

## SECTION H SYNTHESIS

### INTRODUCTION

The synthesis module presents a compilation of results with an attempt to summarize the most significant hillslope hazards and aquatic resource conditions for improvement. The information compiled will be a summary of sediment inputs, presentation of aquatic habitat condition ratings (on target, marginal, deficient), and any water quality information available. The synthesis module presented here differs from the protocols presented in the Washington state watershed analysis manual (Version 4.0, Washington Forest Practices).

### Sediment Inputs

The estimated sediment inputs for the Greenwood WAU have been summarized and are presented. The purpose of this summary is to demonstrate the relative amount of different sediment sources, indicate priorities for erosion control, and assist with interpretation of stream channel conditions in relation to sediment deposition and transport. A sediment budget provides quantification of sediment inputs, transport, and storage in a watershed (Reid and Dunne, 1996). In this case we are not doing a true sediment budget, only an estimation of the sediment inputs. Care must be used when interpreting these estimated values; by no means can the estimates be considered absolute. Rather, the sediment input estimates are best interpreted for relative comparisons between processes and planning watersheds.

This section combines and summarizes the sediment input results from the Mass Wasting and Surface and Point Source Erosion modules of the watershed analysis. Sediment input for the Greenwood WAU is estimated from hillslope mass wasting, road associated mass wasting, road surface and point source erosion, and skid trail erosion. The sediment inputs are shown as a rate for current conditions (1990-2003).

The average estimated sediment input for the time period 1990-2003 for the Greenwood WAU is 1050 tons/square mile/year. The inputs in the Greenwood WAU over this time frame have come from mass wasting (41%) and surface and point source erosion (59%). The breakdown of total sediment input is presented by planning watershed for the Greenwood WAU (Table G-1 and Figure G-1).

Road associated sediment delivery is the major contributor in the Greenwood WAU. By adding the contribution of road surface, point source and mass wasting sediment delivery, roads represented 74% of the sediment inputs from 1990-2003 in the Greenwood WAU. However, MRC has made great efforts in correcting this issue. Currently 60,549 cubic yards of controllable erosion is associated with the road network. Since 1998, when the company was formed, 9,705 cubic yards of erosion from the road network has been controlled. This represents an improvement of 7% of the total controllable erosion within the last 5 years. Further improvements will continue to occur.

Figure G-1. Estimated Percentage of Sediment Inputs by Source for the Greenwood WAU, 1990-2003.

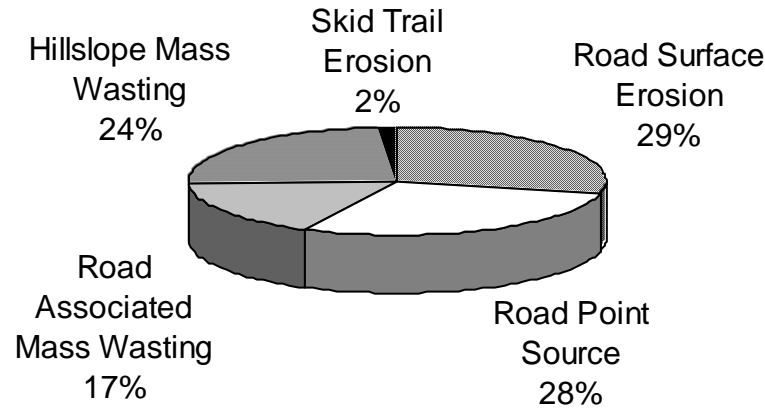
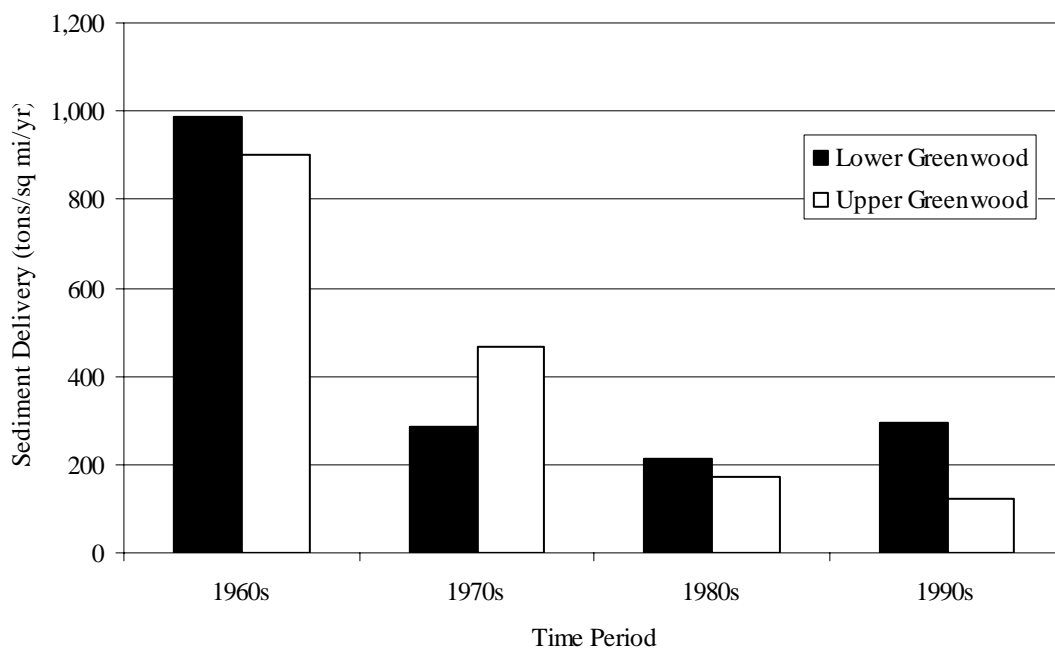


