Monterey Peninsula Water Management District

Installation of Large Wood Habitat Structures at the deDampierre Restoration Project

Work benefits sensitive aquatic species found in the Carmel River such as steelhead (*Oncorhychus mykiss*), California red-legged frogs (*Rana aurora draytonii*), and Western pond turtles (*Clemmys marmorata*).

The Monterey Peninsula Water Management District in cooperation with the University of California at Santa Cruz, Big Creek Lumber Company, the California Department of Fish and Game, and the Monterey Peninsula Regional Parks District installed five large wood habitat structures along 400 lineal feet of the Carmel River.

THREATENED SPECIES

Using state of the art electro fishing equipment, an MPWMD crew (shown above) made four passes through the site prior to the beginning of construction. A total of 160 steelhead were captured and relocated.

California red-legged frog
(*Rana aurora dratonii*)

MPWMD found evidence of California red-legged frogs (CRLF) at the site in late spring 2002. Prior to the start of construction in October, Dawn Reis lead a team of biologists who conducted four night-time surveys during which ten adult CRLF and two juveniles were found and relocated. Inspections were also conducted prior to each day's activities.

STEELHEAD (*Oncorhynchus mykiss*)

This 1994 MPWMD file photo shows an adult netted out of the 70-foot high San Clemente Dam fish ladder. The returning adult population plummeted to a low of one fish counted in the ladder in 1991. Efforts by local fishermen and resource agencies have brought the run back from near extinction. Recent counts have been averaging between 600 and 1,000 adults annually. Estimates of the historical run range from 4,000 to 20,000 adults. MPWMD estimates that the perennial portion of the main stem up to Los Padres Dam at River Mile 25 currently supports between one and two fish per lineal foot (including all life phases), or 100,000 to 200,000 fish. Steelhead were listed as a Federally threatened species in 1998.

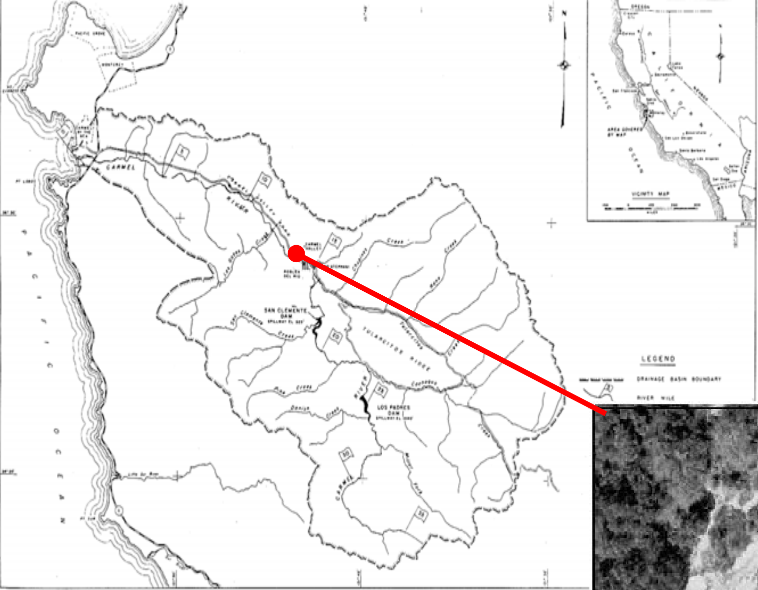
CATCH AND RELEASE PROGRAM

Photo courtesy of the Carmel River Steelhead Association

Fishermen are eager to restore the steelhead fishery. Organizations such as the Carmel River Steelhead Association routinely volunteer their time for summer rescues, monitoring, and habitat enhancement. Cal Trout, the California Sportfishing Protection Alliance, and the Sierra Club are also actively involved with advocating for the protection and enhancement of the steelhead fishery.

