below the confluence of several of the tributaries. GMA (2001b) compared the transport capacity of the mainstem under recent flow conditions (1980-2000) with the projected flow regime under the ROD, assuming sediment delivery to the mainstem remained the same. GMA determined that ROD flows are capable of transporting more total sediment load (1995 tons/mi2/year) than under recent flows (1145 tons/mi2/year). However, ROD flows are still not able to transport the amount of combined tributary and mainstem derived sediment at the gaging station near the confluence with Reading Creek. Consequently, sediment source reductions are necessary in order to allow the mainstem to “flush” out the existing, accumulated sediment and achieve dynamic equilibrium between mainstem transport capacity and tributary inputs.

Table 4-7. Comparison of sediment transport values for mainstem Trinity River and tributary sites, between historic flows (1981-2000) and projected ROD flows (GMA 2001b).

Location of transport measurement		Sediment transport based on recent flows, 1981-2000 (tons/mi2/year)	Sediment transport based on projected ROD flows (tons/mi2/year)
Combined tributary and mainstem transport[1] above gaging station[2]	Suspended	1,335	1,903
	Bedload	519	717
Total Upstream Load		1854	2620
Mainstem transport at gaging station	Suspended	892	1,517
	Bedload	253	478
Total Mainstem Load		1145	1995
Difference (Amount not transported)	Suspended	(443)	(386)
	Bedload	(266)	(239)

1. The tributary sediment outputs under both flow scenarios is the same since the tributary flows are the same. However, the mainstem transport upstream of the gaging station increases due to the increased mobilization of existing mainstem sediment under ROD flows.

2. The Trinity River Douglas City gaging station is located on the mainstem near the confluence of Reading Creek.

CHAPTER 5

TMDL AND ALLOCATIONS

The purpose of this chapter is to determine the total loading of sediment which the Trinity River and its tributaries can receive without exceeding water quality standards, and to apportion the total among the sources of sediment.

5.1. Approach

This TMDL is set equal to the loading capacity of the stream. It is the estimate of the total amount of sediment, from both natural and human-caused sources, that can be delivered to streams in the Trinity River watershed without exceeding applicable water quality standards. For North Coast sediment TMDLs, EPA has used three approaches for deriving the loading capacity: (1) a comparison with a reference time period; (2) a comparison with a reference stream; and (3) the estimated needed improvement from existing loading rates, based on a comparison between current and target instream conditions. The approach used in a particular TMDL depends on the availability of data and the characteristics of the specific watershed.

EPA is using the second approach, reference watersheds, for developing several TMDLs on a subarea basis for the Trinity River Basin. The reference watershed approach is an appropriate basis for TMDL development because the Trinity River Basin contains representative subwatersheds with healthy aquatic habitat and watershed conditions considered to be supporting beneficial uses. Reference watersheds are used as benchmarks against which to compare conditions and sediment delivery rates in watersheds where beneficial uses are not currently being met.

Based on sediment delivery rates in the reference watersheds, EPA determined the total percentage of background sediment delivery that could occur and still meet water quality objectives. EPA then applied this percent (125% of background) to the subareas throughout the basin to determine the loading capacity or TMDL for each subarea. EPA then apportioned the TMDLs between background and management sources and determined the percent reduction from management activities necessary to attain the TMDLs in each subarea.

Reference Watersheds

EPA is defining “reference watersheds” as those watersheds that are generally exhibiting high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Physical and biological conditions suggest that aquatic and riparian systems are predominantly functional in terms of supporting dependent species and beneficial uses of water. The risks of management induced disturbance have not been expressed (i.e. any disturbance has not resulted in significant alteration of geomoprhic, hydrologic, and biotic processes) (definition from USFS 2000c). EPA selected reference watersheds based on evidence suggesting that beneficial uses, primarily cold water fish habitat, were being supported. Additionally, EPA considered potential threats to water quality by evaluating the level of management-related sediment delivery in relation to background rates. Reference subwatersheds are useful in determining the allowable level of disturbance that can occur in each of the assessment areas without negatively impacting beneficial uses.

Table 5-1 includes the list of reference subwatersheds for each area and, for each subwatershed, a summary of supporting information, including the total sediment delivery expressed as a percentage of background (e.g., if there was half as much management-related sediment as background, then the “percent of background” would be 150%). EPA did not identify reference watersheds in the Upper Middle Area. However, since the geology of the Upper Middle Area is generally similar to portions of the Upper Area (e.g., Granitic and Ultramafic Rocks) and Lower Middle Area (e.g., North Fork Terrane, Central Metamorphic Subprovince and Hayfork Terrane), EPA considers the reference watersheds for those areas of the basin as applicable to the Upper Middle area. See GMA (2001b) for more details on geology.

Table 5-1. Summary of Reference Watersheds and Supporting Information.

Reference Watershed by Assessment Area		Aquatic Habitat Conditions (from Chapter 2)		Sediment Yield and Watershed Disturbance Risk		
		Fish and Aquatic Habitat Information	**Channel rating[1]**	**Rate t/mi2/yr**	**Percent of background**	**Hazard rating [2]**
Upper	Stuart Fork	Focal watershed[3] (USFS 1998) SCI Habitat data[4] (USFS 2001) Potential Wild Trout Stream (CDFG 2001)	Properly Functioning	474	104%	Low
	Coffee Creek	Refugia Trout Stream (CDFG 2001) Middle Fork: Focal watershed (USFS 1998)	Properly Functioning	2258	137%	Low
	Swift Creek	Refugia Trout Stream (CDFG 2001) N. Fork Swift: Focal watershed (USFS 1998)	Properly Functioning	1081	138%	Low
Lower Middle	North Fork	Healthy summer steelhead pop. (USFS 2000) Key watershed[5] Focal watershed SCI Habitat Data (USFS)	Properly Functioning	1624	101%	Low
	East Fork North Fork	High juvenile steelhead densities (USFS 1989) Key watershed SCI Habitat Data (USFS)	Properly Functioning	252	117%	Low
	New River	Healthy summer steelhead pop. (USFS 2000) “Key”watershed “Focal” watershed	Properly Functioning	2138	101%	Moderate
	Manzanita	Healthy steelhead pop. (USFS 2000) Focal watershed	Properly Functioning	178	101%	Low
	Big French Creek	High juvenile salmonid densities (USFS 1989) Focal watershed	Properly Functioning	200	111%	Low

Lower	Horse Linto Creek	Stable Chinook and steelhead populations Tier-1 Key Watershed "properly functioning" rating	Properly Functioning	2706	128%	Moderate

1. Based on indicators that largely reflect the expression of watershed condition in the stream including floodplain connectivity, water quality, flow regime, stream corridor vegetation, stream channel condition, and native aquatic faunal integrity. Indicators are rated as impaired, functioning at risk, or properly functioning (USFS 2000)
2. Indicators that dominantly reflect the *hazard* or risk of impairment to watershed condition based on road condition, surface erosion, and mass wasting. Hazard indicators are rated as high, medium or low (USFS 2000)
3. Defined as "...critical areas supporting a mosaic of high-quality habitats that sustain a diverse or unusually productive complement of native species..." USFS 1998.
4. USFS is collecting baseline stream condition data following Stream Condition Inventory (SCI) methods
5. Key watersheds are intended to serve as refugia for maintaining and recovering habitat for at-risk stocks of anadromous salmonids (USDA and USDI 1994)

The sediment delivery rates vary tremendously between reference watersheds, from 178 t/mi2/year in Manzanita Creek to 2258 t/mi2/year in Coffee Creek (Table 5-1). This is due in part to differences in natural factors such as topography, soils, geology, storm events, etc. as well as different landuse histories during the assessment period. For example, a large storm in 1997 had a more profound effect on erosional processess in the Upper Assessment Area compared to the Lower Area. Consequently, channel conditions in portions of the upper reference subwatersheds are currently recovering as the system redistributes the sediment load. Whereas, the Lower Assessment Area was more strongly impacted by the 1964 flood event and consequently, Horse Linto Creek in the Lower Area has had more time to recover compared with Coffee Creek and Swift Creek in the Upper Area. Despite the differences in sediment delivery rates, these reference watersheds generally consist of functioning physical and biological processes and contain relatively few watershed risks that might disrupt the conditions outside the range of natural variability.

5.2. Loading Capacity (TMDL) and Allocation Calculations

Given the wide range in sediment delivery rates in the reference watersheds, it does not appear that a single sediment delivery rate is the best way to estimate the loading capacity for the Trinity River system. In several other TMDLs, EPA has calculated the loading capacity based on an analysis that the systems could tolerate about one part of sediment from management-related sources for every four parts of sediment from background sources without exceeding water quality standards (i.e., the loading capacity is 125% of the background sediment delivery rate). EPA believes that the latter approach is preferable for the Trinity River system as well.

Setting the loading capacity at 125% of the background sediment delivery rate is supported by an analysis of the reference watersheds. If the reference watersheds with very little management-related sediment (due, in part, to the fact that most of the lands in these watersheds are designated Wilderness and have not been actively managed in the recent past) are excluded[1], then the remaining reference watersheds have sediment delivery rates that cluster around 125%. EPA considered setting the loading capacity at 138%, because it is the loading rate for the reference watershed with the highest percent over background (i.e., Swift Creek), but we decided to take a more conservative approach and use 125% because the watersheds with delivery rates above 125% may have areas where water quality standards are not being met, even though the watersheds as a whole have good water quality, and reductions in those areas would be appropriate.

For the purpose of calculating TMDLs, EPA is further dividing the Assessment Areas into subareas,

---

[1] Exclusion of a watershed with very little management-related sediment is appropriate since the loading capacity is defined as the maximum amount of a pollutant that does not result in exceedance of water quality standards. Reference watersheds are those where there is some management and healthy watershed conditions.

because it provides a finer resolution to distinguish differences within each assessment area while at the same time combines small subwatersheds with similar characteristics. EPA calculated the TMDL for each subarea by multiplying the estimated background rate for the subarea by 125%. That is,

$$\text{Background Rate}_{subarea} \times 1.25 = \text{TMDL}_{subarea}.$$

In accordance with EPA regulations, the loading capacity (i.e., TMDL) is allocated to the various sources of sediment in the watershed, with a margin of safety. The margin of safety in this TMDL is not added as a separate component of the TMDL, but rather is incorporated into conservative assumptions used to develop the TMDL, as discussed in Section 5.3.

Although nonpoint sources are responsible for most sediment loading in the watershed, point sources may also discharge some sediment in the watershed. Current and prospective future point sources that may discharge in the watershed and are therefore at issue in this TMDL include:

- CalTrans facilities that discharge pursuant to the CalTrans' statewide NPDES permit issued by the State Water Resources Control Board, and
- Construction sites larger than 5 acres that discharge pursuant to California's NPDES general permit for construction site runoff.

The draft TMDL set wasteload allocations at zero. On further consideration prompted in part by public comments, however, EPA has determined that it is more accurate to consider the rates set forth in this TMDL as load allocations to also represent wasteload allocations for point sources in the watershed, as discussed below.

This TMDL identifies wasteload allocations for point sources and load allocations for nonpoint sources as pollutant loading rates (tons/square mile/year) for subareas within the Trinity Basin. The source analysis supporting these allocations evaluated sediment loading at a subarea scale, and did not attempt to distinguish sediment loading at the scale of specific land ownerships. Nor did the source analysis specifically distinguish between land areas subject to NPDES regulation and land areas not subject to NPDES regulation. Therefore, the TMDL includes separate but identical load allocations (LAs) for nonpoint sources and wasteload allocations (WLAs) for point sources for each subarea. (See US EPA 2001 for additional details concerning the WLAs.)

Identifying WLAs as well as LAs in this TMDL does not result in an increase in allowable loading from that set forth in the draft TMDL, because the allowable loading is expressed as a rate of tons/square mile/year. Rather, this change from the draft TMDL merely clarifies that the same rate applies to the existing and potential point sources noted above (CalTrans and construction sites) as to nonpoint sources.

Thus, the TMDL for sediment for the Trinity River and its tributaries is apportioned between background sources and total management-related sources of sediment within each of the subareas in the basin. The background load allocation was set at the current rate of background sediment delivery since controlling or reducing natural background sources is generally not beneficial nor feasible. EPA then subtracted the background load allocation from the TMDL to determine the management allocation.

$$\text{TMDL}_{subarea} - \text{Background Load Allocation} = \text{Management Allocation}$$

Finally, EPA determined the percent reduction needed from current rates of management-related sediment delivery to attain the TMDL in each subarea. The reduction levels are intended to provide resource managers with guidance regarding the magnitude of erosion control necessary to protect beneficial uses in each subarea. EPA calculated the percent reduction by dividing the management load allocation by the current management-related sediment delivery rate then subtracting from 100.

100 - (Management Allocation/Current Management Load Rate) = % Reduction Needed

Unlike other sediment TMDLs on the North Coast, EPA did not further subdivide the management allocation of this TMDL into specific management sources such as roads and timber harvest. Instead, EPA divided the basin into subareas. Due to the wide range of sediment delivery rates in the subareas, EPA believes it is appropriate in this case to allow resource managers the flexibility of meeting the management load reduction through any combination of erosion control for roads, timber harvesting, or legacy activities depending on the degree to which each source is contributing to the problem within each subarea. Nevertheless, EPA recommends the use of the sediment source assessment, Chapter 4 or GMA (2001b), as a reference for identifying which management activities are contributing the most sediment on a subarea or subwatershed basis.

Tables 5-2, 5-3, 5-4, and 5-5 contain summaries of the current sediment loading rates by source category followed by the TMDL, associated allocations (for background and management) and percent reduction needed from management within each subarea within each assessment area.

Table 5-2. TMDL and Allocations by Source Category for Upper Area

Source Categories		Subareas within the Upper Assessment Area				
		Reference Subwatersheds[1] (235 mi2)	Westside Tributaries[2] (93 mi2)	Upper Trinity[3] (161 mi2)	East Fork Tributaries[4] (115 mi2)	East Side Tributaries[5] (89 mi2)
Current Sediment Delivery Rate						
Background (non-management)		1125	421	2759	258	241
Management	Roads	129	101	162	319	48
	Timber Harvest	240	31	1084	46	22
	Legacy (Roads,Mining)	7	25	21	26	26
	Total Management	376	157	1267	391	96
Total Sediment Delivery		1501	578	4026	649	337
Total as percent of background		133%	137%	146%	252%	140%
Loading Capacity (TMDL) and Allocations (tons/mi^2/yr)						
TMDL (= 1.25 x Background)		1406	526	3449	323	301
Background Allocation		1125	421	2759	258	241
Total Management Allocation (= TMDL - Background)		281	105	690	65	60
Percent reduction needed in management to attain TMDL		25%	33%	46%	83%	37%

1. Stuarts Fork, Swift Creek, Coffee Creek
2. Stuart Arm Area, Stoney Creek, Mule Creek, East Fork Stuart Fork, West Side Trinity Lake, Hatchet Creek, Buckeye Creek;
3. Upper Trinity River, Tangle Blue, Sunflower, Graves, Bear Upper Trinity Mainstem Area, Ramshorn Creek, Ripple Creek, Minnehaha Creek, Snowslide Gulch Area, Scorpion Creek
4. East Fork Trinity, Cedar Creek, Squirrel Gulch Area
5. East Side Tributaries, Trinity Lake

Table 5-3. TMDL and Allocations by Source Category for Upper Middle Area

Source Categories		Weaver and Rush Creeks (72 mi2)	Deadwood Creek, Hoadley Gulch and Poker Bar Area (47 mi2)	Lewiston Lake Area (25mi2)	Grass Valley Creek[1] (37 mi2)	Indian Creek (34 mi2)	Reading and Browns Creek (104 mi2)
		Subareas within the Upper Middle Assessment Area					
Current Sediment Delivery Rates (tons/mi^2/yr)							
Background (non-management)		675	273	195	175	324	263
Management	Roads	144	220	83	287	1570	126
	Timber Harvest	61	280	37	1136	330	204
	Legacy (Roads,Mining)	81	62	69	65	68	42
	Total Management	286	562	189	1488	1968	372
Total Sediment Delivery		961	835	384	1663	2292	635
Total as percent of background		142%	305%	197%	950%	707%	241%
Loading Capacity (TMDL) and Allocations							
TMDL (= Background x 1.25)		844	341	244	219	405	329
Background Allocation		675	273	195	175	324	263
Total Management Allocation (= TMDL - Background)		169	68	49	44	81	66
Percent reduction needed in management to attain TMDL		41%	88%	74%	97%	96%	82%

1. The rates in Grass Valley Creek do not account for the amount of sediment trapped by Buckhorn Dam and Hamilton Ponds.

Table 5-4. TMDL and Allocations by source category for Lower Middle Assessment Area

Source Categories		Subareas within the Lower Middle Assessment Area				
		Reference Subwatersheds[1] (434 mi2)	Canyon Creek (64 mi2)	Upper Tributaries [2] (72 mi2)	Middle Tributaries[3] (54 mi2)	Lower Tributaries[4] (96mi2)
Current Sediment Delivery Rates (tons/mi²/yr)						
Background (non-management)		1568	1302	268	210	221
Manage ment	Roads	11	2482	60	37	41
	Timber Harvest	4	4	29	16	20
	Legacy (Roads ,Mining)	9	17	46	28	29
	Total Management	24	2503	135	81	90
Total Sediment Delivery		1592	3805	403	291	311
Total as percent of background		102%	292%	150%	139%	141%
Loading Capacity (TMDL) and Allocations						
TMDL (= Background x 1.25)		1592	1628	335	263	276
Background Allocation		1568	1302	268	210	221
Total Management Allocation (= TMDL - Background)		24	326	67	53	55
Percent reduction needed in management to attain TMDL		0	87%	50%	35%	39%

1. New River, Big French, Manzanita, North Fork, East Fork North Fork.
2. Dutch, Soldier, Oregon Gulch, Conner Creek Area
3. Big Bar Area, Prairie Creek, Little French Creek.
4. Swede, Italian, Canadian, Cedar Flat, Mill, McDonald, Hennessy, Quinby Creek Area, Hawkins, Sharber.

Table 5-5. TMDL and Allocations by source category for Lower Assessment Area

Sediment Source Categories		Subareas within the Lower Assessment Area, outside of the Hoopa Valley Tribe Reservation boundaries				
		Reference Subwatershed (Horse Linto Creek: 64 mi2)	Mill Creek and Tish Tang (39 mi2)	Willow Creek (43 mi2)	Campbell Creek and Supply Creek (11 mi2)	Lower Mainstem Area and Coon Creek (32 mi2)[1]
Current Sediment Delivery Rates (tons/mi²/yr)						
Background (non-management)		2110	839	374	7845	252
Management	Roads	483	703	854	14349	76
	Timber Harvest	87	83	201	785	15
	Legacy (Roads ,Mining)	26	26	26	26	22
	Total Management	596	812	1081	15160	113
Total Sediment Delivery		2706	1651	1455	23005	365
Total as percent of background		128%	197%	389%	293%	145%
Loading Capacity (TMDL) and Allocations						
TMDL (Management +Background)		2638	1049	468	9806	315
Background		2110	839	374	7845	252
Total Management		528	210	94	1961	63
Percent reduction needed in management to attain TMDL		11%	74%	91%	87%	44%

1. Since background rates for Lower Mainstem Area and Coon Creek were not available from GMA (2001), EPA used the same rate as was calculated for the Quinby Creek Area which is immediately upstream, because Quinby Creek Area is comparable in size and underlain by the same geology type (Galice Formation).

These levels are adequate to protect aquatic habitat, which is the most sensitive of the beneficial uses. Given the hydrologic variability typical of the Northern California Coast Ranges, EPA expects the TMDL to be evaluated as a ten-year rolling average. Moreover, EPA acknowledges that actual rates of sediment delivery differ tremendously between subwatersheds within each planning area. EPA believes expressing the TMDL as an average for each area and over a 10 year rolling average is an accurate estimation of the overall loading rate for each planning area that will achieve water quality standards. The sediment reduction levels can be achieved through implementing any combination of restoration practices, improved management techniques, and/or reduction in intensity of timber harvesting and road density. An assortment of existing regulatory, voluntary and assistance programs are available for achieving the load allocations, as discussed further under implementation recommendations (Chapter 6).

The allocations are expressed in terms of yearly averages (tons/mi²/yr). They could be divided by 365 to derive daily loading rates (tons/mi²/day), but EPA is expressing them as yearly averages, because sediment delivery to streams is naturally highly variable on a daily basis. In fact, EPA expects the allocations to be evaluated on a ten-year rolling average basis, because of the natural variability in sediment delivery rates. In addition, EPA does not expect each square mile within a particular source category to necessarily meet the load allocation; rather, EPA expects the average for the entire source category to meet the allocation for that category.

EPA would also like to emphasize that where current loading rates are below or meeting the TMDL threshold (e.g., several of the reference watersheds), the antidegradation provisions of the CWA and Basin Plan prohibit an "increase in pollution." In other words, high quality waters must be maintained as such. In particular, resource managers must continue to prevent, protect and restore conditions in the reference subwatersheds which provide critical refugia for aquatic species while habitat in other areas of the basin improve, in part due to TMDL implementation.

5.3. Margin of Safety

The margin of safety is included to account for uncertainties concerning the relationship between pollutant loads and instream water quality and other uncertainties in the analysis. The margin of safety can be incorporated into conservative assumptions used to develop the TMDL, or added as an explicit separate component of the TMDL.

EPA is incorporating an implicit margin of safety into the Trinity River TMDLs. Table 5.6. identifies the uncertainties in the TMDL and the adjustments or assumptions that were made to account for the uncertainty to ensure that the beneficial uses will be protected.

Table 5-6. Uncertainties in Trinity River TMDL

Uncertainty	Adjustment to Account for Uncertainty
Interpretation of the amount of sediment delivery associated with management activities versus natural background sources.	GMA (2001b) generally attributed most or all of the sediment load of any landslide occurring within a recent harvest unit as being harvest related. This is a conservative assumption because some slides may have occurred naturally even if the land had not been harvested recently. The USFS (2000) estimated that 25% of all slides attributed to management are actually natural.
Instream habitat and watershed condition data were not available for the entire Trinity River Basin.	In areas where water quality or watershed condition data were lacking, EPA generally assumed that conditions were not meeting water quality standards. EPA encourages further watershed monitoring to fill data gaps.
Will the ROD flows for the Upper Middle mainstem be capable of transporting the sediment loads called for in the TMDLs for this area?	The TMDLs established for the subareas within the Upper Middle Area (based on 125% of background) result in a total sediment load to the mainstem of 756 t/mi2/yr which is well below the transport capacity of the mainstem under ROD flows (1995 t/mi3/yr) calculated by GMA (2001). Based on this comparison, the ROD flows should be fully capable of transporting and achieving dynamic equilibrium with sediment TMDLs.
The target values for the instream water and watershed indicators may not be completely applicable to the Trinity Basin since many of the values are based on research or other watersheds.	The target levels for the sediment indicators (instream and watershed), against which existing conditions were compared, represent optimal conditions for beneficial use support (i.e., salmonid habitat). The targets are conservative since the represent "ideal" conditions that may not be attainable in all cases in the watershed.
There is inherent variability in the spacial scales and physical watershed conditions (terrain, channel type, slope, vegetation, etc.) of sediment delivery from the hillslope to the channel.	EPA does not expect each square mile within a particular source category to necessarily meet the allocation; rather, EPA expects the average for the entire source category to meet the allocation across the subarea for that category.

There is inherent annual and seasonal variation in the delivery of sediment to the stream channel from the source mechanisms.	The allocations are expressed as 10-year rolling averages to account for variability in delivery rates. The TMDL also includes watershed indicators to reflect sediment delivery risks.

5.4. Seasonal Variation and Critical Conditions

The TMDL must describe how seasonal variations were considered. Sediment delivery in the Trinity River watershed inherently has considerable annual and seasonal variability. The magnitudes, timing, duration, and frequencies of sediment delivery fluctuate naturally depending on intra- and inter-annual storm patterns. Since the storm events and mechanisms of sediment delivery are largely unpredictable year to year, the TMDL and load allocations are designed to apply to the sources of sediment, not the movement of sediment across the landscape, and to be evaluated on a ten-year rolling average basis. EPA assumes that by controlling the sources to the extent specified in the load allocations, sediment delivery will occur within an acceptable range for supporting aquatic habitat, regardless of the variability of storm events.

This TMDL does not allocate flow, and the calculation of the loading capacity (TMDL) and allocations was not baed on any particular flow regime. However, TMDLs must take into account critical conditions for stream flow, loading, and water quality parameters. As discussed throughout this TMDL, the control of stream flow due to the TRD has greatly contributed to the impairment of the mainstem below Lewiston dam. EPA considered the current flow conditions (absent of ROD flows) and the estimated flows under the ROD when setting the TMDLs and allocations. In order for the TMDL to be fully effective in protecting beneficial uses and attaining water quality standards, the ROD flows and restoration program must be implemented. The ROD flows are intended to achieve several attributes of a healthy alluvial river system that sediment allocations through the TMDL cannot achieve alone. For example, the ROD flows include inter- and intra-annual flow variations that mimic the natural snowmelt period. These peak flows are critical to support several river functions including the mobilization of channelbed particles, scour pools, create point bars and connect the mainstem to the floodplain. Such conditions are necessary to support habitat elements for spawning, rearing and migration of salmonids. The TMDL sediment allocations will be more effective in supporting beneficial uses if implemented in consort with the ROD flows. Similarly, the ROD flows will be more effective in achieving the river health goals when the TMDL load allocations are implemented.

Because of the uncertainty concerning what the actual flows in the river will be, EPA considered in our analysis both existing flows and also the flow regime discussed in the ROD and the Trinity River Flow Evaluation on which the ROD was based. Although a preliminary injunction currently limits additional water releases into the Trinity River to implement the ROD to 28,600 acre feet (the amount in the ROD for critically dry years) over the statutorily-mandated 340,000 acre feet, the decision granting the preliminary injunction did not question the science supporting the need for more flows to restore Trinity River fisheries. EPA considered the flow regime recommended in the ROD because in EPA’s opinion this flow regime is based on the best available scientific analysis, and also represents the most recent decision of the Department of Interior concerning Trinity River flows.

Another critical condition that affects beneficial uses in the Upper Middle Area is the deficit of coarse sediment in the upper most reach (just below Lewiston dam). Both Lewiston and Trinity dam block the mainstem supply of coarse sediment which is needed to support spawning fish below the dam. The US FWS and HVT (1999) recommended supplementing 10,000 yds^3 of properly graded gravel material on the short term to the reach immediately below the dam to offset gravel export and presumably enhance spawning capacity. Consistent with Trinity River Restoration Program, EPA is recommending the augmentation of clean gravel in appropriate locations of the upper mainstem and appropriate times of the year to further meet the needs of spawning salmonids in that area.

CHAPTER 6

IMPLEMENTATION AND MONITORING RECOMMENDATIONS

The main responsibility for water quality management and monitoring resides with the State. EPA fully expects the State to develop and submit implementation measures to EPA as part of revisions to the State water quality management plan, as provided by EPA regulations at 40 C.F.R. Sec. 130.6.

The State implementation measures should contain provisions for ensuring that the allocations (see Chapter 5) in the TMDL will in fact be achieved. These provisions may be non-regulatory, regulatory, or incentive-based, consistent with applicable laws and programs, including the State's recently upgraded nonpoint source control program. These provisions should also recognize the variable need to control sediment in each subarea of Tables 5-2 through 5-5. Sediment load reduction, appropriate for each subarea, may be accomplished through site-specific management practices, variable regulatory requirements, sediment trading credits or other mechanisms.

Furthermore, the State implementation and monitoring measures should be designed to determine if, in fact, the TMDL is successful in attaining water quality standards. To assist in this effort, the Trinity River TMDL contains water quality indicators (see Chapter 3) as well as allocations. Both the indicators and allocations are essentially extensions of the water quality standards, but they were developed using independent approaches. Different approaches were used because the relationship between land management practices and the effects on water quality related to sediment is highly complex, with factors such as highly variable seasonal and inter-annual precipitation and landscape response to disturbance, and complexities in geology and sediment routing mechanisms from watershed sources to and through streams. Given the complexities, EPA believes that using two approaches provides a better basis for evaluating the success of the TMDL in attaining water quality standards.

