

COMPLIANCE REPORT
CONSTRUCTION OF THE CHEDA CREEK FISH PASSAGE STRUCTURE
FILE NUMBER 25315N



Submitted by the National Park Service
Point Reyes National Seashore
Point Reyes Station, California, 94956

Project Description:

Cheda Creek is a small but important tributary of the Lagunitas Creek watershed and provides critical habitat for steelhead trout (*Oncorhynchus mykiss*) and coho salmon (*Oncorhynchus kisutch*). The Lagunitas Creek watershed supports 10% of the remaining wild stock of coho salmon in the central California coast Evolutionary Significant Unit (Brown and Moyle, 1994). Both species are listed as federally threatened. Past land-use within the Cheda Creek drainage has resulted in serious alterations to the natural hydrologic and riparian condition of the creek. These factors have negatively impacted salmonid populations, water quality, and the ability of the aquatic ecosystem to function properly. The construction of a fish passage structure in the fall of 2000 was part of an overall watershed restoration project designed by the National Park Service to restore the system to a more natural and sustainable condition. NPS staff removed a large cement barrier left over from a failed sediment capture structure that was installed through the local resource conservation district and repaired a 7' headcut that was migrating upstream. Engineers from the National Marine Fisheries Service (NMFS) designed a 7-step cross-vein boulder weir fish passage that NPS staff used to restore the damaged habitat. The NMFS design allows for stream bed elevation differences to be maintained, stabilizes stream banks, returns fish migration routes, and provides refugia and rearing habitat for salmonid populations.

The purpose of this report is to summarize the hydrologic performance and effectiveness of the fish passage structure in its first year of operation. Since project completion, NPS has monitored the following parameters: flow conditions, stream levels, structural integrity, the fishery resource, revegetation, and sedimentation. NPS staff will continually monitor the project site in coming winters and will prepare a similar document in 2002 and 2003.

Mitigating actions taken by NPS staff during the project included the removal of all fish from the project site, diversion of water flow from direct impact, and the installation of fish fences upstream and downstream of the project site to prevent fish access during construction. Project revegetation and erosion control efforts included the sprigging of willow stakes and construction of willow walls, alder and *Juncus* sp. transplants, installation of curlex bundles, and the redistribution of leaf litter and debris to break surface water flow patterns. Permits were obtained from the appropriate regulatory authorities including the U.S. Army Corps of Engineers, Regional Water Quality Control Board, National Marine Fisheries Service, and the U.S. Fish & Wildlife Service.

2000-2001 Hydrologic Conditions

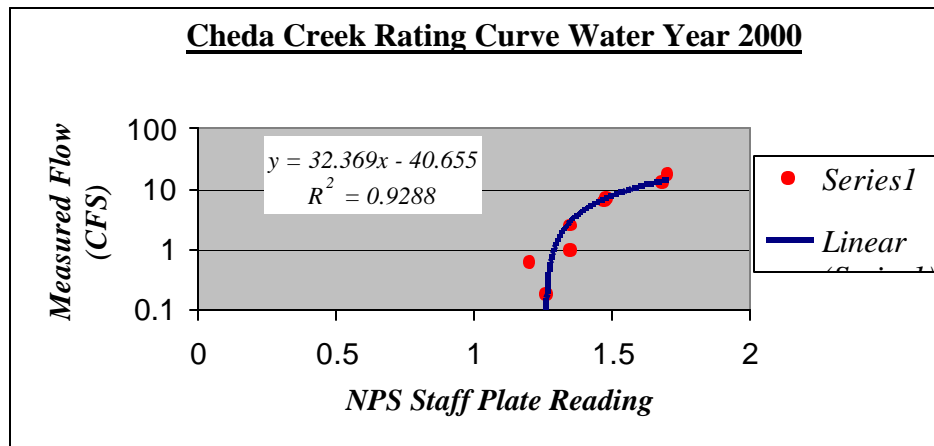
Rainfall was light in water year 2000 and was approximately 60% of normal. Cumulative rainfall ranged from 15 to 24 inches at various rain gages located in the park. NPS staff monitored flow conditions at the Cheda Creek project site at the completion of the project, and in close proximity to the storm events of winter 2000 – 2001 (Table 1). Stream flows were taken at the Weir 6 pool tail-out (upstream end of structure) with a Marsh-McBirney Flomate Model 2000 portable Flowmeter. Velocities were recorded at either every foot or half-foot depending on total stream width. Event flows were calculated in cubic centimeters per second (CFS).