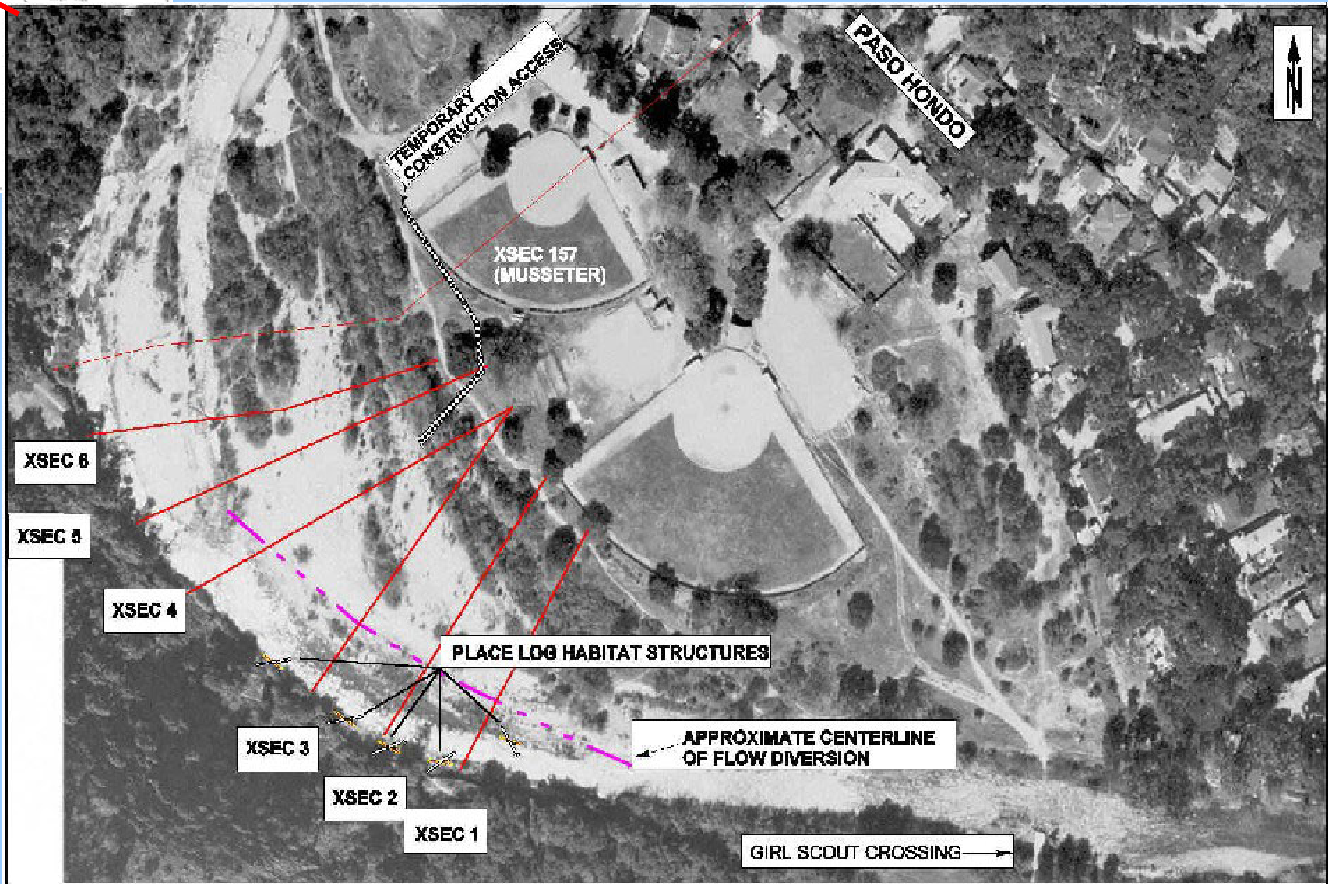
LEFT: Nick Larson, an avid young fisherman holds up a 26-inch steelhead caught in Garland Park in the spring of 2001 under CDFG's catch and release program.

PROJECT LOCATION



The project area is centered at approximately River Mile 13.5 (measured from the Pacific Ocean), across from the deDampierre Little League fields near Carmel Valley Village.

The Carmel River is located about 100 miles south of San Francisco in a Mediterranean climate. It hosts the largest remaining steelhead run on the West Coast south of San Francisco. The river begins in the Ventana Wilderness at nearly 5,000 feet, flows for 20 miles through narrow canyons, then crosses a wide (up to 1/2 – mile) alluvial valley for the last 16 miles before emptying into the Pacific Ocean. Drainage area at the mouth is 255 square miles. Winter flows can peak at over 16,000 cfs. In summer, the lower eight miles often go dry.



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INSTALLATION OF LARGE WOOD HABITAT STRUCTURES AT DEDAMPIERRE RESTORATION PROJECT
PLAN VIEW SCALE 1: 2000

0m 20 40 60 80 100 120m

August 9, 2001

LOG DONATION

These redwood and Douglas fir logs were removed by the Big Creek lumber company from the University of California at Santa Cruz to make way for the Physical Sciences Building. Big Creek, located in Davenport, stored the logs for two years after Marty Gingras (pictured on top of the fir logs) and Jennifer Nelson, biologists with the California Department of Fish and Game, negotiated with Big Creek and UCSC to use the logs in habitat restoration along the Central Coast of California. In addition to donating the logs, which were valued at $10,000, Big Creek Lumber Company donated labor to take the logs to the Carmel River.