In addition, the implementation measures should include a public participation process and appropriate recognition of other relevant watershed management processes, such as local source water protection programs, State programs under Section 319 of the Clean Water Act, or State continuing planning activities under Section 303(e) of the Clean Water Act.

Summary of Existing Erosion Control Programs

Several existing programs in the Trinity Basin are intended to control pollution from the types of nonpoint sources of sediment (i.e. roads and timber harvest) that are identified in this TMDL. On Federal land for example, the Aquatic Conservation Strategy (ACS) of the Northwest Forest Plan calls for an aggressive program of watershed analysis, riparian buffer protection, road rehabilitation and aquatic monitoring. The implementation of the ACS is critical to achieving the allocations and target conditions identified in the TMDL on federal land which composes approximately 70% of the basin. Some of the existing programs, however, are not currently being implemented in a manner that will achieve allocations. The sediment source analysis (chapter 4) identified several subareas where management-related sediment delivery is significantly above background levels and resulting in water quality impairment. EPA has summarized some of the key management programs intended to address sediment control in the Trinity Basin and provided recommendations for improving effectiveness in meeting the TMDLs and protecting beneficial uses (Table 6-1). This should not be considered a complete list of sediment control programs.

Table 6-1. Summary of Implementation Recommendations for the Trinity River Basin

Management Jurisdiction	Existing Program	Recommendations
U.S. Forest Service (Six Rivers and Shasta Trinity) and Bureau of Land Management (70% of basin)	Aquatic Conservation Strategy, Northwest Forest Plan - Watershed Analysis (WAs) - Riparian Buffer network - Key Watershed Best Management Practices per MAA[1] Fisheries/Water Programs per LRMPs National Road Plan	- Complete WAs, particularly in Upper Assessment Area, and implement recommendations; - Complete roads analysis (USDA 1999) and implement findings with focus on TMDL hillslope targets. - Continue cooperative watershed restoration with local watershed groups, TCRCD, and TMC. - Evaluate and limit effects of suction dredge operations in stream reaches that overlap spawning sites. - Development and implement a Comprehensive Aquatic Monitoring Plan for the Basin including: habitat, fish populations, management effectiveness.
Private Industrial Timber (15% of basin)	California Forest Practice Rules (FPRs), - MAA between BOF/CDF and SWRCB[2] - Timber Harvest Plan (THP) Process	- Incorporate TMDL assessment, load reduction information, and hillslope targets into THP development. - Improve cumulative watershed effects (CWE) assessment and reduce CWE's on a subwatershed scale (UC Committee on Cumulative Effects 2001). - Improve monitoring of THP/BMP implementation and effectiveness throughout basin.
Smaller Private Landowners (8% of basin)	Technical and Financial Assistance Programs: Trinity County Resource Conservation District (TCRCD) and the Natural Resources Conservation Service (NRCS)	- Continue and expand small landowner technical and financial assistance for road inventory/maintenance, erosion control and fuels management.
County (Trinity and Humboldt)	5 County Salmon Recovery Program County General Plan	Continue implementation of the 5 County Program, particularly fixing the county roads, developing a grading ordinance and monitoring water quality.
Tribes and other federal, state, and local entities	Trinity River Restoration Program CalTrans statewide NPDES permit and maintenance program	- Implement the ROD, signed in Dec. 2000, including flow regime, mainstem/watershed restoration, and adaptive management[3] - Implement the erosion control measures setforth in the CalTrans NPDES permit and conduct routine maintenance to minimize sediment delivery.

1. The US Forest Service signed a Management Agency Agreement (MAA) with the State Water Resources Control Board (SWRCB) in 1981 resulting in the designation of the USFS as the water quality management agency for the public lands it administers. EPA approved the MAA and practices established by USFS to serve as Best Management Practices (BMPs).
2. EPA has not certified the California FPRs as BMPs according to section 208 of the CWA. As such, EPA expects the NCRWQCB to actively participate in the THP review team process to ensure water quality is protected.
3. EPA recognizes that currently a preliminary injunction limits implementation of ROD flows, other than those for critically dry years, and that the Department of Interior is currently preparing a supplemental environmental impact statement, which could result in changes to the ROD. EPA notes that the preliminary injunction was based on inadequate consideration by DOI of the California energy crisis and biological opinions concerning species outside of the Trinity River basin, and did not question the science supporting the need for more flows to restore Trinity River fisheries. Therefore, EPA is hopeful that if changes are made to the ROD, the increased flows currently included in the ROD will be retained.

Monitoring Recommendations:

Through the process of identifying the "best available information" for the Trinity River TMDL, EPA found that fish habitat and watershed condition information was not well coordinated nor easy to locate and obtain. Although some central repositories of information exist, such as the Trinity County Library in Weaverville and the Klamath Resource Information System (KRIS) compact disc database, much of the information is still spread amongst several agencies and organizations in different locations. The various types of information collected to date, did not appear to be well-coordinated or integrated. For example, tributaries in the upper middle area were assessed separately from the mainstem, fish data was not integrated with fish habitat data and very little information was collected at all regarding conditions above the reservoirs. There did not appear to be a clear strategy or plan consisting of goals, objectives, methodologies, locations, etc. for all the various types of water quality, fish habitat, channel morphology and/or watershed-related monitoring that is occurring throughout the basin. The lack of a basin-wide monitoring strategy will continue to inhibit the ability of resource managers, including those charged with implementing, assessing or updating the TMDLs, to determine the overall health and condition of the entire basin in the future.

To remedy the situation, EPA supports the formation of a Technical Modeling and Analysis Group (TMAG), as set forth in the ROD, to work with all the representative stakeholder groups, to develop a basin-wide monitoring strategy that would include areas of the basin beyond just the upper middle mainstem. The strategy should address the following: goals, objectives, parameters (biological, physical, chemical), protocols, locations, responsibilities, data quality assurance/control, data management, documentation and dissemination. The strategy should integrate all the disciplines (fisheries biology, water quality, fluvial geomorphology, riparian ecology, watershed hydrology, computer modeling, etc.) and coordinate the collection, analysis and reporting of such information. Such a strategy would result in the long-term evaluation of TMDLs along with the numerous other programs intended to protect and restore the health of the Trinity River Basin.

For TMDL purposes, EPA specifically recommends the continuation of the following types of sediment-related monitoring:

- Substrate quality on the mainstem and some tributaries;
- Turbidity and suspended sediment on specific tributaries (reference and impaired for comparison purposes) as well as periodic locations on the mainstem;
- Annual stream condition assessment in tributaries following the US Forest Service Stream Condition Inventory;
- Hypothesis testing on the middle mainstem as part of the adaptive management program; and
- Adult spawner escapement estimates and outmigrant trapping on the mainstem and certain tributaries.
- Implementation and effectiveness monitoring of watershed restoration activities, including those identified in Table 3-3.

CHAPTER 7: PUBLIC PARTICIPATION

EPA regulations require that TMDLs be subject to public review (40 CFR 130.7). EPA is provided public notice of the draft Trinity River sediment TMDL by placing a notice in the Times Standard, Trinity Journal, Record Searchlight and Sacramento Bee, newspapers of general circulation in the Trinity River watershed area and in other areas potentially affected by the decision. EPA has prepared a written response to all written comments on the draft TMDLs received by EPA through the close of the comment period on November 19, 2001.

EPA held a public information meeting regarding the purpose and scope of the Trinity TMDL at the initiation of the assessment process on July 6, 2000 in Weaverville. EPA gave TMDL information presentations to the Natural Resource Advisory Committee of Trinity County and also attended several Trinity River Task Force and Technical Advisory Committee meetings to keep their members informed of the TMDL development process. On August 21 and 22, 2001, in Trinity Center and Douglas City, the Trinity County Resource Conservation District and a landowners group, sponsored workshops for local residents to learn about TMDLs. EPA has also met individually with numerous agencies, citizens, businesses and organizations during the process of developing this TMDL. Finally, public informational meetings were held on October 30 and November 6, 2001 (during the public comment period to provide any interested parties opportunities to obtain further information and present comments regarding the draft TMDL.

References

Aguilar, Bernard. Associate Fisheries Biologist, California Department of Fish and Game. 2001. Personal communication. September.

Bias, Paul. 2001. Trinity River interviews. Prepared as a class requirement at Humboldt State University.

Bilby, Robert E. and James W. Ward. 1989. Changes in characteristics and function of woody debris with increasing size of streams in western Washington. Transactions of the American Fisheries Society, 126.

Boles, G.L. 1980. Macroinvertebrates abundance and diversity as influenced by substrate size in the Trinity River. Department of Water Resources, Northern District. January, 1980.

Brown, L.R., P.B. Moyle, and R.M. Yoshiyama. 1994. Historical decline and current status of coho salmon in California. North America Journal of Fisheries Management. Vol. 4, No. 2.

Chapman, D.W. 1988. Critical review of variables used to define effects of fines in redds of large salmonids. Transactions of the American Fisheries Society. Volume 117, No. 1.

CDFG (California Department of Fish and Game). 1994a. Petition to the Board of Forestry to list Coho Salmon (Oncorhynchus Kisutch) as a Sensitive Species. California Department of Fish and Game. Sacramento CA.

CDFG (California Department of Fish and Game). 1994b. Annual Report, Trinity River Basin salmon and steelhead monitoring project, 1991-1992 season. Inland Fisheries Division, Sacramento, CA.

CDFG (California Department of Fish and Game). 1996. Annual Report, Trinity River Basin salmon and steelhead monitoring project, 1991-1992 season. Inland Fisheries Division, Sacramento, CA.

CDFG (California Department of Fish and Game). 2001. Letter from Robert McAllister (CDFG). June 7.

CDFG-Water Pollution Control Laboratory. 1996. California stream bioassessment procedure. Rancho Cordova, CA.

CDWR (Department of Water Resources). 1980. Mainstem Trinity River watershed erosion investigation.

De la Fuente, J., T. Lauent, D. Elder, R. VendeWater, A. Olsen. 2000. Watershed condition assessment beta-test results of northern province forests. Pacific Southwest Region, US Forest Service.

Everest, Loren. Fisheries Biologist, Shasta Trinity National Forest. August, 2001. Personal communication.

Flosi, Gary, S. Downier, J. Hopelain, M. Bird, R. Coey and B. Collins. 1998. California salmonid stream habitat restoration manual, third edition. California Department of Fish and Game. Inland Fisheries Division. Sacramento, CA.

Fredericksen, Kamine, and Associates. 1980. Proposed Trinity River Basin fish and wildlife management program, Appendix B - sediment and related analysis. Report prepared for Bureau of Reclamation by Trinity River Basin Fish and Wildlife Task Force, Sacramento, CA.

Glase, J.D. 1994. Monitoring juvenile salmon and steelhead outmigrants produced in the upper Trinity River, Northern California, 1991-1993 progress report. U.S. Fish and Wildlife Service, Trinity River Restoration Program, progress report.

GMA (Graham Matthews and Associates). 2001a. Gravel quality monitoring in the mainstem Trinity River. Prepared for Trinity County Board of Supervisors. Weaverville, CA.

GMA (Graham Matthews and Associates). 2001b. Trinity River sediment source analysis for the Trinity River, Trinity County, CA. Prepared for Tetra Tech, Inc.

Harrelson, C.C., C.L. Rawlins, and J.P. Potyondy. 1994. Stream channel reference sites: an illustrated guide to field technique. USDA Forest Service, General Technical Report RM-245.

Harvey, Bret C., and Thomas E. Lisle. 1998. Effects of suction dredging on streams: a review and an evaluation strategy. fisheries 23(8): 8-17.

HVT (Hoopa Valley Tribe). 2000. Water quality control plan Hoopa Valley Indian Reservation. Prepared by the Hoopa Valley Tribal Environmental Protection Agency.

Knopp, Chris. 1993. Testing indices of cold water fish habitat. North Coast Regional Water Quality Control Board and California Department of Forestry, Santa Rosa. CA.

Kondolf, G.M. 2000. Assessing salmonid spawning gravel quality. Transactions of the American fisheries Society 129:262-281.

LaFaunce, D.A. 1963. King (chinook) salmon spawning escapement in the upper Trinity River, 1963. Marine Resources Administrative Report No. 65-3. California Department of Fish and Game.

Leland, David, North Coast Regional Water Quality Control Board. 2001. Personal communication. August.

Lewis, Jack. 1998. Evaluating the impacts of logging activities on erosion and suspended sediment transport in the Casper Creek watersheds. In: Proceedings of the Conference on Coastal Watersheds: The Casper Creek Story. USDA Forest Service Gen. Tech. Rep. PSW-GTR-168.

Lisle, Thomas E. 1989. Sediment transport and resulting deposition in spawning gravels, north coastal California. Water Resources Research. Vol. 25., no. 6. Pp. 1303-1319. June.

Lisle, T.E. and S. Hilton. 1992. The volume of fine sediment in pools: an index of sediment supply in gravelbed streams. Water Res. Bulletin. 28:2. Paper No. 981120. April 1992.

Matthews, G. and Anderson. 1997. Mainstem Trinity River draft sediment total maximum daily load reconnaissance survey.

McBain, S. and W. Trush. 1997. Trinity River maintenance flow study final report. Prepared for the Hoopa Valley Tribe, Trinity River Task Force.

McBain, S. and W. Trush. 2000. Spawning gravel composition and permeability within the Garcia River watershed, CA. Report submitted to Mendocino County RCD, Ukiah, CA.

McNeil, W.J. and W.H. Ahnell. 1964. Success of pink salmon spawning relative to size of spawning bed materials. U.S. Fish and Wildlife Service Special Scientific Report-Fisheries 469. January.

Moffett, J.W. and S.H. Smith. 1950. Biological investigations of the fishery resources of Trinity River, California. Special Scientific Report No. 12. US Fish and Wildlife Service.

Montgomery, D.R. and J.M. Buffington. 1993. Channel classification prediction of channel response and assessmetn of channel condition. Final report TFW-SH10-93-2002.

NMFS (National Marine Fisheries Service). 1995. Endangered and threatened species: Proposed threatened status for three contiguous ESUs of Coho Salmon ranging from Oregon through Central California. Department of Commerce. National Oceanic and Atmospheric Administration. Federal Register/Vol. 60, No. 142/Tuesday, July 25, 1995/Proposed Rules.

NMFS (National Marine Fisheries Service). 1996. Making Endangered Species Act determinations of effect for individual or grouped actions at the watershed scale. US Department of Commerce. National Oceanic and Atmospheric Administration.

Pacific Watershed Associates. 2000. Results of stream channel survey and sampling Grass Valley Creek watershed Trinity County California. Final Report. Prepared for County of Trinity and the Trinity River Restoration Program.

Phillips, R.W., R.L. Lantz, E.W. Claire, and J.W. Moring. 1975 Some effects of gravel mixtures on emergence of coho salmon and steelhead trout fry, Trans. Am. Fish. Soc., 104: 461-466.

Quihillalt, Rick R. 1999. Mainstem Trinity River fall chinook salmon spawning redd survey, 1996 through 1998. Prepared for US Fish and Wildlife Service. Arcata, CA.

Raines, M. 1998. South Fork Trinity River sediment source analysis, draft. Tetra Tech, Inc. October, 1998.

Reid, L.M. and T. Dunne. 1996. Rapid evaluation of sediment budgets. Reiskirchen: Catena Verlag, Germany..

Regional Water Board (North Coast Regional Water Quality Control Board). 1996. Water quality control plan for the North Coast Region. Adopted May 23, 1996. Santa Rosa. CA.

University of California Committee on Cumulative Watershed Effects. 2001. A scientific basis for the prediction of cumulative watershed effects. University of California Wildland Resource Center Report No. 46.

Sigler, J.W., T.C. Bjornn and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Transactions of the American Fisheries Society 113:142-150.

Tappel, P.D. and T.C. Bjornn. 1983. A new method of relating size of spawning gravel to salmonid embryo survival. Idaho Cooperative Fishery Research Unit. North American Journal of Fisheries Management 2:123-135.

USBLM (Bureau of Land Management). 1995. Mainstem Trinity River watershed analysis. Section VI, Detailed Investigations. Redding Resource Area.

USDA Forest Service and USDI Bureau of Land Management. 1994. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl, and standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl (FSEIS ROD). Volumes I and II. Portland, OR. Apr. 1994.

USFS (Forest Service). 1988. Habitat typing report Canyon Creek. Prepared by Shasta-Trinity National Forest under contract to the Bureau of Reclamation.

USFS. 1989. Habitat typing survey of Big French Creek. Prepared by Shasta-Trinity National Forest under contract to the US Bureau of Reclamation.

USFS. 1991. Stream habitat report. Shasta-Trinity National Forest. Weaverville, CA

USFS. 1997. An ecosystem strategy for maintaining the ecological processes that create and sustain good aquatic habitat in the basins of the Shasta-Trinity National Forests. Adopted by Forest Leadership Team. May 8, 1997.

USFS. 1998. Stream condition inventory guidebook version 4.0. Final Draft. Pacific Southwest Region.

USFS. 1999. Roads Analysis: Informing Decisions about managing the National Forest Transportation System. Misc. Rep. FS-643. Washington, D.C.: U.S. Dept. of Agriculture Forest Service. 222 p.

USFS. 2000a. New River watershed analysis. Pacific Southwest Region, Shasta-Trinity National Forest. May.

USFS. 2000b. Horse Linto, Mill, and Tish Tang watershed analysis. Six Rivers National Forest, Eureka, CA.

USFS. 2000c. Rating watershed condition: Reconnaissance level assessment for the National Forests of the Pacific Southwest Region. Pacific Southwest Region. June.

USFS. 2000d. Effects of the 19999 Big Bar Fire on selected streams in the New River watershed. Shasta Trinity National Forest report.

USFS. 2001a. 2000-01 Chinook and Coho spawning report. Lower Trinity Ranger District. Six Rivers National Forest. Prepared by Kenneth Fetcho and Bryan Drew.

USFS. 2001b. Final environmental impact statement fuels reduction for community protection phase 1. Pacific Southwest Region. Six Rivers National Forest..

USDI. 2000. Record of decision for the Trinity river mainstem fishery restoration final environmental impact statement/environmental impact report. December, 2000.

US EPA. 1991. Guidance for water quality-based decisions: The TMDL process, EPA 440/4-91-001.

US EPA. 1998. South Fork Trinity river and Hayfork Creek sediment total maximum daily loads. Region IX Water Division. San Francisco, CA. December 1998.

US EPA. 1999. Noyo River TMDL for Sediment. San Francisco, CA.

US EPA. 2001. Memo to file re: wasteload allocations for Trinity River TMDL.

US FWS and CDFG. 1956. A plan for the protection of fish and wildlife resources affected by the Trinity River Division, Central Valley Project.

US FWS and HVT (Hoopa Valley Tribe). 1999. Trinity River flow evaluation final report. June.

US FWS. 1983. Final environmental impact statement. Trinity River Basin fish and wildlife management program. U.S. Department of Interior, U.S. Fish and Wildlife Service, Sacramento, CA. INT/FES 83-53.

US FWS, US Bureau of Reclamation, Hoopa Valley Tribe, Trinity County. 1999. Public draft Trinity River mainstem fishery restoration: Environmental impact statement/report.

Weaver, W.E. and D.K. Hagans. 1994. Handbook for forest and ranch roads: a guide for planning, designing, constructing, reconstructing, maintaining and closing wildland roads. Prepared for the Mendocino County Resource Conservation District, Ukiah, CA, in cooperation with the California Department of Forestry and Fire Protection and the USDA Soil Conservation Service.

Wilcock, P.R., G.M. Kondolf, A.F. Barta, W.V.G. Matthews, C.C. Shea. 1995. Spawning gravel flushing during trial reservoir releases on the Trinity River.

Ziemer, Robert. 1998. Proceedings of the conference on coastal watersheds: The Casper Creek story. USDA Forest Service Gen. Tech. Rep. PSW-GTR-168.

Glossary

Aggradation	Elevated stream channel bed resulting from deposition of sediment.
Anadromous	Refers to aquatic species which migrate up rivers from the sea to breed in fresh water.
Beneficial Use	Uses of waters of the state designated in the Basin Plan as being beneficial. Beneficial uses that may be protected against quality degradation include, but are not limited to: domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and the preservation and enhancement of fish, wildlife and other aquatic resources or preserves.
Basin Plan	The Water Quality Control Plan, North Coast Region-- Region 1.
CDF	The California Department of Forestry and Fire Protection.
CDFG	The California Department of Fish and Game.
CWE	Cumulative Watershed Effects. "Cumulative impacts are defined in the Board of Forestry Forest Practice Rules (CDF 2000) by reference to the CEQA Guidelines (Section 14 CCR 15355). Paraphrased, they are defined as two or more individual effects, which, when considered together, make a significant (usually adverse) change to some biological population, water quality, or other valued resource, or which compound or increase other environmental effects. The individual effects may be changes resulting from a single project or a number of separate projects..."(UC Committee on Cumulative Effects 2001).
Debris torrents	Long stretches of bare, generally unstable land areas or stream channel banks scoured and eroded by the extremely rapid movement of water-laden debris, commonly caused by debris sliding or road stream crossing failure in the upper part of a drainage during a high intensity storm.
Deep-seated landslide	Landslides involving deep regolith, weathered rock, and/or bedrock, as well as surficial soil. Deep seated landslides commonly include large (acres to hundreds of acres) slope features and are associated with geologic materials and structures.
Drainage structure	A structure or facility constructed to control road runoff, including (but not limited to) fords, inside ditches, water bars, outsloping, rolling dips, culverts or ditch drains.
Embeddedness	The degree that larger stream bed sediment particles (boulders, rubble or gravel) are surrounded or covered by fine sediment. It is usually visually estimated in classes (<25%, 25-50%, 50-75%, and >75%) according to percentage of random large particles that are covered by fine sediment.
EPA	The United States Environmental Protection Agency.
Erosion	The group of processes whereby sediment (earthen or rock material) is loosened, dissolved, or removed from the landscape surface. It includes weathering, solubilization, and transportation.
ESU	An Evolutionarily Significant Unit is a term used by NMFS to identify a distinctive group of Pacific salmon or steelhead for purposes of the federal Endangered Species Act.
Flooding	The overflowing of water onto land that is normally dry.
FWS	The United States Fish and Wildlife Service
Fry	A young juvenile salmon after it has absorbed its egg sac and emerged from the redd.
GIS	Geographic Information System.
Head of Riffle	The beginning (i.e., upstream end) of a riffle.
HVT	Hoopa Valley Tribe
Inner gorge	A geomorphic feature generally identified as that area of stream bank situated immediately adjacent to the stream, having a slope generally over 65% and being situated below the first break in slope above the channel.
Inside ditch	The ditch on the inside of the road, usually at the foot of the cutbank.
KRIS	Klamath Resource Information System
Landslide	Any mass movement process characterized by downslope transport of soil and rock, under gravitational stress by sliding over a discrete failure surface-- or the resultant landform.
Large woody debris	A piece of woody material having a diameter greater than 30 cm (12 inches) and a length greater than 2 m (6 feet) located in a position where it may enter the watercourse channel.
LRMP	Land and Resource Management Plans for US Forest Service lands.
Mass wasting	Downslope movement of soil mass under force of gravity-- often used synonymously with "landslide." Common types if mass soil movement include rock falls, soil creep, slumps, earthflows, debris avalanches, debris slides and debris torrents.
NMFS	The United State National Marine Fisheries Service.

Pool Tail-out	The downstream end of a pool, where the main current narrows, forming a “tail.”
Reach	The stretch of water visible between bends in a river or channel.
Redd	A gravel nest or depression in the stream substrate formed by a female salmonid in which eggs are laid, fertilized and covered with gravel for a period of incubation.
Regional Water Board	The California Regional Water Quality Control Board, North Coast Region.
Riffle	A rocky shoal or sandbar lying just below the surface of a stream, or the stretch of choppy water caused by such a shoal or sandbar.
ROD	Record of Decision, Trinity River Mainstem Fishery Restoration Final Environmental Impact Statement / Environmental Impact Report (December 2000)
Sediment	Fragmented material that originates from weathering of rocks and decomposed organic material that is transported by, suspended in, and eventually deposited by water or air.
Sediment delivery	Material (usually referring to sediment) which is delivered to a watercourse channel by wind, water or direct placement.
Sediment discharge	The mass or volume of sediment (usually mass) passing a watercourse transect in a unit of time.
Sediment source	The physical location on the landscape where earthen material resides which has or may have the ability to discharge into a watercourse.
Sediment yield	The total amount of sediment (dissolved, suspended, and bed load) passing through a given cross section of a watercourse channel in a given period of time.
Shallow -seated landslide	A landslide produced by failure of the soil mantle on a steep slope (typically to a depth of one or two meters; sometimes includes some weathered bedrock). It includes debris slides, soil slips and failure of road cut-slopes and sidecast. The debris moves quickly (commonly breaking up and developing into a debris flow) leaving an elongated, concave scar.
Skid trail	Constructed trails or established paths used by tractors or other vehicles for skidding logs. Also known as tractor roads.
Steep slope	A hillslope, generally with a gradient greater than 50%, that leads without a significant break in slope to a watercourse.
Stream	See watercourse.
Stream order	The designation (1,2,3, etc.) of the relative position of stream segments in the drainage basin network. For example, a first order stream is the smallest, unbranched, perennial tributary which terminates at the upper point. A second order stream is formed when two first order streams join. Etc.
Tail-out	The lower end of a pool where flow from the pool, in low flow conditions, discharges into the next habitat unit, usually a riffle. Location where spawning generally occurs.
TCRCD	Trinity County Resource Conservation District
Thalweg	The deepest part of a stream channel at any given cross section.
Thalweg profile	Change in elevation of the thalweg as surveyed in an upstream-downstream direction against a fixed elevation.
TRFE	Trinity River Flow Evaluation
TRMFR EIS	Trinity River mainstem Fishery Restoration Environmental Impact Statement
TMDL	Total Maximum Daily Load.
Unstable areas	Locations on the landscape which have a higher than average potential to erode and discharge sediment to a watercourse, including slide areas, gullies, eroding stream banks, or unstable soils. Slide areas include shallow and deep seated landslides, debris flows, debris slides, debris torrents, earthflows, inner gorges, and hummocky ground. Unstable soils include unconsolidated, non-cohesive soils and colluvial debris.
V*	A numerical value which represents the proportion of fine sediment that occupies the scoured residual volume of a pool, as described by Lisle and Hilton (1992). Pronounced "V-star."
Watercourse	Any well-defined channel with a distinguishable bed and bank showing evidence of having contained flowing water indicated by deposit of rock, sand, gravel, or soil.
Waters of the state	Any ground or surface water, including saline water, within the boundaries of the state.
Watershed	Total land area draining to any point in a watercourse, as measured on a map, aerial photo or other horizontal plane. Also called a basin, drainage area, or catchment area.
Water Quality Criteria	Numeric or narrative criteria established under the Clean Water Act to protect the designated uses of a water.

Water Quality Indicator	An expression of the desired instream or watershed environment. For each pollutant or stressor addressed in the problem statement, an indicator and target value is developed.
Water quality objective	A State Basin Plan term equivalent to the Clean Water Act's water quality criteria. Water quality criteria are limits or levels of water quality constituents or characteristics established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area.
Water quality standard	A Clean Water Act term which includes the designated uses of a water, the water quality criteria established to protect the designated uses, and an antidegradation policy.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Comment Responsiveness Summary
for the
TRINITY RIVER
TOTAL MAXIMUM DAILY LOAD
FOR SEDIMENT

(December 20, 2001)

Introduction:

The Environmental Protection Agency (EPA) solicited public comments on the proposed Trinity River TMDL for Sediment, from October 17, 2001 to November 19, 2001. The public submitted several comments, questions and recommendations to EPA during the period via written letters and/or verbal statements made at public meetings held on October 30, 2001 and November 6, 2001. For each comment received, this document summarizes the comment and EPA's response, and identifies whether the final TMDL was revised based on the comment. The document is organized according to the individual or organization submitting the comments. In most cases, comments are quoted directly from the source. In certain cases, comments are paraphrased. EPA did not address comments that did not pertain to the Trinity River TMDL. EPA appreciates the level of interest and constructive input received by the public on this TMDL. Further questions about this document or the final TMDL should be directed to Chris Heppe at (707)825-2311, Heppe.Christopher@epa.gov.

