95-PC-319(H) - PH 54

Final Report: Shasta River Water Quality Improvement Project

Phase Four 319(h)

Great Northern Corp.

Agreement Number 14-48-0001-95704

November 18, 1997

Great Northern 319(h) Phase IV
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Abstract:

With the exception of Dwinnell Dam, the Shasta River has not been subjected to major modifications. Nevertheless, livestock grazing and other human influenced impacts have greatly affected water quality in the Shasta. Since most of the length of the river is in private ownership, improvements in water quality need to be achieved by the cumulative effects of a variety of restoration projects, each tailored to individual ownerships.

This report describes a variety of projects on several different properties dealing with bioengineered reduction of sediment from rapidly eroding streambanks, and livestock exclusion fencing. It also involves providing technical support in data acquisition for the cooperating teachers in Siskiyou Co. Schools who are participating in 319(h) projects, and help with the ongoing development of the Klamath Resources Information System.

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Introduction:

The Shasta River has long been. recognized as the single most important spawning tributary for fall chinook salmon in the entire Klamath/Trinity basin. It has also supported a substantial number of steelhead, and unknown numbers of coho. All of these fish appear to be in serious decline, with steelhead likely to receive protection under the endangered species act fairly soon, and coho already protected. In the Shasta River that decline appears to be due in part to impaired water quality.

Restoration work has focused on those three species of fish. The primary focus of the restoration work that has been done has been on long-term, permanent improvements in water quality, with the expectation that improved in-river water quality will yield higher survival of salmonids. The major water quality problems encountered are high temperatures, low levels of dissolved oxygen, and sedimentation of spawning gravels.

Land adjacent to the Shasta River is primarily in private ownership. Most of it is used for cattle ranching operations including grazing of irrigated and non-irrigated pastures, and grass hay production. Most of the ranches are small, and each has been developed with its own specific land uses to suit the owner's needs and the land's ability to produce. This ownership and use pattern has a major impact on restoration work, necessitating the development of individualized programs to minimize the impacts of a large number of landowners, while still meeting their needs to remain economically viable. The availability of Clean Water Act 319(h) funds in a "block grant" fashion has greatly facilitated this necessary micro-management planning.

The Shasta River has not been subjected to many of the planned and unplanned modifications that have so greatly affected most of the rivers in California, particularly channelization, channel straightening and downcutting of the channel. On the other hand, it has in the upper third of its drainage a permanent dam and lake (Dwinnell Dam and Lake Shastina) for winter storage of water for irrigation. A new dynamic equilibrium may now exist, and while livestock have tended to de-stabilize the streambank, at the same time the dam has greatly reduced the erosive forces present by capturing winter runoff. The net result seems to be a river that has been able to retain its pre-settlement structure in terms of slope, meander pattern, approximate width, etc., yet one that has lost the shade, water temperatures, fish rearing habitat, and sediment transport mechanisms that were critical components of the pre-historic Shasta River. The major consequence of this from a restoration/water quality standpoint is that major earth moving, channel restructuring and rip-rapping projects often seen elsewhere are seldom appropriate in those portions of the Shasta accessible to anadromous fish where the bulk of the restoration work is being done.

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Description of Study Area

The Shasta Valley is located near Yreka, in north-central California (see attached map). It covers approximately 800 square miles, from Mt. Shasta in the south, to the Klamath River in the north. Geologically, soils and land-from throughout the valley are strongly influenced by lava and debris flows originating from Mt. Shasta.

Rainfall varies from 6 to 19 inches, as both rain and snow. A large quantity of moisture is captured as snow on Mt. Shasta, where it melts over the course of the summer. This snowmelt percolates into the ground, and appears in the flow of large springs that produce nearly all of the summer flow of the Shasta River. The Shasta River itself is a low gradient meandering river generally 20 to 30 feet wide, flowing through a largely treeless plain.

Land uses in the Shasta Valley include cattle ranching, grass, alfalfa and grain farming, and small urban areas. Most agricultural activities rely on irrigation, either from the Shasta River or its tributaries, or utilizing pumped ground water. One permanent dam (Dwinnell Dam) captures winter flows in the upper third of the drainage, and stores the water for use in summer irrigation. It forms Lake Shastina, with a storage capacity of 50,000 acre feet. Numerous other smaller reservoirs also store winter runoff throughout the basin.

Further information will be included in the descriptions of each work site.

Project Sites:

1. Freeman Ranch

Background

The Freeman family has owned their Ranch along the Shasta River since 1940. It is situated in the prehistoric floodplain formed by the confluence of Julian Creek and the Shasta River. Julian creek has deposited large quantities of sand and gravel in this area, and the soils are quite sandy and erodible. As a consequence the river tends to form islands, and meander more than occurs elsewhere.

The Freeman's have become concerned at the consequences of the rate of erosion, both to themselves and to people downstream. Working with the Shasta CRMP, they secured funding from the Cantara Trust Committee to construct livestock exclusion fencing along both sides of the 3/4 mile of river through their property. 319-H funds were used to begin applying willow

matting to the rapidly eroding banks in order to slow the rate of erosion and allow vegetative stabilization to protect the banks.

Methods and materials:

Large quantities of willow trees, roughly one inch in diameter, and 10 to 20 feet long were gathered from an area of mine tailings near Yreka. They were transported to the work site, where they were wired into bundles approximately nine inches in diameter. Those bundles were placed diagonally, side-by side on the banks, from the toe to near the top. They were secured with wires running from steel "T" posts that had been driven into the bank three to four feet. Once the entire surface had been covered with matting, the "T" posts were driven in further, tightening the wires, and forcing the matting into the underlying mud.

