



THE FEATHER RIVER
COORDINATED RESOURCE
MANAGEMENT GROUP

WOLF CREEK RESTORATION
PROJECT

Fact Sheet #5

March 1996

THE PROBLEM

Less than forty years ago, Wolf Creek was a small, willow-lined stream narrow enough to jump across in many places as it flowed through the small mountain town of Greenville in the Northern Sierra Nevada of California. But years of human intervention and catastrophic floods have caused major changes in Wolf Creek. By 1990, its channel had widened to 100 feet, in some places. Erosion gullies kept growing and denuded stream banks were collapsing into the creek and washing away during rain storms. Two houses, a 200 foot section of a Union Pacific Railroad trestle, a 1,000 foot section of State Highway 89, a municipal water pipeline, an auto wrecking yard, and a mill dump were within 15 feet of the eroding banks of Wolf Creek.

PROJECT LOCATION

Wolf Creek's waters begin in the rugged terrain of the Sierra Nevada, 1,700 feet above the floor of Indian Valley in Plumas County, California. The stream travels 12 miles through dense mixed conifer forests before it winds its way to the valley floor and flows for two miles through the town of Greenville, population 2,200. Past Greenville, Wolf Creek joins Indian Creek, a tributary to the East Branch of the North Fork of the Feather River (EBNFFR).

WATERSHED HISTORY

Erosion is a natural process which is often accelerated by the way humans use land. The following uses no doubt increased erosion on Wolf Creek:

Road and railroad construction: The wagon road along Wolf Creek built in 1863 was improved and realigned in the 1930's, to become State Highway 89. The highway was paved and widened along the creek in Greenville. The Western Pacific Railroad was completed in 1931 following Wolf Creek's channel for five miles upstream of Greenville. Altogether, this transportation corridor created a total of 125 acres of hard surfaces that block rain from soaking in, increasing the amount and speed of water runoff during storms, and thereby increasing flooding. Cut and fill slopes along the road and railroad bed also erode when rain falls on areas bare of vegetation.

Urbanization/industrial development: Two lumber mills operated in the Wolf Creek floodplain in the 1940's and 50's. Many homes and commercial business are located along the creek as it winds for two miles through Greenville. Hard surfaces such as streets and driveways don't allow rain to soak into the ground, thereby speeding

EROSION LOSS SINCE 1955

Property lost - average 30 feet of stream side land
along 10,000 feet of stream

Soil lost - 140,000 tons from channel banks + 100,000 tons from channel bottom = 240,000 tons
Total sediment discharge from Wolf Creek - 14,100 tons per year, 2900 tons per square mile per year
Contribution of Wolf Creek to Indian Creek sediment load - less than 5%

up runoff of rain water and increasing flooding.

Timber harvesting: In the 1940's, logging roads were constructed throughout the lower watershed. Since 1963, most Forest Service lands have been helicopter logged. A private timber company also began logging in 1983 on 600 acres, roughly 11% of the watershed. However the impact of timber harvesting is considered small (Cawley 1984).

Dam failures: In the late 1950's, a cedar mill dam about one and a half miles upstream of the project area blew out, sending a pulse of water through Wolf Creek that carried away creek bottom sediments, lowering the creek in town by an average of six feet. In the 1960's, a 1920's irrigation dam was removed just downstream from the project area which caused scouring of the stream bed.

Previous stream alterations: In 1955, the Army Corps of Engineers dynamited five feet of bedrock from the lower end of Indian Valley, to help ranchers drain marshy fields so livestock grazing could begin earlier in the season. This led to down cutting of the creek channel in town. The Corps then tried to stabilize the channel by straightening it in 3 places, and removing all riparian vegetation (Little, 1994). In 1978, the county constructed walls along the creek banks, which were undermined during 1980 floods.