List of Comments and Response (Alphabetically by Commenter)

1. Summary Response to Flow Related Comments 2
2. Fall, C. 3
3. Mathis, H. 3
4. Nelson, D. 4
5. North Coast Regional Water Quality Control Board 7
6. Northern California Power Agency 10
7. Riley, V. 13
8. Sacramento Municipal Utility District 16
9. San Luis & Delta-Mendota Water Authority and Westlands Water District 21
10. Sierra Pacific Industries 25
11. Timber Products Company 33
12. Trinity County 39
13. U.S. Bureau of Indian Affairs 45
14. U.S. Bureau of Reclamation 46
15. U.S. Fish and Wildlife Service 49
16. U.S. Forest Service, Shasta-Trinity 51
17. Yurok Tribe Environmental Program 51
18. Yurok Tribal Fisheries Program 54
19. Public Comments from Informational Meeting, October 30, 2001 56
20. Public Comments from Technical Information Meeting, Nov. 7, 2001. 59

1. Summary Response to Flow Related Comments

Response 1.1. EPA received several comments concerning the issue of Trinity River flows below the Lewiston dam and the Department of Interior's Trinity River Mainstem Fishery Restoration Record of Decision (ROD) in relation to the TMDL. The commenters expressed a wide range of views. For example, some commenters essentially objected to any mention of flow issues in the TMDL document, while others contended that flow issues should be given more weight in the TMDL analysis. EPA is providing this summary response, in addition to individual responses when necessary, to clarify our perspective regarding flow considerations in the Trinity River TMDL.

On the general issue of flow, we note that the Clean Water Act regulations provide that TMDLs shall take into consideration "critical conditions for stream flow." See 40 C.F.R. 130.7(c)(1). The regulations, however, do not provide specific guidance as to how flow should be addressed in a TMDL. Given this regulatory provision, along with the well-documented relationship between sediment impairment and flow in the upper middle mainstem river (below the dams), it was incumbent on EPA to carefully consider issues related to flow in its analysis for this TMDL.

At present, there is uncertainty concerning what the actual flows in the river will be. Therefore, we felt it appropriate to consider in our analysis both existing flows and also the flow regime discussed in the ROD and the Trinity River Flow Evaluation on which the ROD was based. We considered the flow regime recommended in the ROD because in our opinion this flow regime is based on the best scientific analysis of which we are aware, and because it represents the most recent decision of the Department of Interior concerning Trinity River flows. Although, as some commenters have pointed out, a preliminary injunction has been issued prohibiting DOI from implementing the flow requirements of the ROD, we note that the preliminary injunction was not based on any criticism of the scientific bases for the ROD decision. (We also note, moreover, that the preliminary injunction allowed DOI to implement the flow requirement of the ROD for critically dry years.)

Some commenters objected to the use of geomorphic indicators and targets in the TMDL because they were developed for the Trinity River Restoration Program to evaluate the effects of the flow regime. However, several of these geomorphic indicators are directly related to sediment conditions, in addition to flow, and therefore serve as appropriate indicators of the health of the beneficial uses of concern in the TMDL. Therefore, EPA has retained these indicators in the final TMDL.

Although we carefully considered the implications of various flow regimes in our analysis, we did not base the calculation of the loading capacity (TMDL) and allocations on any particular flow regime, nor does the TMDL in any way allocate flow or require a specific flow regime. We note that TMDLs are required by the Clean Water Act only for pollutants that are causing or contributing to the impairment of a waterbody, and EPA interprets the definition of "pollutant" as excluding flow alterations. Therefore, the TMDL should not be construed as allocating flow. However, our analysis of existing information strongly supported the conclusion that in order to fully protect beneficial uses, implementing the flow regime set forth in the ROD appears to be necessary. Thus, we are recommending that the State, when it develops implementation measures for this TMDL, carefully consider the relationship between flow and sediment loads. Additionally, we are recommending that DOI implement the flow regime called for in the ROD. In this regard, we respectfully disagree with those commenters who appear to suggest that any action taken under the CWA which could influence decisions by the State, Tribes or DOI regarding flow would be impermissible. We note that the strict dichotomy these commenters appear to urge between water quality and water quantity authorities was rejected by the US Supreme Court in *P.U.D. No. 1 of Jefferson County and City of Tacoma v. Washington Dept. of Energy*, 511 U.S. 700 (1994) (upholding a

State's decision under the CWA to require a minimum stream flow in order to protect water quality standards, despite the incidental effects on water quantity).

Some of the commenters suggested that the TMDL would not be effective without changes in the flow regime of the waterbody. With regard to these comments, we note that the Clean Water Act and its implementing regulations provide that TMDLs shall be established at a level necessary to implement the applicable numeric and/or narrative water quality standards. 40 CFR 130.7(c)(1). The Trinity River TMDLs are being set at levels necessary to attain the narrative water quality standards related to sediment discharge, as set forth in section 5.2 of the TMDL. EPA acknowledges, however, that in order to fully restore fish habitat in the mainstem, control of sediment sources alone will not be sufficient.

2. Fall, Carol. Letter dated November 19, 2001.

Comment 2.1. "I strongly support the TMDL report's recognition of the critical role that increased flows play in restoring the beneficial uses of the Trinity River. The river will not meet water quality standards for sediment or temperature unless the Trinity River Mainstem Fishery Restoration Record of Decision is implemented. Control of sediment sources alone will not restore the fishery."

Response 2.1. See response 1.1.

Comment 2.2. "The TMDL recognizes variability within the watershed...The implementation recommendations in chapter 6 should also recognize this variability, so that landowners are not unfairly burdened with stringent sediment reduction requirements that are not appropriate for their subarea. I suggest that you add language at the end of the second paragraph, chapter 6, which states: 'These provisions should also recognize the variable need to control sediment in each subarea of Tables 5-2 through 5-5. Sediment load reduction, appropriate for each subarea, may be accomplished through site-specific management practices, variable regulatory requirements (similar to snow loads), sediment trading credits or other mechanisms.'"

Response 2.2. Change made.

Comment 2.3. "...Based on personal observation, I think it is also important that Caltrans develop management practices that reduce sediment transport from state-maintained roads. I live on Hwy 3 and have observed Caltrans annual fall maintenance program, in which the toe of the slopes adjacent to the road are cut away by plows to create a drainage-way. This moves vegetation and creates unstable, loose soils that easily wash away. I have measured turbidity levels in these temporary 'ditches' in excess of 200 NTU. I suggest that you add language to Table 6-1 that recommends that Caltrans develop a maintenance program designed to minimize sediment transport."

Response 2.3. Change made.

3. Mathis, Hal. Written comment submitted via email on November 16.

Comment 3.1. "...it was stated by EPA representative individuals that, except on exceptional evidence, ALL landsliding with any evidence of a road, current, or 'Legacy', was considered to be 'Management Associated'. This, by definition could greatly increase 'Management Associated Loads', and reduce 'Background Associated Loads'. This change in apportionment would increase the amount of mitigation required, by any method of calculation of management associated to background associated total load, and thus skew required mitigation."

Response 3.1. The technical consultant for this TMDL (Graham Matthews and Associates) used professionally accepted methods when analyzing air photographs to determine whether there was any association between the landslide and land management activities. Air photo analysis is a commonly used methodology for a large scale, basin-wide inventory. The landslide data was combined with other field surveys of plots, roads and mining ditches, etc. to determine relative contributions of sediment between the various source categories. EPA acknowledges that the assignment of the erosional features as either management or non-management related affects the calculation of the loading capacity (TMDL) and allocations (chapter 5 of TMDL).

Comment 3.2. "TIMBER HARVEST: It appears as if all data used in evaluating timber harvest are either dated prior to EPA ban on harvesting, or upon USFS THP (which does not accurately represent harvested acreage."

Response 3.2. As described in Chapter 4, EPA determined sediment delivery rates from timber harvesting practices by evaluating landslides from harvested areas (federal and non-federal timberlands) using several years of air photos, applying surface erosion rates to harvested acres and some field plot analysis of erosional features. EPA used the best available information to calculate harvest areas, which included digitizing timber harvest plan (THP) areas into a geographic information system (GIS) for analysis. EPA has not instituted a "ban on harvesting."

Comment 3.3. "Between these two deficiencies alone, it appears that the TMDL management based apportionment, and thus mitigation required, has been exponentially raised above what an evaluation, using accurate timely and unbiased data would have produced."

Response 3.3. EPA believes the TMDLs and load allocations are based on accurate, timely and unbiased data. The commenter did not provide additional data or recommend alternative methodologies in order to change the TMDL.

4. Denver Nelson. Written comment received by EPA on 10/31/01.

Comment 4.1. "The statistical basis for the computation of this TMDL does not appear to be as rigorous as some of the other TMDL's in the Northern California Region. Specifically it appears only about 40 plots of 40 acres were analyzed to derive a sediment load. It is not clear that these were randomized so that the values obtained could be extrapolated to the entire river basin. There appears to have been no attempt to analyze the basin by different soil types and thereby establish the sediment load for varying soil type, based on the 40 acre parcels and/or air photo analysis."

Response 4.1. The sediment delivery rate was based on several assessment methods, one of which was the inventory of 40 plots. The plots were randomly selected, however limited to public ownership due access constraints on private land. The plot assessments were intended to identify erosional features not visible from air photos such as gullies and rills from various sources. Other assessment methods included air photo analysis to identify large landslide features, road inventories, and limited field inventory of legacy mining ditches as summarized in Chapter 4. Although the sediment source data could be extrapolated to soil types, EPA chose to present the data according to source categories (roads, timber harvesting, mining, background, etc.) within subareas in order to allocate loads to each category as described in Chapter 5.

Comment 4.2. "The road component of sediment production was not measured, but instead was based on sediment production from roads measured in other allegedly similar watersheds. This means that in the implementation plan the only way to reduce the sediment load is to decrease the number of roads, leaving the implementation plan in a "Catch 22" situation. It may be that sediment production is proportional to miles of roads and therefore decreasing the miles of roads decreases sediment production in some sort of mathematic formula, but without measuring the sediment production before and after road removal, one can only speculate on the tie between roads and sediments in the Trinity River Basin."

Response 4.2. As described in Section 4.1, the TMDL assessment did include a field inventory of roads located within the Trinity Basin to estimate surface and gully erosion. Decommissioning roads is one method for reducing or eliminating sediment delivery from roads. However, there are several other cost-effective practices available to resource managers to reduce the risk of sediment delivery from roads, particularly regarding drainage structures and stream crossing construction and maintenance, as cited in the Watershed Indicators of the TMDL (Section 3.3). In addition, several local entities including Trinity County, U.S. Forest Service, Resource Conservation District and timberland managers have conducted or are in the process of assessing potential sediment delivery from roads. As identified by the commenter, EPA strongly recommends monitoring before and after road mitigation or decommissioning to measure the effectiveness of these practices on water quality.

Comment 4.3. "Timber harvesting effects on sediment production is not rigorously tied to objective measurements of natural vs. timber related sediment production. A reproducible conclusion cannot be reached regarding timber harvesting activities without measuring pre-timber harvest and post-timber harvest sediment production in multiple areas. There must be enough areas measured to produce statistical significance when extrapolated to the entire Trinity basin."

Response 4.3. The degree to which timber harvesting affects sediment production is influenced by several factors such as the silvicultural method (clear cut, selection, etc.), proximity of harvest to watercourse, stability of slope, soil types, magnitude of storms following harvest, etc. EPA used the best available information to determine the relative contribution of sediment delivery from timber harvest, compared with other source categories, primarily based on air photo analysis of landslides occuring in harvested areas and the application of surface erosion rates to harvest areas according to time periods (Chapter 4). EPA encourages additional research to further quantify the magnitude of various harvesting methods on sediment delivery to streams and associated impacts on aquatic habitat.

Comment 4.4. "Figure 4-1 Percent Sediment Input by Source Category Within Each Assessment Area. This is a helpful graph. To me an even more helpful graph would be to add an additional graph showing these same values in tons per square mile per year instead of percent..."

Response 4.4. EPA has included the recommended graph in the administrative record for the TMDL.

Comment 4.5. "On Page 52, I note that the data collection is based only on water year 2001. This cannot be statistically significant. Surely there must be a way to collect data for more than one water year."

Response 4.5. Although GMA collected detailed turbidity and suspended sediment data during only one winter season, GMA assessed sediment data from several gages with long-term records, particularly in Grass Valley Creek, as described in Section 4.3.

Comment 4.6. "In the Trinity Basin there is a 500 pound gorilla who does not get enough respect in this TMDL. I am referring to the dams, reservoirs and the diversion of 90% of the Trinity river flow to the Sacramento River...In order to restore the river to a healthy state, even the non-management sediment must be reduced to 140 tons from the present 1400 tons."

Response 4.6. EPA summarized and referenced the effects of the dams on flow in relation to sediment under Habitat Conditions (Section 2.4), Sediment Budget (Section 4.3), Critical Conditions (Section 5.4) and Implementation Recommendations (Chapter 6) in the TMDL. EPA believes this level of consideration for flow is appropriate in the context of a sediment TMDL. See also response 1.1.

Comment 4.7. "Since sediment, either dissolved or particulate, is carried away from the basin by water, the amount of water flowing in the Trinity River has had, and continues to be, far and away the major factor in the health of the Trinity River. Since the construction of the Trinity River diversion, 90% of the flow of the river has been diverted out of the river into the Central Valley and has not been available to Transport sediment in the Trinity River. A recent Record of Decision recommended increased flows but has been stopped by court order. The court ordered Trinity flow releases are only slightly greater than what has been occurring since the construction of the Trinity diversion, and therefore will not have a significant effect on sediment transport. The Trinity River TMDL draft does not take into account the tremendous effects of the diversion of 90% of the river flow out of the basin. Much more emphasis should be placed on attaining the new increased flows outlined in the Record of Decision."

Response 4.7. EPA has recommended that the Department of Interior implement the flow schedule called for in the ROD based on several years of study in order to protect cold water beneficial uses in the mainstem below the dams. However, TMDLs are developed for the pollutant for which the basin was listed in accordance with Section 303(d) of the Clean Water Act. Consequently, EPA is establishing this TMDL for sediment while giving appropriate consideration to flows. See also response 1.1.

Comment 4.8. "The Trinity River TMDL document concentrates more on the tributary stream sediment production and much less on the Trinity River sediment. The dams have blocked virtually all of the sediment transport from the Upper Basin and have produced a deficiency of spawning type gravel sediment below the dam. Artificial attempts at introducing spawning gravel below the dams have merely served to fill in deep holes... The effect on Trinity River sediment below the dams is, of course, the essence of the need for this TMDL. Reducing the river flows by 90% reduces the river's ability to handle sediment by at least 90% and, in the case of large rock type sediment, without normal and high flows there can be no sediment transport at all. It must be emphasized in this TMDL that the only way to effectively deal with sediment, whether it be natural or management related, is to restore the normal river flow."

Response 4.8. See response to previous comment. In addition, EPA reminds the commenter that the TMDL applies to all the tributaries (excluding the South Fork which is covered under a previously adopted TMDL, and areas under tribal jurisdiction) as well as the watershed area above the reservoirs.

Comment 4.9. "If the Trinity River flow were increased from its 10% of the normal flow to 100% (a ten fold increase), there would be no need to reduce any management activities in order to meet healthy river guidelines. If the flows are not restored, the sediment produced will continue to accumulate in the Trinity river with no hope for any restoration of the river. This TMDL must emphasize the extreme detrimental effects the dams, reservoirs and diversion have had on the Trinity River. The implementation plan must deal with increasing flows."

Response 4.9. The Trinity River is listed under Section 303(d) as being impaired by sediment, and EPA's analysis underlying the TMDL supports the conclusion that the amount of sediment being delivered to the Trinity River is excessive, even if no water was diverted from the Trinity basin. Thus, EPA is establishing a loading capacity (i.e., TMDL) and allocations for each subarea that apply regardless of flow. See also response 1.1.

Comment 4.10. "...The implementation portion of this TMDL will need millions more for road assessment and removal. It is clear that spending millions of dollars will not restore the Trinity River unless the water flowing in the Trinity River is restored."

Response 4.10. Comment noted. See also response 1.1.

Comment 4.11. "...To measure the effectiveness of this process a new TMDL will have to be done and compared with this present TMDL to determine if the process has been successful. Because of funding limitations, this TMDL was not as complete as need be and therefore lacks statistical significance. This means that it will be impossible to make a statistically significant appraisal of the restoration efforts effect."

Response 4.11. EPA expects the State to determine the effectiveness of the TMDL using a "weight of evidence" approach by evaluating the attainment of the stream habitat and watershed indicators (Chapter 2), the allocation and reduction levels from management activities (Chapter 5), as well as the successful implementation of the sediment control measures (Chapter 6 recommendations). EPA has also recommended a coordinated monitoring approach among all the resource managers and interest groups in order to provide the information necessary to track the health of the watershed in the future.

Comment 4.12. "The cost of the Trinity River TMDL has not been reported, but the EPA report 'The National Cost of the TMDL Program' shows that average cost of the most expensive TMDLs to be $123,476. Over $93,952,547 has already been spent restoring the Trinity River and $10,000,000 more is budgeted. It is false economy to not spend enough on this TMDL to get a statistically significant baseline with which to evaluate the effect of the millions of dollars of restoration work."

Response 4.12. Comment noted.

5. North Coast Regional Water Quality Control Board. Letter dated November 19, 2001.

Comment 5.1. "As a general comment, the assumptions, potential sources of error, and confidence level in the analysis should be discussed in the TMDL document."

Response 5.1. EPA has accounted for uncertainties (Margin of Safety, Section 5.3), season variation and critical conditions (Section 5.4) as required for TMDL development. Any further discussion of assumptions, potential sources of error and confidence level can be found in the specific references upon which the TMDL assessment was based.

Comment 5.2. "Table 3-3, Sediment Indicators and Targets: Road-related sediment in this watershed is too high for properly functioning conditions. In order to reduce the amount of road-related sediment, the number and lengths of roads should be reduced. Perhaps this could be addressed by changing the scope of the existing target for roads so that all roads in the watershed are included, not only roads adjacent to streams."

Response 5.2. Most of the road-related targets apply to roads and/or features of roads that represent a risk of sediment delivery to the watercourse. EPA believes that the road-related targets as well as the management load allocations in Chapter 5, allow resource managers the flexibility of addressing sediment sources from roads that are not just located adjacent to streams.

Comment 5.3. “Table 3-3: It should be noted that the units for spawning gravel quality are % dry weight.”

Response 5.3. In the “Description” column of Table 3-3, dry weight is specified for spawning gravel quality.

Comment 5.4. “Table 3-3 and page 35. Information reported in the literature about salmonid response to turbidity levels can help to explain the potential relevance of turbidity data to beneficial uses even with limited data. A summary of literature-reported turbidity effects is provided below...the data presented at the public meeting on November 6, 2001 in Weaverville show that Trinity watershed streams exhibit storm turbidity values above values the literature reports as creating adverse conditions, even if the limited data do not allow a definitive comparison to the indicator targets.”

Response 5.4. EPA has added a brief summary of the maximum turbidity values sampled by GMA (2001b) during WY2000 and 2001, under Section 3.2.

Comment 5.5. “Page 34. Riffle Embeddedness. It is not clear at the end of the first paragraph whether it is the threshold or the protocols that is not available.”

Response 5.5. An embeddedness threshold based on the USFS monitoring protocol has not been established.

Comment 5.6. “Page 36, Thalweg Profile. It would be useful to include reference on this indicator. USGS may have some recent work in this area.”

Response 5.6. EPA added the following reference: “Harrelson et al. (1994) provides a practical guide for performing thalweg profiles and cross sections.”

Comment 5.7. “ Page 38, Stream Crossing Failure Target. It would be useful to include a reference for the <1% value.”

Response 5.7. The <1% value was first recommended by the US Forest Service as a numeric target in the South Fork Trinity TMDL.

Comment 5.8. “Table 3-4. How is the composite rating calculated?”

Response 5.8. The composite rating is calculated using additional road parameters that are not all included in Table 3-4. For a thorough description of the calculation, EPA refers the commenter to De la Fuente (2000). Contact EPA or the US Forest Service for a copy of this document if one is needed.

Comment 5.9. “Page 43, 44; Section 4.1: it would be helpful to discuss the Trinity River watershed aerial photo analysis in more detail. Specifically, the number of photo years used and the extent of the area analyzed should be included in more detail so that the reader can better understand the spatial and temporal coverage of the aerial photo analysis. In addition, limitations of the aerial photo analysis such as the ability to detect and accurately delineate features given aspect, shading, and revegetation considerations, and the impact of these limitations on sediment delivery estimates should be discussed. A discussion of the confidence in sediment delivery estimates derived from the aerial photograph analysis should be included to help understand the robustness of the analysis."

Response 5.9. EPA refers the commenter to a more thorough discussion of the analysis in the Sediment Source Analysis for the Mainstem Trinity River by Graham Matthews and Associates (2001).

Comment 5.10. "Page 44, Section 4.1, paragraph 2:...Please include the criteria that were used to determine whether a slide was 'questionable' and therefore discarded from the aerial photo analysis. The prevalence, nature, and any anticipated effect of features identified as 'questionable' should be explained to clarify why they were left out and the impact (if any) this procedure might have on the results of the aerial photo analysis."

Response 5.10. EPA refers the commenter to a more thorough discussion of the analysis in the Sediment Source Analysis for the Mainstem Trinity River by Graham Matthews and Associates (2001).

Comment 5.11. "Page 44, Section 4.1: methods used to extrapolate sample plot inventories to the entire Trinity watershed and associated confidence in these extrapolations were not explained. An explanation of the confidence in the extrapolation methods used would help to clarify the amount of uncertainty associated with sediment delivery from sample plots."

Response 5.11. EPA refers the commenter to a more thorough discussion of the analysis in the Sediment Source Analysis for the Mainstem Trinity River by Graham Matthews and Associates.

Comment 5.12. "Page 46, Section 4.1, Paragraph 3: It is stated that for pre-1974 harvesting, the rate of surface erosion from harvested areas is assumed to be 12 tons/ac/year. The basis of the application of this rate should be clarified."

Response 5.12. This rate was based on a best professional estimate as described in the Sediment Source Analysis for the Mainstem Trinity River by Graham Matthews and Associates.

Comment 5.13. "Page 46, Section 4.1, paragraph 4: It is state that for the extremely erodible Shasta Bally Formation, the surface erosion rate from harvested areas is assumed to be 40 tons/ac/year. The basis of the application of this rate should be clarified."

Response 5.13. This rate was based on a best professional estimate as described in the Sediment Source Analysis for the Mainstem Trinity River by Graham Matthews and Associates.

Comment 5.14. "Page 47, Section 4.1, Paragraph 2: It is stated that for sediment delivery from legacy roads, a delivery period of 30 years was applied for observed features. The basis of the application of this time period should be clarified."

Response 5.14. This time period is based on the best professional judgement as described in the Sediment Source Analysis for the Mainstem Trinity River by Graham Matthews and Associates.

Comment 5.15. " page 53, 54; Section 4.3; Table 4-6, Table 4-7. In general, the variance associated with sediment yield and transport estimates can be significant. A qualitative description or quantitative estimate of the variance associated with the sediment transport values presented in Table 4-6 and 4-7 would be valuable in evaluating and comparing tributary sediment transport rates.

Response 5.15. EPA has described how the TMDL accounted for any uncertainties within the Margin of Safety (Section 5.3).

Comment 5.16. " Table 5-1, Table 4-5 and text on page 57. There are some disagreements among the figures cited at these locations for some drainages, e.g., Coffee Creek and Horse Linto Creek."

Response 5.16. EPA has reconciled these differences in the TMDL.

6. Northern California Power Agency. Letter dated November 19, 2001.

Comment 6.1. We also hope to continue with a collaborative and science-based dialog on implementation and monitoring of the TMDL and associated water quality standards. We are encouraged by the report's objectivity and basin-wide perspective, which has been delinquent in the larger Trinity River Restoration Program process."

Response 6.1. EPA encourages the continuation of a collaborative and science-based dialogue on implementation and monitoring of the TMDL.

Comment 6.2. "It is readily evident that sediment is a problem in the basin. However, *the report fails to clearly acknowledge the degree of impairment (i.e., detriment to the fishery) and the causal relationship (sediment-fishery production) cannot be quantified*, especially as related to salmonid rearing and migration. This acknowledgment does not change the need for action, but emphasizes the need for and the importance of adaptive management concepts in resolving the habitat impacts."

Response 6.2. EPA used the best available information to characterize the relationship between sediment and fish habitat in Chapter 2. EPA agrees that adaptive management concepts are appropriate as new information becomes available.

Comment 6.3. "The report forages into restoration issues that are not within the purview of the TMDL. For example, loss of coarse sediment supply (pg. 22), inadequate bed mobilization (pg. 23), encroaching riparian vegetation (pg. 23) and dynamic geomorphological features (pg. 24) are not water quality issues as established and defined by EPA (pg. 12). Changes in sediment loads via a TMDL implementation program will not significantly affect these features."

Response 6.3. EPA believes, based on the TRFE and common literature regarding geomorphology (e.g., Ritter 1986), that each of the features identified above are related to sediment loads and protection of freshwater habitat beneficial uses. As such, changes in sediment loads via a TMDL will affect these features.

Comments 6.4. "While they are issues potentially related to fishery production goals, a more complete and open discussion of the causes, impacts and resolution of such issues need to be addressed. Such dialog is appropriate with the Trinity River Restoration Program, rather than as part of the TMDL process. The minimal reference to these issues in the report precludes consideration of important dialog, and implies more knowledge than is reality. While much work has been performed in attempting to understand the mainstem conditions, very little causal relationship information is known. These discussions need to be deleted, with perhaps a reference to the Mainstem Trinity River EIS and flow evaluation for discussion of other factors impacting fisheries within the basin. They offer no value to an otherwise objective report. The discussion in this section needs to stay within the U.S. Forest Service criteria and considerations (pg. 20) in presenting an assessment of the plan watershed and riverine water quality conditions (e.g., impaired) without causal reference to the causes and solutions beyond the pollutant of concern."

Response 6.4. EPA is required to base the TMDL on best available information. The Trinity River Mainstem EIS and supporting scientific documents provide a tremendous amount of information regarding the physical, hydrological and biological processes of the upper middle mainstem river. Such information cannot be overlooked or casually referenced in a TMDL for sediment where the condition of aquatic habitat is of primary concern. Based on all the available information, in addition to the EIS, EPA has determined that sediment-related water quality objectives are not currently being attained and that sediment reduction levels from management activities as assigned in the TMDL are necessary. EPA encourages and supports continued dialogue within the Trinity River Restoration Forum regarding all issues pertaining to the restoration of the fishery including attainment of TMDLs for sediment.

Comment 6.5. "There appears to be some confusion about and misuse of the indicator concept throughout the document. The term indicator has traditionally been interpreted as a reference to an indirect performance measure utilized to evaluate project progress when other more direct means do not exist. It does not generally serve either as a replacement standard (pg.65), a description of water quality (pg. 28), nor an interpretation of standards (pg. 28). As well, direct measures of the standards and effects of the standards do exist, and are partially identified in the report (p. 32). For example, spawning gravel quality and permeability are the impaired habitat. Measuring these attributes will give you direct indication of program progress. Keeping performance measures fuzzy and vague provides a disservice to the technical community and to a healthy adaptive management process. This language needs to be corrected so that readers are not inadvertently misled and confused. You might instead consider use of the term *performance measures* in this context."

Response 6.5. EPA believes that "indicators" is an appropriate term because the parameters described in the TMDL provide an "indication" of the condition of the watercourse with respect to sediment water quality objectives.

