

Final Report

Kuck Bioengineered Bank Protection

Great Northern Corp.
PO Box 20
Weed, Ca 96094

2000-HR-04
14-48-11333-00-J003

July 10, 2002

Abstract:

Private property restoration work to protect salmon and steelhead along the Shasta River takes many forms. On the Kuck Ranch previous work included livestock exclusion fencing, and limited tree planting. After several years, it was apparent that significant stretches of the excluded area were not significantly improving, primarily due to accelerated erosion resulting from years of livestock impacts and recent river avulsion. Temporary hardening of the bank was accomplished using bioengineered techniques, followed by planting of tules and willows. Bioengineered bank protection will function much like rock rip-rap for about 10 years, by which time it will have rotted. During that period the unstable areas will be colonized by planted and naturally recruited riparian and emergent plants. In all, 1500 feet of unstable bank were treated with a dense coverage of willow mattresses made up of approximately 6100 individual bundles of willows 14-12 feet long, and inter-planted with 35 cubic yards of tule root balls. During the late winter following installation of the matting, 1250 willow whips were planted immediately above the matting. Funding for this project was provided by the Klamath river Basin Fisheries Task Force and the California Department of Fish and Game SB 271 program.

Introduction

The Shasta CRMP has utilized bioengineered bank protection measures along the Shasta River periodically since 1991. The Klamath River Basin Fishery Task Force, California Regional Water Quality Control Board and California DFG have all provided funding for this type of effort. For this project funds from both the Task Force and DFG were utilized.

This project will re-establish the stabilizing presence of local native riparian plants, and create a self-sustaining riverbank able to adjust to changing future conditions. Installing willow matting, planting tules, and planting willows will help repair damage done by erosion to the bank of the Shasta River. Planting willows will help stabilize the bank and provide shade for habitat improvement and lowering of water temperatures. Planting tules will stabilize the bank with their root systems and reduce the water flow velocity along the edge of the Shasta River. The willow matting will reduce water flow velocity and catch debris and silt during the first 10 years until the tules and willows get established. The willow mats will also serve as habitat for small fish (steelhead, coho, and fall chinook).



Description of Project Area

The Shasta Valley is located in Northern California, and is part of the larger Klamath Basin.

Because of its geology, vegetation and climate, the Shasta Watershed should be thought of as part of the Great Basin, with conditions similar to those typical of Eastern Washington, Eastern Oregon, Northern Nevada, and those parts of California east of the Sierras. It totals just under 800 square miles, and is part of the larger Klamath Basin.

It is an area of frequent winds, high evaporation rates, limited rainfall and sunny days. Because of its elevation (2300-3500 feet

or higher) the growing seasons are short, limiting the crops which can be grown. Distance to markets and lack of infrastructure further limit agricultural activities that can be profitably pursued.

Much of the perimeter Shasta Watershed is steep, dry, and frequently volcanic ground. Because the terrain is so dry and rugged, it has been relatively little impacted by human activities over the last 150 years.

The flat, central portions of the Shasta Valley present a very different picture. Here, despite the fact that it contains areas of as little as 5 inches of precipitation per year, agricultural activities predominate. Most ground is dedicated to cow-calf beef production including dryland grain and grazing, irrigated and sub-irrigated pastures, and grass, and to a lesser extent alfalfa hay.

A variety of reports exist describing specific conditions in the Shasta Valley. Collectively all investigations into resource needs of the Shasta Valley tend to call for: 1. Improvements in all phases of irrigation to reduce water withdrawals and subsequent tailwater return, and minimize other irrigation related impacts on fish, 2. Erosion reduction to minimize fine sediment impacts on spawning gravel, 3. Measures to reduce livestock impacts on riparian zones of streams.

This project primarily addresses the need to minimize erosion.

The Kuck Ranch:

This project is located approximately half way between Grenada and Montague. The land is irrigated pasture with occasional trees growing along the Shasta River as shown in picture one.

The currently excessive lateral migration of the stream on the Kuck property is a result of a combination of events including fairly recent river avulsion, intensive grazing, longstanding loss of woody riparian plants and sandy erodible soil.



This fence post was 20 feet back from the edge of the stream when installed in 1996.

Livestock exclusion fencing proved insufficient to allow the stream to re-stabilize itself, and over the approximately 5 years since it was installed, parts of the river have moved over 20 feet, undermining sections of the exclusion fence and sending tons of fine sediment down the river. When it became apparent that natural forces would be inadequate to reverse the erosion problem anytime soon, we chose to utilize willow mattresses as a way to provide temporary “rip-rap” to the bank to allow time for riparian and emergent plants and trees to stabilize the site. The willow mattresses are expected to last about 10 years, during which time the site will be

colonized by the trees and tules planted there.

Methods and Materials

Willow Matting

Willow matting is used along the Shasta River to provide temporary (5-10 years) protection from bank erosion. During that time, both naturally-propagated and planted trees, tules and grasses stabilize the bank. Those plants and trees create a buffer strip to provide long-lasting protection, while still allowing the river to change slowly over time. In conjunction with installing willow matting, the area is fenced to exclude livestock for a minimum of 10 years to allow vegetation to grow.

