Figure 3.6.1.4.1 Regional Wildlife Corridors Map

Mountain Lion Killed on Highway 33 near Foster Park, Dec. 2014.
Animals killed by cars are regularly seen on Highway 33 near Foster Park.
Photo courtesy of Kim Stroud

Collected data on roadkill reveal locations in the watershed where highly travelled roads intersect with well-travelled wildlife movement corridors. One such location is on Highway 33, just south of Foster Park. Roadkill in this area is unfortunately fairly common. Roadkill is also common on Highway 150 east of Lake Casitas (Anderson 2014).

Impediments to wildlife movement include not only roads and development, but also instream barriers that prevent the migration of fish and other aquatic organisms. See "3.6.2 Steelhead" for a discussion on barriers to fish passage in the watershed.

3.6.1.5 Species

Species richness is a hallmark of the Ventura River watershed. The watershed is located within the California Floristic Province (CFP), an area designated by Conservation International as one of the world's top 35 biodiversity hotspots—areas where species diversity, numbers of endemic species, and threats to diversity are all particularly high (CEPF 2014). Los Padres National Forest, which comprises half the land area in the watershed, is one of the more diverse national forests in California, supporting over 468 species of fish and wildlife (URS 2010).

One indicator of the health and productivity of the watershed's ecosystems is the number of large carnivores and other large mammals that it supports. It generally takes large areas of connected natural habitat to support the foraging and breeding needs of top predators and large mammals. These large animals, or their sign, are observed regularly in the watershed. Black bears, for example, are fairly regular visitors in local orchards, especially during drier years, and it is not unusual to see bear tracks on some local trails. Coyotes are commonly observed around some Ojai neighborhoods. Mountain lions, bobcats, and foxes are also occasionally seen in the area.

Mountain Lion Visits Sulphur Mountain Road Home, 2014

Photo courtesy of Fred Rothenberg

Black Bear Visits Ojai Orchard, 2013

Photo courtesy of Emily Ayala

Grey Fox on Fox Canyon Trail, Ojai, 2013

Photo courtesy of Bardley Smith

Coyote in Mira Monte, 2013

Photo courtesy of Tania Parker

Special Status Species

The Ventura River watershed is home to numerous special status plant and animal species. Over 130 species are protected at either the federal, state, or local level, including 16 species listed as endangered, threatened, or fully protected at the state or federal level.

Table 3.6.1.5.1 lists the special status plants and animals known to occur in the watershed, along with their federal, state, or local protection status. The federally endangered southern California steelhead is of particular significance, and is discussed at length in "3.6.2 Steelhead."

Locally Important Species

The Ventura County General Plan defines a *Locally Important Species* as a plant or animal species that is not an endangered, threatened, or rare species, but is considered by qualified biologists to be a quality example or unique species within the County and region. The following criteria further define what local qualified biologists have determined to be Locally Important Species (VCPD 2011b):

Locally Important Plants

Taxa that are declining throughout the extent of their range AND have five or fewer element occurrences in Ventura County.

Locally Important Animals

- Taxa for which habitat in Ventura County is crucial for their existence either globally or in Ventura County. This includes:
- Taxa for which the population(s) in Ventura County represents 10 percent or more of the known extant global distribution; or
- Taxa for which there are five or fewer element occurrences, or less than 1,000 individuals, or less than 2,000 acres of habitat that sustains populations in Ventura County; or,
- Native taxa that are generally declining throughout their range or are in danger of extirpation in Ventura County.

Table 3.6.1.5.1 Special Status Species

Scientific Name	Common Name	Status[2]	FE, FT, SE, ST, SFP[2]
Plants			
Alisma plantago-aquaticum	common water-plantain	LIS	
Allium praecox	early onion	LIS	
Allophyllum divaricatum (Nuttall) A.D. Grant & V. Grant	divaricate allophyllum	LIS	
Amaranthus californicus	California amaranth	LIS	
Ammannia coccinea	purple ammannia	LIS	
Aphanisma blitoides	aphanisma	S1.1, CNPS-1B.2, LIS	
Astragalus didymocarpus var. milesianus	Miles' milk-vetch	S2.2, CNPS-1B.2	
Astragalus pycnostachyus var. lanosissimus	Ventura marsh milk-vetch[1]	FE, SE/S1.1, CNPS-1B.1	x
Atriplex serenana var. davidsonii	Davidson's saltscale	S2?, CNPS-1B.2	
Baccharis plummerae var . plummerae	Plummer baccharis	CNPS-4.3	
Baccharis salicina	emory baccharis	LIS	
Calandrinia breweri	Brewer calandrinia	CNPS-4.2	
Calochortus catalinae	Catalina mariposa lily	CNPS-4.2	
Calochortus clavatus ssp. clavatus	club-haired mariposa lily	CNPS-4.3	
Calochortus fimbriatus	late-flowered mariposa-lily	S2.2, CNPS-1B.2	
Calochortus palmeri var. palmeri	Palmer's mariposa-lily	S2.1, CNPS-1B.2	
Calochortus plummerae	Plummer's mariposa-lily	S3.2, CNPS-1B.2	
Carex triquetra	triangluar-fruited sedge	LIS	
Castilleja attenuata	valley tassels	LIS	
Chorizanthe clevelandii	Cleveland spineflower	LIS	
Chorizanthe membranacea Benth.	pink spineflower	LIS	
Clinopodium douglasii	yerba buena	LIS	
Cornus sericea ssp . sericea	creek dogwood	LIS	
Crassula aquatica	water pigmy-weed	LIS	
Cryptantha torreyana	Torrey forget-me-not	LIS	
Delphinium parryi ssp . purpureum (F. Lewis & Epling) M.J. Warnock	Mount Piños larkspur	CNPS-4.3	
Delphinium umbraculorum	umbrella larkspur	S2S3.3, CNPS-1B.3	
Dudleya caespitosa	sea lettuce	LIS	
Elatine californica A. Gray	California waterwort[1]	LIS	
Eleocharis rostellata	beaked spikerush	LIS	
Eriodictyon traskiae Eastw. Trask	yerba santa[1]	LIS	
Fritillaria ojaiensis	Ojai fritillary	S1.2, CNPS-1B.2	
Heuchera caespitosa	urn-flowered alumroot	CNPS-4.3, LIS	

Table 3.6.1.5.1 Special Status Species *(continued)*

Scientific Name	Common Name	Status[2]	FE, FT, SE, ST, SFP[2]
Hordeum brachyantherum Nevski *ssp . brachyantherum*	meadow barley	LIS	
Horkelia cuneata var. puberula	mesa horkelia	S2.1, CNPS-1B.1	
Imperata brevifolia	California satintail	S2.1, CNPS-2.1	
Isoëtes howellii var. howellii	Howell quillwort	LIS	
Juglans californica var. californica	southern California black walnut	CNPS-4.2	
Juncus acutus ssp . leopoldii (Parl.) Snogerup	spiny rush	CNPS-4.2	
Juncus patens	spreading rush	LIS	
Lepidium virginicum var. robinsonii	Robinson's pepper-grass	CNPS-1B.2	
Lilium humboldtii ssp . ocellatum	ocellated Humboldt lily	CNPS-4.2	
Madia sativa Molina	coast tarplant	LIS	
Malacothrix glabrata A. Gray	desert dandelion	LIS	
Malacothrix saxatilis var . saxatilis	cliff-aster	CNPS-4.2	
Marsilea vestita Hooker & Greville *ssp. vestita*	hairy pepperwort[1]	LIS	
Meconella denticulata	tiny poppy	LIS	
Monardella hypoleuca spp. hypoleuca	thickleaf monardella	LIS	
Navarretia ojaiensis	Ojai navarretia	CNPS-1B.1	
Nolina cismontana	chaparral nolina	CNPS-1B.2	
Papaver californicum	wind poppy	LIS	
Pedicularis densiflora	indian warrior	LIS	
Phacelia cicutaria var. Hubbyi	caterpillar phacelia	CNPS-4.2	
Pilularia americana A. Braun	American pillwort[1]	LIS	
Piperia michaelii (E. Greene) Rydb.	Michael piperia	CNPS-4.2	
Plagiobothrys undulatus	undulate popcornflower	LIS	
Plectritis ciliosa ssp. insignis	petite long-spurred plectritus	LIS	
Plectritis macrocera	white plectritis	LIS	
Polygala cornuta	fish milkwort	CNPS-4.3	
Polystichum imbricans ssp. imbricans	sword fern	LIS	
Pseudognaphalium leucocephalum	white everlasting	CNPS-2.2	
Quercus dumosa	Nuttall scrub oak	CNPS-1B.1	
Ribes aureum var. gracillimum	slender golden currant	LIS	
Romneya coulteri Harvey	Coulter Matilija poppy	CNPS-4.2	
Sagittaria sanfordii	Sanford's arrowhead[1]	CNPS-1B.2	
Schoenoplectus saximontanus	RockyMountain bulrush	LIS	
Sidalcea neomexicana	Salt Spring checkerbloom	CNPS-2.2	
Streptanthus campestris	southern jewel-flower	LIS	