Table 1 – Flow Table for Cheda Creek Fish Passage Structure (winter 2000-2001)

<i>Date</i>	<i>Flow (CFS)</i>
December 14, 2000	0.18
January 12, 2001	0.93
January 25, 2001	12.63
January 30, 2001	0.60
February 12, 2001	6.97
February 13, 2001	2.45
February 19, 2001	6.07
February 21, 2001	16.85
April 12, 2001	0.13
May 30, 2001	0.05 (estimate)

From these data, a rating curve for Cheda Creek has been developed to interpolate flow conditions during the course of water year 2000 (Chart 1). The rating curve is only accurate from the December installation until March 2001, and only that data set is incorporated into the rating analysis. In March, cross-sectional streambed character was altered enough to dictate the need for a new rating curve, which NPS staff will develop for the water year 2001 analysis. Water levels recorded by a Global WaterLogger WL-14 are entered into the logarithmic equation to determine correlated flow conditions at the project site. The Global WaterLogger WL-14 has recorded stream water levels since its installation in December 2000 and will operate indefinitely.

Chart 1 – Rating Curve for Cheda Creek Water Year 2000 (December – March)



The fish passage structure has performed more than adequately in response to the flow conditions of this past winter. The apex boulder of weir 5 (weir 1 = downstream end of structure) was undercut during a high flow event but NPS staff repaired the problem by redirecting flow and stabilizing the damaged area with gravel and small boulders. All other boulder weirs are maintaining position and remain stable. Areas of scour, small amounts of gravel deposition, and revegetation have occurred on a continual and self-maintaining basis since the completion of the project.

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Stream Bedload Condition

Long-term stability and success of the cross-vein structures is tied to the recruitment and maintenance of natural bedload within the system. The structure drops twelve feet in elevation and is subject to significant scour and flow velocity. The balance against scour is the recruitment and replacement by upstream bedload. In the first year following construction, stream flow induced scour but no natural bedload material was recruited from upstream. The NPS will continue to monitor bedload recruitment potential and prescribe solutions if natural recruitment to the structure does not recover.

Electrofishing and Habitat Surveys

NPS staff conducted habitat and electrofishing surveys of the Cheda Creek project site prior to project initiation and after project completion (Table 2). Surveys of the restored habitat will be conducted annually to monitor fish use and density. Adult spawner surveys have been and will continue to be conducted on an annual basis. Prior to construction, six identifiable habitat units were present, most of which were severely impaired. The new boulder weir fish passage incorporates thirteen identifiable habitat units that are available for salmonids at different life stages. Seven plunge pool units provide summer refugia and rearing habitat for juvenile fish. Six low-grade riffles have the potential to provide winter spawning areas, and provide habitat for macroinvertebrates, aquatic vegetation, and other aquatic components to develop.

Table 2 – Cheda Creek Fish Passage Structure Habitat Types and Electrofishing Results

<i>Downstream</i> →													← <i>Upstream</i>
<i>Unit #</i>	1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Unit Type 2000</i>	pool	low-gradient riffle		dammed pool		low-gradient riffle			pool	low-gradient riffle			
<i>Catch 2000</i>	yoy=42 SH=1 CO=0	yoy=2 SH=0 CO=0		yoy=29 SH=8 CO=1		no fish			yoy=23 SH=4 CO=0	yoy=1 SH=0 CO=0			
<i>Unit Type 2001</i>	pool	riffle	pool	riffle	pool	riffle	pool	riffle	pool	riffle	pool	riffle	pool
<i>Catch 2001</i>	yoy=0 SH=22 CO=0	N/A	yoy=0 SH=16 CO=0	N/A	yoy=0 SH=9 CO=0	N/A	yoy=0 SH=6 CO=0	N/A	yoy=0 SH=9 CO=0	N/A	yoy=0 SH=3 CO=0	N/A	yoy=0 SH=5 CO=0
yoy = young of year steelhead trout SH = steelhead trout > one year in age CO = young of year coho salmon													

Revegetation Efforts

Increased water temperature can negatively impact fish success. Providing adequate shade and cover for salmonids at the project site is an important concern for NPS staff. In November 2000, nearly 300 willows stakes were planted at the project site by NPS staff and an Americorps team. Willows were harvested from on-site mature willow trees and from willows recovered from project construction. Approximately two-thirds of the willow

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plantings have been successful. 15 bunches of *Juncus* sp. were transplanted directly to the project site. Approximately 50% of the transplants were successful and have taken root along the creek bed. In January 2001, through a contract with the Marin Municipal Water District, the Marin County Youth Conservation Corps installed four willow walls to assist with erosion control and to increase shade production. Willow wall success has been nearly 100% and will become a reliable source of shade. Several six-foot willow posts were installed and are already beginning to provide a small amount of shade and cover to the upper pool of the structure. In coming years, these posts, willow walls, and stakes will provide an increasing amount of shade and cover for salmonids. As well, woody debris resulting from the construction of the structure was placed within the creek bed to provide more shade and cover. Shade production and associated water temperature reductions at the site are long-term goals of the CSRP.