Table G-1. Estimated Sediment Inputs by Input Type for Planning Watersheds of the Greenwood WAU Averaged over Forty-three Years (1990-2003).

Planning Watershed	Road Surface Erosion (tons/mi <sup>2</sup> /yr)	Road Point Source Erosion (tons/mi <sup>2</sup> /yr)	Road Associated Mass Wasting (tons/mi <sup>2</sup> /yr)	Hillslope Mass Wasting (tons/mi <sup>2</sup> /yr)	Skid Trail Erosion (tons/mi <sup>2</sup> /yr)	Total (tons/mi <sup>2</sup> /yr)
Lower Greenwood	410	340	140	140	20	1040
Upper Greenwood	340	420	250	30	20	1070
<b>Greenwood WAU Total</b>	<b>380</b>	<b>370</b>	<b>180</b>	<b>100</b>	<b>20</b>	<b>1050</b>

The highest level of sediment inputs in the Greenwood WAU occur in the 1960’s time period, excluding road surface and point source erosion (Figure G-2). This is predominately from a high level of mass wasting and skid trail erosion during this time period. The 1970’s were the next highest level of sediment inputs. The subsequent decades (1980s and later) have been relatively constant in the sediment inputs and represent lower sediment inputs than historic levels. Road surface and point source erosion is only evaluated for current conditions, we were not able to confidently determine past road surface and point source erosion so it was left out of this presentation. However, we are confident in saying that road practices have been much improved over the past and have followed the same improving trend of decreased inputs over time.

**Figure G-2.** Sediment Delivery by Planning Watershed for Time Periods 1960s through 1990s for the Greenwood WAU; excluding road surface and point source erosion.



**HABITAT QUALITY RATINGS**

The habitat quality ratings for LWD, stream temperature, stream shade, stream gravel permeability, and fine sediment are presented here. Some of the ratings were previously presented in this watershed analysis.

**LWD Quality Ratings (as reported in Section D, Riparian Function)**

Table G-2 shows the instream LWD quality rating for major streams and sections of Greenwood Creek in each of the two Calwater planning watersheds in the WAU. This quality rating will provide a tool to monitor the quality of the LWD in major streams over time. The entire mainstem of Greenwood Creek is currently classified as deficient. The large size of the channel requires larger LWD which is currently at low levels in Greenwood Creek. Most of the tributaries of Greenwood have marginal or on target ratings. One tributary, Corrals tributary, is deficient primarily due to lack of key LWD.

Table G-2. Instream LWD Quality Ratings for Tributaries and Sections of Greenwood Creek in Calwater Planning Watersheds for the Greenwood WAU.

Stream	Calwater Planning Watershed	Instream LWD Quality Rating
Greenwood Creek	Lower Greenwood Creek	Deficient
Greenwood Creek	Upper Greenwood Creek	Deficient
Pond Tributary (CG16-22)	Lower Greenwood Creek	On Target
Corrals Tributary (CG25-38)	Lower Greenwood Creek	Deficient
Valente Gulch	Upper Greenwood Creek	Marginal
Big Tree	Upper Greenwood Creek	On Target

**Shade Quality Ratings (as reported in Section D, Riparian Function)**

The Greenwood WAU generally has favorable stream shade conditions as demonstrated by the stream shade ratings (Table G-3). All of the tributaries of Greenwood Creek, that were rated, have an “on target” stream shade rating. Greenwood Creek rates as “marginal” in both the upper and lower segments. However, both of these sections of Greenwood Creek are close to being “on target”. It is anticipated that over time with policies promoting stream shade these ratings will improve. There are no “deficient” stream shade quality ratings in the Greenwood WAU.