Table 3.6.1.5.1 Special Status Species *(continued)*

Scientific Name	Common Name	Status[2]	FE, FT, SE, ST, SFP[2]
Suaeda taxifolia	woolly seablite	CNPS-4.2	
Thermopsis californica var. argentata	silvery false-lupine	CNPS-4.3	
Thermopsis macrophylla var. macrophylla	Santa Ynez false-lupine	SR, SR, CNPS-1B.3	
Verbena bracteata	prostrate verbena	LIS	
Invertebrates			
Coelus globosus	globose dune beetle	S1	
Danaus plexippus	monarch butterfly	S3	
Haplotrema caelatum	slotted lancetooth snail	LIS	
Helminthoglypta phlyctaena	Zaca shoulderband snail	LIS	
Helminthoglypta willeti	Matilija shoulderband snail	LIS	
Fish			
Cottus asper	prickly sculpin	LIS	
Eucyclogobius newberryi	tidewater goby	FE, SSC	x
Gasterosteus aculeatus microcephalus	threespine stickleback	FSS, LIS	
Gila orcutti	arroyo chub	SSC	
Lampetra tridentata	pacific lamprey	LIS	
Oncorhynchus mykiss irideus	southern California steelhead	FE, SSC	x
Amphibians			
Anaxyrus californicus	arroyo toad	FE, SSC	x
Aneides lugubris	arboreal salamander	LIS	
Rana boylii	foothill yellow-legged frog	SSC	
Rana draytonii	California red-legged frog	FT, SSC	x
Scaphiopus hammodii	Western spadefoot toad	SSC	
Taricha torosa	Coast Range newt	SSC	
Reptiles			
Anniella pulchra pulchra	silvery legless lizard	SSC	
Arizona elegans occidentalis	California glossy snake	LIS	
Cnemidophorus tigris multiscutatus	coastal western whiptail	S2S3	
Emys marmorata (also Actinemys marmorata pallida)	western pond turtle (also Southwestern pond turtle)	SSC	
Phrynosoma blainvillii	coast horned lizard	SSC	
Thamnophis hammondii	two-striped garter snake	SSC	
Birds			
Accipiter cooperii	Cooper's hawk	G5 S3, SWL	
Agelaius tricolor	tricolored blackbird	SSC	

Table 3.6.1.5.1 Special Status Species *(continued)*

Scientific Name	Common Name	Status[2]	FE, FT, SE, ST, SFP[2]
Aimophila ruficeps canescens	southern California rufous-crowned sparrow	G5T2T4 S2 S3, SWL	
Aquila chrysaetos	golden eagle	SFP	x
Ardea alba	great egret	SSA	
Ardea herodias	great blue heron	SSA	
Athene cunicularia	burrowing owl	SSC	
Botaurus lentiginosus	American bittern	G4 S3	
Carduelis lawrencei	Lawrence's goldfinch	FBCC	
Chaetura vauxi	Vaux's swift	SSC	
Charadrius alexandrinus nivosus	western snowy plover	ST, SSC	x
Circus cyaneus	northern harrier	SSC	
Contopus copperi	olive-sided flycatcher	SSC, FBCC	
Cypseloides niger	black swift	SSC	
Dendrocia petechial brewsteri	Yellow warbler	SSC	
Elanus leucurus	white-tailed kite	SFP	x
Empidonax traillii extimus	southwestern willow flycatcher	FE, SE	x
Eremophila alpestris actia	California horned lark	G5T3Q S3, SWL	
Falco columbarius	merlin	G5 S3, SWL	
Falco peregrinus anatum	American peregrine falcon	SE, SFP	x
Gymnogyps californianus	California condor	FE, SE	x
Icteria virens	Yellow-breasted chat	SSC	
Lanius ludovicianus	loggerhead shrike	SSC	
Pandion haliaetus	osprey	G5 S3, SWL	
Passerculus sandwichensis beldingi	Belding's Savannah Sparrow	SE	x
Pelecanus occidentalis californicus	California brown pelican	FE, SE	x
Phalacrorax auritis	double-crested cormorant	SSC	
Picoides nuttallii	Nuttall's woodpecker	FBCC	
Plegadis chihi	white-faced ibis	SSC	
Selasphorus rufus	rufous hummingbird	FBCC	
Selasphorus sasin	Allen's hummingbird	FBCC	
Sterna antillarum browni	California least tern	FE, SE, SFP	x
Vireo bellii pusillus	least Bell's vireo	FE, SE	x
Xobrychus exilis	least bittern	SSC	
Xanthocephalus xanthocephalus	yellow-headed blackbird	SSC	
Mammals			
Antrozous pallidus	pallid bat	SSC	
Bassariscus astutus	ringtail	SFP	x

Table 3.6.1.5.1 Special Status Species *(continued)*

Scientific Name	Common Name	Status[2]	FE, FT, SE, ST, SFP[2]
Choeronycteris mexicana	Mexican long-tongued bat	SSC	
Eumops perotis californicus	western mastiff bat	SSC	
Lasiurus cinereus	hoary Bat	SSC	
Lepus californicus bennettii	San Diego Black-tailed jackrabbit	SSC	
Neotoma lepida intermedia	San Diego desert woodrat	SSC	
Taxidea taxus	American badger	SSC	

1. indicates species known to be or possibly extirpated (locally extinct)
2. **Federal Rankings:**
   FE = Federally listed as Endangered
   FT = Federal listed as Threatened
   FBCC= Federal Birds of Conservation Concern

   State Rankings:
   SE = State-listed as Endangered
   ST = State-listed as Threatened
   SFP = State Fully Protected Species
   SR = State Rare
   SSA = State Special Animal
   SSC = State Species of Special Concern
   SWL = State Watch List Species
   G1 or S1 = Natureserve Global or State Status Critically Imperiled Species
   G2 or S2 = Natureserve Global or State Status Imperiled Species
   G3 or S3 = Natureserve Global or State Status Vulnerable Species
   G4 or S4 = Natureserve Global or State Status Apparently Secure Species
   G5 or S5 = Natureserve Global or State Status Secure Species

   Local Ranking:
   LIS = Locally Important Species

   CNPS Rankings:
   CNPS-1B = Plants Rare, Threatened, or Endangered in California and Elsewhere
   .1 = Seriously endangered in California (over 80% of occurrences threatened)
   .2 = Fairly endangered in California (20–80% occurrences threatened)
   .3 = Not very endangered in California (<20% of occurrences threatened or no current threats known)
   CNPS-2= Rare or endangered in California, more common elsewhere

Data source: List compiled by local biologists based upon experience, knowledge, and data sources including Cal Flora, eBird, U.C. California Fish Website, California Natural Diversity Database, CNPS Inventory of Rare and Endangered Plants.

California Red-Legged Frog.
Federally Threatened, State Species of Special Concern
Photo courtesy of Chris Brown

Invasive Species

The watershed is also home to or at risk from a number of non-native species that are problematic because of their invasiveness. The term "invasive" is used for those non-native species that invade natural landscapes and establish self-sustaining populations that significantly degrade the value of native ecosystems.

Removal of Invasive Mexican Fan Palms, Stewart Creek
Photo courtesy of Brian Stark

Invasive Cape Ivy

Invasive plants share certain characteristics that contribute to their destructive spread across riparian habitats:

- They reproduce quickly—by producing large quantities of seed, resprouting from roots, or spreading by stem fragments.
- They often lack local competitors and predators, and may be unsusceptible to local diseases. Without these limitations, invasive plants can spread unchecked across a landscape, often resulting in an area dominated by a single weedy species. Some invasive plants produce chemicals that inhibit the growth of other plants. Certain species are also poisonous to humans and animals.
- They establish quickly, dominating disturbed sites before native plants have a chance to re-establish.
- They reduce biodiversity by overtaking the native plants that provide superior shelter, nest sites, and food for native animals. This disrupts and degrades the ecosystem and decreases the species richness of an area.
- They often consume considerably more water than native plants, which reduces water availability for native plants, wildlife, and people.
- They are hard to eradicate, requiring regular monitoring and treatment.

Invasive animal species also pose problems from a watershed management perspective. Potential invasion of exotic quagga and zebra mussels in Lake Casitas, for example, is a major concern because these invasive mussels would threaten the ecosystem and increase the management costs of Lake Casitas dramatically. See "3.5.4 Drinking Water Quality" for more information about this issue.

Table 3.6.1.5.2 lists some of the common invasive non-native plants and animals found in riparian and aquatic habitats in the watershed.

Table 3.6.1.5.2 Riparian and Aquatic Non-Native Invasive Species

Common Name	Scientific Name
Plants	
Trees:	
Mexican fan palm	*Washingtonia robusta*
Peruvian pepper tree	*Schinus molle*
tamarisk	*Tamarix ramosissima*
Tasmanian blue gum	*Eucalyptus globulus var. globulus*
tree of heaven	*Ailanthus altissima*
Shrubs:	
castor bean	*Ricinus communis*
giant reed	*Arundo donax*
myoporum	*Myoporum laetum*
pampas grass	*Cortaderia jubata*
poison hemlock	*Conium maculatum*
Spanish broom	*Spartium junceum*
sweet fennel	*Foeniculum vulgare*
tree tobacco	*Nicotiana glauca*
Groundcovers and Low Shrubs:	
Bermuda grass	*Cynodon dactylon*
black mustard	*Brassica nigra*
Cape ivy	*Delairea odorata and Senecio mikaniodides*
common iceplant	*Mesembryanthemum crystallimum*
field mustard	*Brassica rapa*
fountain grass	*Pennisetum setaceum*
German ivy	*Senecio mikanoides*
greater periwinkle	*Vinca major*
Himalayan blackberry	*Rubus discolor*
Hottentot fig	*Carpobrotus edulis*
Italian Thistle	*Carduus pycnocephalus*
Kikuyu grass	*Pennisetum clandestinum*
perennial pepperweed	*Lepidium latifolium*
summer mustard	*Hirschfeldia incana [Erucastrum incanum]*
tocalote	*Centaurea melitensis*
wild radish	*Raphanus raphanistrum*
Aquatic Plants:	
water primrose	*Ludwigia spp.*

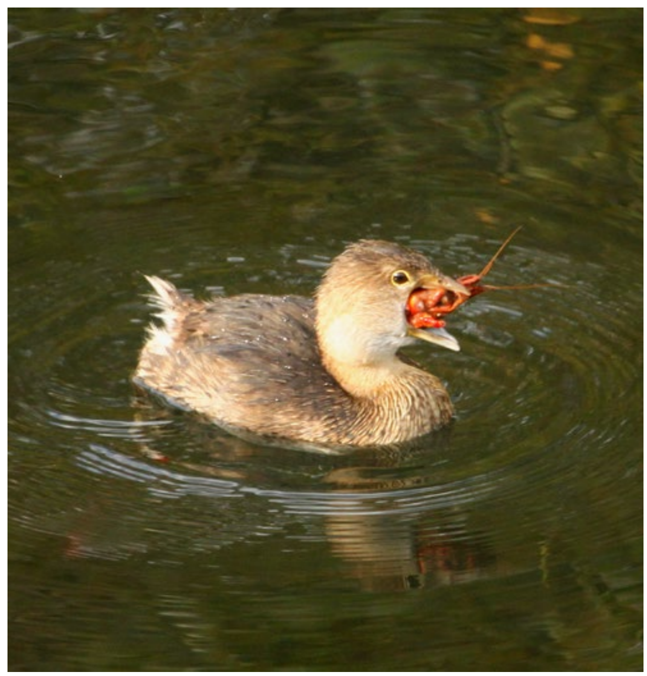
Table 3.6.1.5.2 Riparian and Aquatic Non-Native Invasive Species *(continued)*

Common Name	Scientific Name
Animals	
African clawed frog	*Xenopus laevis*
black bullhead	*Ameiurus melas*
brown-headed cowbird	*Molothrus ater*
bullfrog	*Rana catesbeiana*
carp	*Cyprinus carpio*
channel catfish	*Ictalurus punctatus*
green sunfish	*Lepomis cyanellus*
red swamp crayfish	*Procambarus clarkii*
green sunfish	*Lepomis cyanellus*
largemouth bass	*Micropterus salmoides*

Sources: VCPD 2006, Stark 2013, Magney 2005, Wetland Research Assoc. 1994, CMWD 2008

Bullfrog on Lion Creek. Invasive non-native predator of other frogs and wildlife.

