

Final Report

Red Clover/McReynolds Creek Restoration Project

Agreement Number 04-116-555-01



Feather River Coordinated Resource Management - Plumas Corporation

January 28, 2008

Background

The Red Clover/McReynolds Creek Restoration Project encompasses a 775-acre area, covering 715 acres of privately owned land and 60 acres of public land on Plumas National Forest (PNF). This portion of Red Clover Creek drains a watershed area of 84 square miles, and is a tributary to Indian Creek and ultimately, the East Branch North Fork Feather River. The watershed has been historically used for grazing and logging with an extensive road and historic logging railroad grade system. The combination of road-like features and historic grazing along with a 1950's-era beaver eradication effort, initiated moderate to severe incision (downcutting) of the stream channels throughout Red Clover Valley, resulting in extensive gully networks that have lowered the shallow groundwater tables in the valley meadow, concurrently changing the plant communities from mesic species to xeric species such as sage, and increasing the sediment supply. This in turn has resulted in a loss of meadow productivity, diminished summer flows, and severe bank erosion. Due to severe channel incision and bank erosion, the Red Clover Creek Watershed channel system was determined to be the third highest sediment-producing subwatershed in the East Branch North Fork Feather River watershed (EBNFFR Erosion Inventory Report, USDA- Soil Conservation Service, 1989). Prior to project implementation remnants of the original meadow vegetative community occurred only near springs, hill slope sub-flow zones, and in gully bottoms. Due to the significant size of the Red Clover watershed and Red Clover Valley, and the rapid rate of erosion, the Feather River Coordinated Resource Management group (FRCRM) completed its first demonstration project in this area in 1985. The demonstration project consisted of a series of check dams to raise the water level in the gully, so that it could access the floodplain. The project area was monitored extensively for ten years, and was successful in controlling erosion and improving habitat. Pacific Gas and Electric undertook the ten-year research project. Results were published in the *Red Clover Creek Erosion Control Demonstration Project Ten-Year Research Summary 1985-1995*, (1997, PG&E). Copies of this report can be requested from the FRCRM.

A. Project Summary

The goal of the Red Clover/McReynolds Creek project was to improve the water and sediment retention functions of the watershed, with the primary purpose of restoring the functionality of 400 acres of effected floodplain within Red Clover Valley, along the stream channels of Red Clover Creek and McReynolds Creek in eastern Plumas County. The scope of the project focused on: eliminating the existing gullies within the project area; restoring bankfull flows to the historic remnant channel(s) on the surface of the meadow; restoring floodplain function; improving water temperatures; reducing sedimentation; improving forage production for cattle; improving fish and wildlife habitat; and improving long-term stability of the channel/floodplain system. Stream flows were returned to the original meadow/channel elevations utilizing the "pond and plug" technique along 3.3

miles of entrenched, eroding stream channels on both private and public lands. The pond and plug technique addresses floodplain function as the fundamental pre-cursor to all other project objectives (i.e. reduced bank erosion, improved water quality, improved fish and wildlife habitat, reduced flood flows, and increased base flows). After 22 years, and completion of 60 restoration projects, it has been the experience of the FR-CRM that once full floodplain function has been restored, other project objectives are more effectively achieved, because in a riparian ecosystem, they are inextricably linked. Expected project outcomes are to reverse the vegetative trend from xeric species and bare compacted soils to a vigorous community of wet meadow species. The root system of this community, as well as the restored function of the floodplain, are expected to increase absorption rates, thereby attenuating flood flows, and increasing summer base flows. In addition, benefits to wildlife and fisheries are expected due to restored habitat and reduction in water temperatures.

The Red Clover/McReynolds Creek Restoration Project was a cooperative effort by the Feather River Coordinated Resource Management (FRCRM) group, private landowner, George Goodwin, and the USDA- Plumas National Forest, Beckwourth Ranger District. The Goodwin Ranch acquired the property in 1988-89, after the 1985 Red Clover Demonstration Project had been completed. A new headcut threatening the original project led to the landowner requesting the FRCRM to continue restoration efforts. This in turn evolved into the development of the Red Clover/McReynolds Creek Restoration Project, which continues the restoration work completed over twenty years ago.