Table G-3. Stream Shade Quality Ratings for Streams in the Greenwood WAU.

Stream	Calwater Planning Watershed	Stream Shade Quality Rating
Greenwood Creek	Lower Greenwood Creek	Marginal
Greenwood Creek	Upper Greenwood Creek	Marginal
Pond Tributary (CG16-22)	Lower Greenwood Creek	On target
Corrals Tributary (CG25-38)	Lower Greenwood Creek	On target
Valente Gulch	Upper Greenwood Creek	On target
Big Tree	Upper Greenwood Creek	On target

**Stream Temperature Quality**

Stream temperature quality is evaluated by use of the mean weekly maximum temperature (MWMT) for the year 2003 for the species present in the watershed. The rating for stream temperature quality is derived from information in the draft Habitat Conservation Plan and Natural Community Conservation Plan that MRC is developing. In the case of Greenwood Creek the salmonid species utilizing the streams evaluated are steelhead trout, though coho salmon may have historically utilized Greenwood Creek. For coho salmon and steelhead trout the stream temperature quality ratings are defined below.

Species	DEFICIENT (C°)	MARGINAL (C°)	ON TARGET (C°)
coho	>18	16-18	<16
steelhead	>21	17-21	<17

Table G-4. Stream Temperature Quality for Streams in the Greenwood WAU.

Stream	Calwater Planning Watershed	Steelhead Temperature Quality Rating	Coho Temperature Quality Rating
Greenwood Creek	Lower Greenwood Creek	Marginal	Deficient
Greenwood Creek	Upper Greenwood Creek	Marginal	Deficient
Pond Tributary (CG16-22)	Lower Greenwood Creek	n/a	n/a
Corrals Tributary (CG25-38)	Lower Greenwood Creek	On Target	Marginal
Valente Gulch	Upper Greenwood Creek	On Target	Marginal
Big Tree	Upper Greenwood Creek	On Target	Marginal

From the information available stream temperature ratings are favorable for both coho and steelhead in the tributaries of the Greenwood WAU. The stream temperature ratings are favorable for steelhead in the mainstem of Greenwood Creek.

**Stream Gravel Quality**

Stream gravel quality has been monitored in one long term stream monitoring segment in the Greenwood WAU (stream segment CU1). Both permeability and bulk gravel samples have been collected. The percent fine sediment from bulk gravel samples and permeability quality ratings are defined below.

Permeability Ratings	
ON TARGET (OT)	>10,000 cm/hr permeability = >55% survival index.
MARGINAL (M)	>2000 cm/hr permeability = >30% survival index.
DEFICIENT (D)	<2000 cm/hr permeability = <30% survival index.

Fine Sediment Ratings	
ON TARGET (OT)	<7% in the size class 0.85 mm using dry sieve techniques. <sup>1</sup>
MARGINAL (M)	7-14% in the size class 0.85 mm using dry sieve techniques.
DEFICIENT (D)	>14% in the size class 0.85 mm using dry sieve techniques.

<sup>1</sup> MRC used information from the Noyo TMDL for sediment (EPA 1999) to develop the target for fine sediment from dry-sieve techniques; the target is less than 7% of the gravel composition in the size class 0.85 mm. In the TMDL for the Garcia River (NCRWQCB 1997), where dry sieving is not specified, the target for gravel composition in the size class 0.85 mm is less than 14%.

**Table G-5.** Stream Gravel Quality Ratings for Permeability and Fine Sediment for Upper Greenwood Creek Long Term Monitoring Segment, 2001 and 2003.

Year	Stream Gravel Permeability Rating	Fine Sediment Rating
2001	Deficient	On Target
2003	Deficient	On Target

Stream gravel quality has mixed results within the long term monitoring segment (CU1) in the Greenwood WAU. Fine sediment meets “on target” conditions while permeability is “deficient”. These parameters contradict each other and will need to be watched over time particularly the permeability.

### **Aquatic Habitat and Water Quality Summary**

The habitat quality ratings and sediment input summaries show that large woody debris recruitment and road associated sediment have the greatest need for improvement. Stream temperature and shade provide good conditions for steelhead trout, but show less desirable conditions for coho salmon (a species not known to reside in Greenwood Creek). Currently MRC has made good improvements in its efforts to controlling road sediment with 7% of the total controllable erosion addressed in the past 5 years. Although fine sediment levels in one long term monitoring segment are good, permeability levels are poor. Hopefully through increase road improvements and time the permeability observations will improve.

### **LITERATURE CITED**

NCRWQCB (North Coast Regional Water Quality Control Board). 1997. Garcia River water quality attainment strategy. Santa Rosa, CA.

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

USEPA. 1999. Noyo River Total Maximum Daily Load for sediment. Region IX, San Francisco.