Photo courtesy of Santa Barbara Channelkeeper



Pied-billed Grebe Eating Crayfish

Photo courtesy of Allen Bertke

Arundo

Arundo donax, or giant reed, is by far the most problematic non-native invasive plant species problem in the watershed. It is a large bamboo-like grass that can reach heights of up to 30 feet and is among the fastest growing terrestrial plants in the world—it can grow up to four inches a day in its early growth stages (CIPC 2011). *Arundo* has become established in and is spreading throughout riparian ecosystems in California.

Arundo can grow into massive thickets of vegetation that cover many acres, forming monocultures that virtually eliminate all other plant species, along with the rich biodiversity, structural diversity, and wildlife habitat of riparian ecosystems. Avian and fish species are the most impacted by *Arundo* infestations, and amphibians are also highly impacted (CIPC 2011).

***Arundo donax* Below Foster Park, 2012**
Photo courtesy of Santa Barbara Channelkeeper

Freshly Cut *Arundo,* Above Matilija Reservoir

Photo courtesy of Mary Meyer

Arundo has a thick, persistent underground stem system that looks like giant pieces of ginger. Like Bermuda grass, it grows by sending out underground vegetative shoots, called rhizomes, which readily take root and send up new stalks. *Arundo* spreads when pieces of cane or rhizome fragments break off, travel downstream, and take root in moist soil. The durability of these rhizomes is what makes eradication of *Arundo* so difficult. *Arundo* seeds appear to be almost always sterile in California (VCPD 2006).

Arundo consumes exceptionally large quantities of water: during the warm months, one acre of *Arundo* can use up to 39,000 gallons per day, three times the quantity of water used by the native streamside plants that it outcompetes. In one year, each acre infested with *Arundo* can consume 4.8 million gallons of water, or 3.2 million gallons more than native streamside plants (Dudley & Cole 2013). Hundreds of acres of *Arundo* have already been removed in the watershed, and (as of 2014) it is estimated that there are over 180 acres still infested.

Arundo is highly flammable, even when green, creating a significant fire threat to the environment and landowners. Fires also increase the dominance of *Arundo* in riparian ecosystems because it recovers more quickly than most native plant species after a burn (VCPD 2006).

> *Arundo* stands have two main effects on wildfires: 1) when a wildfire burns riparian habitat containing *Arundo,* it burns hotter than the habitat would have without the presence of *Arundo* and 2) *Arundo*-infested riparian habitat can act as a fire conveyor across the landscape. This can increase the size of riparian fires and may spread fires to upland areas that would normally have been separated by less flammable native riparian vegetation.
>
> —*Arundo donax Distribution and Impact Report* (CIPC 2011)

Arundo infestations can alter geomorphic and fluvial processes, by redirecting water against streambanks, undercutting them, and accelerating erosion that causes property damage. Large stands of *Arundo* have been found to functionally increase bed elevations and significantly reduce the flow capacity of streams (CIPC 2011). During floods, *Arundo* can also create hazards when uprooted plants clog flood control infrastructure.

Removing and managing the spread of *Arundo* is a watershed management priority. See "2.3.6 Arundo-Free Watershed Campaign" for more information on efforts to control *Arundo*.

3.6.1.6 Key Data and Information Sources/ Further Reading

Below is a summary of some of key documents that address habitats and species in the watershed. See "4.3 References" for complete reference citations.

Arundo donax Distribution and Impact Report (CIPC 2011)

Botanical Resources at Emma Wood State Beach and the Ventura River Estuary, California (Ferren et al. 1990)

California River Parkways Trailhead Project, Initial Study (Aspen Environmental 2010)

City of Ojai Urban Watershed Assessment and Restoration Plan (Magney 2005)

Designing Road Crossings for Safe Wildlife Passage: Ventura County Guidelines (Cavallaro et al. 2005)

Draft Ventura River Habitat Conservation Plan (Entrix & URS 2004)

Final Revegetation Report on Former S.P. Milling Co. Surface Mine, Lower Ventura River (Hunt 2004)

Functions and Values of Wetlands (USEPA 2001)

Guide to Native and Invasive Streamside Plants: Restoring Riparian Habitats in Ventura County & along the Santa Clara River in Los Angeles County (VCPD 2006)

Habitat Restoration Options for the Lower Ventura River (Pitterle 2010)

Historical Ecology of the lower Santa Clara River, Ventura River and Oxnard Plain: an analysis of terrestrial, riverine, and coastal habitats (Beller et al. 2011)

Lake Casitas Final Resource Management Plan Environmental Impact Statement, & Appendices (URS 2010)

Land Management Plan: Part 2 Los Padres National Forest Strategy (USFS 2005a)

Locally Important Animals (VCPD 2014)

Locally Important Plant List (VCPD 2014b)

Matilija Dam Ecosystem Restoration Project, Draft Environmental Impact Statement/Environmental Impact Report (USACE 2004)

Ojai Meadow Preserve Habitat Restoration and Flood Control Plan (Condor Environmental 2004)

Oak Woodlands Management Plan (VCPD 2007)

Acronyms

CFP—California Floristic Province

LIS—Locally Important Species

NWI—National Wetlands Inventory

SIA—Special Interest Area

USFWS—Fish and Wildlife Service

Post-treatment Vegetation Monitoring for the Matilija Dam Ecosystem Restoration Project, Giant Reed Removal Element (Hunt & Associates Biological Consulting 2009)

Preliminary Comparison of Transpirational Water Use by Arundo donax and Replacement Riparian Vegetation Types in California (Dudley & Cole 2013)

San Antonio Creek Watershed Vegetation Mapping Project (Wildscape Restoration 2008)

South Coast Missing Linkages: A Wildland Network for the South Coast Ecoregion (South Coast Wildlands 2008)

Surfers' Point Managed Shoreline Retreat Environmental Impact Report (City of Ventura and Rincon Consultants 2003)

The Ecology of Riparian Habitats of the Southern California Coastal Region: A Community Profile (Faber et al. 1989)

Upper San Antonio Creek Watershed Giant Reed Removal Water Quality Monitoring Plan (VCWPD 2010c)

Ventura County General Plan, Resources Appendix (VCPD 2011)

Ventura County Initial Study Assessment Guidelines (VCPD 2011b)

Ventura River Delta Marine Algae Collection (Capelli 2010)

Ventura River Estuary Enhancement and Management Final Plan (Wetlands Research Associates & Philip Williams and Associates 1994)

Ventura River Multiple Species Habitat Conservation Plan, Draft, Technical Appendices (Entrix 2007)

Vertebrate Resources at Emma Wood State Beach and the Ventura River Estuary, Ventura County, California: Inventory and Management (Hunt & Lehman 1992)

Wetlands of the Central and Southern California Coast and Coastal Watersheds: A Methodology for their Classification and Description (Ferren et al. 1995)

3.6.2 Steelhead

In the Ventura River watershed, 48 miles of river and tributaries are designated as critical habitat for southern California steelhead trout (*Oncorhynchus mykiss* or *O. mykiss*), a federally listed endangered species. The presence of the endangered steelhead is a very significant concern for some stakeholders with regard to watershed management. The streamflow, pools, and associated food chain required for its survival are indicators of healthy aquatic ecosystems. Given the watershed's often dry and always variable climate, the availability of water to support that healthy aquatic ecosystem is a constant challenge and a continuing source of stakeholder controversy.

This section discusses the characteristics of the steelhead, its history, habitat needs, existing habitat conditions, and efforts to manage and recover the local population. A number of other sections of the plan address issues of importance to steelhead survivalh, including "3.3.1 Surface Water Hydrology," "3.3.3 Groundwater Hydrology," "3.5.1 Surface Water Quality," and "3.4.3 Water Demands."

Steelhead and Rainbow Trout. Steelhead and rainbow trout are the same species, *Oncorhynchus mykiss* (*O. mykiss*), from the salmon family. All *O. mykiss* hatch in gravel-bottomed rivers and streams. *O. mykiss* that stay in freshwater all their lives are called "resident rainbow trout," and those that spend part of their lives in the sea are called "steelhead." Steelhead develop a slimmer profile, become more silvery in color, and typically grow much larger than resident rainbow trout (NMFS 2014).