CALFED was a state-federal partnership formed to address the issues associated with Sacramento/San Joaquin Delta water allocation for competing needs such as agriculture, industry, residential, fish, and etcetera. Millions of dollars have been appropriated to fund project proposals that meet CALFED objectives, with most of the watershed restoration funds distributed to projects in California's Central Valley. This was the second FRCRM project that expands the CALFED area of concern upstream of the Central Valley, at the water's source. Similar to our first CALFED-funded project in the headwaters of the Last Chance Creek drainage, the Red Clover project employed the same "pond and plug" restoration technique.

1. Project Administration/ FRCRM Program Coordination

Tasks for project administration were outlined in Exhibit B – Invoicing, Budget Detail, and Reporting Provisions of the SWRCB Grant Agreement. Quarterly reports were submitted to the state outlining the status of the project and the progress that had been made under each task at the end of each calendar quarter (March, June, September, and December). In addition, an invoice billing for the accomplishments under each task was included with the quarterly progress reports (Exhibit B, Task 6.1/1.1). Regular communication with the SWRCB Grant Manager was kept, including notification and invitation to all public or media events publicizing the accomplishments and/or results of the project. At completion of the project, a project survey form was completed on the

Natural Resource Project Inventory database (NRPI) managed by UC Davis. A copy of the survey form is attached to this final report and was sent to the SWRCB Grant Manager (Exhibit B, Task 6.4).

FRCRM Coordination included organizing tours, Management, Steering, and Monitoring Committee meetings, attending regional watershed meetings and conferences to exchange information, maintaining the FRCRM website, and preparing an Annual Report (Task 3.9). A total of six Steering Committee meetings, nineteen Management Committee meetings, three Monitoring Committee meetings, and seven public tours were held between September 2004 and November 2007 (Task 3.9.1-.2). Meeting and tour announcements were advertised via email, the FRCRM website, letters of invitation, and through the local newspaper. Many articles highlighting the restoration efforts of the FRCRM were published in both local and regional newspapers and newsletters. All announcements and articles were sent to the SWRCB Grant Manager. Three Annual Reports were submitted to the SWRCB Grant Manager summarizing FRCRM's completed work, partner and watershed benefits, and future planned work (Task 3.9.5-.6). In addition, in 2005 a commemorative DVD sharing 20 years of the FRCRM's success was made and distributed to all partners and stakeholders. FRCRM staff attended several regional watershed meeting and conferences with other watershed practitioners to share information and experience. Presentations or a display was given at the following events by FRCRM staff or representatives: Headwater 2005 International Conference on Headwater Control VI: Hydrology, Ecology, and Water Resources in Headwaters; Canaan Valley Institute Restoration conference; Soil and Water Conservation Society annual conference; Urban Water Institute conference; Sierra Nevada Alliance (SNA) Sierra Watershed Restoration Workshop and Field Tour; SNA annual conference; California Watershed Network's Watershed Day at the Capitol; and the California Watershed Forum (Task 3.9.3). The FRCRM maintained their website bimonthly, updating meetings, publications, links, monitoring and project information (Task 3.9.4). A draft Project Report was submitted to the SWRCB Grant Manager for review and comment, incorporating the Grant Manager's input into this Final Project Report (Task 3.10).