Comment 6.6. "There is no need, and moreover, it is counterproductive, to isolate a set of 'indicators' for the mainstem from the other streams and rivers of the Trinity River Basin. The Basin-wide indicators should, and do, apply to the entire basin. No argument has been shown that suggests otherwise, and certainly not because of suggested differences in geomorphic features, being more altered, having been studied more, or having more hypotheses (pg. 29). As well, most of the Upper Middle Mainstem geomorphic 'indicators' have no significant relationship to the TMDL and water quality standards and measures to achieve such. For example, spatially complex channel geomorphology uses sediment but does not result from the existence of excessive sediment. The one that does have relationship - balanced fine and coarse sediment budget - also does not apply to water quality objectives (pg. 12), and is addressed by the general goal of reducing fine sediment as would be gauged through the various basin-wide indicators. It is especially inappropriate to use a flow target (pg. 30) as an indicator of sediment management program success. Mainstem flow has NO relationship to load allocations and changes in those allocations. Costs to plan and implement monitoring of these 'indicators' is a misuse of TMDL program resources. These 'indicators' should be deleted from the report, leaving their discussion for appropriate forums (e.g., the Trinity River restoration program)."

Response 6.6. EPA maintains that the upper middle mainstem is unique for several reasons and warrants a unique set of indicators. In addition to the four reasons identified in the TMDL, the upper middle mainstem is important biologically for anadromous fish spawning and rearing habitat. The infomation in the EIS and supporting studies is strongly related to sedimentation process and must be acknowledged in the TMDL. Moreover, EPA only included geomorphic indicators and targets from the

EIS that are closely associated with sediment. One of the water quality objectives identified in the Water Quality Control Plan for the North Coast ("Basin Plan") that applies to the Trinity is based on "settleable material" defined as follows (and in Section 2.1 of the TMDL): "Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses." From the studies cited in the TMDL, EPA believes that deposition of material in the mainstem below the dams is adversely affecting beneficial uses. EPA also considers that most of the indicators in Table 3-1 are sufficiently associated with "deposition of material" that they are appropriate for inclusion as indicators of river health. In fact, most of these indicators and targets are described in terms of sediment-related characteristics (e.g., alternate bar sequences, channelbed particle size, channelbed surface, median bars, pool tails, spawning gravel deposits, etc.)

Comment 6.7. "In general, reference to the value and need for implementing the ROD (e.g., pg. iii) should be deleted because of its associated narrow focus (mainstem only, no specific watershed actions, no tributary actions) and Graham Matthews Associates's findings that flows appear to not benefit the TMDL goals. Linkage of the TMDL effort to the currently controversial and dysfunctional Trinity River Restoration Program can only harm an otherwise objective and constructive process."

Response 6.7. Although the ROD is focussed on the mainstem, it also addresses watershed restoration activities, including sediment reduction in the tributaries, as an important component to the overall success of the program. As such, sediment reduction is a common to both the ROD and TMDL. EPA is not aware of any findings by Graham Matthews and Associates suggesting that flows do not benefit TMDL goals.

Comment 6.8. "Additional 'indicators' and a narrowing of the wide range of parameters should be considered. A direct measure of program success could include monitoring of localized juvenile production, incubation survival, and/or adult use of habitats (e.g., pools). The spawning gravel quality and permeability measures are also direct measures of program effectiveness (these are the impaired habitats), and thus other monitoring could be minimized for TMDL purposes. Since this indicator list provides recommendations for consideration (by the State Water Resources Control Board) in the implementation and monitoring plan development, we encourage you to emphasize the need for a broad based technical group (similar to reference on page 66, but without reference to ROD processes) to review and refine the appropriate set of performance measures (indicators). Such a group would benefit from agency, stakeholder and non-vested scientific representatives in a collaborative, open dialog. In fact, such a group would have greatly enhanced the TMDL product itself."

Response 6.8. EPA encourages the State to obtain a broad spectrum of stakeholder input as they develop measures to implement and monitor effectiveness of the TMDL.

Comment 6.9. "The reference watershed approach appears to be the most viable approach to determine load allocations, but it is clearly a rough estimate of the 'solution'. The relationship between the desired outcome (improving spawning success and rearing conditions) and the standards by which to achieve that outcome (1:4 ratio between management load and non-management load) is clearly unknown. Given this unknown, a fixed sediment load allocation standard is clearly inappropriate. Without flexibility in the load allocation standard, costly bureaucratic processes are required with subsequent harm to either the environment or the community. We would recommend consideration of a range of the standard (e.g., based on 15-25 percent of non-management load), with a initial fixed value (e.g., 25%) to be reassessed within a certain time frame (e.g., 3 years) by a scientific review panel. The overall water quality standards with appropriate metrics (i.e., indicators) would not change and would guide subsequent changes in the load allocation standard. While this is not the traditional approach, it or something similar is necessary to truly allow for adaptive management practices."

Response 6.9. EPA expects the State to review the TMDL periodically. We agree that an evaluation by a scientific review panel after 3 years or so should be considered by the State as they develop measures to implement and monitor effectiveness of the TMDL. EPA will forward this comment to the State for their consideration as they implement and measure effectiveness of the TMDL.

7. Riley, Vicki. Letter submitted by email dated 11/18/01.

Comment 7.1. "The whole point of reducing sediment in the Trinity River is based on the assumption that sediment is harmful to Trinity River fisheries. This assumption is undercut by the information given in the tables 5-1, 5-2, 5-3, 5-4, 5-5, where many of the listed reference streams, termed 'properly functioning,' have quite high background sedimentation rates, especially in comparison with many of the streams draining watersheds where most of the land is privately owned. In other words, sedimentation itself is not bad, only 'management' sediment, i.e., sedimentation coming from private lands, is considered harmful."

Response 7.1. The adverse effects of excessive sediment on salmonid habitat are well documented (a summary of the information is presented in the TMDL in section 2.3). However, it is also true that salmonids inhabit streams with a wide range of natural average sediment rates. The underlying process which is important is the relationship between sediment delivery and channel stability. Stream channel shape and structure have adjusted to the rainfall/sediment runoff relationships (Simon et al., unpublished) that existed in the period before contact with euro-americans/settlers. These stream channel shapes and structures included properly functioning conditions for salmonids. Channels which have high absolute average levels (e.g., some Trinity reference streams) and are stable (within the context of historical conditions), often provide better habitat conditions than streams which have overall lower absolute levels, but are unstable (e.g., some Trinity non-reference streams). Thus, the absolute level of sediment delivery, except when looked at as a long term average for a particular watershed, is not diagnostic of channel stability of good fish habitat conditions. What is important is the CHANGE in the rainfall/sediment delivery relationship. In summary, it is not that management-related sediment is any different than natural sediment, it is that increases in sediment delivery due to management activities can disrupt the rainfall/sediment delivery balance causing the streams to become unstable and adversely impacting salmonid habitat (e.g., stream widening, filling pools, degrading spawning gravels).

Simon, A., R. Kuhnle, S. Knight, and W. Dickerson. "Reference" and Enhanced Rates of Suspended-Sediment Transport for Use in Developing Clean-Sediment TMDL's: Examples from Mississippi and the Southeastern United States. unpublished.

Comment 7.2. "...since management load allocations are calculated as a percentage of background sedimentation rate, the lower the background rate the lower the management allocation. This plan insures that the management allocation will be very low on all privately owned land by using judgement calls to assign sediment loads to 'management' rather than 'background' on these lands, keeping the background rates much lower on privately owned watersheds than on federally owned watersheds."

Response 7.2. With regard to "judgement calls to assign sediment loads to 'management' rather than 'background,'" EPA wishes to point out that not all erosion from private land was identified as "management-related." Nor does EPA expect that future assessments will assume that all erosion from private land is management-related. In order for a slide or other erosional feature to be considered management related, there must be a clear indication of a recent (in the case of timber harvest) and/or direct (in the case of roads) association between the feature and the management activity. By utilizing the "percent of background" approach, EPA is emphasizing the ratio of management to natural sources rather than absolute rates of sediment delivery. Clearly, in watersheds with high intensity management, the probability is higher that sediment delivery is associated with management activities. However, even in a predominantly private watershed, EPA believes that the 125% of background condition can be achieved through a combination of restoration and prevention measures and/or a sustainable level of management over the long-term. The TMDL provides a basin-wide comparison of the subareas and the degree to which sediment reductions are necessary to achieve the 125% of background threshold. EPA expects the State to strongly consider the ratio of management to natural, in addition to the absolute sediment delivery rate, when evaluating the attainment of the allocations.

Comment 7.3. "This would require one to believe that the geology of all federally owned lands are less stable than all privately owned lands because federally owned lands generally seem to produce a higher rate of background sediment load. Granted, much of the federally owned land is quite steep and includes high elevations. However, all of Trinity County has steep grades, and most watersheds include peaks where rain on snow is a possible event producer."

Response 7.3. EPA agrees that factors such as steepness and elevation influence sediment loading rates.

Comment 7.4. "Furthermore, streams which produce far less total sediment than the reference watersheds are nevertheless targeted for very high percentage reductions, even though these reductions will turn out to be insignificant amounts when compared to the permitted background sedimentation rate. Again these streams mostly drain private lands..." The commenter then provided an example.

Response 7.4. See response 7.1.

Comment 7.5. "...since the watersheds on the eastern side which drain mostly private lands have very low background rates, they must have very stable soils. Since the method of calculating the management allocation of a watershed is as 25% of the background, the management allocations of these lands no where near covers the current roads. Consequently, future economic activity will be discouraged on these stable lands with low background rates, and encouraged in watersheds with higher background rates, because those watersheds have much higher management allocations. This does not seem to me to be a desirable consequence. High background watershed get high allocations for human activity, while low background watersheds get very low allocations for human activity."

Response 7.5. The comment seems to be based on the assumption that use of 125% to estimate the loading capacity is more stringent when the soils are very stable. This assumption would not be correct. While it is true that the management allocation might be lower in a watershed with very stable soils, it would also be true that management activities (including operation of roads) would be expected to generate less sediment in such a watershed than similar activities on less stable soils. Thus, while the allocation for management-related sediment delivery would be lower on more stable land (all other factors equal), the amount of human activity associated with that level of sediment delivery may well be comparable. Please note, however, that while use of 125% neither discourages or encourages activity on stable watersheds relative to unstable watersheds, at the watershed level, the TMDL contains a water quality indicator (section 3.2) that encourages activities in unstable areas within a watershed to be avoided or eliminated.

Comment 7.6. "Where very little is given for management allocation, much of that can be eaten up by 'legacy,' old stuff from mining claims etc., much of which probably cannot be reduced."

Response 7.6. EPA disagrees that sediment from legacy activities cannot be reduced.

Comment 7.7. “A lot of folks on these creeks live in small houses on dirt roads. To achieve even a 40% reduction in sedimentation what kind of pressure will be put on these folks? Will the government fine folks for non-compliance who live on private dirt roads?”

Response 7.7. The State is responsible for developing effective and equitable implementation measures that will result in the attainment of the load allocations on a subarea basis, not necessarily by each individual landowner.

Comment 7.8. “A lot of these roads would have to be paved in order to achieve any major reduction, as they often go steeply up hill from the creek. Who would pay for paving them? What will happen to folks who can’t afford to do anything about their roads? This is, after all, one of the poorer counties in California. What will the need for reducing sediment allocations do in regard to the need for fuels reduction in residential areas, as these areas tend to be close to the creeks? Will it prevent owners from building on their property? What will it do to the few remaining jobs in timber harvest? The way this plan is set up, the impact on private property and on the people who live in the county will be entirely out of proportion to the benefits to be gained. For very small amounts of sediment load, economic activity could be brought to a standstill, while federal lands which do nearly nothing for the economy of the county, and even that nearly nothing is further reduced every year, are dumping truly significant amounts of sediment in the river as ‘background’ sediment.”

Response 7.8. The reduction in sediment loads from management activities is proportional to the degree to which management is impacting the resource in each subarea. There are techniques for reducing sediment from rural roads that do not involve paving (Weaver and Hagans 1994). Trinity County has an excellent track record of attracting funding to implement erosion control and fuel management projects on private and public land through entities such as the Trinity County Resource Conservation District. EPA encourages the commenter to remain involved in the State’s implementation planning process to address concerns about TMDL implementation on private lands.

Comment 7.9. “NEPA requires that economic effects must be taken into consideration. Recent court decisions have reinforced the concept that if the government reduces the value of property by regulations, the government must reimburse the property owners. These economic and political consequences must also be considered in any plan produced.”

Response 7.9. EPA’s action is not subject to NEPA nor do the TMDL regulations specifically require the consideration of economic effects. An essential feature of the TMDL is that is based on an assessment of what is necessary to meet water quality standards, independent of economic considerations. The appropriate point in the process for consideration of economic factors is in the development of implementation measures. EPA expects the State to devise effective and achievable implementation measures using a collaborative planning process with local property owners. EPA has identified TMDLs and Allocations for subareas within the Trinity River Basin at levels necessary to attain water quality objectives for sediment, according to the regulations.

Comment 7.10. “The endangered status of the coho, which was part of the underlying basis of the original suit, is now in question. Therefore, part of the reasons for the plan are also questionable. Even more questionable is the idea that small reductions in sediment are going to make any difference at all to significant quantities of fish. Yet generally small reductions would be the results of the largest percentage targets. The percentages may be in the 80's and 90's, but the sediment reduction would be very small compared to the amount of sediment reaching the river as permissible background rates. And for these relatively insignificant amounts, of questionable usefulness, the humans who inhabit the county will likely be penalized heavily."

Response 7.10. The recent court ruling regarding the coho salmon in Oregon (*Alsea Valley alliance v. Evans*) does not in any way affect the existing information regarding aquatic habitat and fish populations that EPA evaluated for the Trinity River TMDL assessment and therefore that ruling will have no effect on this TMDL. EPA believes that the "relatively insignificant amounts" of sediment reductions, described by the commenter, will actually have significant effects on the aquatic habitats within their respective subareas. EPA agrees that some of the subarea sediment reduction levels are small compared to sediment delivery rates in certain reference watersheds or the basin as a whole. However, the TMDLs are calculated on subarea basis and intended to meet the water quality objectives for each subarea. EPA encourages residents of Trinity County who are concerned about how the TMDL may affect them to participate in the State's development of implementation measures.

8. Sacramento Municipal Utility District. Letter dated November 19, 2001.

Comment 8.1. "... the text of the Draft sediment TMDLs for the Trinity River is focused - not on sediment loads or their reduction - but on the increase of releases from Trinity Reservoir (flows) that the Draft asserts are necessary to manage sediment in the mainstream, most of which is contributed by tributaries...the Draft is attempting to push TMDLs beyond their statutory limits for purposes of controlling matters that are outside EPA's statutory responsibility..."

Response 8.1. The focus of the TMDL is on sediment loads. EPA assessed the amount of sediment delivered to watercourses from various sources and locations (Chapter 4) then determined TMDLs and allocations for sediment (Chapter 5), expressed in terms of tons of sediment per square mile per year (t/mi2/yr). However, it is appropriate that EPA also consider flows as part of its analysis for this TMDL. Mainstem flows below Lewiston Dam have a significant effect on sediment conditions in the Upper Middle mainstem and therefore warrant consideration in the development of TMDLs. In addition, 40 CFR 130.7(c)(1) requires that, "Determinations of TMDLs shall take into account critical conditions for stream flow..." See also response 1.1.

Comment 8.2. The Secretary of the Interior has responsibility over allocation matters, with EPA's regulatory responsibility and authority being limited to pollutants and pollution added to the River. "Congress expressly withheld regulatory authority over water allocation and water rights from EPA (and as to the Trinity conferred it on the Secretary) and instead limited EPA's responsibility to control of pollution and pollutants added to water bodies."

Response 8.2. EPA acknowledges the role of the Department of Interior in ensuring adequate flow from the Trinity River, and also notes DOI's responsibility to comply with Clean Water Act requirements under CWA Section 313. The TMDLs and allocations being established for the Trinity River do not mandate specific flow regimes, nor do they mandate a reallocation of water. See also response 1.1.

Comment 8.3. "...the Trinity, like many rivers in California and elsewhere in the West, serves beneficial uses not just in its watershed but also in distant regions of California without substantial indigenous water supplies."

Response 8.3. The beneficial uses addressed by the TMDL are those that are listed for the Trinity in the Basin Plan (Table 2-1) not in distant regions of California.

Comment 8.4. Under the heading, “TMDLs are not intended to resolve all of the Nation’s water quality issues,” the commenter provided a summary of Clean Water Act programs including TMDLs. The commenter then stated, “...Section 319 of the Clean Water Act provides the states with a specific, detailed approach to the development and implementation of these management plans that accounts for the vastly greater technical and political complexity associated with ‘pollution’ control. The TMDL program, which focuses on ‘pollutants’ discharged into water, was not intended to deal with these complexities.”

Response 8.4. Implementation of the TMDL program is intended to result in the attainment of water quality standards.

Comment 8.5. “The Clean Water Act simply does not authorize the EPA, or the states, to take any and all actions perceived as desirable for water quality, even for the purpose of meeting water quality standards... Likewise, the Clean Water Act does not authorize the EPA, or the states, to reallocate water supply or other natural resources in order to change stream morphology for the purpose of improving habitat for aquatic species.”

Response 8.5. See response 1.1. EPA does not reallocate water supply in the TMDL. As noted in the Summary Response (1.1), moreover, the Supreme Court has specifically upheld actions under the Clean Water Act which may have incidental effects on water quantity.

Comment 8.6. “The TMDL program is specific, limited tools that contributes to achievement of water quality standards: The sole function of a TMDL is to limit the amount of a pollutant that is introduced into a water body from the outside world.” The commenter then provided a description of Section 303(d) of the CWA and TMDLs.

Response 8.6. EPA agrees that the TMDL program is intended to result in the achievement of water quality standards. The function of a TMDL is to establish the maximum amount of a pollutant that can be present in a water body and still achieve water quality standards.

Comment 8.7. “The Draft TMDL attempts to manage the location and transport of sediment in the River by establishing indicators and targets, and recommending management measures, that are not related to reducing the introduction of sediment in the River.”

Response 8.7. The indicators and targets are indeed related to reducing the introduction of sediment into the river because they are a reflection of what happens to sediment once it has entered a waterbody. If one only measured the introduction of sediment and not channel conditions, one would not know the effects of that sediment on beneficial uses. In addition, the recommended management measures in the draft TMDL are appropriate because they support the protection of beneficial uses and restoration of the river.

Comment 8.8. “For the most part, chapters 4, 5, 6 of the Draft TMDL generally conform to the Statutory and regulatory scheme for TMDLs.”

Response 8.8. Comment noted.

Comment 8.9. “...In Chapter 3, the Draft TMDL establishes indicators and targets for the river that depend on factors other than reduction in introduced sediment, including, among others, restoration of the alluvial channel, creation and maintenance of complex alternate bar sequences...Table 3-1 at p. 30...

this table and the accompanying text are explicit in their assumption that these indicators and targets require substantially increased flows if they are to be met."

Response 8.9. The indicators and targets are intended to, "...provide a useful reference in determining the effectiveness of the TMDL in attaining water quality standards... No single indicator adequately describes water quality related to sediment, so a suite of instream and watershed indicators is identified" (Chapter 3). The targets referenced in this comment are related to sediment input as well as flow. EPA believes it is appropriate to include sediment-related geomorphic indicators and targets for the Upper Middle mainstem, especially given the vast body of information used to develop those indicators. Although the TMDL does not allocate flow, it is entirely appropriate that the TMDL contain indicators that are useful in determining the effectiveness of the TMDL, whether or not those indicators have a relationship to flow.

Comment 8.10. "And, in Chapter 6, the Draft TMDL specifically recommends implementation of an increased flow regime for the purpose of managing the location and transport of sediment, even though the flow regime does not control the introduction of the pollutant sediment. Because the TMDL program is limited to managing the aggregate amount of sediment introduced to the Trinity River from the outside world, these latter aspects of the Draft TMDL exceed the authority provided in section 303(d) of the Clean Water Act and must be eliminated."

Response 8.10. Section 303(d) of the Clean Water Act does not limit EPA from making recommendations. There is a tremendous scientific foundation supporting the need for increased flows in order to improve fish habitat conditions, one component of which is sediment transport and storage. EPA is not allocating higher flows in the TMDL, merely recommending the implementation of actions which we believe will assist in the achievement of the beneficial uses of the Trinity River currently impaired in part by sediment. See also response 1.1.

Comment 8.11. "...most of the indicators for the Upper Middle Mainstem, and many of the basin-wide indicators, are focused on achievement of goals other than a reduction in sediment 'pollutant' loading. Indeed, as Table 3-1 indicates, the EPA expects that achievement of most if not all of the targets and indicators result not from a reduction in sediment loading, but instead on dramatic change to the current flow regime. ...Neither the TMDL program nor any other part of the Clean Water Act authorizes the EPA to engage in or recommend this type of resource reallocation."

Response 8.11. EPA only included the targets from the EIS that are closely associated with sediment. One of the water quality objectives identified in the basin plan that applies to the Trinity is based on "settleable material" defined as follows (and in Section 2.1 of the TMDL): "Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses." From the studies cited in the TMDL, EPA believes that deposition of material in the mainstem below the dams is adversely affecting beneficial uses. EPA also considers that most of the indicators in Table 3-1 are sufficiently associated with "deposition of material" that they are appropriate for inclusion as indicators of river health. In fact, most of these indicators and targets are described in terms of sediment-related characteristics (e.g., alternate bar sequences, channelbed particle size, channelbed surface, median bars, pool tails, spawning gravel deposits, etc.)

Comment 8.12. "...the Draft TMDL identifies three targets: (1) the creation of channel avulsions every ten years; (2) obtaining channel migration in alluvial reaches; and (3) maintaining channel geometry as the channel migrates. Id. These targets have virtually no relationship to sediment introduced to the River as a "pollutant:" The Draft TMDL even states that reduction in sediment loading will not accomplish the goal of channel migration."

Response 8.12. EPA disagrees that these three targets have "virtually no relationship to sediment introduced to the River as a 'pollutant:'" Sediment input does have an influence on channel avulsions, migration, and geometry. As an example, the mainstem channel directly below Lewiston dam, where sediment supply is virtually cut off, behaves differently than further downstream where sediment is contributed by the tributaries. Under the existing controlled flows, the uppermost mainstem channel is downcutting while, further downstream, the channel is aggrading. EPA acknowledges that flow is a critical factor in channel migration. However, it does not operate independent of sediment supply. Consequently, these channel conditions are appropriate TMDL indicators in conjunction with the suite of other instream and watershed indicators.

Comment 8.13. "EPA regulations also recognize that implementation plans for a TMDL must be limited to achieving reductions in pollutant loading. 65 Fed. Reg. 43586, 43626 (July 13, 2000) (stating that implementation plans must include 'a description of specific regulatory or voluntary actions, including management measures or controls ... that provide reasonable assurance that *load reductions* will be achieved, and the schedule by which these measures are expected to be implemented') (emphasis added)."

Response 8.13. EPA concurs that implementation plans must address load reductions. However, the regulation cited above (which has not gone into effect) does not preclude EPA from making recommendations to the State, Department of Interior, or other entities regarding implementation actions that are necessary to attain the beneficial uses currently impaired in part by the listed pollutant.

Comment 8.14. "...TMDLs control only the loading (introduction) of 'pollutants,' and the recommendations must be limited similarly." The commenter then described how flows are not considered a pollutant.

Response 8.14. EPA believes it is appropriate to include implementation recommendations in the TMDL report regarding actions that are necessary to attain the beneficial uses currently impaired in part by the listed pollutant. See also response 1.1.

Comment 8.15. "The primary reason why sediment is not suitable for TMDL calculation is because not all of the sediment present in waterbody qualifies as a 'pollutant,' and it is impossible to distinguish between 'pollutant' sediment and other sediment present in the River – a distinction that must be made in the context of the TMDL regulatory program that is limited, by statutory mandate, to 'pollutants.'"

Response 8.15. EPA considers sediment a pollutant for purposes of section 303(d), notwithstanding that some sediment in a water body may be natural. The Federal District Court for the Northern District of California has held that sediment is a pollutant suitable for TMDL calculation. See discussion in *Pronsolino v. Marcus*, 91 F. Supp. 2d 1337 (N.D. Cal. 2000)(appeal pending).

Comment 8.16. "The Draft TMDL improperly relies on the Record of Decision (ROD) issued by the Secretary of the Interior on December 19, 2000 in which the Secretary adopted recommendations for flow increases, habitat management, and other measures contained in the U.S. Fish and Wildlife Service's Mainstem Fishery Restoration Environmental Impact Statement/Environmental Impact Report (1999)....The Draft TMDL cannot rely on the ROD flows because in March 2001, a federal district court enjoined implementation of the ROD with respect to any flows above the 369,000 acre-feet per year....the Trinity River TMDLs must be based on existing flows, not on those which the Secretary may - or may not - adopt in the future.

Response 8.16. The calculation of the loading capacity (TMDL) and allocations (Section 5.2) are based on the sediment delivery rates expressed as a percent of background. This approach is based on conditions in reference watersheds and is independent of any particular flow rate. See also response 1.1.

Comment 8.17. "The Draft TMDL does not account for natural variation in sediment loading...The Draft TMDL fails to explain why, given these factors, a ten-year rolling average is appropriate."

Response 8.17. EPA believes that a ten year rolling average is appropriate because it is a substantial period of time over which natural variation can be averaged, and yet it is not so long that it would be difficult to assess the effectiveness of the TMDL.

Comment 8.18. "The Draft TMDL establishes appropriate sediment loading at 125% of background sediment, stating only – without citation – that the approach has been used successfully elsewhere. Ud, at 57-58. Estimates of background sediment delivery rates from reference subwatersheds vary by an order of magnitude which provides a poor basis for extrapolation unless the variance can be explained, and then appropriately applied to other similar watersheds."

Response 8.18. The commenter is correct that EPA based the estimate of loading capacity for the various subareas using a reference watershed approach. EPA compiled information related to aquatic habitat conditions and compared this to information on sediment yield and watershed disturbance. The information for the reference streams is summarized in Table 5-1 of the TMDL. Upon examination of this information, EPA concluded that there was a much better correlation between aquatic habitat condition and sediment yield expressed as a percent of background, than between aquatic habitat condition and sediment yield expressed directly as a rate (in tons/mi2/yr). As described in the TMDL, EPA concluded that 125% of background was the appropriate way to estimate the loading capacity of a subarea, rather than extrapolating the loading rate for a reference watershed. EPA has used 125% of background to estimate the loading capacity in other TMDLs, although the basis was somewhat different than in the Trinity. EPA first estimated the loading capacity as 125% of background in the South Fork Eel sediment TMDL, where the use of 125% was supported by information for the Noyo River which showed that salmonid populations were relatively high during a period when sediment delivery was about 125% of background. EPA has also used 125% of background in the Ten Mile and Navarro River sediment TMDLs, and in the recently proposed TMDLs for the Big and Gualala Rivers.

Comment 8.19. "No reference watersheds were identified for the Upper Middle area which is that portion of the Trinity River below Lewiston Dam. Id. at 56-57. The Draft TMDL provides no basis for the conclusion that the geology is similar to portions of the Upper and Lower Middle areas..."

Response 8.19. In Section 5.1, EPA has added a reference to the geologic map and information by GMA (2001b) which illustrates how the geology in the Upper Middle Area is similar to the Upper Area (e.g., Granitic and Ultramafic Rocks) and Lower Middle Area (e.g., North Fork Terrane, Central Metamorphic Subprovince and Hayfork Terrane).

Comment 8.20. "To comply with section 303(d), the Draft TMDL must (1) calculate and analyze success of the TMDL reductions in sediment loading according to existing flows; (2) remove all indicators and targets that are not primarily related to reductions in sediment loading; and (3) remove all references to the flow regime of the December 2000 ROD, with the exception of the discussion regarding the uncertainties as the level of future flows."

Response 8.20. See response 1.1.