Drawings by Joseph Tomelleri

> Southern California steelhead were listed as endangered under the federal Endangered Species Act in 1997. The Endangered Species Act (ESA) allows listing of full taxonomic species, but also named subspecies and distinct population segments (DPSs) of vertebrates. The southern California steelhead DPS or Evolutionary Significant Unit (ESU) is a subset of *O. mykiss* classified based on location and life form—in this case anadromy, or the strategy of living in the sea and migrating to fresh water to spawn.
>
> Because of presumed evolutionary, ecological, genetic, and physiological differences from steelhead stocks in other parts of the range, the National Marine Fisheries Service (NMFS) has designated steelhead in California from the Santa Maria River south to the Mexican border as a DPS. Individuals within this DPS are referred to as southern California steelhead.
>
> —*The History of Steelhead and Rainbow Trout (Oncorhynchus mykiss) in the Santa Ynez River Watershed, Santa Barbara County, California* (Alagona 2012)

The southern California steelhead DPS encompasses all naturally-spawned anadromous *O. mykiss* populations in watersheds from Santa Maria to Mexico. These steelhead are believed to have adapted to the southern weather patterns and inconsistent streamflow conditions of these coastal watersheds. Steelhead in southern California migrate in and out of rivers during years with sufficient river flow. Extended freshwater sequestration (or isolation) of *O. mykiss* populations in streams and rivers during dry and extended drought years is a natural phenomenon.

The Endangered Species Act requires designation of critical habitat when a species is listed as endangered or threatened. Critical habitat is a specific area that has the physical or biological features essential to conservation and recovery of the species. In 2005, NMFS designated critical habitat for steelhead in many areas, including the Ventura River watershed (NMFS 2005). Forty-eight miles of river and tributaries in the watershed are included in the designation (see Figure 3.6.1.3 Critical Habitat Map, in “3.6.1 Habitats and Species”).

Indicators of Watershed Health

Steelhead are often cited as an “indicator species,” and this perspective is held by many watershed stakeholders. Because they are particularly sensitive to environmental degradation, steelhead are indicators of the watershed’s overall ecological health. The conditions that support steelhead, such as sufficient clean streamflow, riparian vegetation, and a lack of fine sediment, also support life in other levels of the food chain and potentially other endangered species.

3.6.2.1 Life History Highlights

Steelhead have varied life histories that depend upon both freshwater and saltwater habitats. Highlights of their life history are provided below. This information was compiled from three sources: *Southern California Steelhead Recovery Plan Summary* (NMFS 2012a), *Draft Ventura River Habitat Conservation Plan* (Entrix & URS 2004), and *San Luis Obispo Creek Watershed Enhancement Plan* (Stark 2002).

Juveniles born and reared in freshwater undergo a physiological change (smoltification) that allows them to migrate to saltwater.

After maturing in the marine environment for typically one to four years, steelhead leave the marine environment to reproduce in the relatively sheltered and predator-free freshwater environment. Returning adults may migrate from several to hundreds of miles upstream to reach spawning grounds in their natal rivers or streams (streams where they were spawned). They can also spawn in non-natal streams and thus re-colonize watersheds whose populations have been extirpated (or gone extinct locally).

Steelhead typically migrate upstream when streamflows are receding after a storm and after the sandbar, present across the mouth of most southern California streams during the dry season, is breached.

Depending on rainfall, upstream migration and spawning typically occur from January to March in most southern California streams.

Once in spawning habitat, a female will excavate a nest, termed a "redd", in streambed gravels where she deposits her eggs, which a male then fertilizes. Steelhead produce more eggs per individual than typical resident rainbow trout.

***O. mykiss* Eggs, North Fork Matilija Creek, 2012**
Photo courtesy of Paul Jenkin

The period between fertilization by the male and hatching varies, lasting from about three weeks to two months. Young fish emerge from the gravel two to six weeks after hatching.

During incubation, sufficient water must circulate through the interstitial space between gravels in the redd to supply embryos with oxygen and remove waste products.

Juvenile Rainbow Trout, Matilija Creek, 2010

Photo courtesy of Tenkara USA

Steelhead do not necessarily die after spawning and may return to the ocean, sometimes repeating their spawning migration one or more times.

In the mainstem Ventura River, steelhead can have very high growth rates, growing to smolt size during their first year, especially when higher-than-normal flow conditions are present.

Within this basic life-history pattern, there can be great variation in the timing or age at which migration to and from the ocean occurs for individual *O. mykiss*. Some may never go to the sea; some may only go as far as the estuary where conditions are similar to the sea in that productivity and growth rates are higher. This plasticity allows *O. mykiss* to take advantage of different habitats and to persist in the highly variable and challenging southern California environment.

3.6.2.2 Current Populations and Conditions

Steelhead habitat requirements vary and are dictated by their life stage and seasonal behavior patterns—migration, spawning, and rearing. These habitat needs and conditions in the watershed are discussed in the following sections. Since steelhead spend a portion of their lives in the ocean, oceanic factors, such as ocean water conditions, food availability/productivity (which is higher when cold water upwelling occurs), fishery harvest rates, and predation, also play a significant role in steelhead survival.

Steelhead habitat requirements vary and are dictated by their life stage and seasonal behavior patterns—migration, spawning, and rearing.

Regular fish surveys, conducted fairly consistently since 2003, are helping to create a more detailed picture of current populations of *O. mykiss* and associated habitat conditions in much of the watershed. The data show that there is considerable variation in populations from year to year depending in part on rainfall and streamflow. The survey excerpts below describe some of these findings.

> The Lower North Fork of the Matilija [Creek] appeared to contain some of the best habitat for steelhead spawning and rearing within the upper basin. The majority of the channel was type B and was enclosed by riparian forest or, in Wheeler Gorge, by canyon walls. Spawning gravels were very abundant and in good condition, although there was some mineral cementation in areas. Rainbow trout were frequently observed, and several redds and spawning adults were also seen during the March survey. Potential access for steelhead was good throughout most of this reach, despite some steep cascades and falls in the lower end that were expected to be passable at higher flows.
>
> —*Assessment of Steelhead Habitat in Upper Matilija Creek Basin. Stage One: Qualitative Stream Survey* (Thomas R. Payne 2003)

Based on recent surveys, good quality rearing and/or spawning habitat currently occurs in Matilija Creek headwaters, North Fork Matilija and Murietta creeks, a portion of Matilija Creek downstream of Matilija Dam, Coyote and Santa Ana creeks above Casitas Dam, and portions of San Antonio Creek. Much of the mainstem Ventura River steelhead rearing habitat was of generally poor quality except in the Casitas Springs/Foster Park Reach. However, different reaches of the river offer diverse habitat conditions, and even within a given reach, habitat conditions can vary among years depending on flow conditions. The Ventura River Lagoon may also provide rearing habitat.

—*Ventura River Habitat Conservation Plan - Draft* (Entrix & URS 2004)

Estimating Historical Steelhead Populations

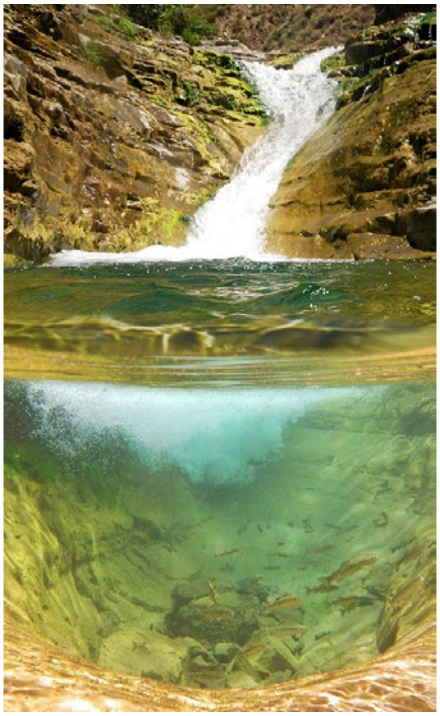
The extent to which native steelhead were found in the watershed historically is an important question for some stakeholders, in part because it is assumed that expectations for the species' recovery are based upon natural, historical population numbers. A related question is the role that the extensive stocking of steelhead in the past has played in the genetic makeup of the fish: Are the fish that are protected today actually the native fish historically adapted to this region? All of these issues—historical populations, expectations for recovery, and the role and impact of historic stocking—are complicated and controversial topics.

The first "hard" data on historical steelhead populations in the watershed that involved an actual count of observed adult steelhead occurred in 1947 (Evans 1947). Prior sources of information consist largely of newspaper references, estimates, and extrapolations. These often incomplete and anecdotal accounts are the sources that have been pieced together to describe the history of a species whose population is known to have large fluctuations over time and space in response to the highly variable climatic conditions.

The difficulty of estimating steelhead populations given the lack of objective data was summarized in the technical document that characterized the population of the southern California steelhead for the Southern California Steelhead Recovery Plan:

> The authors of this report are members of a Technical Recovery Team (TRT), convened to advise NMFS on technical aspects of recovery in the study area. This report has two goals: to describe the normal (reference) condition of each ESU; and to identify existing and potential populations of steelhead that could form the basis for recovery.
>
> It should be noted at the outset, however, that these two goals are burdened with numerous uncertainties and judgment calls on the part of the authors. The uncertainty stems from several interacting factors:
>
> 1) The extremely large and heterogeneous planning area, comprising the south-west range limit for the species. Environmental heterogeneity appears to constrain the distribution of the species at a number of spatial scales, making the task of describing this distribution somewhat complex.
>
> 2) Most of the information about the species in the study area comes from anecdotal reports (descriptive in nature) or from studies conducted at restricted spatial scales (individual reaches, or at best, large sections of individual watersheds).
>
> 3) The task of delineating populations and characterizing recovery potential is largely reliant on quantitative data samples from across the planning domain. Since such information is unavailable, we are confined to the less satisfactory exercise of A) applying simplistic yet uniform methods over large spatial extents, and B) describing existing small-extent studies, and making uncertain inferences of their implications for the larger ESU. For the most part, these two approaches lack the level of quantitative description that is necessary for making concrete recommendations.