2. Project Development & Implementation

The Red Clover/McReynolds Creek Restoration Project was awarded funding from the SWRCB Proposition 13 CalFed Watershed Program in June of 2004. The scope of work was outlined by Task in Exhibit A of the Grant Agreement. In November 2004 a project Technical Advisory Committee (TAC) was formed to assist in the development of overall project objectives, a project plan, and a project effectiveness monitoring program (Task 3.1.1). A list of TAC members was submitted to the Grant Manager with the first quarterly report (Task 3.1.2). The TAC met a total of four times to review the project design progress and give input and guidance to the FRCRM staff and landowner (Task 3.1.3). A Quality Assurance Project Plan and Monitoring Plan were submitted to the state in May 2005 (Task 2) outlining the scope of sampling efforts, type of data analyses, previous, existing, and ongoing monitoring that affects Red Clover watershed, questions to be answered by the

project monitoring, monitoring parameters and estimated budget. Several informal pre-project meetings were held with the landowner to discuss project objectives, features of the restoration and grazing management plan, and maintenance responsibilities that would be outlined in a Landowner Agreement. The TAC, SWRCB Grant Manager, and landowner approved the Final Agreement in the Spring 2006 (Task 3.2).

Field surveys of the project area to determine gully and remnant dimensions, and nuances in terrace and floodplain topography using a laser level and sensor were conducted by FRCRM staff during the Fall of 2004 and Spring of 2005 (Task 3.3.2). Based on field survey data gathered in 2004-2005 and existing flood frequency information, a Hydrology and Geomorphology report was completed verifying the suitability of the remnant channel and floodplain (Task 3.3.3). All cross sections were plotted, with gully and remnant channel dimensions calculated and vegetation types noted to determine geomorphic attributes of the channel and valley for conceptual design development (Task 3.3.4). The project manager worked with the landowner and the Natural Resources Conservation Service to develop plan and design Grazing Infrastructure Improvements, including fencing and water developments (Task 3.6.1-.3). During the summer 2005, the TAC made a field visit (Task 3.3.5) to review the Draft Survey and Design Pond and Plug Project Plan (Task 3.3.1/3.3.6) and Plan and Design Grazing Infrastructure Improvement (Task 3.6.4).

FRCRM Steering Committee reviews Red Clover/McReynolds Project, 2005

TAC comments were incorporated into the Draft Pond and Plug Project Plan (Task 3.3.7) and the Draft Grazing Infrastructure Improvement Plan (Task 3.6.4). The Final Pond and Plug Plan (including typical before and after cross-sections) (Task 3.4) and the Final Grazing Infrastructure Improvement Plan was submitted to the TAC and



SWRCB Grant Manager on a plan view map with the completed CEQA documentation. A final TAC field review of the design and project layout was held in April 2006. The CEQA Notice of Determination was filed in February 2006 and the NEPA Record of Decision and Finding of No Significant Impact was signed in April 2006 (Task 1.2). All permit applications, supporting documentation and fees were completed and submitted to the following agencies: Regional Water Quality Control Board 401 Water Quality Certification, the Army Corps of Engineers Nationwide Permit 27, and California Dept. of Fish & Game Streambed Alteration Agreement. A 401 permit was received from the RWQCB; CDF&G sent a letter stating a permit was not necessary for this project; and the ACOE sent a copy of a letter

sent to the State Historic Preservation Officer regarding the archaeological Evaluation of Significance report concurring with the findings of the document and determining that no historic properties would be affected by issuance of a permit (Task 1.3).

Photo documentation was made before, during, and after construction of the pond and plug restoration project and grazing infrastructure improvements (Task 3.5.3/3.7.2). Pre-project photo points were established as part of the monitoring plan and were taken in 2005. Photo sets are attached to this final report and the attached monitoring report. Fence construction and water development work began in June 2006 and was completed in May 2007 (Task 3.7). Pond and plug construction began in July 2006 and was completed in November 2006 (Task 3.5). As-built plans were submitted to the SWRCB Grant Manager after completion of all construction work (Task 3.5.4/3.7.3).