Prior to placing the willow matting, balls of tule roots were also worked into the mud along the water's edge. Those tules will grow up through the matting, and begin the stabilization process. Later this winter, willow trees will also be planted in the matting, adding to species diversity, root strength, and shade.

Extensive stretches of vertical bank exist on this site. Additional areas will be similarly treated in the future.

Results and discussion:

It is far too early to arrive at any conclusions about the long term effectiveness of the work done. Other willow matting that we have installed elsewhere along the Shasta Rive has survived the last two winters' high water completely intact, so this work should survive well also.

One conclusion that we reached this summer was that we could and should pre-plant with tules as early as possible in the spring, to give them a maximum growing season. We can then return in late summer when river flows are at their lowest and install the willow matting on top of them. Using that technique should give us better and more vigorous survival.

2. <u>Himmel Fence</u>

Background:

The Himmel's own a small ranch with about 1/2 mile of river frontage. The property is used for haying and grazing. We constructed a livestock exclusion fence to keep cattle from grazing in the riparian zone.

Methods and materials:

This was a standard five wire barbed wire fence with numerous corners to match the meanders of the river. We also included several gates to allow the easy removal of any cattle that found themselves on the wrong side of the fence. Fence corners were constructed with railroad ties set 4 feet deep, 6" wooden line posts were placed every 60 feet, with heave duty T posts every 12 feet.

Results and conclusions:

This area had good riparian growth of trees already. Fencing will protect that, plus will minimize sediment movement into the water from hoof impact and bank erosion. This fence is above most of the normal flood plain, and should last a long time.

3. Work with Siskiyou County Schools

Background:

Earlier phases of 319-h grants in the Klamath Basin had included an educational component. Over time, the nature and scope of anticipated student involvement has changed somewhat. In phase 4 greater emphasis was placed in working more closely with a few teachers who were directly involved in project monitoring.

Methods and Materials:

The collection of stream cross section data is a process that seems to be well suited to the interests and abilities of a variety of high school students, ranging from those taking trigonometry and algebra, to those more interested in construction type measurements. We have worked with students from Weed High School, Yreka High School and Discovery High School, and have collected cross section data on the Meamber Ranch (second year), the Freeman Ranch (baseline) and the Fiock Ranch(baseline). The techniques used include transit and leveling rod surveys, and string line surveys, depending on the abilities and interests of the students involved.

Results and discussion:

We assume that the report from the schools will examine the educational benefits of the cooperative effort. From our standpoint, we were able to secure cross section data that might otherwise not be collected. Over time, it should allow us to document changes occurring to the

banks and bottom of the river, which presumably will verify that progress is being made. Beyond that, we should not minimize the need to expose as many people as possible to the restoration process, and its complexities.

4. Riparian Tree Protection

Background:

While a great deal of time and money is being spent on re-planting native trees along the Shasta River, protecting existing trees has been frequently overlooked. Large trees obviously take decades to grow, and provide essential components of the aquatic and riparian ecosystem, including shade, woody debris, leaf drop, and rearing habitat. In the absence of smaller and easier trees to eat, beavers do cut down large trees. There are so few remaining that we have found them to be worth protecting.

Methods and materials:

Once livestock have been excluded from the immediate riparian zone, beavers are the only major threat to tree survival. Wrapping existing trees with 2" by 4" fencing, to a height of 3 to 4 feet seems to completely deter beavers. We wrapped most of the large trees on about 3/4 mile of river in this fashion. In order to allow room for growth, we used flood debris--branches and sticks--as spacers between the fence and the tree trunks.

Results and discussion:

Experiments elsewhere on the river seem to have demonstrated that while beavers are certainly strong enough to remove fences, and are fully capable of climbing trees, wrapping trees seems to create a foreign situation for them, and they don't attempt to circumvent it. So far there has been no instance of beaver damage to any wrapped tree, except to those branches which grow out from the sides of the cage.

5. KRIS System related work

Background:

For several years consultants to the Regional Water Quality Control Board have been working to develop a computer based system that will receive and disseminate data pertinent to fisheries restoration in the Klamath Basin, especially that which relates to water quality. That system was initially intended to contain primarily data, and be useful as a management tool. Over time it has

been evolving into a complete GIS system, with data, text, and photographic images all tied to a map base. It is now seen as not only the future place to go for all data available for management, but also as a way to make interesting and useful information available to the general public, either via a computer located in some public place, or on the Internet. In addition, it will help tie together all aspects of restoration from one end of the basin to the other.

Methods and Materials:

Since its inception, we have worked closely with the developers of the KRIS system. Ongoing participation includes:

- providing photographs of restoration activities and key places along the Shasta,
- assembling and transmitting data and text,
- reviewing materials included in the KRIS system for accuracy and completeness,
- ground truthing map layers,
- suggesting sources of additional data and information,
- providing feedback on various versions of the KRIS system as they have been released
- participating in group meetings with other KRIS cooperators
- identifying data gaps that need to be filled
- upgrading our computer system to allow it to handle the expanding KRIS files

Results and Discussion:

The KRIS System is still a work in progress. As the vision of what it should be has expanded, it has gone through many changes. Those changes have resulted in great improvements, but they have also resulted in a system whose hardware requirements are expanding, and whose future format is at times uncertain. We foresee a need for it to continue in a developmental mode for at least another year, however, at the request of the USFWS, within the next month we will be moving the RWQCB supplied computer to Yreka, where it will become a public access KRIS station.

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Matching Contributions:

Student labor:	
Aviani 5x4x5x5=	$500
Velarde 6x1x5x5=	$150
O'Connor 3x5x5x5=	$375
Personal Photos	$200
Cantara work done to date	$30,000
Willow trees for matting	$3,000
DFG/STEP labor tree planting	$5,000
Total Match:	$39,225