—*Steelhead of the South-Central/Southern California Coast: Population Characterization for Recovery Planning* (Boughton et al. 2006)



***O. mykiss* on Matilija Creek**
Photo compilation courtesy of Mark Allen/Normandeau

> The Ven 3 [Casitas Springs "live reach"] data illustrates the high variability of *O. mykiss* distribution and abundance in this southern California basin; it reveals the potential significance of this mainstem reach in rearing juvenile steelhead (consistent with some historical data, such as Moore 1980); and it also shows the important role of San Antonio Creek for providing spawning and rearing habitat for steelhead.
>
> —*Steelhead Population Assessment in the Ventura River/Matilija Creek Basin, 2008 Summary Report* (Thomas R. Payne 2009)

> In most previous years and in 2011, overall abundance was highest in the upper basin segment above Matilija Dam, intermediate in the middle basin segment between Robles Diversion Dam and Matilija Dam, and lowest in the lower basin segment. The upper basin was estimated to contain 77% of *O. mykiss* fry [under one year of age], with only 1% in the lower basin. However, several important tributaries were not included in the basin-wide estimates, namely Murietta Creek in the upper basin and San Antonio Creek in the lower basin.
>
> —*Steelhead Population Assessment in the Ventura River/Matilija Creek Basin, 2010 Data Summary* (Normandeau 2011)

Limiting Factors

The following summary of limiting factors for steelhead was compiled from the 1997 *Ventura River Steelhead Restoration and Recovery Plan* (Entrix & Woodward Clyde 1997) and the 2005 *City of Ojai Urban Watershed Assessment and Restoration Plan* (Magney 2005). Additional descriptions of southern California steelhead habitat requirements were taken from the *San Luis Obispo Creek Watershed Enhancement Plan* (Stark 2002). The 2004 *Draft Ventura River Habitat Conservation Plan* (Entrix & URS 2004) contains a more specific description of limiting factors for each creek in the watershed and the Ventura River.

Streamflow Variability

Steelhead in the Ventura River watershed are dependent upon a pattern of water flows in the mainstem of the river and significant tributaries, sufficient in time and place to provide for migration, spawning, rearing, and holding habitats. Peak storm flows typically break the estuary sand bar and entice adult steelhead into the river network. Once in the river network, insufficient streamflow is a critical limiting factor to the spawning and rearing activities of steelhead. Steelhead prefer to spawn in perennial streams since one to three years is generally required for offspring to mature and reach the ocean. Intermittent reaches in the watershed often lack riparian vegetation,

A Drying Ventura River

Photo courtesy of Ojai Valley Land Conservancy

have very high temperatures (when wetted), and are generally not very productive spawning habitat.

Deficient streamflow is often a limiting factor for steelhead survival in upper San Antonio Creek and parts of its tributaries (Thacher, Reeves, and Senior Canyon Creeks), parts of Matilija Creek upstream of Matilija Dam, Coyote Creek downstream of Casitas Reservoir, Cañada Larga and Cañada del Diablo Creeks, and the upper mainstem Ventura River downstream of Robles Diversion Dam. Figure 3.6.2.2.1 illustrates the extreme variability in streamflow in the watershed.

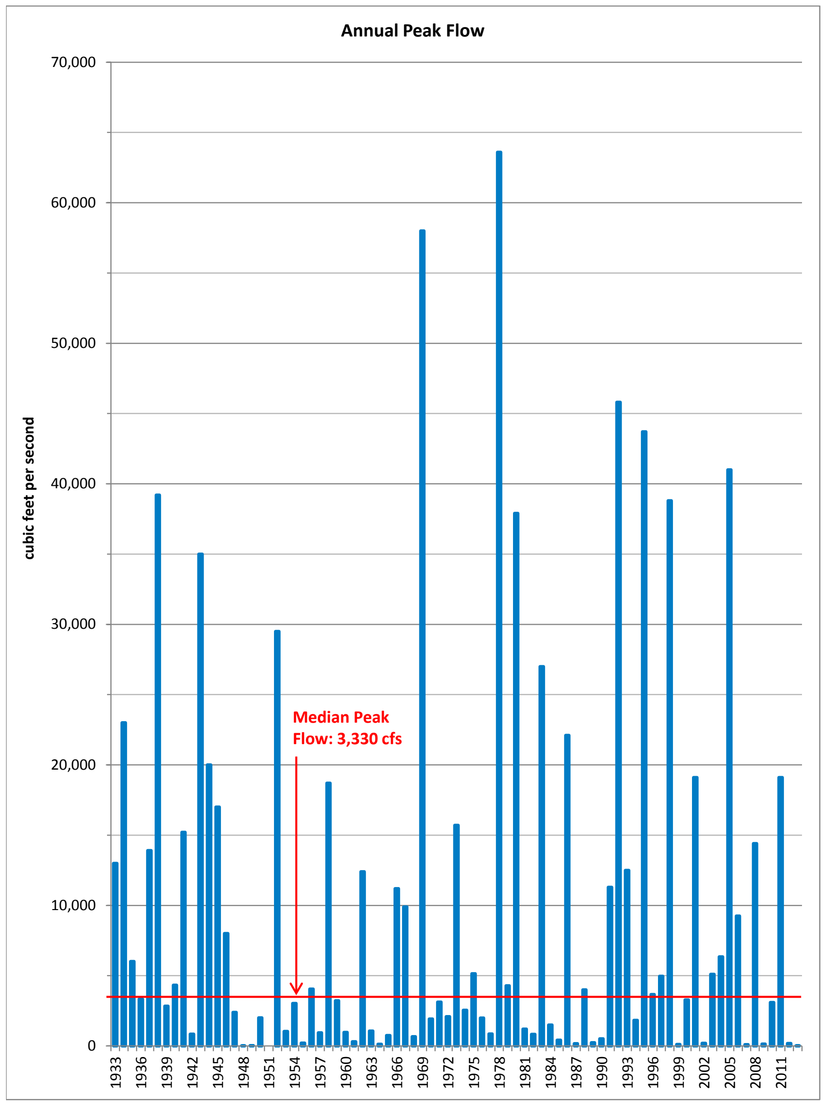


Figure 3.6.2.2.1 Annual Peak Flow at Foster Park, 1933–2013 (Water Years). Charting the highest peak flow in each water year (some years had many peaks) illustrates the variability of annual peak flows. The median annual peak flow year in the dataset (or the midpoint of the dataset) is 1936, with an annual peak flow of only 3,300 cubic feet per second (cfs). 1936 received 20.35 inches of rain in downtown Ojai (the median rainfall in Ojai is 19.20 inches). The largest annual peak flows are many orders of magnitude greater than the median.

Data Source: Ventura County Watershed Protection District's website (VCWPD 2013)

> Low flow barriers have a greater effect during the dry years, not only for limiting upstream spawning steelhead, but also for limiting movements of steelhead juveniles and wild resident trout into late summer refugia habitats.
>
> —*Draft Environmental Impact Statement/Environmental Impact Report for the Matilija Dam Ecosystem Restoration Project* (USACE 2004)

Poor Water Quality/Elevated Water Temperature

Steelhead require cool, clear, well-oxygenated fresh water flows for optimum growth and survival. Water temperature is a function of air temperature, stream depth, stream width, flow magnitude, overhead canopy density, and shading from surrounding terrain. Excessively warm water temperatures can retard steelhead growth, reduce rearing densities, increase susceptibility to disease, and impair the ability of young steelhead to compete with other species for food and avoid predation. Warmer water also retains less dissolved oxygen, which can stress steelhead trout and increase their vulnerability to disease.

In all of the reaches surveyed, water temperatures are likely to be higher than optimal during the summer months. Even during these May surveys, water temperatures in the afternoon ranged from 23 to 25°C.

Water quality problems that affect fish, such as high temperatures and low dissolved oxygen, are seen in many areas of the watershed when flows are low. Areas that tend to have perennial flow are the exception to this. Water quality is also adversely impacted by urban runoff.

> In all of the reaches surveyed, water temperatures are likely to be higher than optimal during the summer months. Even during these May surveys, water temperatures in the afternoon ranged from 23 to 25°C. These temperatures are stressful to steelhead, and it would be difficult for steelhead to maintain growth unless substantial amounts of food were available. Fortunately, the cobble gravel substrate and predominantly run habitat in the mainstem make excellent food producing areas. Moore (1980) found that steelhead in the Ventura River near Casitas Springs had growth rates similar to or higher than those observed in other populations. This indicates that there was sufficient food production during that study to offset the high water temperatures, even during the drought years of 1976 and 1977.
>
> —*Draft Ventura River Habitat Conservation Plan* (Entrix & URS 2004)

Fish Passage Barriers

Steelhead require unobstructed streams for migration to upper stream reaches where potential spawning and rearing habitat exists. Dams, road crossings, culverts, and other types of modifications to streams present barriers or impediments that can threaten steelhead survival by blocking their access to inland spawning habitat. In addition to presenting physical obstructions, channel modifications can concentrate flow such that velocities are too high for fish to negotiate.

Lower Wheeler Campground Crossing, Total Barrier, North Fork Matilija Creek

Photo courtesy of Mark Allen/Normandeau

Matilija Dam completely blocks access to most of Matilija Creek and its tributaries. Casitas Dam is a complete barrier, which blocks access to Coyote and Santa Ana Creeks. Other passage barriers and impediments, both natural and manmade, exist throughout the watershed, including on Matilija Creek and its tributaries, North Fork Matilija Creek, and upper San Antonio Creek and its tributaries.

Fraser Street Crossing, Partial Barrier, San Antonio Creek

Camp Comfort Bridge Apron, Partial Barrier, San Antonio Creek

Fish passage barriers can be total barriers, partial barriers, or temporary barriers (e.g., from construction), and some barriers are only problematic at low flows. Barriers can also change over time, as storms blow out pipes or other obstructions that had acted as barriers. An on-the-ground assessment of current barriers and their priority for removal is needed in the watershed. Based on existing information, the barriers listed in Table 3.6.2.2.1 were identified by a Ventura River Watershed Council technical advisory committee as priorities for removal or mitigation in the watershed.

Table 3.6.2.2.1 Priority Barriers to Fish Passage[1]

Subwatershed	Barrier Location	Barrier Type
Matilija Creek	Matilija Dam	Total
Matilija Creek	USGS Gauge Weir	Partial
North Fork Matilija Creek	Lower Wheeler Campground crossing	Total
North Fork Matilija Creek	Upper Wheeler Campground crossing	Partial
North Fork Matilija Creek	Bear Creek, Lower Wheeler Campground crossing	Partial
North Fork Matilija Creek	Bear Creek, Upper Wheeler Campground crossing	Partial
North Fork Matilija Creek	Ojai Quarry	Partial
San Antonio Creek	Camp Comfort bridge apron	Partial
San Antonio Creek	Fraser St. crossing	Partial
Coyote Creek	Casitas Dam[2]	Total

1. This is only a partial list intended to highlight known barriers that are a priority for removal. Many other partial barriers exist. A formal on-the-ground assessment of current barriers in the watershed is needed.