B. Monitoring and Management Practices

An Effectiveness Monitoring Program documenting pre-project conditions and assessing the project related benefits to Red Clover Creek hydrology, water quality, and aquatic and riparian habitat was established (Task 3.8.1). The effectiveness monitoring parameters were outlined in a plan narrative submitted to the SWRCB Grant Manager (Task 3.8.3) and included quantifying benefits to the CALFED Bay-Delta Program (Task 3.8.2). Attached is a Final Monitoring Report documenting pre- and post-project monitoring results, including a map with corresponding locations. Management measures implemented as part of the project plan entailed deferred grazing within the project area for a minimum of three years after project construction. Grazing was deferred the first year in 2007 as part of the grazing management plan. Corresponding locations for grazing infrastructure improvements (fencing and offsite water developments) are included on the as-built plan map attached to the final progress report.

C. Project Performance

The Red Clover/McReynolds Creek Restoration Project is the largest 'pond and plug' project constructed to date. In order to finish the project in one field season (June-November), the basic equipment package onsite continuously consisted of 2 excavators, 2 wheel loaders, 1 track loader and 1 water truck. This configuration of equipment allowed for maximum efficiency and volume and minimal congestion. This is important information for those practitioners planning to use this technology in the future.

Channel after 2/13/07 flood event, snow line is high water mark



Additionally, this was the first project to have an excavator dedicated to vegetation transplanting. Paired with the track loader, this allowed for the most effective use of existing vegetation yet. Given the size and complexity of this project, the implementation was nearly flawless, including constant coordination with the landowner and fencing contractor regarding livestock management and fence installation.

It should be noted that these projects typically exhibit visually dramatic recovery for three years after construction. In subsequent years recovery continues at a slower pace driven more by annual and inter-annual processes. First year performance is qualitatively and quantitatively discussed below. The water year immediately following construction (WY '06-'07) was very dry (76% of average) with one minor flood event on 2/10/07. Despite the dry year, several hydrologic metrics indicate the project is beginning to meet objectives.

More detailed monitoring results are available in the appended Red Clover Monitoring Final Report. Turbidity monitoring was conducted during high water events in 2007. Turbidity samples were collected at the top of the project, above the confluence with McReynolds Creek, just below the end of the project. Turbidity entering the project during the one high water event Feb. 10- 13 was 71 and 77 NTUs, respectively. Turbidity leaving the project was 30 and 52 NTUs respectively. Additionally, one measurement was taken during snowmelt runoff April 18. Turbidity entering the project was 6 NTUs and 2.7 NTUs leaving the project.

**Vegetation changes 7/2/07,
sage is rapidly dying.**

The increase in perennial grasses and forbs is well documented in the Monitoring Final Report. To summarize here, all project areas measured increased total biomass weights between 1750 lbs. and 8200 lbs. per acre, while the control also increased by 300 lbs. per acre. Sagebrush, which had encroached on the de-watered meadow, began dying back rapidly.



Wildlife monitoring conducted by California Dept. of Water Resources (DWR) has yielded mostly avian responses in the first year. Eighty total species were observed pre-project with 96 species observed post-project. New species detected included three birds closely associated with riparian and wetland areas: marsh wren, pied-billed grebe and Wilson's phalarope.

Nine waterfowl species were observed pre-project, with three species breeding; mallard, green-winged teal and common merganser. Eighteen species were present post-project with eight species breeding; bufflehead, gadwall, green-winged teal, blue-winged teal, mallard, Canada goose, common merganser and pied-billed grebe. Sandhill cranes were

also present on several occasions when FRCRM staff were visiting the project area.



Wilson's phalarope

Despite the dry water year and only initial vegetation recovery, water temperatures showed a marked improvement over the pre-project condition. The pre-project temperature increase from upstream to

downstream was 6.3° F. Post-project increases over the same reach were reduced to

4.6°F. The average increase in daily maximum water temperature declined 5°F. from June 15 through July 12.

In summary, the project is performing at or exceeding expectations. All parties to the project are extremely pleased with the implementation and subsequent recovery of the Red Clover/McReynolds restoration Project.