WATERSHED CHARACTERISTICS

Drainage area - 49 square miles above project
Precipitation - 40 - 45 inches average, 50% as snow
Elevation - 3,450 to 7,499 feet
Slopes - 30 - 40% average
Gradient - 2 - 3% average
Stream type - 3rd order
Vegetation - predominantly mixed conifer
Soils - 40% granitic, 40% meta-sediments, 8% meta-volcanic,
6% alluvium, 6% other
Erosion hazard rating - mostly moderate

PROJECT PLANNING

Land ownership patterns presented a major complication to efforts to stabilize the channel of Wolf Creek. The greatest property damage from flooding and erosion was occurring within the town of Greenville on land owned mostly by home owners and small business owners. Individual property owners had attempted to protect their creek front property, but trying to tackle such a big problem as isolated individuals was not leading to successful results.

In 1987, the Greenville Community Services District, on behalf of urban property owners on Wolf Creek, requested assistance from the East Branch North Fork Feather River (EBNFFR) Coordinated Resources Management group (CRM) to help stop the erosion. The agencies involved in the EBNFFR CRM accepted the challenge to improve Wolf Creek because stream improvement would not only help property owners but would also fulfill agency goals to improve water quality and fish and wildlife habitat, and to stop erosion. Together with 70 owners of creek front residential, commercial, and industrial property, and community members, they initiated the Wolf Creek Restoration Project.

CRM technical experts, consultants, and property owners worked together in town hall meetings, field tours and working sessions to agree on the goal of creating a natural appearing and functioning creek and riparian system in the 100 year floodplain. Their objectives were to:

- Protect urban property,
- Stop erosion of stream beds and banks,
- Improve water quality and aesthetics,
- Improve fish and wildlife habitat and urban recreational opportunities,
- Demonstrate the cooperative implementation of meander reconstruction on private land, and
- Build community pride.

WOLF CREEK CHARACTERISTICS IN PROJECT AREA

Length of stream - 9,636 feet

Stream type(Rosgen classification system)- F preproject, C&B post project

Flow - bankfull 400 cubic feet per second(CFS), 1995 high flow 4,470 CFS, previous high flow 3,880 CFS

Sediment yield - 40,718 tons per year

Bankfull width - 40 feet post project

Bankfull depth - 2.5 feet post project

PROJECT DESIGN

After project planning and permitting, the Wolf Creek Project was implemented in three phases. Construction of Phase I, which reconstructed meanders for a wide and



Wolf Creek before the project. this relatively straight section of stream has little flood plain to accommodate flood waters.



Wolf Creek Phase III after the spring 1995 floods. The rock wier at the bottom of the photo is slowing down the Creek's waters and dissipating erosive energy.

winding section of creek, occurred in Fall 1990. Phases II and III, which installed rock weirs in several straight and narrow sections of the creek, were completed in Fall 1992. Revegetation was completed by the following spring. The project's design included the following elements:

- **Reconstruction of the braided stream channel** into one meandering channel increasing the stream length by 25%, and creation of rock step pools to slow stream energy.
- **Reconstruction of 29 acres of floodplain** to accommodate more flood waters, slow stream energy and reduce flood damage.
- **Armoring of the outsides of newly constructed meanders** with logs, rootwads, boulders, and native vegetation to protect against erosion.
- **Revegetation of the floodplain, stream banks, gullies, and terraces** with native grasses, shrubs, and trees.
- **Reaching of maintenance agreements** with the 70 creek front property owners ceding repair and maintenance to the Greenville Community Services District.
- **Monitoring of project results** using local school and community organization volunteers.