2. It is not expected that Casitas Dam will be removed, however NMFS would like this barrier mitigated to allow for fish passage.

Priority Barriers to Fish Passage

ID#	Stream & Location
1	Coyote Creek, Casitas Dam*
2	San Antonio Creek, Fraser Street
3	San Antonio Creek, Camp Comfort
4	Matilija Creek, USGS Gauge Weir
5	Matilija Creek, Matilija Dam
6	North Fork Matilija Creek, Ojai Quarry
7	North Fork Matilija Creek, Lower Wheeler Campground Crossing
8	Bear Creek, Upper Wheeler Campground Crossing
9	Bear Creek, Lower Wheeler Campground Crossing
10	North Fork Matilija Creek, Upper Wheeler Campground Crossing

Ventura River Watershed

Points indicate partial fish passage barriers, based on the preliminary estimate of local experts. Many other partial barriers exist. A formal on-the-ground assessment of barriers is needed.

Points indicate full fish passage barriers.

* It is not expected that Casitas Dam will be removed, however regulators would like this barrier mitigated to allow for fish passage.

Data Source:
California Fish Passage Assessment Database (PAD), Spring 2014

Map Created by GreenInfo Network using Esri software, Oct. 2014
www.greeninfo.org

Figure 3.6.2.2.2 Priority Barriers to Fish Passage Map

Matilija Dam

Matilija Dam is the watershed's most significant fish passage barrier because it blocks access to a large area of primary spawning and rearing habitat in the upper reaches of Matilija Creek and its tributaries (USACE 2004). The dam is located one-half mile above the Matilija Creek/North Fork Matilija Creek confluence, which is also the beginning of the Ventura River. Dam removal efforts started in the 1990s and continue today. Removing the dam is considered the highest priority issue for steelhead recovery in the watershed in the long term. The major effort to remove the dam, which also addresses sediment transport issues, is addressed in a separate section, "3.6.3 Matilija Dam."

Matilija Dam

Since its construction in 1947, Matilija Dam has blocked Ventura River adult steelhead access to roughly 13 miles of this watershed's most valuable steelhead spawning and rearing habitat (NMFS 2003). Dam removal would restore access to this vital habitat.

Robles Diversion

The Robles Diversion was built on the Ventura River in 1958 to divert water to the Lake Casitas reservoir. The diversion was initially constructed without provisions for passage of fish migrating upstream or downstream. Without fish passage, the Robles Diversion cut off approximately eight miles of prime steelhead spawning and rearing habitat, and reduced flows in the lower 14 miles of the Ventura River (NMFS 2003a).

The Robles Fish Passage Facility was completed in 2006 to reestablish access to upstream steelhead spawning and rearing habitat. The project was designed to provide an accessible route over the Robles Diversion and restore a portion of the flows necessary for fish to reach the Robles Fish Passage Facility. The Fish Passage Facility also allows passage of juvenile steelhead migrating downstream to pass to the ocean.

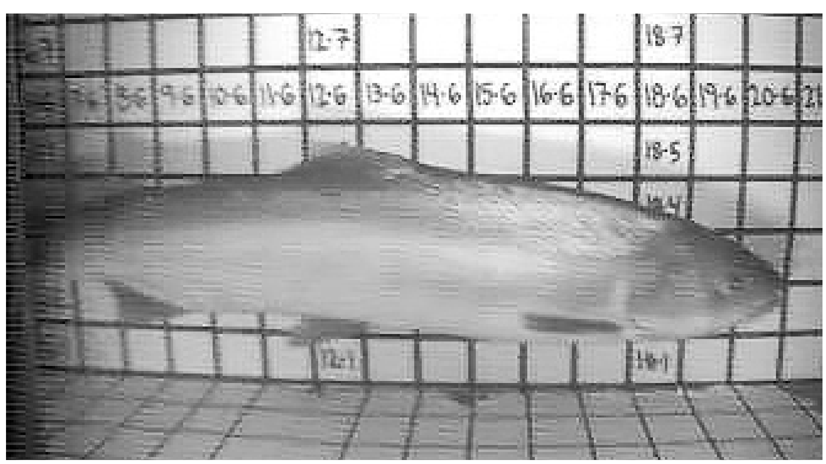
Additionally, requirements to allow a minimum amount of water to bypass the facility during steelhead spawning and migration season (January through June) may improve spawning and rearing habitat in the lower mainstem of the Ventura River (NMFS 2003a).

The cost to build the Fish Passage Facility was $8.1 million (Lewis 2014).

Robles Diversion and Fish Passage Facility

Robles Fish Passage Facility Ladder. The Robles fish ladder (vertical slot design) works well in systems with variable flows and high levels of debris. Principal components include: 1) boulders arranged to create a series of pools to improve passage over the road crossing/flow measurement gauge; 2) a vertical slot fish ladder to provide fish passage over a 15-foot elevation change; 3) an auxiliary water supply pipeline to provide additional fish ladder "attraction water" and to supplement downstream release flow; 4) a fish counting device to determine number of fish migrating through the fish ladder; 5) a fish screen to prevent upstream and downstream migrants from entering the diversion canal; 6) a guidance device and high flow fish channel exiting upstream of the facility to prevent upstream migrant fallback through the spillway gates (NMFS 2003a; Lewis 2014).
Photo courtesy of Casitas Municipal Water District

The Robles Fish Passage Facility operates when there is sufficient natural streamflow to allow migration of fish upriver from the ocean past the Robles Diversion Dam, and downstream to the Ventura River estuary. The number of days each year that the facility operates depends upon the timing and duration of winter storms (NMFS 2003a).



Adult Steelhead in Robles Fish Counter
Photo courtesy of Casitas Municipal Water District

Surveying for Steelhead on San Antonio Creek. Lack of deep pool habitat limits steelhead rearing potential in parts of the watershed.

Lack of Deep Pools

Steelhead rely on a diverse assemblage of instream habitats: pools, runs, riffles, and flatwater. The distribution of these habitats, their quality, ease of access, and degree of shelter determine the health of instream habitat. Deep pools are important because they provide cover for fish to avoid predation.

Juvenile steelhead generally prefer to inhabit riffles and pools, and as stated above, pool size is also important to steelhead for jumping over barriers. Large woody debris, large cobble or boulders, and geomorphic features help support instream pools.

> Deep water (greater than half of the vertical jump) is necessary to gain the leaping momentum. Resting pools are necessary in long sections of high velocity flows. During low flows, boulder cascades, bedrock slides, and low gradient riffles may become barriers to upstream fish movement. Steelhead may become stranded on their upstream migration if flows rapidly decline. The presence of good deep pools is essential during this period, as fish may need to wait out the period between storms.
>
> —*Draft Environmental Impact Statement/Environmental Impact Report for the Matilija Dam Ecosystem Restoration Project* (USACE 2004)

Lack of pool habitat limits steelhead rearing potential in parts of the watershed, such as portions of San Antonio Creek.

Lack of Spawning Substrate

Adult steelhead have been reported to spawn in substrates from 0.2 to 4.0 inches in diameter. Steelhead utilize mostly gravel-sized material for spawning; however, they will also use mixtures of sand-gravel and gravel-cobble. The gravel must be highly permeable to keep incubating eggs well oxygenated, and should contain < 5% sand and silt. Creek reaches that contain no gravel or cobbles, or that contain gravels or cobbles embedded with silt or sand, are a limiting factor for steelhead spawning.

A factor that limits spawning substrate in the watershed is the tendency of substrate materials in some areas to become cemented together, at least temporarily, by mineral deposits (calcification).

> The surfaces of gravel, cobbles, and boulders were physically gritty due to the deposits, which effectively "cemented" the particles together. These deposits appeared to significantly reduce substrate quality for spawning, and benthic invertebrate production appeared to be very low. However, it is unknown to what degree

these depositions are removed or if gravels are significantly loosened during winter and spring high-flow events. Several gravel deposits were revisited in April following the March 15th storm event, but such deposits showed little evidence of becoming significantly loosened following that event.

—*Assessment of Steelhead Habitat in Upper Matilija Creek Basin. Stage One: Qualitative Stream Survey* (Thomas R. Payne 2003)

Cemented Gravels, North Fork Matilija Creek. Calcification cements gravels together and limits the availability of gravels needed for fish spawning.
Photo courtesy of California Department of Fish and Wildlife

Steelhead Vocabulary

Anadromous – Anadromous fish are born in fresh water, migrate to the ocean to grow into adults, and then return to fresh water to spawn.

DPS or Distinct Population Segment – An ecologically discrete subset of *O. mykiss.* A population segment is considered distinct if it is discrete from and significant to the remainder of its species based on factors such as physical, behavioral, or genetic characteristics; or if it occupies an unusual or unique ecological setting; or if its loss would represent a significant gap in the species' range. A DPS is the smallest division of a taxonomic species that can be protected under the U.S. Endangered Species Act.

ESU or Evolutionary Significant Unit – A population (or group of populations) which exhibits two biological characteristics: 1) it is substantially reproductively isolated from other conspecific (of the same taxonomic species) population units; and 2) it represents an important component of the evolutionary legacy of the species.

Fry – Refers to fish in their first year of life (e.g., from spring emergence until the following spring).

Migration Season – January through June. Most smolts will emigrate between February and June.

Redd – The nest constructed by steelhead. Fertilized eggs are deposited in an excavated depression and covered by gravel.

Resident Rainbow Trout – *O. mykiss* that remain in freshwater throughout their life.

Smolt – Juvenile *O. mykiss* that is physiologically adapted to seawater and emigrates to the ocean.

Steelhead – *O. mykiss* that rears to maturity in the ocean before entering freshwater to spawn.