D. Lessons Learned

One of the most challenging aspects of the pond and plug technique is in establishing replicable monitoring sites and photo points. This technology often results in streamflows being re-routed to the opposite side of the valley as well as changing channel morphometry. Past project experiences have helped this process, but did not completely eliminate difficulty in re-creating fish monitoring reaches. Photo points must have 'horizon' features that can be matched up for pre- and post project photo monitoring (attached photo series illustrates this point well).

This project incorporated the anticipated return of beaver to the site in the design process. During the design survey and layout process numerous relic dams, lodges and food caches were located in the remnant channels. This evidence bolstered the anecdotal information



that Red Clover Creek had numerous beaver prior to eradication and subsequent channel degradation.

Beaver dam @ X-section 15, secondary channel in foreground now carrying flow

Beaver colonies were present up- and downstream of the project area prior to construction. The primary design

measures incorporated for the beaver were: 1) to increase the frequency of plugs to minimize the elevation differences; 2) to maintain connectivity of all remnant channels across the valley surface. These measures would accommodate the potential for the beaver to disperse water across the valley with their dams. The beaver moved into finished portions of the project before it was completed. In the first year post-project, over twenty beaver dams have been built in the project area. The measures incorporated are working as designed and the beaver are augmenting the project objectives, not putting them at risk.



Work on the rock constriction plug. Rarely was all equipment in one photo frame.

E. Outreach

Outreach efforts entailed leading numerous tours of the Red Clover project area both before and after restoration work was completed. These tours enabled federal and state agency personnel, federal, state and local government representatives, academia, environmental organizations, municipal districts, students, media reporters, and community members to visit the project area. Project benefits were shared through pre- and post-project photo sets, data graphs, and presentations to private, local, state, and federal agencies and organizations. In the interest of the project and promoting the benefits of floodplain restoration, we will continue to monitor the project and share the results with watershed practitioners, partners, and other stakeholders through presentations and tours. Outreach and coordination with landowners both up and downstream of the project will continue to promote benefits to the landowner and watershed, both locally and regionally, and develop possible future projects.

F. Funding

The State Water Resources Control Board (SWRCB) Proposition 13 CALFED Watershed Program provided primary project funding, with contributions from Department of Water Resources (DWR), Natural Resource Conservation Service (NRCS), U.S. Forest Service (USFS), the landowner, and volunteers. Total funding from the SWRCB Proposition 13 was \$1,101,000. Personnel time for wildlife and fish monitoring, and technical engineering support contributed by DWR was \$43,700. California Department of Fish and Game contributed \$1,500 of personnel time to help with fish monitoring. U.S. Forest Service,

Plumas National Forest committed \$2,800 of personnel time for monitoring purposes, and provided \$55,000 of rock for grade control structures. The Natural Resources Conservation Service (\$47,800) and landowner (\$32,600) put in a total of \$80,400 towards fencing costs, off-site water development, prescribed grazing management (deferred livestock use for 3 years), and technical support. University of California Extension service provided technical support (\$1000) for vegetation monitoring and grazing management. Volunteers contributed over 480 hours assisting with native seed collection and spreading, willow planting, and fish monitoring. Volunteers from Trout Unlimited, Feather River Land Trust, Greenville High School, Jim Beckwourth High School, Loyalton high school student members of Future Farmers of America, Sierra Valley Resource Conservation District, California Conservation Corps from Chico, and numerous individuals contributed a total of \$9,820 in time and effort. Total project cost was \$1.3 million.

G. Planned/Potential Follow-up Activities

Monitoring of all parameters outlined in the Project Monitoring Plan will continue for at least one more year. Additional revegetation work and potential maintenance activities may occur in 2008. Grazing deferment will continue for the next two years (2008-2009), at which time the project area will be evaluated with the landowner and Natural Resources Conservation Service (NRCS) to determine if the site has recovered sufficiently to resist significant flood flow stress and sustain livestock grazing. After livestock re-introduction the riparian enclosures will continue to be monitored on an annual basis by the FRCRM, landowner, and NRCS. Plans to achieve additional implementation have already begun. Over the last three years we have been coordinating with the U.S. Forest Service and the landowner to continue restoration efforts both upstream and downstream of the project area. The Forest Service will be completing the NEPA documentation in 2008 required for implementation of floodplain restoration efforts downstream, and the FRCRM completed cross-sectional surveys in 2007 of the upstream area. In addition the Forest Service has implemented and is planning timber management and road improvement projects within the watershed. Plans to seek planning and implementation funding through partners, landowner contributions, and grants will be pursued.