While willow matting as practiced in more humid coastal areas will frequently sprout and grow, efforts to achieve that in the high desert environment of the Shasta Valley beginning in the late 1980's were never successful. Eventually matting techniques were modified to maximize their structural benefits, with planting occurring separately when conditions were optimum.

Construction Details:

The willow whips used range from 10 to 15 feet long, and are approximately 3/4 to 1 inch in diameter. The individual whips are wired into bundles approximately 6 to 9 inches in diameter.

Whips are gathered off site, generally from waste areas including dredge tailing areas upstream of Greenhorn Reservoir near Yreka, or tailings areas near Yreka Creek formerly used for log storage, and since then colonized heavily by willows. No willow whips are collected where their absence would impact surface waters. The willows re-grow, and can be harvested every 3-4 years.

On the bank to be matted, 6-ft. steel "T" posts are driven deeply into the ground on a 2 -3 foot grid. The bundles of whips are then set in place and temporarily wired together. The bundles of whips are installed between 30 and 45 degrees to the horizontal, with 45 degrees the target angle. Curvature of the bank below the water line and the stiffness of the bundles may dictate that the angle be reduced to as little as 30 degrees. This change may be necessary to assure that the finished mat will conform closely to the existing bank without leaving voids, yet still reach out over the stream bottom to prevent undermining. Matting proceeds shingle fashion, working from downstream to upstream.

Once the bank is covered with bundles, willow cross bars are installed the length of the matting, and permanently tied to the "T" posts.

With the matting in place, steel bars are used to pry open areas in which to insert tule root masses near the water line. If the soil is damp, additional tule root balls are jammed into the ground adjacent to the upper end of the bundles. The tule roots then re-sprout and grow for the remainder of the summer, and in following years. Tule roots are gathered from irrigation ditches or reservoirs using an excavator, and transported to the site in 10 yard dump trucks.

Once all that is done, all the "T" posts are then progressively driven further into the bank, pulling the entire assembly tightly into the substrate. Finally, the T posts are bent over pointing downstream to minimize potential hazards to boaters.

In late winter or early spring following installation of the willow matting, willow whips (primarily sandbar willow, a species that spreads readily from root sprouts) are brought to the site and forced into the bank near the water line by hand, where they can root and then spread.

Kuck Matting Project Details:

Feet of Matting: 1500 feet.

Number of Willow Wattles: Approx. 6100.

Wattle Diameter: Average 8”.

Wattle Length: 14’ to 20’.

Number of T-Posts: Approx. 520.

Length of Wire: Approx. 7 feet of wire per wattle (twisted, three strand .045 stainless lashing wire).

Amount of Tules Planted: Approx. 35 cubic yards (planted usually every 2 square feet of bank).

Willow whips Planted: Approx. 1250

Tim Louie Construction brought tules for bank planting which they had removed from irrigation ditches. The tules were planted as large root balls along the bank roughly every 2 square feet. Resource Management Co. of Fort Jones did the planting.

Willows for matting were donated by the City of Yreka from a site scheduled to be stripped of all vegetation for expansion of sewage treatment operations. They were cut and hauled by the Resource Management crew from city property to the project site. The wattles were attached to the T-Posts that were driven into the bank in 2 to 3 staggered rows spaced 6 feet between posts and 3 feet between rows.

The Resources Management crew made wattles by tying clumps of willows together with wire. The wattles were then placed in the river angling down into the river. As the wattles are put in they are tied to the T-



Long vertical bank with matting newly completed.



Close-up showing closely spaced willow bundles and bent T posts.

Posts. As this process takes place the wattles form into a mat tightly covering the bank and reaching out over the bottom of the stream. When enough wattles were placed to cover the bank to within 2' of the top of the bank, cross bars of larger willow were installed, then the entire assemblage was tied to the T posts. The T posts were driven an additional 6-12 inches into the bank to pull the mat down tightly, then the T-Posts were bent over in the downstream direction.

Willow whips were planted in mid-spring into the vertical banks

immediately above the matting.

Post project monitoring will consist of annual site visits in early summer to determine success of tree growth, and will be captured photographically, and physical condition of matting. Flow velocity measurements will be taken in areas where emergent plants are not successfully colonizing banks to develop data on stream velocities that inhibit revegetation as an aid to future planning.

Limited funds remaining at the completion of the project were used to replace warehouse stocks drawn down for this project (T posts), purchase materials needed for future similar projects (coir fabric) and make repairs to the flowmeter to be used in project monitoring.

Results and Discussion of Accomplishments

The result of this project is 1500 feet of Shasta River bank that is matted with willows and planted with tules and willows. This matting will protect the bank from erosion for 10 years, giving the tules and willow whips time to get established so that they can stabilize the bank and prevent future erosion in a natural and sustainable manner.

Summary and Conclusions

Before this project much of the bank over a ½ mile distance was eroding and dumping silt into the Shasta River. Salmon and steelhead spawning gravel both in this stretch of the river and further downstream was being badly affected by the unnaturally high silt load. The willow matting will protect the banks long enough for the planted tules and willow whips grow, allowing the Shasta River to return to a natural state and provide it own protection. During the first few years the willow mats will also offer habitat for juvenile salmon and steelhead. As time goes on the willow mats will deteriorate and the tules and willows will establish themselves and offer natural bank protection and habitat.