Lack of Shade. Lack of shady riparian vegetation adjacent to stream channels limits steelhead rearing potential on parts of the Ventura River.
Photo courtesy of Santa Barbara Channelkeeper

Lack of Riparian Vegetation and Shade

Riparian vegetation is a vital factor for steelhead habitat. Riparian buffers reduce flood water velocity, sort sediment loads for creation of spawning habitats, and mitigate contaminants associated with nearby roads and agricultural, industrial, and residential activities. Riparian vegetation also stabilizes channel banks, thereby reducing erosion and preventing excessive sedimentation into the creeks. The overhead canopy provided by mature riparian trees maintains cooler water temperatures and serves as a source of woody debris that contributes to pool and instream cover habitat formation. In addition, leaf litter from trees is an important input into the stream that supports the aquatic food chain. The roots of these trees can also contribute to other instream shelter types such as undercut banks. Robust canopy may also reduce algal blooms that can cause dissolved oxygen depletion in creek waters by reducing solar exposure.

Shade reduces heating of water. As temperatures rise, fish experience increasing difficulty extracting oxygen from water, while at the same time the amount of oxygen in the water decreases.

Lack of riparian vegetation adjacent to low flow channel limits steelhead rearing potential in parts of the watershed, especially along intermittent reaches.

Excessive Sediment

Over the long term, sediment settles and fills the spaces between streambed gravels and rocks, spoiling fish spawning habitat by reducing oxygen-rich water flow to trout eggs that are buried in the gravel beds. Accumulated sediment also reduces the habitat required by smaller organisms (aquatic insects), which are a vital source of food for fish.

Sediment settles and fills the spaces between streambed gravels and rocks, spoiling fish spawning habitat by reducing oxygen-rich water flow to trout eggs

Streambank stability is very important for minimizing excess sedimentation. Excess sediment from eroding streambanks accumulates in the stream channel downstream of erosion sources and increases the instability of the channel system. The accumulated sediment can divert water into adjacent banks and create new areas of erosion.

Excess fine sediments severely limit steelhead spawning and juvenile rearing in Coyote Creek downstream of Casitas Reservoir, Cañada Larga Creek, and Cañada del Diablo Creek. Fine sediments are also a problem in upper Matilija Canyon, in the Ventura River just below North Fork Matilija Creek, and in parts of the Ventura River mainstem. Ground disturbing activities and dirt roads can be sources of fine sediment during rain events. Fine sediments are also attributable to natural causes.

Lack of Instream Cover

Instream cover is composed of elements within a stream channel that provide fish with protection from predation, reduce water velocities so as to provide resting and feeding areas, and reduce competition through increased living space and visual isolation within the stream. Instream cover includes objects under water that provide shade and resting areas, such as over-hanging vegetation, submerged cobbles and boulders, logs, root wads, submerged vegetation, and undercut banks. Lack of riparian vegetation is the primary factor contributing to a lack of instream cover.

Current Populations

Determining how many steelhead are spawning under existing conditions in the Ventura River watershed is fraught with challenges. Until a steelhead reaches a large adult size, it is not easy to distinguish it from a resident rainbow trout just by sight. The flexibility that the species exhibits in terms of which life form it takes on (residency or anadromy) presents another challenge. For example, fish that have clearly started to smolt (undergo changes necessary to go to sea) can reverse that physiological process if conditions warrant it—they can revert to being a resident. Fish also move around, making definitive counts challenging. Fish radio-tagged by Casitas Municipal Water District (CMWD) staff have been tracked moving downstream and back upstream through the Robles Fish Passage Facility. This has occurred with other radio-tagged smolts in lower portions of the Ventura River.

25-Inch Steelhead at Shell Road Bridge, 2007

Photo courtesy of Mark Capelli

> The present number of adult steelhead returning annually to spawn is difficult to determine, in part because there are so few fish, but the present run of steelhead is probably less than 100 fish annually.
>
> —*Robles Fish Passage Facilities Biological Opinion, Q & A* (NMFS 2003a)

Annual Watershed-Wide Survey Data

Annual *O. mykiss* distribution and abundance surveys have been conducted in the watershed by Normandeau Associates since 2006. "3.6.2.5 Current Steelhead Surveys and Monitoring" describes this program in more detail. The combined data from these surveys over time (Tables 3.6.2.2.2 and 3.6.2.2.3) provide a good description of fry, juvenile, and adult *O. mykiss* abundance in the Ventura River watershed, including the dramatic range of population abundance, reflective of the highly variable flow characteristics in the watershed.

Table 3.6.2.2.2 *O. mykiss* Abundance Data by Study Site, 2006 to 2012

Zone[1]	Study Segment	Study Site	Years of Data	Study Site: Length	Study Site: Flow (Avg.)	Abundance Estimates: # O. mykiss <10 cm		Abundance Estimates: # O. mykiss ≥10 cm	
				Mile	cfs	Min	Max	Min	Max
Anadromous	**Lower** *Below Robles Diversion Dam*	Ventura River (101 Bridge)	6	0.96	20.3	0	0	0	9
		Ventura River (Shell Rd.)	6	1.00	18.4	0	50	0	150
		Ventura River (Casitas Springs)	7	0.90	13.8	0	843	4	1400
		San Antonio Creek (mid)	5	0.40	3.4	0	0	0	33
		San Antonio Creek (up)	3	0.48	3.0	6	26	15	167
		Ventura River (Preserve)	3	0.55	0.5	0	10	0	19
Anadromous	**Middle** *Between dams*	Ventura River (Camino Cielo Rd.)	7	0.51	11.0	119	207	10	328
		North Fork Matilija Creek (low)	7	0.41	1.7	70	410	23	263
		North Fork Matilija Creek (mid)	7	0.41	1.6	133	847	90	243
Resident	**Upper** *Above Matilija Dam*	Matilija Creek (low)	6	0.50	7.3	0	421	7	94
		Matilija Creek (mid)	6	0.44	4.9	92	517	69	272
		Matilija Creek (up)	5	0.44	3.4	118	515	58	561
		Upper North Fork Matilija Creek	6	0.50	1.3	186	802	77	207
		Murrieta Creek	1	0.45	0.5	340	340	169	169

1. Zones are distinct areas that support either the anadromous or resident life form of *O. mykiss*.

Data for each study site include both minimum and maximum estimates of fish abundance over the number of years studied. The number of observed/captured fish within each study site is extrapolated to produce an estimate for the entire length of the study site.

Source: Normandeau 2014

Table 3.6.2.2.3 *O. mykiss* Abundance Data by Study Segment and Year, 2006 to 2012

Year	Abundance Estimates: # Fry <10 cm			Abundance Estimates: # Juvenile/Adult >10 cm			Total
	Lower	Middle	Upper	Lower	Middle	Upper	
2006	5	1,759	3,878	22	2,269	4,703	12,636
2007	0	4,250	6,294	11	524	1,192	12,271
2008	326	2,413	5,003	3,739	3,555	2,641	17,677
2009	0	3,867	n/a	494	1,415	n/a	—
2010	709	3,357	4,428	1,328	2,240	2,785	14,847
2011	16	1,522	5,263	1,639	1,942	3,435	13,817
2012	2,348	6,637	10,033	967	1,149	3,000	24,134

Data represent annual abundance estimates extrapolated for each *entire* study segment (upper, lower, or middle), not just the representative study sites shown in Table 3.6.2.2.2. San Antonio and Murrieta creeks were not included because they had fewer years of data.

Source: Normandeau 2014

Robles Fish Passage Facility Data

The Robles Fish Passage Facility includes equipment to count the fish passing through the facility. Since 2006, when the facility first became operational, this equipment has been modified to improve its effectiveness at detecting fish. Counting fish with automated equipment will always have limitations however, so snorkeling or bank surveys are conducted in the area above and below the Robles Fish Passage Facility every week during the migration season. The snorkel count data are as important as count data from the facility in providing indices of relative abundance of *O. mykiss* upstream and downstream of the facility. Tables 3.6.2.2.4 and 3.6.2.2.5 summarize CMWD's fish count data since 2006, as well as the important limitations of these data.

Table 3.6.2.2.4 *O. mykiss* Observations at Robles Fish Passage Facility

	Peak Weekly Counts	
Year	**Adults Counted in Fish Detector[1]**	**Fish Counted via Snorkeling and Bank Surveys[2]**
2006	4	5
2007	0	10
2008	6	13
2009	0	131
2010	1	30
2011	0	94
2012	0	36
2013	0	7
2014	0	0
Total	**11**	**326**

1. Numbers represent only the fish that swam through the detector pictured on page 80.

2. Fish (adult and juvenile) counted above and below the Robles Fish Passage Facility via snorkeling or streambank surveys conducted weekly during the fish migration season. The peak data represent the weekly count that was highest during the period. These one-day counts avoid double counting fish that may meander back and forth.

Data Source: Lewis 2014

Fish Detection Equipment Limitations

The fish detecting equipment at the Robles Fish Passage Facility has limitations that are important to understand.

- Fish detection equipment is generally designed for larger fish and larger flows. The operators of the Robles facility have had to make modifications over the years as they have learned about these limitations. The equipment now has much better detection efficiencies.
- It appears that the equipment still underestimates the number of smaller fish. The larger the fish the better the detection efficiency.
- Two pieces of information collected by the detector, a silhouette captured by a scanner plate and a video clip, are used to confirm that an object passing through is an *O. mykiss*. If conditions are turbid, the video is often unusable and the object cannot be confirmed.
- Once a data validation and calibration analysis that takes into account the above limitations has been done on the existing data, the operators of the Robles Facility may be able to adjust earlier data such that year-to-year comparisons can be made. Until then, year-to-year comparisons of the data in Table 3.6.2.2.5 provide only relative abundance information.

Table 3.6.2.2.5 Total Annual *O. mykiss* Detections in Robles Fish Ladder

Year	Upstream	Downstream	Total
2006[1]	14	19	33
2007[1]	0	0	0
2008[2]	112	94	206
2009[2]	84	84	168
2010[3]	54	40	94
2011[3]	101	49	150
2012[3]	396	263	659
2013[3]	0	0	0
2014[3]	1	0	1

1. Detections by the original crowder (fish detector) operational at flows >35cfs with no downstream camera, including probable but unconfirmed *O. mykiss*.