H. Photos and Graphs



McReynolds Creek pre-project, 2004 above; post-project, 2007 below





Confluence McReynolds/Red Clover Creeks pre-project, 7/2004 above; post-project, 7/2007 below

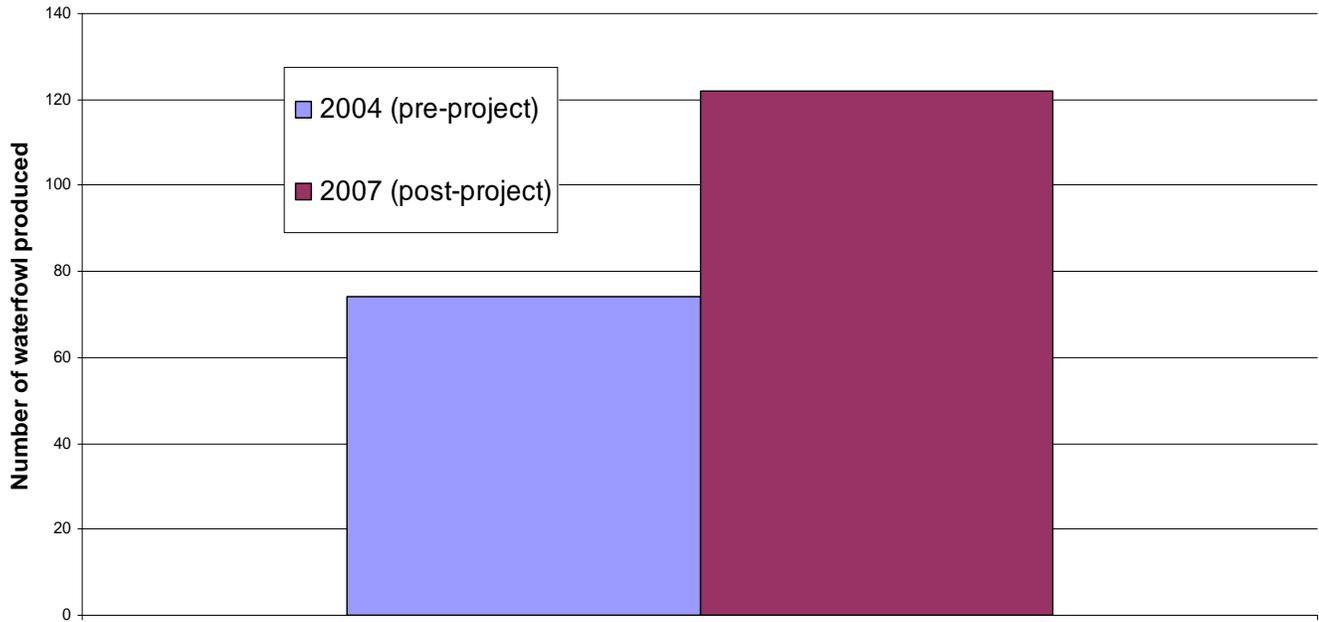




Red Clover Creek @ X-section #19 pre-project, 6/2006 above; post-project, 6/2007 below



Red Clover/McReynolds Creek Project Annual waterfowl production



Canada Geese with goslings taken near west end of project, 2007



I. Items submitted for Review

- Red Clover/McReynolds Creek Restoration Project Final Monitoring Report
- Natural Resource Projects Inventory Project Survey Form
- Final Progress Report #12
- Final Invoice #13

J. Addl info requested by Grant Manager