<p align="center">PROJECT RESULTS</p> <p>Stream shape and characteristics were substantially changed by construction of the project. These improvements remained in place in Phase I of the project with few changes for the first year after the project (Wolf Creek Technical Advisory Committee 1992). Small improvements in stream cover and fish habitat were measured. However, the presence of insects and macroinvertebrates continued to be low. Vegetation cover decreased because of project construction. Survival of planted vegetation was 70%.</p> <p>STREAM CHANNEL STABILITY: Changes in the channel structure constructed during the project occurred after the floods of the winter of 1994-1995. In March 1995, eight inches of rain fell on an already soaked watershed in a four day period. Wolf Creek swelled to a volume of 4,400 cubic feet per second, over eight times its normal flow (Meadowbrook 1995). These flood waters carried an estimated 112,000 tons of sediment through the project area. The majority of this erosion came from roads, new erosion gullies, and unprotected stream banks upstream of Greenville. CRM members estimate that about 6,400 tons of this soil (6%) came from stream banks that failed in the project's Phase III area, leading to a small net increase in</p>	<p align="center">MONITORING PARAMETERS</p> <p>Greenville High School students have been collecting data on the following stream characteristics since 1990:</p> <p align="center">STREAM/AIR TEMPERATURE POOL/RIFFLE RATIO OVER STREAM SHADE FISH & MACROINVERTEBRATE(INSECT) POPULATIONS AVIAN POPULATIONS REVEGETATION SUCCESS STREAM CHANNEL STABILITY CROSS SECTIONAL PROFILES</p> <p>the width and depth of the stream channel.</p> <p>Rock weirs installed in Phases II and III, the straightest section of the Creek performed as expected, while channel reconstruction measures in Phase I, the meandering section of the project, were lost. Although the creek's banks did not enlarge in this section, the stream was moved out of the carefully constructed channel into newly formed channels (Meadowbrook 1995). Most of the new meanders and armored stream banks were bypassed. Despite loss of these meanders and the severity of the flood, the majority of the stream banks treated during the project showed little erosion and little private property was lost.</p>
---	--

PARTICIPANT ROLES

FEDERAL	US Forest Service	\$95,500	Donated logs, root -wads, and boulders. Did assessments & surveys.
Total-\$17,500	Natural Resources Conservation Service	\$25,000	Did watershed assessments and river basin study.
STATE	California Department of Water Resources	\$300,000	Funded construction, hydrology & monitoring input.
Total- \$525,040	California Department of Fish and Game	\$1,000	Designed fish passage and monitoring plan.
	State Water Resources Control Board	\$191,180	Funded project, materials delivery and administration.
	California Department of Forestry & Fire Protection	\$13,100	Funded project, donated labor of a Conservation Camp Crew.
	California Army National Guard	\$2,760	Donated labor to haul boulders and rock to the site.
	California Department of Transportation	\$16,000	Donated 2,000 cubic yards of rock for construction.
REGIONAL	Pacific Gas & Electric Company	\$114,100	Funded design, construction, training, & administration.
Total- \$133,100	Regional Water Quality Control Board	\$7,000	Funded collection of monitoring data.
	North Cal-Neva Resource Conservation & Development District	\$12,000	Funded revegetation and training.
LOCAL	Plumas County Flood Control District	\$12,000	Did aerial flight and survey of Wolf Creek.
Total- \$75,350	Indian-American Valleys Resource Conservation District	\$1,500	Funded revegetation.
	Wolf Creek Project Technical Committee	\$11,600	Technical input on project design, revegetation & monitoring plans.
	Plumas Job Training Center	\$38,250	Donated equipment high school monitoring, funded monitoring.
	Plumas County Road Department	\$2,000	Donated rental trachoe maintenance during construction.
	Golden West Women Flyfishers	\$1,000	Donated "salmonids in classroom" curriculum.
TOTAL - \$850,990	Roundhouse Council, Greenville schools, Greenville Rotary, Soc. of American Foresters		Donated labor, food and mementos.

Page 4

Little, Jane Braxton. A current of hope: Saving a si
Meadowbrook Conservation Associates. Summary
Unpublished. July 6th, 1995.
Wolf Creek Technical Advisory Committee and th
post-construction monitoring. Prepared for the Eas
U.S. Forest Service. Cawley, Ken. Watershed cond

**FOR MORE INFORMATION
CONTACT**

Plumas Corporation

P.O. Box 3880
Quincy, CA 95971
Telephone (530) 283-3739
Fax (530) 283-5465

Fact sheet series produced by the University of California Cooperative Extension with funding by the California Biodiversity Council, March 1996.

Adapted for World Wide Web 2000

Project Director: Michael De Lasaux, U.C. Cooperative Extension, Natural Resources Advisor,
Plumas & Sierra Counties
Educational Outreach Coordinator: Susie Kocher, U.C. Cooperative Extension, Program Representative

 **BACK**

HOME