9. San Luis and Delta-Mendota Water Authority and Westlands Water District, Letter dated November 19, 2001.

Comment 9.1. "The EPA should also be aware that the Secretary failed to adequately consider and address the environmental and other impacts of the lost water and power supply that the ROD would cause...A federal district court has ruled that the Authority and Westlands will likely prevail on their claims that the ROD was adopted in violation of the National Environmental Policy Act...The proposed TMDL should not, as it does, assume that the same flow regime as is set forth in the existing ROD will be readopted without change."

Response 9.1. See response 1.1.

Comment 9.2. "A TMDL that results in reductions of discharges of fine sediment to the Trinity River is therefore appropriate and salutary."

Response 9.2. Comment noted.

Comment 9.3. "Regrettably, however, the proposed TMDL goes far beyond the scope of EPA's authority to regulate discharges of pollutants under the Clean Water Act to establish a TMDL. It seeks ultimately to compel implementation of the entire ROD, including the flow-related portions that were illegally adopted by the Secretary, and which are now undergoing supplemental environmental review. EPA should amend the proposed TMDL to eliminate these provisions, and clarify that changes to the flow regime are not and cannot be mandated pursuant to the proposed TMDL."

Response 9.3. EPA is establishing TMDLs for the Trinity River for sediment, the pollutant for which the Trinity River is listed in accordance with Section 303(d) of the Clean Water Act. See also response 1.1.

Comment 9.4. The commenter provided definitions of TMDLs then stated, "In sum, the proposed TMDL, and the measures recommended to implement it, should be addressed to discharges of sediment into the Trinity River....as drafted the proposed TMDL attempts to reach beyond limiting sediment discharges to require other actions to improve fish habitat. To this extent, it is contrary to law."

Response 9.4. See response 1.1.

Comment 9.5. "The fundamental defect of the proposed TMDL is that it exceeds the defined scope of TMDLs authorized by the Clean Water Act. It is not limited, as it must be, to determining the allowable level of discharges of sediment to the Trinity River. Instead, it seeks to dictate habitat conditions not achievable by reductions in sediment discharge...."

Response 9.5. The TMDL and allocations (Chapter 5) are expressed in terms of allowable levels of sediment discharge (tons/mi2/yr). See also response 1.1.

Comment 9.6. "The proposed TMDL states that the indicators are to be used to assist in determining 'if, in fact, the TMDL is successful in attaining water quality standards.'...A number of the indicators selected in the proposed TMDL, however, are not measures of the impact of discharges of sediment to the Trinity River....Thus, the proposed TMDL establishes some “indicators” that have no nexus to the pollutant discharge that is supposed to be the subject of the proposed TMDL.”

Response 9.6. All the indicators included in this TMDL have a “nexus” to sediment and thus are appropriate indicators of the success of the TMDL. See also responses 8.12 and 1.1.

Comments 9.7. “Whatever the merits of the ‘healthy alluvial river’ approach to restoration of fish in the Trinity River, which we will not address here, it is not an appropriate indicator for a sediment TMDL. These ‘attributes’ were not designed as a measure of the impact of ongoing discharges of sediment to the Trinity River as part of a TMDL. Instead, the ROD measures were developed under a different regulatory process, for a different and broader purpose.”

Response 9.7. EPA only included the geomorphic indicators from the EIS that are closely associated with sediment. One of the water quality objectives identified in the basin plan that applies to the Trinity is based on “settleable material” defined as follows (and in Section 2.1 of the TMDL): “Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.” From the studies cited in the TMDL, EPA believes that deposition of material in the mainstem below the dams is adversely affecting beneficial uses. EPA also considers that most of the indicators in Table 3-1 are sufficiently associated with “deposition of material” that they are appropriate for inclusion as indicators of river health. In fact, most of these indicators and targets are described in terms of sediment-related characteristics (e.g., alternate bar sequences, channelbed particle size, channelbed surface, median bars, pool tails, spawning gravel deposits, etc.). It is appropriate, therefore, to incorporate these sediment-related attributes into the TMDL, regardless of the regulatory process through which they were developed.

Comment 9.8. “EPA should revise the proposed TMDL to eliminate ‘indicators’ that would require increased flows in order to be achieved. Instead, EPA should include only indicators that measure future discharges of sediment to the Trinity River, and the impact of such discharges on water quality. As described below, EPA should conservatively estimate allowable sediment discharges or ‘loading’ by assuming that the existing flow regime will continue.”

Response 9.8. EPA believes the upper middle mainstem geomorphic indicators are, in part, measures of sediment discharges and expressions of the cold freshwater habitat beneficial uses and therefore are appropriate TMDL indicators. EPA does not believe that sediment reductions beyond those necessary to achieve the allocations in the TMDL under existing flow conditions would result in the attainment of cold freshwater habitat beneficial uses in the mainstem below the dams. As stated in the Critical Conditions (Section 5.4) of the TMDL, the peak flows called for in the ROD are critical to support several river functions including mobilizing channelbed particles, scouring of pools, creating point bars and connecting the mainstem to the floodplain. These are functions that the TMDL sediment allocations cannot achieve alone. Therefore, EPA recommends that the Department of Interior implement the science-based flow regime called for in the ROD to enhance the effectiveness of the TMDL and result in the protection of beneficial uses below the dam. See also response 1.1.

Comment 9.9. “...the flow regime in the ROD is not directed at what the TMDL is supposed to address - the load of discharges of sediment to the Trinity River.”

Response 9.9. The goals of both the ROD and TMDL are related to the achievement of healthy river habitat conditions and are therefore similar and compatible. Moreover, the Department of the Interior has a responsibility to comply with Clean Water Act requirements in accordance with CWA Section

313. See also response 1.1.

Comment 9.10. "The proposed TMDL adopts the wrong approach to factoring flows in the Trinity River into its analysis. Changes in flows cannot be mandated pursuant to section 303(d) of the Clean Water Act." The commenter goes on to describe how flows are to be considered based on the final TMDL regulations, published in the Federal Register on July 13, 2000, at 65 FR 43586...EPA should calculate and allocate the total sediment load 'in light of' the existing flow regime, and develop the TMDL based on the existing flow regime. It should not - and cannot legally - simply assume implementation of the flow regime contained in the ROD. Nor may it legitimately recommend implementation of the ROD flows as 'necessary' to 'implementation' of a TMDL."

Response 9.10. EPA did not base the calculation of the loading capacity (TMDL) and allocations on any particular flow regime, nor does the TMDL in any way allocate flow or require a specific flow regime. See also response 1.1.

Comment 9.11. "... The way to meet this mandate of conservatism is to base the TMDL on the flows currently mandated by law, in section 3406(b)(23) of the Central Valley Project Improvement Act. That provision requires the release of 340,000 acre feet per year to the Trinity River from the Trinity Reservoir Division. That amount, plus tributary inflow from the below the dam, should form the basis for calculation of the total pollutant load."

Response 9.11. The CVPIA did not specify a level of flow for the Trinity River. Rather, it established a minimum flow, along with a process for the Department of Interior, in consultation with the Hoopa Valley Tribe, to further evaluate Trinity River flow needs. The numerous years of flow evaluation studies clearly support the need for increased flows, along with sediment reduction from the tributaries, in order support cold freshwater habitat conditions in the mainstem below the dams. The calculation of the loading capacity (TMDL) and allocations (Section 5.2) is based on the sediment delivery rates expressed as a percent of background. This approach is based on conditions in reference watersheds, and is independent of any particular flow rate.

Comment 9.12. Commenter suggests that these TMDLs are inconsistent with provisions of the Central Valley Project Improvement Act (CVPIA), specifically those provisions discussing flows on the Trinity River.

Response 9.12. EPA disagrees with commenter for several reasons. First, EPA's TMDL is not predicated on the existence of any particular flow regime. Nor did the CVPIA specify a level of flow for the Trinity River. Rather, it established a minimum flow, along with a process for the Department of Interior, in consultation with the Hoopa Valley Tribe, to further evaluate Trinity River flow needs. Both the CVPIA and the previous 1984 statute establishing a process for determining Bureau of Reclamation operations on the Trinity River are silent as to the Clean Water Act. In other words, there has been no explicit Congressional decision to subordinate the requirements of the Clean Water Act to the CVPIA. EPA recognizes that the Department of the Interior is preparing a supplemental environmental impact statement with regard to its Trinity River record of decision, and can be expected to take further action to set minimum flows. Also, EPA expects the State to take actions to implement these TMDLs. These decisions will require an evaluation of the potential interplay of the CVPIA, Section 303 and Section 313 of the CWA, California's own water laws, and the standards for preemption articulated by the U.S. Supreme Court in *California v. U.S.*, 438 U.S. 645 (1978) and related cases, to ensure that the measures implementing the CVPIA and measures implementing these TMDLs are compatible.

Comment 9.13. “The EPA has no authority to mandate that the State of California develop or carry out any particular implementation measure. Pronsolino v. Marcus, 91 F.Supp.2d 1337, 1354 (N.D.Cal. 2000).” The commenter then describes EPA guidance regarding the development of implementation plans. “If EPA adopts the proposed TMDL, and then seeks to coerce the State of California to adopt measures to ‘implement’ such portions of the proposed TMDL, it will be acting in excess of its authority and contrary to law.”

Response 9.13. EPA is not mandating any particular implementation measures.

Comment 9.14. “... EPA should revise the proposed TMDL by deleting the recommendation that the ROD flow regime be implemented. EPA should address ‘low flows’ by calculating the TMDL based on the existing flow regime, and should not assume that the ROD flow regime will be implemented. EPA should expressly disavow any intention to require that the Trinity River flow regime be altered to satisfy the TMDL for sediment in the Trinity River.”

Response 9.14. See response 1.1.

Comment 9.15. “Page iii, second paragraph on page: ‘Up to 90% of water flowing into Lewiston exported to Sacramento River.’ This statement is very misleading...In fact, diversions have been as low as 37%.”

Response 9.15. EPA has changed this statement to, “Significant water exports from the Trinity to the Sacramento River since early 1960's.”

Comment 9.16. “Page iii, Summary, Loading Capacity: ‘Based on sediment delivery rates in reference watersheds.’ The USFWS has continually indicated that the conditions of the Upper Trinity River are unique and cannot be compared to any other streams. If this is the case, it is not appropriate to use data from ‘reference watersheds,’ especially since much of that information was obtained during a critically dry water year.”

Response 9.16. The mainstem condition in Upper Middle Area of the Trinity is certainly unique for several reasons including the influence of the dams on the flow. However, the geology in the Upper Middle area is similar to the Upper area (Eastern Klamath Province and Weaverville Formation) and Lower Middle area geolgoy (North Fork Terrane, Hayfork Terrane). The Central Metamorphic Subprovince geologic formation occurs throughout all three assessment areas. Therefore, as a basis for determining appropriate sediment delivery rates, it is appropriate to apply reference watershed data to the tributary watershed area in the Upper Middle Assessment Area. To account for the uniqueness of the upper middle mainstem, the TMDL contains geomorphic indicators tailored specifically to the mainstem conditions.

Comment 9.17. “...it was noted that some of the data used in determining sediment budgets was ‘synthetic’ since only limited real data were available and much of the information was gathered in only one year - a critically dry year. These data had to be modified or extrapolated to fit wet years, dry years and average years over a period of time. The analysis therefore appears to rely considerably upon ‘professional judgement’ rather than actual conditions.”

Response 9.17. The TMDL relies upon best available information which incorporates data regarding actual conditions where such data exist.

Comment 9.18. “The ‘reference watersheds’ have a much higher background or ‘natural’ sediment rate than do the streams of concern. EPA should explain why, given this difference, it is appropriate to rely upon the ‘reference watersheds’ to develop loading capacity.

Response 9.18. EPA compiled information related to aquatic habitat conditions and compared this to information on sediment yield and watershed disturbance. The information for the reference streams is summarized in Table 5-1 of the TMDL. Upon examination of this information, EPA concluded that there was a much better correlation between aquatic habitat condition and sediment yield expressed as a percent of background, than between aquatic habitat condition and sediment yield expressed directly as a rate (in tons/mi2/yr). As described in the TMDL, EPA concluded that 125% of background was the appropriate way to estimate the loading capacity of a subarea, rather than extrapolating the loading rate for a reference watershed. EPA has used 125% of background to estimate the loading capacity in other TMDLs, although the basis was somewhat different than in the Trinity. EPA first estimated the loading capacity as 125% of background in the South Fork Eel sediment TMDL, where the use of 125% was supported by information for the Noyo River which showed that salmonid populations were relatively high during a period when sediment delivery was about 125% of background. EPA has also used 125% of background in the Ten Mile and Navarro River sediment TMDLs, and in the recently proposed TMDLs for the Albion and Gualala Rivers. See also response 7.1.

Comment 9.19. “The ROD was adopted illegally. The Department of the Interior is reassessing the impacts of the flow regime proposed in the ROD. That flow regime may change. The TMDL should not assume that the flow regime in the ROD will, in fact, be implemented.”

Response 9.19. It is appropriate for EPA to recommend to the Department of Interior the flow regime called for in ROD that, according to the best available information, is necessary to support beneficial uses in the mainstem Trinity River below the dams. See also Response 1.1.

<u>10. Sierra Pacific Industries (SPI). Letter dated November 19, 2001</u>

Comment 10.1. “...I found it difficult to obtain copies of the information sources listed in Section 1.2....the lack of availablity of these source is a severe impairment (pun intended) of our ability to critically review the draft TMDL.”

Response 10.1. EPA similarly had difficulty obtaining copies of all the relevant information that exists from different sources and in different locations. Please contact EPA if you still would like copies of specific documents.

Comment 10.2. “...I believe that the EPA has not correctly identified the major impairment to the salmonid fisheries. That impairment is clearly the 2 dams on the river at Lewiston...the construction and management of these dams has removed more than 50% of the highest quality habitat for these fisheries while reducing the quality of the remaining habitat. This level of impairment deserves a place at the head of the list when discussing ‘sources of impairment’.”

Response 10.2. When using the term “sources of impairment” in the TMDL context, EPA is referring to the sources of the pollutant for which the waterbody is listed, in this case sediment. EPA recognizes the impact of the dams on loss of fish habitat and quality of remaining habitat in Section 2.2 and 2.4, respectively, in the TMDL document.

Comment 10.3. "...when discussing what has caused the anadromous salmonid beneficial use to become impaired, the effects of the dams and their ongoing management is ignored..."

Response 10.3. EPA summarized and referenced the effects of the dams, combined with sediment inputs from the tributaries, to the mainstem below the dams in Section 2.4. under Habitat Conditions in Upper Middle Assessment.

Comment 10.4. "...it is abundantly clear that recreational beneficial use in the Trinity River system is more diverse and more heavily used than at any time in the past. However, there is no statement regarding the status of this beneficial use. I believe that the EPA should clearly state that this beneficial use is not impaired."

Response 10.4. The TMDL briefly describes the recreational beneficial uses on the Trinity River and the reservoirs in Section 2.1. As stated in the section, sediment can impact several of these uses, such as recreational fishing in both the river and reservoirs. Rather than make a specific determination as to whether the recreational beneficial uses are impaired, EPA made determinations that the fisheries-related beneficial uses are impaired and that they are the beneficial uses that are most sensitive to sediment impacts. Thus, EPA concludes that any impairment of recreational uses caused by excessive sediment will be addressed by attainment of the loading capacity determined by consideration of fisheries-related beneficial uses.

Comment 10.5. "...the discussion seems to focus, incorrectly, on only 'native anadromous fish populations' and basically ignores hatchery and introduced fish...hatchery and introduced salmon and steelhead (and other species) are just as much a beneficial use as are 'native' species."

Response 10.5. One reason to focus attention on native anadromous fish populations and their habitat is because the Basin Plan includes a beneficial use (applicable to the Trinity River) for Spawning, Reproduction, and/or Early Development (SPWN) defined as: "Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish." Naturally spawned fish need high quality aquatic habitat suitable for reproduction and early development compared with hatchery fish that are raised under artificial conditions. Relatively low numbers of naturally spawned anadromous fish, compared to hatchery produced fish, are an indicator that the SPWN beneficial use is impaired.

Comment 10.6. "It appears that the EPA has assumed that the goals under the Trinity River Restoration Program (TRRP) and the Federal Endangered Species Act (ESA) are synonymous with beneficial uses, which they are not. These TRRP and ESA goals relate to an important sub-set of the overall cold water fish beneficial use. Discussions and resolutions of the impairment of the cold water beneficial use must include all cold water fisheries, not just a subset....hatchery fish must be part of the overall goal for resolution, not just 'native' or 'naturally spawned' fish... there should be no difference regarding hatchery and non-hatchery salmonid production in terms of TMDL objectives."

Response 10.6. The beneficial uses of concern in this TMDL are focussed on supporting cold water ecosystems, the preservation or enhancement of aquatic habitats, and high quality habitats suitable for reproduction, early development and migration of aquatic organisms (described in Section 2.1 of the TMDL and defined in the Water Quality Control Plan for the North Coast Region "Basin Plan"). EPA believes it is appropriate to focus particular attention on the status of native fish populations since they are more dependent on high quality aquatic habitat necessary to support all life stages (particularly reproduction and early development) compared to hatchery populations that are spawned and raised artificially. EPA believes the goal of the TMDL, to attain water quality standards for sediment, is compatible with the fish restoration goals of the TRRP and ESA.

Comment 10.7. "The TRRP goal of 62,200 fall chinook reflect a level of returning spawners greater than was documented prior to dam construction...Instead, something close to 45,000 should be the TMDL target."

Response 10.7. EPA referenced the TRRP goal for purposes of characterizing existing conditions in the watershed, not as a TMDL target. The average inriver escapement of naturally produced fish (11,932 from 1982 to 2000) is still well below the 45,000 level identified by the commenter.

Comment 10.8. "When counting hatchery and non-hatchery adult chinook spawners, the minimum average estimate is about 32,000 from 1982 through 2000. This suggests a reduction of about 13,000 or 30%. This potential reduction is best explained by changes in ocean conditions....When considering coho, current adult returns are well above historic estimates. Having averaged about 6,800 spawners from 1991 to 1999, this exceeds the TRRP goal by about 5 times and is well above the 5000 estimated to exist prior to dam construction. There is no basis to state that the beneficial use of coho salmon is impaired beyond that caused by construction and management of the dams."

Response 10.8. There is a tremendous amount of existing information indicating that sediment-related habitat conditions in the mainstem and certain tributaries below the dams are impaired, as described in Chapters 2 and 3 of the TMDL. Construction and management of the dams appears to be a significant factor for the mainstem. However, habitat conditions in certain tributaries with high ratios of management-related sediment production, not influenced by the dams, are also impaired and warrant sediment reduction as called for in the TMDL. See also response 10.5.

Comment 10.9. "The draft TMDL notes that hatchery fish dominate the adult returns, and asserts that this is evidence of impairment. However, this is most likely due to the loss of the best spawning and rearing habitat by construction of the dams. The remaining habitat is 'naturally' lower quality spawning and rearing habitat as these species utilize the upper portions of streams much more than mid- and lower portions (Meehan 1991)..."

Response 10.9. EPA agrees that construction of the dams blocked access to considerable spawning and rearing habitat. However, an abundance of scientific information suggests that the aquatic habitat below the dams is impaired (summarized in Section 2.4) and will improve in response sediment reduction from tributaries as called for in the TMDL.

Comment 10.10. "...Large sized outmigrants are known to have a much higher survival rate than smaller fish. This is the basis for construction of the hatchery and its management: to replace the lost production above the dam, and to increase survival rates by releasing large smolts and yearlings. The ratio of hatchery to non-hatchery returns is evident that this is working."

Response 10.10. High returns of hatchery fish does not constitute evidence that the beneficial use (high quality aquatic habitat) is being attained. It may be an indicator that other factors (ocean conditions, predation, etc.) may not be limiting production. Whereas, a long-term sustainable level of naturally produced anadromous fish, in conjunction with sediment-related habitat information, would provide a strong indication that the beneficial uses for cold water habitat, spawning, rearing and early development of fish are being attained.

Comment 10.11. "These numbers and information suggest, beyond that caused by the construction of the dams and their subsequent management, reductions in anadromous salmonids in the Trinity system are not at a level to be addressed as having ‘changed dramatically’. The statements regarding coho salmon having been reduced since the 1940's simply are not supported by this information.”

Response 10.11. EPA does not agree with the approach taken by the commenter to combine hatchery with non-hatchery fish in order to determine changes in fish abundance. In addition, the fact that the dams severely impacted fish populations, does not eliminate the need to address other limiting factors, such as sediment.

Comment 10.12. “Habitat typing and biological inventories conducted in these tributaries in 1989 and 1990 documented coho juveniles in Brown’s Creek, Indian Creek, Reading Creek, Deadwood Creek, Weaver Creek, and Rush Creek (Parkinson et al. 1990, 1991; Moore 1990; Frink and Cook 1990. These tributaries are well used by coho for spawning and rearing. Steelhead and chinook were also found in these tributaries.”

Response 10.12. EPA has clarified the second paragraph of Section 2.2 regarding coho utilization of the upper middle tributaries as of 1990. This information does not change the TMDLs and Load Allocations called for in Chapter 5.

Comment 10.13. “We find it interesting that the ‘reference streams’ available to coho are essentially not used by coho, or they are present only at low levels. The North Fork of the Trinity River may be an exception here. However, the point still stands.”

Response 10.13. There are several potential explanations for the degree to which coho salmon are using certain tributaries and/or mainstem reaches as opposed to others such as natural stream gradients, amount of cover, competition, proximity to hatchery, etc. EPA did not base the identification of reference streams solely on limited population data for a single species. Rather, EPA evaluated a variety of physical aquatic habitat and watershed indicators along with biological data where available.

Comment 10.14. “We hope that EPA has access to this information [outmigrant data for Horse Linto Creek] and can utilize it in terms of an instream goal..”

Response 10.14. EPA recommends continued downstream migrant trapping in strategic locations (such as Horse Linto Creek), as well as spawner escapement, to evaluate the long-term fish productivity in the watershed (Chapter 6). However, at this time, there is insufficient information from which to develop a quantitative TMDL target. Based on additional monitoring, an outmigrant indicator and target could be added to the TMDL in the future.

Comment 10.15. “The information from Appendix A [information provided with the comment letter] regarding the currently well recognized effects of ocean condition changes on returning adult salmon, the relatively small reduction in fall chinook, coupled with the increase in coho salmon documented to have occurrred in the Trinity River are not strong evidence of a dramatically impaired beneficial use. If there is an impairment, the most likely cause, other than dam construction and management, is the documented changes in ocean conditions.”

Response 10.15. EPA acknowledges that several factors, including ocean conditions, influence anadromous fish populations. However, the best available information also suggests that freshwater habitat conditions in the Trinity are impaired with regard to sediment and require sediment reduction as called for in the TMDL.

Comment 10.16. "The draft TMDL states that DFG habitat information indicates that coho tend to be found in streams that have as much as 40% of their total habitat in primary pools. This is an incorrect interpretation. The DFG habitat typing protocol (Flosi et al. 1998) interprets 40% or more pool habitat in a stream to be an indicator of good to excellent coho habitat. Pools comprised 35%, 29% and 13% of total habitat in Brown's Creek, Reading Creek and Deadwood Creek, respectively (Parkinson et al. 1990, 1991; Moore 1990; Frink and Cook 1990). ... All of these Creeks are known to support coho spawning and rearing..."

Response 10.16. EPA interprets the information submitted by the commenter as an indicator that pool habitat is not good (<40%) in the streams identified in the comment. Although coho may be present in the streams cited, an improvement in habitat conditions, in part based on sediment reduction, should correspondingly support increased coho abundance.

Comment 10.17. The commenter identified several sediment impairments in the Upper Middle Assessment Area mainstem that are "dam caused" then discussed the effects of eliminating the large peak flows due to the dam. "The combination of loss of peak flows and summer flow variation has damaged salmonid habitats far more than any other factor in the Trinity River. I do not believe these facts to be under dispute. If the mainstem is impaired, it is due to the dams and their subsequent management. This should be the focus of this TMDL."

Response 10.17. The focus of this TMDL is on sediment because that is the pollutant for which the waterbody is listed under Section 303(d) of the Clean Water Act. The best available information suggest that freshwater habitat conditions in the Trinity are impaired with regard to sediment and require sediment reduction as called for in the TMDL. Additionally, EPA summarized and referenced the effects of the dams on flow in relation to sediment under Habitat Conditions (Section 2.4), Sediment Budget (Section 4.3), Critical Conditions (Section 5.4) and Implementation Recommendations (Chapter 6) in the TMDL. EPA believes this level of consideration for flow is appropriate in the context of a sediment TMDL. See also response 1.1.

Comment 10.18. "...over the last 20 years, as measured on a per mile basis, most of the sediment in the Trinity river has come from 'reference streams'....On average, the 'non-reference streams' produce about 1547 tons/mi2/year ... This is about 7 percent less than the 'reference streams' produce. Given this, if sediment reduction is necessary, it should be focused on the 'reference streams' and the 5 'non-reference' sub-areas (Upper Trinity, Grass Valley Creek, Indian Creek, Canyon Creek, Campbell/Supply Creeks)."

Response 10.18. The commenter is correct that EPA is estimating that some reference watersheds have higher sediment delivery rates than some non-reference watersheds. However, we also found that those reference watersheds had relatively high natural sediment delivery rates. Upon examination of the reference stream information, EPA concluded that there was a much better correlation between aquatic habitat condition and sediment yield expressed as a percent of background, than between aquatic habitat condition and sediment yield expressed directly as a rate. As described in the TMDL, EPA concluded that 125% of background was the appropriate way to estimate the loading capacity of a subarea, rather than directly utilizing the loading rate for a reference watershed. Thus, rather than emphasizing sediment reduction where sediment delivery is highest in absolute terms, EPA is emphasizing sediment reduction where sediment delivery is high relative to the natural sediment delivery rate for that area. See also response 7.1.

Comment 10.19. "...these measured [permeability] rates are within the range of acceptable rates as shown in the literature. Rates of 50 cm/hr appear adequate to support acceptable egg-to-emergent survival rates (Fig 4.10, pag. 100, Meehan 1991). In addition, salmon typically remove 40-60% of fine sediment within gravels through redd construction (Chapman 1988; Regnart 1991)."

Response 10.19. The rates referenced by the commenter are measured in terms of mean apparent velocity ("volume of water passing through a given area of redd per unit of time") as opposed to permeability ("ability of particles in the redd to transmit water per unit of time") (Meehan 1991). McBain and Trush (2000) explain that permeability, as opposed to apparent velocity, is a more efficient measure of conditions affecting embryonic survival. Chapman (1988) presents survival to emergence of coho salmon in natural redds and of chinook in laboratory gravel mixes in relation to gravel permeability. Based on this analysis, a permeability measure of 50 cm/hr is essentially zero percent survival.

Comment 10.20. "...in the Garcia River final TMDL, EPA notes that the percent fines in upper Redwood Creek in 1994 was measured at 32.2%<0.85mm, and 57.9%<6.5mm. Outmigrant trapping in upper Redwood Creek in 2000 and 2001, coupled with redd counts, has documented an egg-to-downstream migrant survival rate of about 85% (Sparkman 2001). This survival rate is near the top of the scale and strongly supports the ability of salmon to 'cleanse the gravels.'..."

Response 10.20. EPA finds it difficult to correlate fine sediment data collected in 1994 with outmigrant trapping and redd counts data collected in 2000 and 2001, due to high annual variability in both data sets. EPA acknowledges that adult fish alter gravel particle size distribution during the process of redd construction.

Comment 10.21. "...EPA endorses the development of specific hypotheses to be used as indicators and targets for the middle mainstem reach of the Trinity River. Hypotheses are developed to be tested, not to be used as targets or indicators. This is a wholly inappropriate use of the scientific method and should be removed from the TMDL document."

Response 10.21. EPA will change the statement regarding hypotheses in Section 3.1 as follows, "EPA endorses the testing of specific hypotheses through the AEAM process; the results of which can serve to refine the indicators and targets for the middle mainstem reach of the Trinity River, during future iterations of the TMDL."