UC SANTA CRUZ

BIG CREEK

PROJECT SITE - MAY 2002

This reach of the river underwent significant bank erosion during 1995 and 1998 after winter peak flows of 16,000 cubic feet per second (cfs) and 14,500 cfs, respectively. The stream migrated laterally up to 200 feet during this period, resulting in the loss of streamside vegetation and several acres of adjacent mature riparian forest and oak-covered landslide and terrace deposits. The 700-foot long pool that remained was homogenous, covered with large cobbles, and nearly devoid of streamside cover.

TEMPORARY ROCK DIVERSION DAMS

The low rock dam in the foreground, made of clean cobble and boulders found on site, prevents fish from entering a diversion channel (between the two dams), but allows algae and moss to pass through. A second dam, made from finer material found on site, diverts most of the flow from the main stem into the diversion channel. Flows ranged from about 5 to 8 cubic feet per second (cfs) during construction. Six fish were relocated out of the diversion at the end of the project.

DIVERSION CHANNEL

Flow diversion reduced the volume of water in the work site (out of the picture to the left) and prevented sediment-laden water from moving downstream, except during initial diversion and backfill operations. A small crossing for vehicle access to the worksite can be seen just above the 24-inch culvert. Willow cuttings lining the left side of the diversion trench were laid immediately prior to backfilling. Placing cuttings down to groundwater level during low flows eliminates the need for irrigation during summer months. This reach of the river maintains perennial flow.

AFTER DIVERSION

Before construction of a diversion, flow covered the cobbles up to the grass seen to the left of Thomas Christensen (examining the underside of one of the cobbles). Main stem surface flow ceased completely 2,000 feet downstream (flow went subsurface), which reduced concerns about sediment impacts from construction. By diverting flow, the contractor was able to pump subsurface water out of construction areas.

SITE CONDITIONS – OCTOBER 2002

BIG LOGS

LIMITED ROOM

HIGH WATER TABLE

UNEVEN BOTTOM

Work started in early October 2002, during the lowest flow period. An estimated ½ cfs infiltrated through the coarse alluvium. Work space in the channel bottom varied from about 30 to 60 feet wide. The Contractor (Carmel Valley Construction) estimated that the logs weighed up to eight tons. Large cobbles and small boulders made travel in the channel bottom a bumpy adventure for the excavator.

PREPARING BOULDERS

Will Drew uses an impact drill to make 7/8-inch holes, which were thoroughly cleaned with brush and water and air dried before anchor placement. Bolts were chosen over gluing cable directly into the boulders to fasten logs, as failure of the attachment system could not be tolerated. Hilti HY-150 adhesive was rated at 20,000 pound breaking strength for this application, which required custom work to extend the threaded portion of the anchor bolts (lower left, visible as dark portion of bolt). Bolts, four per boulder, were spaced two feet apart (below). Curing time for the glue ranged from about two to four hours.

HAULING BOULDERS

One of the contract requirements was to pick each boulder up to test the strength of rock anchor bolts. Carrying boulders in the fashion shown at left bent the steel hooks used to lift the boulders as the loader bounced over large cobbles in the stream bottom. The contractor opted to haul boulders in the loader bucket and lift each boulder into place with an excavator, using the four hoisting chains shown at left.

PLACING

BOULDERS

Four to six-ton boulders were individually surveyed into place to provide a line of support and to anchor the logs. Here, the excavator is moving a boulder by hooking on to one of the four ¾-inch cable anchors inserted in each rock.

SETTING FOOTER LOG

A footer log was installed to encourage scour along the toe of the streambank. Although not visible in this photo, the footer log is anchored with four large boulders similar to the ones shown in the previous photo. Willow cuttings placed behind the footer log will be protected from scour during high flows.

DRILLING HOLES FOR CABLING

Will Drew augurs through a redwood log. Cable is passed through the hole, around the log, through cable anchors glued into the boulder and clamped. Redundancy in the anchoring system (two cables per boulder) was a precaution made necessary by the potential cost of failure – one log loose in the river could cause a bridge washout or severe bank erosion.

LOG CABLED IN PLACE

As indicated by the green paint on the end of this log, the diameter is 2.25 feet. The largest diameter log was nearly 3.25 feet at the equivalent of breast height (the logs never were vertical during the project). Logs were anchored to boulders using eight ¾-inch stainless steel cables (two per boulder). Willow cuttings at the lower right were placed behind the log prior to backfilling.