Riparian Exclusionary Cattle Fence

The construction of the NMFS fish passage was one component of an overall assessment and restoration project of the Cheda Creek watershed. In 1999, with the help of several volunteer groups, NPS staff began the construction of a 2.2-mile fence line designed to keep cattle from negatively impacting the riparian zone and to improve water quality. The fence was completed in the summer of 2001 and significant revegetation and water quality improvements have and will continue to be documented.

Concluding Remarks

It is the goal of the NPS that the Cheda Creek restoration site regains as much of its natural character and functionality as possible. This includes the return of healthy salmonid populations, decreased sedimentation rates, revegetation, and increased water quality. Returning a piece of stream to productive use by anadromous fish is an immediate increase to the potential success of a salmonid population. The immediate benefits to the fishery resource are the increased access to the upstream reaches of the creek and the increased habitat that the structure provides. NPS predicts that the restored habitat will recuperate to a fuller extent as more time elapses from the date of project completion. Thus far, the pool-riffle-pool habitat created by the project has provided high winter flow refugia and summer rearing habitat, and has the potential to provide spawning areas for adult fish. NPS electrofishing surveys have shown that after only 9 months, juvenile salmonids have already begun to utilize the habitat that was created by this project. The fish passage structure also provides suitable habitat for other aquatic species, which are important to the overall integrity of the system.

The key to the long-term success of the structure is the bed load recruitment, which, due to flow conditions this year, was not significant. Geomorphic surveys in upcoming years will help NPS staff better determine the recruitment that the upper reaches of the creek will provide to the structure. NPS staff will continue to monitor the project site and make recommendations about its operation and maintenance in years to come.

The NMFS designed structure has allowed NPS staff to successfully restore a section of Cheda Creek that would otherwise have remained impaired. As this was a relatively mild winter in regards to rain fall, the structural integrity of the structure will be monitored closely over the next few years. NPS staff hopes to use similar structures at alternative restoration sites throughout the park. Based on the performance of the two structures in place thus far (see Muddy Hollow Compliance Report, File # 25358N), NPS staff support the use of the NMFS vortex-boulder weir fish passage structure as implemented at Point Reyes National Seashore.

Photographic Documentation

The following pages contain photographs from the first year of operation of the fish passage structure:

Pre-Construction and Removal of Cheda Creek Fish Impediments
(September, 2000)



Upstream Migrating Head Cut (1999)

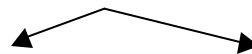


Dammed Pool

Pre-construction →



Removal of Cement
Barrier



Installation of Fish Passage Structure
September and October 2000

Debris Removal



← Boulder Weir Installation ↑



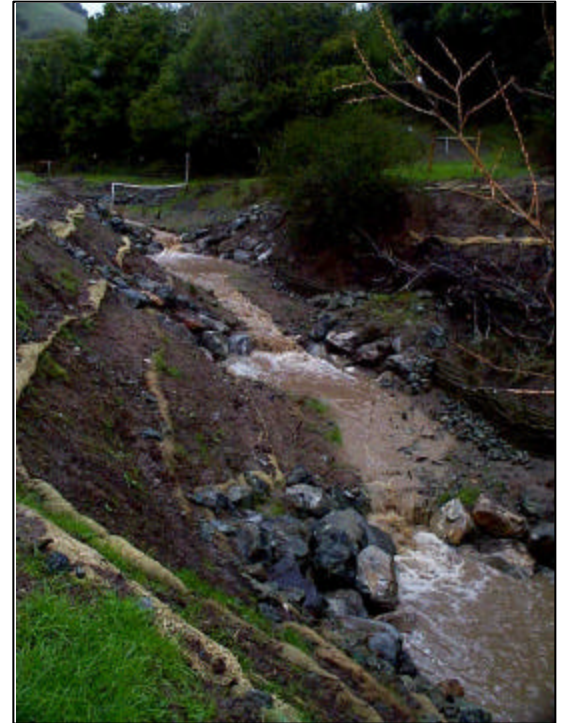
Finished Product

Post Construction Storm Events

First Storm Event

January 10th – 12th, 2001

Flow = estimated max. at 5.0 cubic feet per second (CFS)



↑
Bottom of Structure
↓

Right Bank



Cow Crossing above Structure

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Second and Third Storm Events
January 21st – 25th and February 20th – 25th, 2001
Flow = 12.65 CFS (January)
Flow = 16.85 (February)

Flow Measurements



High Flow Pictures from Bottom of Structure



Revegetation Efforts



Natural Revegetation



Willow Plantings



Transplanted *Juncus* sp.



Willow Wall

Low Flow Summer Conditions

Weir 5 – Summer Habitat



↑
Bottom of Structure
↓



Weir 4 – Summer Habitat