Comment 10.22. "Targets relating to fine sediment, embeddedness, etc. should account for salmon's ability to remove fine sediment during redd construction (Chapman 1988)."

Response 10.22. EPA is aware of the phenomenon of gravel cleaning, however, we do not conclude that this negates the legitimacy of using fine sediment indicators. EPA notes that even if salmonids clean gravel prior to spawning, subsequent deposition of fine sediments during the egg growth period prior to emergence may adversely affect survival (see Kondolf, et al., 1993.)

Comment 10.23. "The section on Legacy and Mining Erosion ignores the significant ongoing contribution of historic terrace mining in EF Trinity River and Indian Creek. These are tremendous, well recognized past, present and future sediment sources within the Trinity River System."

Response 10.23. EPA evaluated legacy sources of erosion to the extent possible given the constraints of availability of existing information, time and resources. It is difficult to accurately determine sediment delivery from historic terrace mining.

Comment 10.24. "...the load allocations and overall TMDL should focus on the major sources of sediment impairment in the Trinity river system. These clearly are the lack of snow hydrograph peak flows, summer low flow variation, Hoopa Reservation, New River, Eagle Creek, Coffee Creek and Canyon Creek...Ignoring these sources dooms any other sediment source management reductions to abysmal failure."

Response 10.24. EPA is not ignoring these issues and sources. The Hoopa Valley Tribe, while not subject to this TMDL, is developing a Water Quality Plan in accordance with all the requirements of the Clean Water Act, including the development of TMDLs and implementation programs to control sediment and other pollutants. The TMDL calls for the following reductions of management-related sediment in the areas identified by the commenter: Eagle Creek in Upper Trinity Subarea - 46%; Coffee Creek in the Upper Reference Subarea - 25%; and Canyon Creek - 87%. The sediment source analysis determined that the New River has a very low management-related sediment delivery rate compared to non-management and therefore no further reductions are feasible or called for in the TMDL.

Comment 10.25. The commenter submitted the following reports (Appendix C): 1) Memo to Tom Walz from Doug Baker (B&H Development) regarding slumps located on SPI property in Indian Creek; 2) Slide Stability, Erosion Prevention, Sediment Control Plan - Coal Pan Slide Trinity County prepared by SHN for SPI; 3) Memorandum for Department of Mines and Geology to Craig Anthony (CDF) regarding Engineering Geologic Review of THP 2-92-266 TRI(4). The commenter then stated, "These reports [Appendix C] contest the assignment in the draft TMDL of several slides to 'management caused' as opposed to 'background'. These reports will also aid the EPA in validating the work by Matthews and Associates, in terms of volumes of sediment and causes. We suspect that many slides were inappropriately assigned to 'management caused' when in fact they were 'naturally caused' or 'background sources'."

Response 10.25. Before responding to each report identified in the comment, EPA would first like to make an overall point regarding the availability of information on SPI land. In January, 2001, EPA requested SPI's permission to access their land in order to field verify the size and causal mechanisms of certain landslides that were identified via aerial photo analysis. SPI denied that request. In March, EPA sent a letter to SPI requesting any sediment-related information such as landslide mapping, in order to maximize the accuracy of the assessment. SPI did not provide any information until they submitted the three landslide reports at the end of the public comment period. If EPA had received the information earlier and had access to field verify the slides, the reports submitted by SPI could have been more useful in determining causal mechanisms. As it stands, EPA requested reviews by geologists from the California Department of Mines and Geology and the Regional Water Quality Control Board of the information provided by SPI. Based on this input, EPA has made the following assessment of the three reports in the order in which they were presented.

1) The B&H Development report does not illustrate the location or distribution of the slides very well nor is it helpful in answering the questions of natural versus anthropogenic causes of the landslides. "...it is quite possible that the timber harvesting activities carried out in Section 21 could have influenced the degree to which mass movement took place or even triggered some sliding that would not have otherwise occurred. Unfortunately, the B&H Development report does not address the manner in which or degree to which the recent or preexisting timber harvest operations, such as silvicultural prescription, yarding method, and alignment, design, and drainage of existing and recently built roads, might have affected on-going or potential landslide activity. Consequently, the degree to which timber-harvesting operations or other anthropogenic activities may have affected the rates of landsliding cannot be determined from the subject document" (Michael Wopat, CDMG, personal communication, 12/12/01). CDMG also notes that the B&H Development report does not appear to have been prepared by a registered geologist. California law requires any geologist providing consulting services in California to

be registered by the State of California. Based largely on CDMG's review, EPA is sticking with GMA's original determination that the slides are related to management activity.

2) With regard to the SHN report on the Coal Pan Slide, the North Coast Regional Water Quality Control Board reported in a memo dated March 1, 2001, that the "proximate (main) cause of the subject landslide was the clearcutting of the hillside above the slide area and especially on the slide body itself." For this reason, EPA is sticking with GMA's original determination that the slides are related to management activity.

3) EPA does not question the credibility or accuracy of the DMG Report (June, 1997). However, the survey was conducted prior to the availability of the recent aerial photographs (2000). The 2000 photos provide a more up-to-date assessment of the magnitude of the slide and they identify a potential road feature at the head of the landslide, which has not been field inventoried, in addition to the obvious mid-slope road. In the absence of a more recent field investigation and thorough review of past management activities in the area, EPA is sticking with GMA's original determination that the slide is road-related.

Comment 10.26. "Sediment reduction targets should not be developed using a subjective split between 'management related' and 'background' sources. Total sediment is what counts to the fish."

Response 10.26. The TMDLs are expressed as total sediment loads, according to each subarea (Section 5.2). EPA is required to allocate the total load (TMDLs) to sources of sediment. Most other TMDLs approved by EPA for the North Coast of California have included specific allocation categories between management and natural sources, such as road-related landslides, harvest-related landslides, skid trails, road surface erosion, etc. For the Trinity TMDL allocations, EPA chose to use two broad allocation categories, management and non-management. EPA did not further subdivide the management allocation of this TMDL by source category, as was done for other TMDLs. Rather, EPA used more specific geographic subdivisions (subareas). See also response 7.1.

Comment 10.27. "...we expect the comments at the public meetings provided by Sierra Pacific Industries employees, as well as all other public participants, to be fully addressed by the EPA in finalizing this TMDL."

Response 10.27. EPA held two public meetings during the public comment period. At both meetings, EPA staff stated that the purpose of the meetings was to clarify the contents of the draft TMDL and that, while those EPA staff present at the meetings would certainly listen to any comments that might be made, EPA could ensure a formal agency response to a comment only if it was submitted in writing by the close of the comment period. Nonetheless, the Trinity County Resource Conservation District was generous enough to take notes at the public meetings, and this responsiveness summary includes the comments made at the public meetings, based on their notes.

Comment 10.28. "This draft TMDL must be changed to focus on the major sources of identified sediment problems, namely the 2 dams and their management, the Hoopa Reservation, New River, Eagle Creek, Coffee Creek and Canyon Creek. In addition, loads and allocations should be calculated in a manner similar to past TMDLs, and not based on subjective assignments of sediment sources. To salmonids, sediment is sediment. To get the most reduction in sediment, the major sources should be targeted, not just those most amenable to regulation."

Response 10.28. See responses 7.1 regarding management versus natural sediment, 10.17 regarding the dams and 10.24 regarding major sources.

11. Timber Products Company. Comments submitted in writing 10/29/01.

Comment 11.1. "... The historic hydraulic mining that occurred until 1939 (TMDL pg.21) and numerous high flow floods including 1997 have created watersheds that have a range of habitat conditions. Coffee Creek, Stuart Fork and Manzanita Creek reference watersheds still support abundant fish populations following these manmade and natural disturbances."

Response 11.1. Comment noted.

Comment 11.2. "Within the Lower Middle Assessment area several reference watersheds support strong trends of summer steelhead (TMDL pg.25) The New River supports one of the larger populations in California (TMDL pg.26). The New River has had '...high levels of historic mining activity' (TMDL pg. 26. The '...USFS found a range of 5 to 44 percent of the gravel or cobble in the New River, including tributaries, were embedded more than 50% (TMDL pg. 34). However, this 50% embeddedness violates the proposed numeric target of 25% embeddedness."

Response 11.2. As described in the TMDL (Chapter 3, page 28), EPA expects the targets to be evaluated using a "weight of evidence" approach. No single indicator adequately describes water quality related to sediment, so a suite of instream and watershed indicators is identified. When considered together, the indicators are expected to provide good evidence of the condition of the stream and attainment of water quality standards. In the case of the New River, even though there are some high embeddedness values, several other indicators suggest that the New River is supporting beneficial uses.

Comment 11.3. "The New River also has historic and current water temperatures that are considered impaired by EPA and NCRWQCB (Farber et al., 1998)."

Response 11.3. Although EPA appreciates the identification of additional water quality information (i.e., temperature) in the Trinity River Basin, the current TMDL is focussed on sediment so EPA evaluated sediment-related information.

Comment 11.4. "The New River is another example where a reference watershed which supports abundant fish populations and the watershed instream habitat conditions occur in a range of habitat that even violate TMDL number targets."

Response 11.4. EPA reviewed all of the available information related to the New River. While some values may exceed target levels described in the TMDL, on the whole the data indicate that the New River is supporting beneficial uses. The commenter is suggesting that the targets should be based on the range of natural conditions, presumably such that a target would only be exceeded if the value was outside the natural range. While this is one way to account for natural variability, establishing the range of natural variability would be difficult and EPA is taking a different approach. We have decided that it is preferable to identify target values that best approximate the desired condition. We account for natural variability by identifying a suite of indicators with the expectation that they will be evaluated using a weight-of-evidence approach. While we recognize that not all indicators will be met at all locations at all times, we believe that when data on all of the indicators is evaluated as a whole, it will give a good indication of the extent to which the stream is achieving water quality standards.

Comment 11.5. "From the scientific information provided in the TMDL, 'properly functioning' conditions should be conditions where abundant fish populations are found? Right?"

Response 11.5. EPA considers properly functioning conditions and the attainment of water quality standards more broadly than just the condition of fish populations. The beneficial uses of concern in this TMDL are focussed on supporting cold water ecosystems, the preservation or enhancement of aquatic habitats, and high quality habitats suitable for reproduction, early development and migration of aquatic organisms (described in Section 2.1 of the TMDL and defined in the Water Quality Control Plan for the North Coast Region "Basin Plan"). Certainly, fish populations are an important indicator of the health aquatic habitats and ecosystems, but must be evaluated along with other aquatic dependent species and habitat conditions. This is especially important for areas below the dams, where anadromous fish are present, because factors other than freshwater habitat affect anadromous fish populations.

Comment 11.6. "According to the TMDL, 'properly functioning' conditions are '...the professional judgement to the following indicators that reflect the expression of watershed condition: floodplain connectivity, water quality, water quantity, riparian vegetation, channel stability, and aquatic integrity" (TMDL pg.20). In fact, the TMDL is based on resource professionals preconceived notion of what is "properly functioning' and not based on where abundant fish populations are found. EPA needs to disclose the instream habitat conditions within each of the reference watersheds. From the instream habitat conditions of the reference watersheds an acceptable <u>range of habitat</u> conditions can be determined."

Response 11.6. The identification of reference streams in the TMDL is based on the best available information, which, for much of the basin, was the US Forest Service's watershed condition assessment information mentioned in the comment. This methodology does include consideration of aquatic species, including fish populations, as one of the evaluation criteria. In addition, EPA considered other available fish population and aquatic habitat information as referenced in Table 5-1 of the TMDL. See also response 11.4.

Comment 11.7. "The TMDL references the Trinity River Restoration Program (TRRP) goals of 62,000 inriver spawner for fall chinook salmon (TMDL pg.13). This annual average goal of 62,000 is compared to the pre-1962 Trinity Lake reservoir dam annual average return of 45,600. The EPA acknowledges that Trinity Lake reservoir dam blocks an estimated 59 miles of chinook habitat and 109 miles of steelhead habitat (TMDL pg. 13). With the loss of habitat, the goals for inriver spawning are not likely to ever be achieved whether instream habitat targets or load allocations are achieved. The EPA should reconsider the use of instream numeric targets as indicators of successful salmonid inriver spawning if fundamental limitations (ie. Trinity Lake reservoir dam) to inriver spawning are present."

Response 11.7. For clarification, EPA referenced the TRRP goal for purposes of characterizing existing conditions in the watershed, not as a TMDL target. The average inriver escapement of naturally produced fish (11,932 from 1982 to 2000) is still well below the 45,600 level identified by the commenter. EPA recognizes that other factors besides the instream and watershed indicators identified in the TMDL influence fish populations.

Comment 11.8. "...during the sediment source assessment (Table 4-1, TMDL pg.48) no mention of the temporal scale is discussed. This is in [direct] contradiction to some of the scientific assumptions made to create the assessment. As an example, surface erosion rates for post-1974 timber harvest were allocated an erosion rate of 4 tons/mi2/year. Surface erosion rates for pre-1974 were allocated an erosion rate of 12 tons/mi2/year. This very high erosion rate allocated to historic timber harvests may be responsible for much of erosion currently allocated to timber harvest. If surface erosion is assessed pre-1974 and post-1974 many watersheds may be already under TMDL load allocations due to the limited current timber harvest. The EPA should reassess the sediment source assessment to recognize the temporal scale of the scientific assumptions in the calculations."

Response 11.8. The temporal scale is accounted for in the TMDL. Surface erosion from harvest areas was assumed to only occur in the decade in which the harvest was mapped. EPA believes the TMDL already accounts for the commenter's statement that many watersheds or subareas are already under TMDL load allocations due to the limited current timber harvest (e.g., New River).

Comment 11.9. "The EPA should include the reference cited GMA 2001(a) and GMA 2001(b) as part of the Trinity River TMDL so that landowners, stakeholders and the public can understand the methodology and assessments completed by EPA."

Response 11.9. EPA has made these documents available to individuals upon request.

Comment 11.10. "The TMDL needs to disclose how the EPA correctly identified between different traffic and climate conditions and how extremely sensitive calculations were performed using a remotely collected data...On Timber Products Company ownership two cooperative road inventories have been completed with 10% and 1% of the total road miles found to be insloped (TRCD, 1998) (SFCRMP, 2000). Use of incorrect road prism information for the calculation of road erosion quantities could create errors over 500% (WDNR 1995). The EPA needs to disclose in the TMDL how extremely sensitive road erosion calculations were performed using a remotely collected data."

Response 11.10. The TMDL (section 4.1) summarized the methodology to calculate road erosion estimates. Road erosion rates were based on sediment delivered to the channel from the roads. Road sections that were outsloped and didn't deliver sediment to a channel, would contribute to lowering the overall "average" rate developed for that road type/surface in a given geology, since the total delivered sediment was divided by the road miles to come up with a rate. For more details on the methodology, EPA refers the commenter to the Sediment Source Analysis by GMA. For a copy, please contact EPA at (707)825-2311.

Comment 11.11. "The TMDL assumption in the calculation of surface erosion from historic pre-1974 timber harvest is that every acre is equivalent to an unsurfaced truck haul road? This assumption is not scientifically supported and field examinations within the watershed do not support the assumption."

Response 11.11. GMA (2001) used 12 tons/ac for total pre-1974 erosion from a harvest acre, which includes all surface erosion over the life of the disturbed site until it is effectively revegetated, typically 5-10 years. Since this is a total surface erosion value, it is inappropriate to compare to road surface erosion which is in tons/road mi/yr, without specifying a particular time frame. Road surface erosion also depends on slope position and geology which were accounted for by GMA in developing their rates.

For example: a typical (average of all geologies) unsurfaced (native) riparian road is estimated by GMA to produce 33 tons/road mi/yr or 16.5 tons/ac/yr since a 16' wide road mile is about 2 acres of land. Over a 10 year period, the acre of harvest (pre-1974) was estimated to produce 12 tons/acre, while an unsurfaced riparian road would produce 165 tons/acre or about 14 times as much.

Comment 11.12. "With very large background erosion rate variability in the watersheds, what scientific studies support the setting one numeric target for fine sediment in all streams, everywhere, all the time? The EPA needs to disclose the scientific process and studies that justify the setting of this one-size-fits-all numeric target."

Response 11.12. The impact of fine sediment on spawning gravel quality is well-documented in several studies and summarized in the TMDL (Section 3.2). EPA is not relying on one numeric target for fine sediment. Rather EPA has included three different particle size classes (0.85mm, 2.0mm, and 6.4mm) as well as two measures of central tendency of a substrate sample (median particle diameter and geometric mean). The purpose of including different measures is to account for the variety of ways that different size classes impact salmonid spawning and early development habitat. With regard to "one-size-fits-all," EPA has included several different types of indicators in addition to fine sediment. As described in the TMDL (Chapter 3), EPA expects the targets to be evaluated using a "weight of evidence" approach. No single indicator adequately describes water quality related to sediment, so a suite of instream and watershed indicators is identified. When considered together, the indicators are expected to provide good evidence of the condition of the stream and attainment of water quality standards.

Comment 11.13. "The TMDL does not describe the technique used in GMA 2001a (TMDL pg.31). Table 3-2 implies that techniques used by Wilcock et al 1995 (Table 3-2 TMDL pg.31) and GMA 2001a are similar. In recent proposals by Graham Matthews and Associates (GMA) within the South Fork Trinity River watershed the collection of bulk samples included the removal of the "first layer of aggregate". Was this sample processing technique used for the samples in the Trinity River TMDL? If so, removal of a portion of the sample has no scientific merit. The long standing studies that directly link salmon egg to fry emergence and levels of fine sediments did not remove portions of the sample. The use of this sample processing technique induces large bias to the samples as the "first" layer size and depth vary greatly from sample to sample. This technique needs to be explained if EPA used or is proposing this sample processing technique."

Response 11.13. The Trinity River TMDL spawning gravel sampling included separate treatment of the surface layer (or armor layer), described as the depth of the largest surface particle, as prescribed in Church et al (1987). The surface and subsurface layers of spawning gravel represent two different populations of gravel and the subsurface is the more characteristic of the gravel conditions experienced by salmonid eggs (albeit somewhat cleaner). If surface and subsurface conditions are combined then it is imperative that depth of sampling be consistent between samples to be compared since the deeper the subsurface sample the less the impact of the cleaner surface conditions on the particle size distribution of the sample. Kondolf (2000) presents relationships between the change in %fines due to spawning and suggests methods of adjusting unspawned sample parameters in order to better use survival predictors.

Church, M.A., D.G. McLean, and J.F. Wolcott. 1987. River bed gravels: sampling and analysis. In Sediment Transport in Gravel-bed Rivers. C.R Thorne, J.C. Bathurst, and R.D. Hey, eds. John Wiley & Sons Ltd. Chapter 3. pp. 43-88.

Kondolf, G. Mathias. 2000. Assessing salmonid spawning gravel quality. Transactions of the American Fisheries Society 129:262-281.

Comment 11.14. "EPA claims '...10% [fine sediment <0.85mm] is achievable based on recent data collected by GMA (2001a) indicating the geologic and hydrologic conditions in the Trinity are generally capable of producing relatively small percentages of finer grain material than other Northcoastal rivers.' (TMDL pg.33). The EPA presents no data in the TMDL that justifies this statement."

Response 11.14. Several samples taken by GMA (2001a), indicate that fine sediment samples (<0.85mm) are below 10%. The complete data tables are provided in GMA (2001a).

Comment 11.15. "Sub-basins with background erosion rates of 2759 tons/mi2/year have never and will never support stream channel reaches with less than 10% fine sediment."

Response 11.15. The commenter did not provide any data to justify this statement, nor is EPA aware of any such data.

Comment 11.16. "...the question is not what level of fines support high levels of egg survival to emergence for salmonids (TMDL, pag.33), the question is what range of fines are produced within the highly variable reference watersheds. If the reference watersheds violate water quality standards, have had numerous and frequent landsliding and floods, it is reasonable to assume that the percent fine sediment that supports abundant anadromous fish populations (i.e. reference watersheds) is not 10% fine sediment. Before setting targets for fine sediment <0.85, <2.0mm and below <6.4mm the EPA should examine and report in the TMDL levels of fine sediments in all the reference watersheds."

Response 11.16. Fine sediment data was not available from which to determine a range of fines within reference watersheds. However, EPA encourages the collection of fine sediment information in reference and non-reference streams which could then be used in future iterations of the TMDL. The TMDL analysis, including instream targets, is based on the best available information. See also response 11.4.

Comment 11.17. "The EPA needs to show how all roads on slope >45% are contributing to the impairment of anadromous salmonids. If the are scientific studies within the geology types of the Trinity River that describe this clear correlation (not USFS opinion) between >45% slope roads and impaired stream sediment conditions the EPA should cite the literature. Otherwise the EPA should remove this non-scientific calculation from the formulation of targets for the proposed TMDL."

Response 11.17. EPA does not mean to suggest in the TMDL that "...all roads on slopes >45% are contributing to the impairment of anadromous salmonids." EPA did reference the USFS watershed condition assessment which included the calculation of miles of roads on slopes >45% as one of several road indicators that, when combined, estimate the degree of watershed risk for sediment delivery. In addition, the sediment source analysis by GMA also factored in the location of roads in relation to slopes. The point is that roads on steeper slopes generally represent a higher risk of sediment delivery and impairment to water quality.

Comment 11.18. "The targets apply to every stream channel reach irregardless of channel gradient, channel confinement, and natural geologic conditions... The body of scientific knowledge including literature cited by EPA is contrary to this 'one-size-fits-all' approach stated by EPA..."

Response 11.18. EPA recognizes that water quality related to sediment is highly complex, with factors such as highly variable seasonal and inter-annual precipitation and landscape response to disturbance, and complexities in geology and sediment routing mechanisms from watershed sources to and through streams (chapter 6). However, information is not available to establish targets for all combinations of factors. Therefore, EPA has identified targets for a variety of indicators based on the available information. Recognizing that some of the targets may not fit a specific stream reach perfectly, EPA expects the indicators to be evaluated using a "weight of evidence" approach. The water quality indicators expressed in Chapter 3 are intended to provide a useful reference in determining the effectiveness of the TMDL in attaining water quality standards, although they are not directly enforceable by EPA.

EPA did not intend for the description of indicators and targets in Chapter 3 to be a detailed monitoring plan that specifies the location, timing and other measurement protocols. However, for several indicators and targets, EPA includes a brief description of various factors to consider when monitoring such as: (1) embeddedness "should be estimated during the low-flow period, generally at riffle heads, in potential spawning reaches;" (2) V* is "not appropriate for large rivers, but in large river systems it is appropriate for tributaries." In addition, the V* target specifies that it is based on Franciscan Geology types; (3) Turbidity "should be measured during and following winter storm flows, and upstream and downstream of a management activity to compare changes in the turbidity levels that are likely attributable to that activity." Moreover, EPA established separate geomorphic indicators for the upper middle mainstem, in order to account for the fundamental differences between that stream reach and others in the basin. EPA expects that the State and other resource managers will monitor these indicators in appropriate channel types and stream reaches, in accordance with the appropriate guidance manuals. Additional information from future monitoring and/or new studies can be used to revise the TMDL targets during future iterations.

Comment 11.19. "The EPA should consider the following when setting targets for fish habitat and large woody debris: (a) Percent pool and pool frequency can be influenced by channel gradient, channel width, channel confinement in relation to the flood plain ..." (b) Large woody debris pieces and key pieces are found by lineal stream reach are related to the piece diameter and length, channel gradient, and channel width (Montgomery and Buffington 1993)."

Response 11.19. EPA has inserted these two statements into the narrative descriptions of these indicators in Section 3.2.

Comment 11.20. "The TMDL analysis of sediment for the Upper Trinity assessment area was completed without any recognition of the presence of Trinity Lake reservoir downstream of the area...The sediment source summary (Table 4-1, TMDL, pg.48) does not consider the considerable reduction of sediment caused by sediments settling in the reservoir. Some of these sediments are not delivered to the anadromous salmonid habitat downstream of the dam. The TMDL needs to reflect this fundamental scientific process that is occurring within the Upper Trinity assessment area."

Response 11.20. The TMDL recognizes the presence of Trinity Lake Reservoir in several sections of the TMDL. Table 4-1 illustrates the <u>sources</u> of sediment not the routing of sediment downstream. The reservoir does not influence the amount of sediment that is produced and delivered from the variety of sources listed in Table 4-1 to the watercourses in the Upper Trinity Assessment Area. In addition, the cold water habitat beneficial uses apply to streams above the reservoir, not just anadromous reaches below the dams.

Comment 11.21. "...the erosion generated by the reservoir shoreline alone is equivalent to 352 miles of 18 foot wide unsurfaced forest road. Or the erosion is equivalent to an additional 5,273 acres of post-1974 timber harvest every year with an average erosion rate of 4 tons/mi2/year. This very large amount of active erosion has not been accounted for in the sediment source summary (Table 4-1, 4-2 TMDL, page 48, 50). The TMDL needs to reflect this fundamental erosion process that is occurring within the Upper Trinity assessment area."

Response 11.21. Compared to the volume of landslides (in the millions of tons), 20,000 tons/yr is quite small and since it drains directly into the lake, only affects beneficial uses in the lake rather than in stream channels where far more aquatic habitat is present. Since releases from the dam have not increased turbidity levels except after large flood events (1974, 1983, and 1997), it follows that the annual erosion from the shoreline does not contribute to downstream water quality issues. This is not to say that localized runoff from the shoreline does not create localized water quality issues within the lake (just as boat wakes also contribute a considerable amount of turbidity to the lake), but that due to its location and the beneficial uses involved, it is considered a minor source.

Comment 11.22. "The current scientific information described in the TMDL does not support the conclusion that disturbed area and the amount of timber harvest correlate to anadromous salmonid populations."

Response 11.22. EPA did not specifically attempt to correlate the amount of disturbed area to anadromous fish populations. EPA does believe, however, that beneficial uses for coldwater fish habitat are generally being supported in watersheds where management-related sediment delivery is 25% or less of non-management sediment delivery as described in TMDL and Allocations (Chapter 5). In other words, where management-related sediment has accounted for one part compared to 4 parts of non-management, aquatic habitat is generally in a properly functioning condition and can support healthier fish populations. EPA is retaining the indicator for disturbed area in Section 3.2.

Comment 11.23. "During the development of the Trinity River TMDL the EPA did not consider the information, experience and knowledge of local private landowners...The EPA compiled federal agency information from the USFS and other sources and all but ignored the information and concerns of private landowners."

Response 11.23. EPA considered all existing available information including any provided by local private landowners. EPA held public meetings on July 24, 2000, November 17, 2000, August 20 and 21, 2001, October 30, 2001 and November 7, 2001 with an expressed goal of gathering any available information including private landowner information, knowledge and experience. EPA has considered all of the comments and associated information submitted by Timber Products Co., in their letter dated October 29, 2001, and all the other comments received during the public comment period.

Comment 11.24. "As during the South Fork Trinity River TMDL and now with the Trinity River TMDL, EPA has once again considered only the information necessary to fulfill the agencies obligation."

Response 11.24. The commenter did not identify what information EPA should consider beyond the necessary information to fulfill the EPA's obligation to develop a TMDL based on the best available information.

12. Trinity County Board of Supervisors. Letter dated November 16, 2001.

Comment 12.1. "The TMDL sediment source work within the basin clearly indicates that there are areas where human-caused sediment levels need to be reduced; however, the Board is greatly concerned that the TMDL substantially under-estimates the effects of the Trinity's reduced flows on sediment loading. There is a plethora of readily available information documenting that the historically altered Trinity River flows are impeding salmon recovery and sediment transport to a far greater extent than considered in the current draft. We believe that the lack of sediment transporting or 'flushing' flows is the primary and determinant factor in the accumulation of sediment and the loss of cold water fisheries habitat in the Trinity River."

Response 12.1. EPA summarized and referenced the effects of the dams on flow in relation to sediment under Habitat Conditions (Section 2.4), Sediment Budget (Section 4.3), Critical Conditions (Section 5.4) and Implementation Recommendations (Chapter 6) in the TMDL. The TMDL specifically identifies the importance of ‘flushing’ flows under critical conditions (Section 5.4). EPA believes this level of consideration for flow is appropriate in the context of a sediment TMDL. Also, see Response 1.1.