ROOTBALL PLACEMENT

Setting an eight-ton log and rootball in the right place requires experience and patience. Here, Gerry Paddock, the owner of Carmel Valley Construction, deftly places a 38-foot long log and rootball on top of four boulders. The log was placed at a 30 degree horizontal angle to flow. The log was also angled vertically to place ½ of the rootball below the existing riverbed and the end of the log several feet up the bank. This orientation encourages bottom scour at the rootball and in the middle of the channel during frequent flows (1 to 3-year return), which range from about 1,000 cfs to 3,000 cfs at this location.

NUDGING the ROOTBALL into PLACE

The pump at the left is pumping about 250 gallons per minute or about 0.5 cfs. Channel bottom material was so coarse that water pumped out here infiltrated the alluvium approximately 300 feet downstream, before flowing back into the main stem.

TIGHTENING CABLE CLAMPS

Will Drew checks the four ¾-inch cable clamps placed on each cable. Torque was specified at 130 foot-pounds. Proper cabling was critical to the success of this project.

PLANTING NATIVE SEEDLINGS

Here, MPWMD river workers Matt Lyons and Mark Bekker plant gooseberry, sycamore, buckeye, and alder seedlings in areas disturbed by grading. Rains just one week after installation and close proximity to water mean that these plants, if they can survive winter flows in the first few years, are unlikely to need supplemental irrigation during the dry season.

PLANTING CUTTINGS IN THE FLOODPLAIN

Digging a hole for a three-inch diameter willow or cottonwood cutting with a four-yard excavator bucket may seem like overkill, but the power of an excavator is needed to dig up the large cobble and boulders in the floodplain adjacent to the logs. The largest particle dug up during this project was in the one-ton range. Even a large backhoe with a three-foot wide bucket is not as effective as this excavator. Note the depth of the hole (about five feet), which allows the cuttings access to water year-round.

DIVERSION CHANNEL (slight return)

The US Fish and Wildlife Service has encouraged MPWMD to create backwater areas capable of supporting California red-legged frogs in their various life stages. Here, the downstream 100 feet of the diversion channel was left unfilled in an attempt to create a backwater area. Flow in the main stem is from left to right along the vegetation in the center of the picture, although at flows in excess of 500 cfs, the low area in the foreground is likely to be completely inundated. This area will be monitored to see how effective this technique is at creating backwater habitat.

FINISHED PROJECT- OCTOBER 31, 2002

Work was completed one day before expiration of the permits on November 1, 2002. One week later, 10 inches of rain fell in the upper watershed, causing the river to flow at 400 cfs through this site. At last check, the logs were functioning as intended, causing scour near the rootballs and helping to sort gravels for steelhead spawning. Several young-of-the-year were spotted in deep areas near the logs.

WINTER SCOURING ACTION

Here, flow of 500 cfs is moving from left to right and scouring the channel bottom near the rootball (upper center of photo) and under the log. A hydraulic jump can be seen on the downstream side of the log. At higher flows, the jump is drowned out and becomes a standing wave. Controlled energy dissipation is important in this reach, where chronic bank erosion threatens structures downstream, close to the banks.

MPWMD plans to resurvey the channel bottom during the summer of 2003 to document scouring effects.

ESTIMATED PROJECT COSTS

	BUDGET	ACTUAL
Construction*	$ 62,550	$ 45,500
Environmental Consultant*	4,000	5,000
Legal advertising*	0	1,000
Biological sampling*	2,300	2,300
Total reimburseable costs*	**$ 68,550**	**$ 53,800**
MPWMD in-kind Services	6,400	6,400
TOTAL COSTS	**$ 75,950**	**$ 60,260**

*These costs will be reimbursed by grant funding from the California Department of Fish and Game

A NOTE ABOUT PROJECT DESIGN

John Steinbeck wrote this about the Carmel River: “In the winter it becomes a torrent, a mean little fierce river, …” (Cannery Row, 1945). This river is close to an urban setting without truly being an urban river. More than half of the riverfront is in private hands. The value of real estate along the river is staggering – perhaps as much as $1 billion (more than 400 individual properties, three world-class golf courses, several schools, churches, parks, and commercial areas). In addition, public and private infrastructure crosses the river at many locations.

The Carmel River has historically exhibited high stream power – enough to wash out the middle support for two 80-foot spans of the CALTRANS-maintained Highway 1 bridge in 1995. This was at the end of the river, where channel slope is two to three feet per thousand. For comparison, the channel slope is about 10 feet per thousand at the project site.

This project was based on design recommendations contained in California Salmonid Stream Habitat Restoration Manual (California Department of Fish and Game, 1998). Force analysis used the maximum measured velocity (18 fps) at a bridge just upstream of the project. Boulders anchored to the logs provide a factor of safety of two against sliding. Part of the design, some of which is redundant, could have been downsized and still met applicable minimum standards. However, the risk of failure (logs coming loose) far outweighed the cost of additional hardware.