Comment 12.2. “The TMDL process completely ignores the impact of flow restriction on the rivers ability to effectively move sediment through the system.”

Response 12.2. See response to previous comment.

Comment 12.3. “We are concerned that the proposed targets and allocations within the TMDL fail to address the actual problems of reduced flows and sediment loads within the river. It is the position of Trinity County that the proposed targets cannot be met until the ROD for the Trinity River, or a similar flow regime is fully implemented. Although the Draft TMDL does indicate that the higher flow are necessary, it does not recognize the fact that there is currently a federal preliminary injunction against the implementation of theses flows pending the completion of a supplemental EIR/EIS that more fully analyzes impacts to power and water users as well as to endangered species. For this and other reasons detailed in the following comments, we request that the EPA re-evaluate their assumptions regarding sediment source and the degradation of the river system.”

Response 12.3. EPA has included a statement in the TMDL report recognizing that there is currently a preliminary injunction limiting additional water releases into the Trinity River to implement the ROD to 28,600 (the amount in the ROD for critically dry years) acre feet over the statutorily-mandated 340,000 acre feet. However, EPA does not believe that this constitutes sufficient reason to reevaluate the sediment sources and the TMDL. The federal district court's Memorandum Decision and Order granting the preliminary injunction was based on the California energy crisis and biological opinions concerning species outside of the Trinity River basin; it did not question the science supporting the need for more flows to restore Trinity River fisheries, and gives us no reason to alter our opinion that the Trinity River Flow Evaluation on which the ROD was based is the best scientific analysis available of Trinity River flow issues. See also response 1.1.

Comment 12.4. “The targets and allocations proposed in the TMDL substantially under-estimate the effects of the river’s reduced flows on sediment loading and therefore do not accurately reflect an achievable end.”

Response 12.4. EPA disagrees. The commenter has not provided any additional data regarding flow, nor any specific explanation of why EPA’s analysis of existing data is inaccurate.

Comment 12.5. “The TMDL acknowledges that the beneficial use cannot be met without increased flows, but it does not go far enough to provide specific recommendations to the State of California to provide increased releases from Trinity and Lewiston dams to lower fine sediment in the mainstem Trinity River to levels which would not harm the targeted beneficial use of coldwater fisheries.”

Response 12.5. EPA’s analysis does indicate that additional flow is needed to attain fisheries-related beneficial uses in the mainstem directly below the dams. EPA would encourage all authorities with jurisdiction over water allocation in the Trinity River to work together to ensure adequate flows to protect beneficial uses.

Comment 12.6. “The TMDL states that the Trinity River ROD flow should be provided, but fails to note that those flows cannot be implement due to a federal preliminary injunction which requires preparation of supplemental EIS. The outcome of that process is years away, and there is no guarantee that the science-based ROD flows will ever be implemented."

Response 12.6. See responses 1.1 and 12.3 above.

Comment 12.7. "The listing of cold water fisheries as the only impaired beneficial use is inappropriate as it inaccurately depicts a direct relationship of sediment to fisheries without recognizing the role of other causal factors in fisheries decline including blockage of historic habitat above lewiston Dam, flow diversion, predation, harvest, poaching, disease, migration barriers, oceanic conditions, estuary conditions, and climatic changes."

Response 12.7. The TMDL recognizes that salmonid populations are affected by several factors, in addition to sediment in the freshwater environment (Section 2.3). However, TMDLs are developed to address pollutants. The Trinity TMDL is focussed on sediment, the pollutant for for which the Trinity River is listed according to Section 303(d) of the Clean Water Act. EPA recognizes that achievement of a sediment TMDL, "will facilitate but not guarantee, population recovery" (Section 2.3). EPA acknowledges and supports the variety of authorities and programs that are charged with addressing the other factors listed by the commenter including poaching, harvest, migration barriers, etc.

Comment 12.8. "The TMDL assumes coho population numbers and trends based on inappropriate data sources, using CDF&G estimates based on chinook salmon surveys done in the Trinity River. The TMDL incorrectly infers that coho use the main stem river habitat to a greater extent than they do the tributaries. The CDF&G studies were also timed for chinook runs while coho runs occur over a long period in the fall/winter and often in higher flows and more turbid conditions where sampling is less effective."

Response 12.8. EPA has received similar comments from other sources and has revised the TMDL to reflect that coho utilize tributaries as well as the mainstem in the upper middle area (section 2.2).

Comment 12.9. "The Geomorphic Indicators, Targets, and Beneficial Use within the TMDL (Table 3-1, P. 30) as well as the following Sediment Indicators: Spatially Complex Channel Geomorphology, Frequently Mobilized Channelbed Surface, Periodic Channelbed Scour and Fill, V Star, and Pool Riffle Distribution and Pool Depths of Table 3-3 (p.32) are all flow dependant and should not be incorporated into the Load Allocation or Implementation Plan unless increased flows are also part of the Load Allocation and Implementation Plans. Many of the indicators are directly affected by river flushing flow rather than by tributary stream sediment contributions."

Response 12.9. The targets referenced in this comment are influenced by both flow and sediment input and, consequently, are useful in determining the effectiveness of the TMDL as well as other management actions. EPA has not assigned load allocations for flow, nor are the loading capacity (TMDL) and allocations dependent on any particular flow regime. EPA has included a recommendation that the flows called for in the ROD be provided to facilitate the functions of a healthy alluvial river system necessary to protect beneficial uses, but the development of implementation measures is the responsibility of the State of California.

Comment 12.10. "To some extent the following Sediment Indicators are flushing flow dependent and a sediment target may be difficult to achieve: Balanced Fine and Coarse Sediment Budgets, Periodic Channel Migration and Spawning Gravel Quality."

Response 12.10. These indicators are influenced by both flows and sediment input, and consequently are appropriate as indicators of the effectiveness of the TMDL. As described in the TMDL (Chapter 3), EPA expects the targets to be evaluated using a “weight of evidence” approach. No single indicator adequately describes water quality related to sediment, so a suite of instream and watershed indicators is identified. When considered together, the indicators are expected to provide good evidence of the condition of the stream and attainment of water quality standards.

Comment 12.11. “The use of Large Woody Debris (LWD), as a Sediment Indicator is not an appropriate target for the Main Stem TMDL. ...The Trinity River does not function similarly to coastal streams....”

Response 12.11. See response 15.9. to a comment by the U.S. Fish and Wildlife Service regarding the role of LWD on floodplains and off channel wetted areas of larger streams. EPA has clarified the function of LWD with regard to the mainstem in Section 3.2 of the TMDL.

Comment 12.12. “The turbidity in the river below Lewiston Dam is double what it was prior to the flood of January 1, 1997. The Lakes appear to be a repository of high turbidity that does not clear as quickly as in the tributary streams. The TMDL should be revised to adequately address the effects of dam management on turbidity.”

Response 12.12. EPA acknowledged that discharges from the reservoirs have had high turbidity levels for extended periods during and following high flow years, such as 1997 (Section 2.4, page 22). EPA anticipates that the achievement of the TMDLs and Allocations for the subareas draining to the reservoirs (Chapter 5) will reduce turbidity levels in the reservoirs. The commenter did not provide any new information that would necessitate revising the TMDL and allocations.

Comment 12.13. “Using a measure that rewards a percentage reduction of tons of sediment per square mile of upland area is meaningless in assessing the impact on fisheries. Such absolute measures penalize upland users that have been diligent in controlling sediment and give a free ride to abusers who have had a conversion experience and are now conscious of potential impacts.”

Response 12.13. The TMDL does not penalize diligent land managers. To the contrary, on a subarea basis, diligent land managers who are generating less sediment relative to background, do not need to reduce as much sediment as those land managers who are producing higher levels of sediment compared to background. In other words, those landowners in subareas that are close to or below 25% above background, have to reduce less sediment than those that significantly above background levels. The State has the responsibility to develop implementation measures for this TMDL. All comments regarding implementation, including this one, will be forwarded to the Regional Board for its consideration when developing an implementation strategy. The commenter did not provide any recommendations for expressing the load allocations in an alternative manner. See also response 7.1.

Comment 12.14. “The TMDL fails to incorporate an adequate review of the changes in land use activities, conservation measures and regulations that have become effective since the Pacific Coast Federation of Fishermen’s Associations, et al v. Marcus, was originally filed in 1992. Many restoration efforts and programs have been implemented in the interim. Currently, migration barriers are being removed, roads are being modified, relocated or abandoned to accomplish water quality improvements, and in-stream structural habitat improvements such as riparian revegetation, bank stabilization and similar actions are being undertaken by conservation organizations, restoration specialists, timber companies, and counties. The draft TMDL did not consider these factors in its allocations and conclusions.”

Response 12.14. EPA evaluated the effectiveness of land use activities, conservation measures and regulations by determining the amount of sediment delivered to the watercourse from the multitude of land management sources. The results of EPA's sediment source assessment indicate that the Trinity River Basin contains many areas where these programs may currently be effective and several areas where dramatic improvement is needed. For example, the restoration program in Horse Linto Creek (HLC) is likely one of the reasons why HLC has a low proportion of management-related sediment compared to non-management levels. The EPA applauds all the restoration efforts that have taken place since 1992 and years prior. However, the TMDL assessment along with other assessments (e.g., County Roads Erosion Inventory) strongly suggest that sediment reduction from certain practices and in specific locations will have to be made to protect water quality (Chapters 4 and 5). EPA expects the State to develop an implementation strategy that properly acknowledges the effectiveness and/or weaknesses of existing programs in order to protect water quality.

Comment 12.15. "The TMDL does not specifically evaluate the economic implications that the sediment source reduction requirements may have on private landowners within Trinity County. The Board is concerned that many small landowners within the watershed may end up bearing a disproportionate amount of the costs involved in the TMDL implementation program when the majority of the sediment problem is the result of the federal CVP operations."

Response 12.15. The State has the responsibility to develop implementation measures for this TMDL. All comments regarding implementation, including this one, will be forwarded to the Regional Board for its consideration when developing an implementation strategy.

Comment 12.16. "The TMDL references and targets for roads rely on PWA's 1994 Forest and Ranch Roads Manual, which is appropriate for seasonal and low use forest and ranch road systems. County and State roads within the Trinity River operate on significantly different design, access, speed and safety criteria."

Response 12.16. EPA welcomes additional references and targets for County and State road, in addition to those included for the forest and ranch road systems. At this point in time, those references are not readily available.

Comment 12.17. "The County is also deeply concerned that the federal government is the major impediment to river restoration and that the TMDL does not sufficiently address this fact. The Bureau of Reclamation controls the river flows and cannot initiate the process necessary to begin recovery and improvement of in-stream habitat conditions. The federal EPA proposes rule making in the form of load allocations that do not address the principle Federal government created problem within the basin."

Response 12.17. EPA is addressing the sediment-related problems of the Trinity River by developing TMDLs for sediment in accordance with a court ordered deadline. Please also see Response 1.1.

Comment 12.18. "We strongly recommend that the Sediment Indicators be modified to address hillslope, rather than in-stream targets. In-stream monitoring will continue to gauge past natural and management contributions, while the use of hillslope monitoring will more accurately gauge current sediment source recruitment and delivery. In-stream trend monitoring should be done to document flushing or sediment accumulations within pools but hillslope management should be the focus to assure compliance for current practices."

Response 12.18. EPA believes it is appropriate to include both instream and hillslope indicators because: 1) instream indicators track the trends of sediment accumulation in the channel and impacts to beneficial uses; and 2) hillslope indicators track sediment sources and effectiveness of management measures. Since the purpose of the TMDL program is to achieve water quality standards, it is essential to include indicators of instream conditions as well as hillslope conditions, as described in Chapter 3. The purpose of the indicators is to provide a basis for determining the extent to which water quality standards related to sediment are in fact attained.

Comment 12.19. "USEPA should recommend in the TMDL that the State of California hold a water right proceeding to meet not only geomorphic targets in the TMDL, but also related Basin Plan water quality objectives, as indicated in State Water Resources Control Board Order No. WQ 89-18, (never fulfilled), which states as follows: 'It is further ordered that the Division of Water Rights shall initiate proceedings for the State Board to consider modifying the Bureau's permits for the Trinity River Unit of the Central Valley Project to set appropriate conditions to maintain water quality in the Trinity River.'"

Response 12.19. EPA recommends that the State, when it develops implementation measures for this TMDL, carefully consider the relationship between flow and sediment loads. Additionally, we are recommending that DOI implement the science-based flow regime called for in the ROD.

Comment 12.20. "USEPA has previously stated that in regard to diversions from the Trinity to the Sacramento River are 'controllable factor' for water quality, as defined in the Basin Plan and that: 'Section 313 of the Clean Water Act requires that activities conducted by the Bureau of Reclamation comply with all applicable water quality standards. We believe that it would be inconsistent with the State's obligation to protect beneficial uses to voluntarily limit its authority over diversions if in fact those diversions contribute to water quality degradation on the Trinity River.' (Letter from Daniel McGovern to SWRCB, 3/13/92). USEPA has an obligation to disclose not only problems and load allocations, but also to make clear and firm recommendations which will restore the salmon fishery, by increasing Trinity River flows below the CVP dams. Since the federal process to provide those flows has bogged down, it is inherent on USEPA to make appropriate recommendations to the State of California to fulfill the State's obligations under not only the Federal Clean Water Act, but also the Porter-Cologne Act, the Public Trust Doctrine, the state and federal Endangered Species Acts and last, but hardly least, the Tribal Trust obligation of the U.S. Government to the Hoopa Valley and Yurok Tribes to proved them with a meaningful salmon fishery. The requirement of the SWRCB Order 89-18 to hold a Trinity River Water Right proceeding to maintain Trinity River water quality has languished for 12 years. It is clear that the TMDL is the trigger to initiate that process. USEPA should include the SWRCB order 89-18 recommendation in this TMDL. To do otherwise will assure the failure in meeting Trinity River TMDL and Basin Plan water quality objectives."

Response 12.20. See response to previous comment and response 1.1.

Comment 12.21. "The TMDL discussion and targets should be modified to clarify the different designs and targets for the various road types (County and State roads vs. private or federal resource managmeent). This will necessitate revisions for the targets to address County and State roads design criteria that are not compatible with the PWA manual referenced in the draft document."

Response 12.21. EPA needs additional information regarding specific design criteria for County, State and private roads. EPA expects that the State will consider such information when developing the implementation plan.

Comment 12.22. "The TMDL should clearly indicate conservation measures instituted by the County can be used as an Implementation Plan of county facilities and roads."

Response 12.22. The TMDL does generally acknowledge County conservation procedures under Implementation Recommendations (Chapter 6) of the TMDL. The State is responsible for developing implementation measures for the TMDL. EPA expects that the State will consider conservation measures instituted by the County and other entities during the implementation planning process.

Comment 12.23. "The Trinity River Adaptive Management group will be overseeing the development of a Supplemental EIS/EIR for the flow decision. One of the criteria that must be considered in the supplemental document is the carryover storage in Trinity Lake and the effect of winter spills on sediment accumulation in the mainstem. TMDL levels should only be set after the massive amount of data on the Trinity River is integrated with the TMDL work. Anything less is just an expedient way to meet a bureaucratic requirement without regard to the extensive studies that are ongoing, and the planned mechanical restoration of the main stem that is the implementation of the flow study."

Response 12.23. In accordance with the consent decree in *Pacific Coast Federation of Fishermen's Associations, et al. v. Marcus*, December 2001 is the deadline for establishment of this TMDL. EPA has developed this TMDL based on the best information available at this time. EPA supports and encourages the collection of additional information. Any relevant new information collected after the TMDL is adopted can be utilized in future iterations of the TMDL.

Comment 12.24. "We ask that no TMDL be assigned to the Trinity River in advance of the completion of the Supplemental EIS/EIR. This will allow a full description of the existing conditions in the context of planned flows. Any decision made before the facts have been collected and analyzed will cause a general lack of confidence in the results, and the regulators."

Response 12.24. See response to previous comment. In addition, to EPA's knowledge, the Supplemental EIS/EIR is intended to focus on energy issues and ESA considerations outside of the Trinity Basin not on the science supporting the need for increasing Trinity mainstem flows for fishery restoration. EPA believes the existing body of information is an accurate characterization of existing conditions and restoration needs with regard to the mainstem flows.

13. U.S. Bureau of Indian Affairs. Letter FAXed on November 19, 2001.

Comment 13.1. "Page 2 states that the TMDL does not apply to lands under tribal jurisdiction. We agree with and support this approach because it recognizes the Hoopa Valley Tribe's inherent sovereignty..."

Response 13.1. Comment noted.

Comment 13.2. "Federal policy exists to recognize and foster the special legal and political relationship between Indian tribes and the Federal goverment...."

Response 13.2. Comment noted.

Comment 13.3. "The Hoopa Valley Indian Reservation (HVIR) is situated at the most downstream reach of the TMDL Assessment Area. Even though the HVIR is excluded from the TMDL, the HVIR shares tributary watersheds and the mainstem Trinity River that will be regulated by the TMDL. The

EPA needs to fully consider the indirect effect the TMDL may have on tribal resources or activities. This is to ensure that the TMDL does not impose a regulatory burden on the Hoopa Valley Tribe or threaten the attainment of water quality standards contained in the Tribe's Water Quality Control Plan."

Response 13.3. EPA believes the implementation of Trinity River TMDL allocations and sediment reduction levels will enhance the protection of beneficial uses and attainment of water quality standards within the HVIR and Yurok Reservation. The TMDL does not impose a regulatory burden on either of these tribes.

14. U.S. Bureau of Reclamation. Letter dated November 19, 2001.

Comment 14.1. "We appreciate the extent to which you made use of the information contained in the Trinity River Mainstem Fishery Restoration Final Environmental Impact Statement/Environmental Impact Report, and your recognition of the provisions of the Record of Decsion (ROD), in your analysis."

Response 14.1. Comment noted.

Comment 14.2. "Reclamation's main concern and recommendation is that you fully consider the uncertainty associated with implementation of the ROD's flow schedules, resulting from Judge Wanger's ruling in Westlands Water District v. United States Department of the Interior, and that you retain the maximum flexibility in your analysis as a result of that litigation. As you are aware, Reclamation has initiated a Supplemental Environmental Impact Statement to address the issues identified in that decision."

Response 14.2. EPA has added a statement to the TMDL recognizing that there is currently a preliminary injunction limiting additional water releases into the Trinity River to implement the ROD to 28,600 acre feet (the amount in the ROD for critically dry years) over the statutorily-mandated 340,000 acre feet. However, EPA does not believe that this constitutes sufficient reason to reevaluate the sediment sources and the TMDL. The federal district court's Memorandum Decision and Order granting the preliminary injunction was based on the California energy crisis and biological opinions concerning species outside of the Trinity River basin; it did not question the science supporting the need for more flows to restore Trinity River fisheries, and gives us no reason to alter our opinion that the Trinity River Flow Evaluation on which the ROD was based is the best scientific analysis available of Trinity River flow issues. EPA encourages the Department of Interior to retain, in the SEIS, the years of scientific analysis that supports flow levels and management actions that will protect cold water habitat beneficial uses in the Trinity River. See also response 1.1.

Comment 14.3. "...the above comments suggest that the extensive mitigation measures constructed in recent years, e.g., Buckhorn Dam, were either not taken into account in the development of the sediment source analysis and budget, or are considered to be ineffective. A more detailed explanation of this subject would be appropriate."

Response 14.3. EPA did not specifically evaluate the effectiveness of Buckhorn Dam or the Hamilton Ponds in trapping sediment delivered to Grass Valley Creek. However, Buckhorn Dam traps much of the sediment (all bedload and a portion of suspended sediment) for 26.6% of the watershed (6,300 acres vs. 23,674 acres total). BLM (1995) estimated a long-term trap rate of 8,000 yds3/yr at Hamilton Ponds.

Clearly these structures are controlling a large amount of sediment that would otherwise be deposited in the mainstem. However, the TMDL sets allocations with the goal of reducing sediment at its sources, because the TMDL is designed to attain water quality objectives for sediment in the tributaries as well as the mainstem. EPA has footnoted tables 4-3 and 5-3 in the TMDL to clarify that the sediment delivery rates do not account for the amount of sediment trapped by Buckhorn Dam and Hamilton Ponds.

Comment 14.4. "Will the Trinity River TMDL Implementation Plan support the flow schedule identified in the ROD?"

Response 14.4. Based on the best available information at the time of development of this TMDL, EPA recommends the implementation of the flow schedule identified in the ROD and associated restoration measures in order to establish mainstem geomorphic conditions that support the protection of cold water habitat beneficial uses. The State is responsible for developing implementation measures.

Comment 14.5. "If the flow schedules were insufficient to move the sediment (see above), would the TMDL standards require future increases in Trinity River flows from Lewiston Dam beyond those identified in the ROD?"

Response 14.5. As noted in the Summary Response to Flow-related Comments (1.1.), this TMDL does not require a specific flow regime. However, EPA supports the implementation of the flow schedule identified in the ROD in order to protect cold water habitat beneficial uses, and in that regard notes the Department of Interior's responsibility to comply with Clean Water Act requirements under Clean Water Act Section 313. Additionally, the TMDL can and should be revised in the future to incorporate new studies and information regarding the effects of sediment on water quality standards.

Comment 14.6. "Are the allocations truly realistic and achievable in the overall context of private landowner capabilities and public land management agencies staffing and budgets?"

Response 14.6. The allocations are established at the level necessary to meet water quality standards. While staffing and budgets are not specifically considered in setting the allocations, there are several cost-effective techniques for reducing sediment delivery from management activities, particularly from roads (Weaver and Hagans 1994). In addition, many land management entities have programs in place and/or are already required to implement sediment control practices. The TMDL provides information that will assist land managers in prioritizing locations and relative intensities of sediment control necessary to protect beneficial uses.

Comment 14.7. "...the recommendations included in Chapter 6 - Implementation and Monitoring measures, should be as specific as the analysis permits, both in location (subarea) and type of sediment management or restoration activity. This will be more meaningful to individual property owners, agency program managers, and the Trinity River Restoration Program, than broad programmatic statements. For example (reference p. 66), 'Evaluate and limit effects of suction dredge operations in stream reaches that overlap spawning sites' is more useful than ' Continue cooperative watershed restoration with local watershed groups, TCRCD, and TMC.'"

Response 14.7. EPA agrees that more specific recommendations are more useful to resource managers. However, at this point in the TMDL development process, EPA defers more specific implementation discussions to the State, which is responsible for developing implementation measures for the TMDL. EPA expects the State to use a collaborative planning process to develop implementation measures that address the TMDL allocations in an effective and efficient manner.

Comment 14.8. “Several items in Chapter 5 ... appear to be position or policy statements that will likely influence the implementation measures eventually developed by the State. As such, they should be carried forward into Chapter 6... and any executive summary or decision documents....” The commenter provided examples of such statements. “...Combined with the recognition that the TMDL is an estimate, and to be compatible with the Trinity River Restoration program, an adaptive management approach should clearly acknowledge the potential and the process for modifying the TMDL, if new information warrants a change.”

Response 14.8. EPA agrees that the TMDL can and should be revised if new information warrants a change.

Comment 14.9. The commenter recommended replacing “Up to 90% of water flowing into Lewiston exported to Sacramento River” with “Up to 70%...” on page iii, Trinity River TMDL Summary: under “Major Features.”

Response 14.9. Due to differing comments regarding the exact percentage of water exports out of the basin, EPA has revised the statement as follows: “Significant water exports from the Trinity to the Sacramento River since the early 1960's.”

Comment 14.10. “Page 12, Chapter 2, Section 2.1 - Water Quality Standards: The last paragraph describes two prohibitions to nonpoint source activities related to discharge or placement of materials in streams or watercourses. It might be more accurate to describe these as actions that require permits from the Water Quality Board or other agencies.”

Response 14.10. We have retained the language from the draft TMDL because the Water Quality Control Plan for the North Coast Region (“Basin Plan”) describes these actions as “prohibitions.”

Comment 14.11. “Page 16, Chapter 2, Section 2.2 - Decline of Fish Populations: The last paragraph does not seem to adequately support the concept of a decline in juvenile fish populations. The reference to Canyon Creek densities of juvenile Chinook salmon being lower than those observed by other researchers working in other states appears to be a questionable basis for comparison.”

Response 14.11. The available data indicate that the chinook population has declined.

Comment 14.12. “Page 31, Chapter 3, Section 3.2 ... in the next to the last paragragh, after the last sentence ‘ ...upstream of the sampling site.’ consider adding, ‘and the mechanical introduction of spawning size gravel as part of mainstem restoration efforts.’ Also, on page 34, under ‘V*’, first paragraph, the last sentence, states ‘ V* is not appropriate for large rivers...’ Can it be used on the Trinity River mainstem since it is controlled by the upstream water projects?”

Response 14.12. Lisle and Hilton (1992) state that the V* method is “easily accomplished in small- to moderate-sized stream channels.” The size of the mainstem channel would probably limit the feasibility of using V*.

Comment 14.13. “Chapter 4... Is there any consideration given to setting TMDL targets in tributaries based on the type of sediment they would input to the system? For example, Grass Valley Creek contributes much higher percentages of fine sediments than Rush Creek, which is a significant provider of spawning size gravel to the mainstem. This does not appear to be addressed in the document.”

Response 14.13.   Although gravels from Rush Creek may help offset the retention of upstream gravels behind the dams, EPA is establishing load allocations to attain water quality standards in the tributaries as well as the mainstem. After considering all of the public comments, we still believe that the best way to do this is based on the background loading rates for each subarea. Nevertheless, we would encourage the State, during development of the implementation measures, to consider giving priority attention to areas where sediment delivery is causing the greatest impact.

15.   US Fish and Wildlife Service.   Letter Dated November 19, 2001.

Comment 15.1.   "Besides anadromous fisheries, non-anadromous fish are impacted by excessive sediment. Additionally, recreational use has increased dramatically on the Trinity in recent years and has a positive impact on the local economy. Although these may not be of primary concern, they may warrant some mention."

Response 15.1.   The TMDL does include a brief description of non-anadromous fish (last subsection under 2.2) and recreational uses (section 2.1) and the potential impact of sediment to these beneficial uses. EPA obtained much of the information on fisheries and recreation from the Trinity River Mainstem Fishery EIS.

Comment 15.2.   "Although anadromous fish species are the primary concern, resident fish species including Klamath Smallscale Sucker, Speckled Dace and Sculpin are also impacted by excessive sediment. These species play an important role in the overall ecology of the Trinity, and fluctuations in their populations can affect anadromous populations. Sucker and dace fry may both be food sources for juvenile salmonids that reside in the Trinity for extended periods (e.g., coho salmon and steelhead.)

Response 15.2.   EPA was not able to obtain information regarding the degree to which sediment may be impacting these populations in the Trinity. EPA expects the TMDL allocations to sufficiently protect these species, in addition to anadromous salmonids, unless new information indicates otherwise.

Comment 15.3.   "Another concern regarding excessive sediment is the effect on overwintering habitat for steelhead and possibly coho salmon. Interstitial spaces in clean cobble are critical for overwintering juvenile steelhead. If excessive sedimentation fills cobble interstices, suitable cover may be lacking which can lead to negative impacts on this species. There may be similar impacts to coho, depending on extent of sedimentation."

Response 15.3.   The TMDL (Section 3.2) includes spawning gravel indicators for fine sediment that are intended, in part, to address the need for interstitial spaces in clean cobble.

Comment 15.4.   "Even though the Trinity begins to approach a pre-dam morphology below the North Fork confluence, there are still obvious effects such as riparian berm formation, sedimentation in spawning gravels and pool filling."

Response 15.4.   Comment noted.

Comment 15.5.   "Are there any references with which to compare the permeability numbers in the Trinity basin? If permeability levels in several tributaries were quite low, what rates would be good by comparison? This may help the reader to better understand permeability as it relates to the Trinity and tributaries."

Response 15.5. EPA agrees that a thorough literature review of permeability data in similar rivers would be useful in identifying potential thresholds. At this time, EPA was unable to complete such a review.

Comment 15.6. "The Ten Attributes developed by McBain/Trush may have been specifically developed for Trinity River restoration efforts, but these are attributes of any healthy, unregulated alluvial river. You may want to mention this to lend more credibility to the attributes."

Response 15.6. Comment noted.

Comment 15.7. "The second to last line in this paragraph that states '...0% survival at the Evans Bar site...' is somewhat confusing because of the previous statement that few studies have related permeability to egg survival. Is it assumed that survival is probably 0% because permeability is close to zero? Did conditions improve downstream of Evans Bar, or is survival still assumed to be 0% Figure 3-1 appears to show an improvement in permeability, but this isn't mentioned in the text."

Response 15.7. Chapman (1988) presents survival to emergence of coho salmon in natural redds and of chinook in laboratory gravel mixes in relation to gravel permeability. Based on this analysis, a permeability measure of 50 cm/hr is essentially zero percent survival.

Comment 15.8. "In addition to deeper pools, overhanging banks or logs, cobble interstitial spaces also provide important cover for salmonid and other fry at a critical and vulnerable time in their life history. The quality and availability of these interstitial spaces are directly related to sedimentation rates and the ability of the river to scour fine sediment."

Response 15.8. EPA has added the following statement to the first paragraph under Spawning Gravel Quality (section 3.2): "In addition, interstitial spaces in clean cobble also provide important cover for salmonid and other fry at a critical and vulnerable time in their life history."

Comment 15.9. "Although LWD probably plays a greater role in small stream morphology than in large streams, it still plays a role on floodplains and in off channel wetted areas of larger streams. Since channels that flow during high river flows can be greatly affected by LWD as it relates to sediment routing in these areas. These side channels are important both as spawning and rearing areas. Additionally, LWD plays an important role in nutrient cycling when it is deposited on floodplains, partly broken down by natural processes and then reintroduced to the river channel during the next flood event. LWD that becomes buried by excessive sediment may be effectively removed from this process for long periods of time if flows can't scour sediment."

Response 15.9. EPA has included a statement about LWD to address this comment in the TMDL indicators description (Section 3.2).

Comment 15.10. "Although the 3 components listed may be appropriate to achieve the target of preventing sediment delivery, the requirements are somewhat ambiguous. Target (1) ends with 'the need for the road is clearly justified.' Is there a definition of 'clearly justified' that can be used for the purposes of this TMDL? Target (2) 'road surfacing, drainage methods, and maintenance are appropriate to their use...' Again, is there a definition of 'appropriate' that can be used for this TMDL?"

Response 15.10. EPA expects that these and similar issues will be worked out by the State as it develops implementation measures for the TMDL.

Comment 15.11. "Although process of bank erosion has been affected in certain parts of the Trinity from various activities, it may be worth mentioning that bank erosion is a natural process in alluvial rivers and can be an important part of the formation of habitat complexity."

Response 15.11. Comment noted.

Comment 15.12. "The authors cite a target of 125% of background sediment delivery but fail to fully discuss and describe the theoretical justification. This section needs to be expanded to address this omission."

Response 15.12. EPA compiled information related to aquatic habitat conditions and compared this to information on sediment delivery and watershed disturbance. The information for the reference streams is summarized in Table 5-1 of the TMDL. Upon examination of this information, EPA concluded that there was a much better correlation between aquatic habitat condition and sediment delivery expressed as a percent of background, than between aquatic habitat condition and sediment delivery expressed as a specific numeric value. As described in the TMDL, EPA concluded that 125% of background was the appropriate way to estimate the loading capacity of a subarea, rather than extrapolating the loading rate for a reference watershed. EPA has used 125% of background to estimate the loading capacity in other TMDLs, although the basis was somewhat different than in the Trinity. EPA first estimated the loading capacity as 125% of background in the South Fork Eel sediment TMDL, where the use of 125% was supported by information for the Noyo River which showed that salmonid populations were relatively high during a period when sediment delivery was about 125% of background. EPA has also used 125% of background in the Ten Mile and Navarro River sediment TMDLs, and in the recently proposed TMDLs for the Albion and Gualala Rivers. See also response 7.1.

Comment 15.13. "The line stating that 'a certain percentage of management-related slides would occur, at least to some degree, even without management' is somewhat confusing. A 'management-related slide' should only occur if there is management, but some slides in areas where management occurs would still occur even if management did not occur there?"

Response 15.13. EPA has reworded the statement in the final TMDL.

16. U.S. Forest Service Shasta/Trinity. Verbal comments over the phone November 19, 2001.

Comment 16.1. The commenter recommended changing "healthy summer steelhead populations" to "healthy steelhead populations" in Table 5-1.

Response 16.1. Change made.

Comment 16.2. Explain why road-related sediment delivery is so high for Canyon Creek (Table 4-4).

Response 16.2. The volume of sediment attributed to road-related landslides in Canyon Creek was based on the Mainstem Trinity River Watershed Erosion Investigation by Department of Water Resources (1980). EPA refers the commenter to this document for more specific information.

17. Yurok Tribe Environmental Program. Letter, dated November 19, 2001.

Comment 17.1 "Given the federal government's role in developing this TMDL and its related/dependent federal regulations and management implications (Trinity ROD, ESA, Northwest Forest Plan, etc.), the USEPA is required to consult with the Yurok Tribe under Executive Order 13175 Consultation and Coordination with Indian Tribal Governments."

Response 17.1. EPA is cognizant of its responsibilities under Executive Order 13175 and also the Executive Memorandum of April 29, 1994, on Government-to-Government Relations with Native American Tribal Governments. EPA communicated frequently with both the Yurok and Hoopa Valley tribes during preparation of this TMDL. Specifically, EPA presented updates and invited input on development of the TMDL at several Trinity River Task Force meetings and Technical Advisory Committee meetings, at which representatives from both Tribal Governments were present. EPA met specifically with staff from the Hoopa Valley Tribe water quality programs on two occassions. Additionally, both tribes received copies of the public review draft of this TMDL, and EPA has considered all the comments submitted, as set forth in this comment responsiveness summary.

Comment 17.2. "The statement, 'It (TMDL) does not apply to lands under tribal jurisdiction' needs further explanation and justification. There should be more discussion as to why this TMDL is not applicable to tribal lands and what exists in place of a tribal TMDL. There is analysis of the Mill, Tish Tang, Campbell and Supply Creek watersheds (which lie considerably in tribal jurisdiction) but there is no clear statement as to whether this analysis includes the tribal portion nor any comparison of the impacts that exist between the tribal and non-tribal lands."

Response 17.2. This TMDL is being established to satisfy the requirements of the consent decree in *Pacific Coast Federation of Fishermen's Associations, et al. v. Marcus*, in which EPA agreed to assure that TMDLs would be established for several waterbodies which had been listed on the State of California's Clean Water Act 303(d) list of impaired segments. Therefore, this TMDL only applies to waters under State jurisdiction. The Tribes may certainly use this TMDL as guidance for tribal water quality decisions or actions. With regard to watersheds identified by the commenter, the sediment source analysis by GMA determined erosion rates from both the tribal and non-tribal areas within these watersheds. However, only erosion rates for areas outside tribal boundaries were utilized to calculate the TMDLs since the TMDLs do not cover tribal land. The sediment source summary for the Lower Trinity Assessment Area (Table 4-5) and TMDL and Load Allocations for the same area (Table 5-5) specify that the area does not include tribal land.

Comment 17.3. "A final opinion by the service should be issued and included in this TMDL prior to further finalization or adoption of this document. It is important to the Tribe that the Services findings on the proposed TMDL be available for further review and interpretation by the Tribe."

Response 17.3. EPA has initiated consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service on the TMDL, but the consultation has not been completed. EPA believes it is unlikely that the Services will conclude that the TMDL violates ESA Section 7(2)(a), and we have added language to the TMDL describing the reasons why. However, EPA retains the discretion to revise the TMDL if the consultation identifies deficiencies in the TMDL or allocations.

Comment 17.4. "This section needs further discussion addressing the lack of enforcement associated with the two narrative standards. Why haven't these narrative standards been upheld and how will the TMDL change the way they are enforced. The major sources identified in this TMDL originate from logging practices which are not directly enforced by the NCRWQCB but rather the BOF/CDF. This regulatory nexus (or lack thereof) is the main crux of the problems identified by the TMDL. If the analysis shows that a significant amount of management related sediment is due to current practices, then either the practices need to be more protective (i.e. Forest Practice Rules amendments) or enforcement of the current rules need to be addressed."

Response 17.4. The State is responsible for developing implementation measures for the TMDL as well as enforcing other provisions of the CWA. EPA expects the State to develop implementation measures that address the critical source categories and subareas identified in the TMDL as needing management-related sediment reduction in order to protect beneficial uses.

Comment 17.5. "Although the beneficial uses of the Yurok Tribe are significantly impacted by the water quality of the Trinity there is no mention of their dependence on Trinity River resources. The proposed TMDL has a direct impact on Yurok resources."

Response 17.5. EPA has added the Yurok to the statement: "The Trinity River fishery has been a cultural and subsistence mainstay of the Hoopa and Yurok people for several thousand years" (Section 2.2). EPA believes the implementation of Trinity River TMDL allocations and sediment reduction levels will enhance the protection of beneficial uses and attainment of water quality standards within the HVIR and Yurok Reservation. The TMDL does not impose a regulatory burden on either of these tribes.

Comment 17.6. "...There needs to be clarification on whether point sources do not exist at all or only at insignificant levels. Further, there needs to be clarification whether point sources do or will exist if the allocation is set at zero. This would imply that no placement of fill could occur under any state or federal permit (CDFG 1603 or USACE 404). If this were the case, the TMDL could not allow the deposition of '10,000 yds3 of properly graded gravel material... to the reach immediately below the dam...' (Page 64)."

Response 17.6. EPA has clarified that: "Although nonpoint sources are responsible for most sediment loading in the watershed, point sources may also discharge some sediment in the watershed. Current and prospective future point sources that may discharge in the watershed and are therefore at issue in this TMDL include:

- CalTrans facilities that discharge pursuant to the CalTrans' statewide NPDES permit issued by the State Water Resources Control Board, and
- construction sites larger than 5 acres that discharge pursuant to California's NPDES general permit for construction site runoff.

The draft TMDL set wasteload allocations at zero. On further consideration prompted in part by public comments, however, EPA has determined that it is more accurate to consider the rates set forth in this TMDL as load allocations to also represent wasteload allocations for point sources in the watershed, as discussed below.

This TMDL identifies wasteload allocations for point sources and load allocations for nonpoint sources as pollutant loading rates (tons/square mile/year) for subareas within the Trinity Basin. The source analysis supporting these allocations evaluated sediment loading at a subarea scale, and did not attempt to distinguish sediment loading at the scale of specific land ownerships. Nor did the source analysis specifically distinguish between land areas subject to NPDES regulation and land areas not subject to NPDES regulation. Therefore, the TMDL includes separate but identical load allocations (LAs) for nonpoint sources and wasteload allocations (WLAs) for point sources that are identical for each subarea. (See US EPA, 2001 for additional details concerning the WLAs.)

Identifying WLAs as well as LAs in this TMDL does not result in an increase in allowable loading from that set forth in the draft TMDL, because the allowable loading is expressed as a rate of tons/square mile/year. Rather, this change from the draft TMDL merely clarifies that the same rate applies to the existing and potential point sources noted above (CalTrans and construction sites) as to nonpoint sources."

Comment 17.7. "There needs to be further discussion on the importance of this TMDL's incorporation into the California Forest Practice Rules and local regulations in order for it to be effective."

Response 17.7. The State is responsible for developing implementation measures that will result in the achievement of the TMDL allocations, including load reduction from management activities covered by the Forest Practice Rules.

18. Yurok Tribal Fisheries Program. Letter, dated November 19, 2001.

Comment 18.1. "The mouth of the Trinity River lies entirely on the Yurok Reservation and Yurok ancestral lands extended well up the Trinity River into the Weitchpec Gorge. The importance of the Trinity River fishery to the Hoopa Valley Tribe is recognized throughout the draft TMDL document, but little or no mention is made of the Yurok Tribe's reliance on Trinity fisheries. The fishery resource of the Trinity River are of paramount importance to the Yurok Tribe. The Yurok Tribe typically harvests 85 to 90 percent of the total annual Klamath-Trinity Indian fall chinook harvest allocations set forth by the Pacific Fishery Management Council (PFMC)."

Response 18.1. See response 17.5.

Comment 18.2. The U.S. Forest Service and Pacific Coast Federation of Fishermen's Associations (PCFFA) were the two primary partners in establishing chinook rearing facility on Horse Linto Creek.

Response 18.2. Comment noted.

Comment 18.3. "The U.S. Fish and Wildlife Service emigration estimates at their Willow Creek trapping site effort are indices of abundance only - not true quantified estimates of the number of juveniles. They serve as valuable indices for year-to-year comparison but they are not intended to be used as quantified abundance estimates. As an example, in 1992 the Trinity Hatchery released approximately 2.3 million chinook smolts and 1 million chinook yearlings. In 1994 they released approximately 2.1 million chinook smolts and 1 million chinook yearlings. Hatchery releases alone in both of these years exceed the 'almost 2,000,000' maximum juvenile chinook abundance upstream of Willow Creek weir reported in the draft.."

Response 18.3. Comment noted.

Comment 18.4. "Additionally, the Willow Creek trapping site used by U.S. Fish and Wildlife Service is well downstream of the Willow Creek weir operated by CDFG and the Hoopa Valley Tribe. They are not co-located as is suggested in the Draft."

Response 18.4. Comment noted.

Comment 18.5. "Steelhead generally migrate further up tributaries than other anadromous species, but summer steelhead do not likely extend any further than winter or fall races of steelhead."

Response 18.5.   EPA changed the statements in the TMDL to which this comment relate as follows: “Of all the anadromous species, steelhead extend the furthest up the tributaries. Summer steelhead hold over during the summer months then spawn in the following late winter or early spring.”

Comment 18.6.   “Change to ‘Trinity River Mainstem Fishery Restoration EIS’.”

Response 18.6.   Change made.

Comment 18.7.   “There is much uncertainty about green sturgeon populations status and trends in the Klamath Basin.”

Response 18.7.   Comment noted.

Comment 18.8.   “Change to ‘Deposits of these finer sediments can also prevent the recently hatched fry from emerging from the redds, resulting in entrapment.’”

Response 18.8.   Change made.

Comment 18.9.   “Change to ‘An imbalance of fine or course sediment supply and transport rate can also adversely affect the quality and availability of salmonid habitat by changing the morphology of the stream.’ Helps address sediment deficits suffered in the mainstem downstream of Lewiston Dam.”

Response 18.9.   Change made.

Comment 18.10.   “Pools provide good feeding stations for juvenile salmon, however, most of the food production in a steam comes from riffles. The depth of water in pools can prevent or inhibit photosynthesis.”

Response 18.10.   Clarification made under the Pool Distribution and Depth Indicator (Section 3.2).

Comment 18.11.   “Chronic turbidity can also reduce productivety by impeding photosynthesis.”

Response 18.11.   Comment added to the discussion on Turbidity and Suspended Sediment Indicator (Section 3.2).

Comment 18.12.   “This entire section is italicized in the Draft suggesting that maybe it was copied from another document, but no reference is given. Deep pool habitat has been reduced by sediment filling in mainstem pools, but not entirely eliminated. And summer steelhead and spring chinook likely shared some pools upstream of Lewiston prior to construction of the Lewiston and Trinity Dams.”

Response 18.12.   The section was inadvertantly italicized. The italics have been removed in the final TMDL.

Comment 18.13.   “the riparian berms limit access to shallow, low velocity stream margin habitat - not side channels.”

Response 18.13.   Change made.

Comment 18.14.   “The TMC and subcommittees are indeed developing specific hypothesis and appropriate methods to test relative to the restoration program. But they are not necessarily developing these to address every one of the 'ten attributes of healthy alluvial rivers' reported in the Flow Evaluation Report or the EIS."

Response 18.14. Comment noted.

<u>19. Public Comments from Informational Meeting in Weaverville, CA on October 30, 2001. Notes taken by the Trinity County Resource Conservation District</u>

On October 30 and November 6, EPA held public meetings during the comment period on the draft TMDL. At both meetings, EPA staff stated that the purpose of the meetings was to clarify the contents of the draft TMDL and that, while those EPA staff present at the meetings would certainly listen to any comments that might be made, EPA could ensure a formal agency response to a comment only if it was submitted in writing by the close of the comment period. Nonetheless, the Trinity County Resource Conservation District generously took notes at the public meetings, and EPA has prepared the following responses to the comments made at the public meetings, based on their notes.

Comment 19.1. A concern was expressed about "judgement calls" used in determining whether a landslide was considered management or non-management related. The commenter asserted that these determinations then result in unrealistic load allocations for management activities, particularly in certain streams such as Reading and Brown Creek.

Response 19.1. The technical consultant for this TMDL (Graham Matthews and Associates) used professionally accepted methods when analyzing air photographs to determine whether there was any association between the landslide and land management activities. Air photo analysis is a commonly used methodology for a large scale, basin-wide inventory. The landslide data was combined with other field surveys of plots, roads and mining ditches, etc. to determine relative contributions of sediment between the various source categories. EPA acknowledges that the assignment of the erosional features as either management or non-management related affects the calculation of the loading capacity (TMDL) and load allocation for each category (expressed in Chapter 5). However, EPA does not believe, as stated by the commenter, that the allocations for management activities are unrealistic. They are based on the level deemed appropriate to attain water quality objectives for sediment.

Comment 19.2. How will you measure compliance of the TMDL? In five years are you going to walk same roads and same number of miles to determine if there is an improvement?

Response 19.2. EPA anticipates that the State will evaluate the effectiveness of the TMDL in several ways: 1) an evaluation of the instream and watershed indicators using a "weight of evidence" approach; 2) an assessment of the allocations by conducting a sediment source analysis following a similar methodology as GMA; and 3) compliance with the implementation measures as developed by the State.

Comment 19.3. Will the TMDL implementation plan embody the flow regime spelled out in the flow decision and have more legal authority to the decision?

Response 19.3. The development of implementation measures is the responsibility of the State. See also response 1.1.

Comment 19.4. Will the Aquatic Conservation Strategy of the Northwest Forest Plan become part of the water law if adopted into the North Coast Basin Plan?

Response 19.4. EPA does not anticipate that the ACS will be specifically adopted into the Basin Plan. Rather, the ACS may be used as a tool by the US Forest Service to achieve the requirements set forth in the TMDL implementation measures which will be developed by the State.

Comment 19.5. Are the terms “sediment delivery” and “sediment yield” interchangeable?

Response 19.5. EPA has attempted to use the term sediment delivery consistently throughout the TMDL to reduce confusion.

Comment 19.6. How was the percent load reduction (76%) calculated on Indian Creek?

Response 19.6. The percent load reduction for Indian Creek was calculated incorrectly. EPA has changed it to 96%.

Comment 19.7. Many targets in Chapter 3, especially hillslope targets, need to be carried over into implementation recommendations. The Summary Table on page 66 mentions hillslope targets for the Forest Service but no mention is made for the private industrial timber land.

Response 19.7. EPA has included hillslope targets in Table 6-1 in the private industrial timber category.

Comment 19.8. A recommendation was made for implementation timetables for the TMDL since implementation has taken so long on the South Fork TMDL.

Response 19.8. The State is responsible for developing TMDL implementation measures. EPA has encouraged the State on several occasions to implement TMDLs in a more timely fashion.

Comment 19.9. How do you get copies of KRIS system mentioned in the TMDL?

Response 19.9. The Trinity County Resource Conservation District can distribute copies.

Comment 19.10. Were the allocations established by land use activity or by ownership?

Response 19.10. The TMDL allocations are established for management-related sediment on a subarea basis, not to specific ownerships.

Comment 19.11. The Summary on page 2 does not mention square miles covered by this TMDL.

Response 19.11. The Trinity River TMDL covers approximately 2000 square miles.

Comment 19.12. How do you apply the Garcia River implementation plan approach (options 1, 2, and 3) to watersheds with different problems. For example, one person has to reduce sediment by 10% and another person has to reduce sediment by 90%, yet they have the same options.

Response 19.12. This is an appropriate question for the State to consider and address in the implementation planning process. EPA will forward this question to the State.

Comment 19.13. How does the TMDL take into account flow and how does it address it clearly in the document?

Response 19.13. See response 1.1.

Comment 19.14. The data about Coho is questionable and misleading. The Department of Fish and Game surveys were for Chinook not Coho.

Response 19.14. EPA has clarified the second paragraph of Section 2.2 regarding coho utilization of the upper middle tributaries as of 1990. However, this information does not change the TMDLs and Load Allocations called for in Chapter 5.

Comment 19.15. Why are salmonids the only beneficial use addressed? Physical and biological data should be considered.

Response 19.15. The beneficial uses of concern in this TMDL are focussed on supporting cold water ecosystems, the preservation or enhancement of aquatic habitats, and high quality habitats suitable for reproduction, early development and migration of aquatic organisms (described in Section 2.1 of the TMDL and defined in the Water Quality Control Plan for the North Coast Region "Basin Plan"). In assessing these beneficial uses, EPA did evaluate physical and biological data as described in Chapters 2 and 3. Rather than make specific determinations as to whether other beneficial uses are impaired (e.g., recreation), EPA made determinations that the fisheries-related beneficial uses are impaired and that they are the most sensitive to sediment impacts. Thus, EPA concludes that impairment of beneficial uses caused by excessive sediment will most likely be addressed by attainment of the loading capacity determined by consideration of fisheries-related beneficial uses.

Comment 19.16. There needs to be better communication between Clean Water Act programs and the Department of Fish and Game 1603 permit program. North County residents are getting fined when they remove sticks that hold sediment.

Response 19.16. EPA agrees that communication between the various agencies regarding Clean Water Act programs, California Fish and Game Codes and other related programs could be improved. EPA supports the formation of groups such as the Trinity Management Council, Trinity Resource Conservation District and other watershed groups that can facilitate communication between agencies and landowners.

Comment 19.17. What do the targets mean officially in the TMDL?

Response 19.17. As described in Chapter 3 of the TMDL, the indicators and their associated target values will provide a useful reference in determining the effectiveness of the TMDL in attaining water quality standards, although they are not directly enforceable by EPA.

Comment 19.18. How fast will the state develop the implementation plan?

Response 19.18. The State representative in attendance at the meeting indicated a timeframe of 2-3 years.

Comment 19.19. Are TMDLs an official priority of the water board?

Response 19.19. EPA cannot answer that question for the board.

<u>20. Public Comments from Technical Information Meeting in Weaverville, CA on November 6, 2001. Notes taken by the Trinity County Resource Conservation District</u>.

Comment 20.1. Is there a schedule for implementation?

Response 20.1. See response 19.18.

Comment 20.2. Can we achieve allocation goals with just mechanical restoration on mainstem? What about flow? Why isn't EPA setting allocations for flow as they are for managment activities?

Response 20.2. See response 1.1.

Comment 20.3. Won't mechanical restoration change the indicators used to gage the health of the river?

Response 20.3. EPA would expect that the purpose of any mechanical restoration activities conducted in the mainstem would be to facilitate the achievement of the healthy river attributes, some of which are included in the TMDL. Therefore, any mechanical restoration should contribute to the attainment of the indicators.

Comment 20.4. Assuming EPA indicators were only used as guidelines and aren't absolute, isn't it up to the state to determine the absolute indicators?

Response 20.4. The water quality indicators in the TMDL are intended to assist in determining the extent to which implementation of the TMDL is successful in attaining water quality standards. It is up to the State to adopt measures that will implement the TMDL.

Comment 20.5. The TMDL doesn't consider other factors affecting salmon population (e.g., predation). What other links are there between cold water fisheries and population decline?

Response 20.5. The TMDL recognizes that salmonid populations are affected by several factors, in addition to sediment in the freshwater environment (Section 2.3). However, TMDLs are developed to address pollutants. The Trinity TMDL is focused on sediment, the pollutant for for which the Trinity River is listed according to Section 303(d) of the Clean Water Act. EPA recognizes that achievement of a sediment TMDL, "will facilitate but not guarantee, population recovery" (Section 2.3). EPA acknowledges and supports the variety of authorities and programs that are responsible for addressing the other factors including poaching, harvest, migration barriers, etc.

Comment 20.6. A concern was expressed that management activities will be pushed into less stable areas with high natural sediment rates because the management load allocations are higher there.

Response 20.6. The comment seems to be based on the assumption that use of 125% to estimate the loading capacity is more stringent when the soils are very stable. This assumption would not be correct. While it is true that the management allocation might be lower in a watershed with very stable soils, it would also be true that management activities (including operation of roads) would be expected to generate less sediment in such a watershed than similar activities on less stable soils. Thus, while the allocation for mangement-related sediment delivery would be lower on more stable land (all other factors equal), the amount of human activity associated with that level of sediment delivery may well be comparable. Please note, however, that while use of 125% neither discourages or encourages activity on stable watersheds relative to unstable watersheds, at the watershed level, the TMDL contains a water quality indicator (section 3.2) that encourages activities in unstable areas within a watershed to be avoided or eliminated. .

Comment 20.7. The 97% reduction set for Grass Valley Creek doesn't take into account recent work in Hamilton ponds.

Response 20.7. The TMDL sets allocations with the goal of reducing sediment at its sources, because the TMDL is designed to attain water quality objectives for sediment in the tributaries as well as the mainstem. EPA has footnoted tables 4-3 and 5-3 in the TMDL to clarify that the sediment delivery rates do not account for the amount of sediment trapped by Buckhorn Dam and Hamilton Ponds.

Comment 20.8. Does the TMDL consider that management activity levels have dropped since 1993 resulting in greatly improved conditions?

Response 20.8. EPA evaluated the effectiveness of land use activities, conservation measures and regulations by determining the amount of sediment delivered to the watercourse from the multitude of land management sources. The results of EPA's sediment source assessment indicate that the Trinity River Basin contains many areas where these programs may currently be effective and several areas where dramatic improvement is needed. For example, the restoration program in Horse Linto Creek (HLC) is likely one of the reasons why HLC has a low proportion of management-related sediment compared to non-management levels. The EPA applauds all the restoration efforts that have taken place since 1992 and years prior. However, the TMDL assessment along with other assessments (e.g., County Roads Erosion Inventory) indicate that sediment reduction from certain practices and in specific locations must be made to protect water quality (Chapters 4 and 5). EPA expects the State to develop an implementation strategy that properly acknowledges the effectiveness and/or weaknesses of existing programs in order to protect water quality.

Comment 20.9. Is there a mechanism to adjust certain TMDL standards if later found to require adjustment?

Response 20.9. Yes. The State can revise the TMDL in the future based on new information, studies, monitoring results, etc.

<u>The following comments were directed to EPA's technical consultant, Graham Matthews</u>. <u>The following responses are a summary of how he responded at the meeting.</u>

Comment 20.10. How can you determine the rate of landslides in undisturbed areas from a 1944 photo?

GMA Response 20.10 One must analyze the photos to determine if there are natural disturbances and then calculate the number of slides per area.

Comment 20.11. Do timber harvest plan (THP) areas mapped represent actual disturbed, cut areas or just blocks submitted for THP approval?

GMA Response 20.11. A blend of both. CDF has plans in the next 5-10 years to digitize the actual undisturbed areas. Forest Service harvest areas and management activities weren't included since the data was not available in a digitized form. The Forest Service provided some records of harvest acreages.

Comment 20.12. When did Grass Valley Creek background levels or conditions change to reflect management impacts?

GMA Response 20.12. Conditions changed when Highway 299 was built. Since amounts of sediment are higher near roads, it can be assumed that roads lead to sediment transport.

Comment 20.13. After the 1997 flood, the mainstem was very visibly turbid. GMA data doesn’t reflect that.

GMA Response 20.13. The observed turbidity was due to very fine particles that weren’t represented in the data.

Comment 20.14. Are you saying that even with higher ROD flows, sediment deltas/piles near the dam won’t be moved?

GMA Response 20.14. Not in my opinion. You would need mechanical removal, which could then be maintained with higher flows.