2. Detections by new crowder operational at all flows with limited downstream camera, including probable but unconfirmed *O. mykiss*.

3. Detections by crowder operational at all flow with functional downstream camera, including only confirmed *O. mykiss*

Data Source: Lewis 2014. All data are provisional.

3.6.2.3 Recovery and Management

Lion Creek Bridge Improves Fish Passage. In 2010, a "fair weather crossing" on Lion Creek, a major tributary of San Antonio Creek, was replaced with this bridge, which improved steelhead access to over nine miles of upstream habitat.
Photo courtesy of South Coast Habitat Restoration

Federal and state agencies and local nonprofits are actively involved in efforts to recover a viable population of steelhead in the watershed. These efforts include monitoring and studying fish abundance and distribution (described above), prioritizing efforts in recovery plans, improving the condition of existing fish habitat, expanding habitat through stream restoration and barrier removal, protecting land through acquisition, and educating the public about the importance of protecting this endangered species.

Recovery Plans

The Southern Steelhead Recovery Plan, released in 2012, is the current operating recovery plan for steelhead in the watershed. This section provides details on this plan and briefly describes several prior efforts to develop recovery plans, as well as a recovery plan focused on the stream reaches that drain through the City of Ojai.

2012 Southern Steelhead Recovery Plan

The federal Endangered Species Act directs the NMFS to develop and implement recovery plans for threatened and endangered species. Recovery plans identify actions necessary for the protection and recovery of listed species based upon the best scientific and commercial data available. NMFS's recovery plans are considered guidance documents, not regulatory documents.

Southern California Steelhead Recovery Planning Area

"The Southern California Steelhead (SCS) Recovery Planning Area extends from the Santa Maria River to the Tijuana River at the U.S.-Mexico border. It includes both those portions of coastal watersheds that are at least seasonally accessible to steelhead entering from the ocean, and the upstream portions of watersheds that are currently inaccessible to steelhead due to man-made barriers but were historically used by steelhead. Major steelhead watersheds in the northern portion of the SCS Recovery Planning Area include the Santa Maria, Santa Ynez, Ventura, and Santa Clara Rivers, and Malibu and Topanga Creeks. Major steelhead watersheds in the southern portion of the SCS Recovery Planning Area include the San Gabriel, Santa Margarita, San Luis Rey, San Dieguito, and Sweetwater Rivers, and San Juan and San Mateo Creeks.

"The Southern California Steelhead DPS encompasses all naturally-spawned anadromous *O. mykiss* between the Santa Maria River (inclusive) and the U.S.-Mexico border, whose freshwater habitat occurs below artificial or natural impassible upstream barriers, as well as *O. mykiss* residing above impassible barriers that are able to emigrate into waters below barriers and exhibit an anadromous life-history.

"The SCS Recovery Planning Area is divided into five Biogeographic Population Groups (BPGs): Monte Arido Highlands, Conception Coast, Santa Monica Mountains, Mojave Rim and Santa Catalina Gulf Coast. Each BPG is characterized by a unique combination of physical and ecological characteristics that present differing natural selective regimes for steelhead populations utilizing the individual watersheds.

"The separate watersheds comprising each BPG are generally considered to support individual *O. mykiss* populations (*i.e.,* one watershed = one steelhead population). Thus, single BPGs encompass multiple watersheds and multiple *O. mykiss* populations."

—*Southern California Steelhead Recovery Plan Summary* (NMFS 2012a)

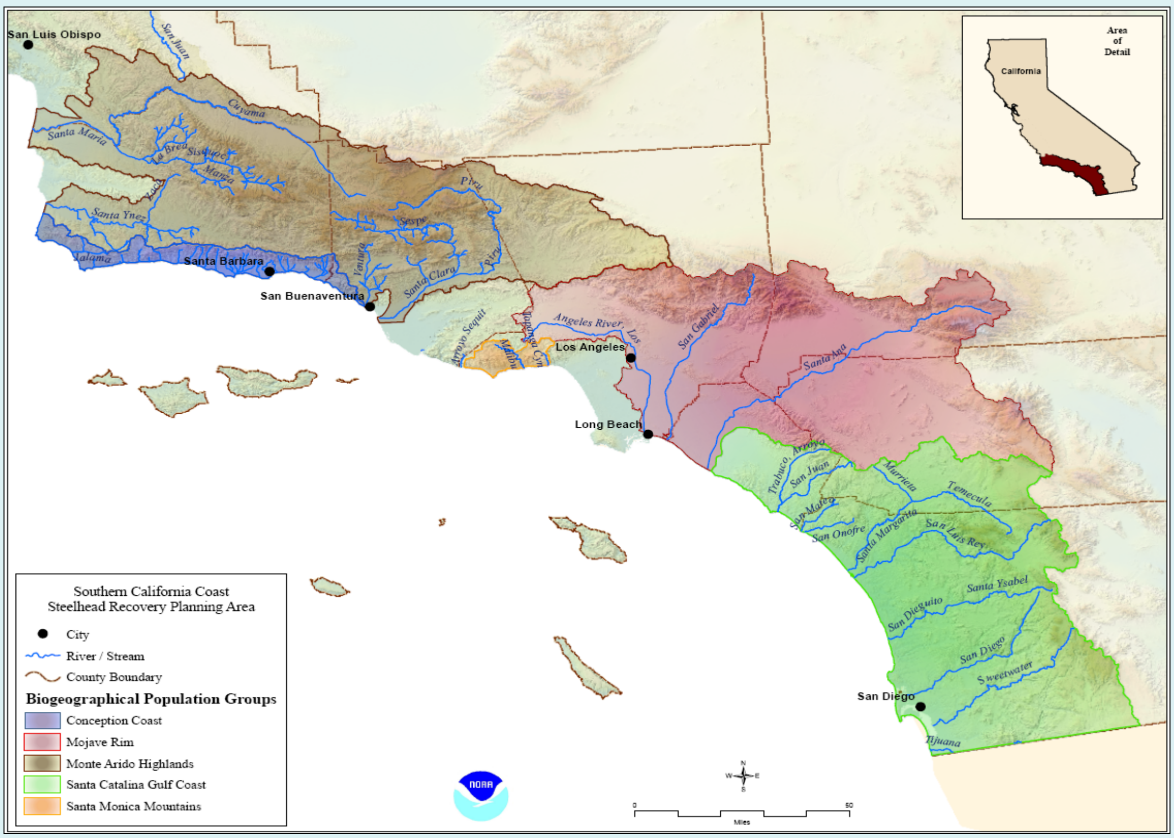


Figure 3.6.2.3.1 Steelhead Recovery Planning Area Map, Southern California Coast. The Ventura River watershed is in the Recovery Plan's Monte Arido Highlands biogeographic population group.

The Ventura River watershed is one of the major steelhead watersheds in the SCS Recovery Planning Area, and Ventura River steelhead are considered a "Core 1" population—the highest priority for recovery actions.

Recovery is defined by NMFS as "the process by which listed species and their ecosystems are restored and their future is safeguarded to the point that protections under the Endangered Species Act are no longer needed" (NMFS 2012). Such restoration first requires a description of the normal condition to which the species is to be restored (Boughton et al. 2006). Attempts to quantify historical or existing populations of steelhead are fraught with uncertainties and lack of reliable, quantitative data. Thus, the recovery goals in recovery plans are based not on historic steelhead run sizes, but upon conceptual models that develop viability criteria applicable across the region. As the technical advisors to the SCS Recovery Plan stated: "The task of delineating populations and characterizing recovery potential is largely reliant on quantitative data samples from across the planning domain. Since such information is unavailable, we are confined to the less satisfactory exercise of A) applying simplistic yet uniform methods over large spatial extents, and B) describing existing small-extent studies, and making uncertain inferences of their implications for the larger ESU." (Boughton et al. 2006)

Definition: Viable Population

A viable population is defined as a population having a negligible risk (< 5%) of extinction due to threats from demographic variation, natural environmental variation, and genetic diversity changes over a 100-year time frame. A viable DPS is comprised of a sufficient number of viable populations spatially dispersed, but proximate enough to maintain long-term (1,000-year) persistence and evolutionary potential (McElhany et al. 2000). The viability criteria are intended to describe characteristics of the species, within its natural environment, necessary for both individual populations and the DPS as a whole to be viable, i.e., persist over a specific period of time, regardless of other ongoing effects caused by human actions (NMFS 2012).

The difference in the time-frames considered for individual populations vs. the DPS as a whole reflects the recognition that individual populations may periodically, but temporarily, go extinct within the longer, 1,000-year time-frame; however, the populations are re-established through natural processes (re-colonization through dispersal from other watersheds, or from native, non-anadromous *O. mykiss* producing progeny that assume an anadromous life-history in sufficient numbers) to re-initiate an anadromous run in the extirpated watershed (Capelli 2014).

Priority Recovery Actions

Priority recovery actions identified in the SCS Recovery Plan for the Monte Arido Highlands Biogeographic Population Group, and applicable to the Ventura River watershed, are summarized below (NMFS 2012a).

- Develop and implement operating criteria to ensure the pattern and magnitude of water releases from dams, including Casitas, Matilija, and Robles Diversion dams, provide the essential habitat functions to support the life-history and habitat requirements of adult and juvenile *O. mykiss*.
- Develop and implement plans to physically modify Casitas, Matilija, and Robles Diversion dams to allow natural rates of adult and juvenile *O. mykiss* migration between the estuary and upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean.
- Develop and implement a groundwater monitoring program to guide management of groundwater extractions within steelhead-bearing watersheds to ensure surface flows provide essential support for all *O. mykiss* life-history stages, including adult and juvenile *O. mykiss* migration, spawning, incubation, and rearing.
- Develop and implement restoration and management plans for the estuaries associated with steelhead-bearing watersheds. To the maximum extent feasible, planned actions should restore the physical configuration, size, and diversity of the wetland habitats, eliminate exotic species, control artificial breaching of the sand bar, and establish effective buffers to restore estuarine functions and promote *O. mykiss* use (including rearing and acclimation) of the estuaries.

Other Recovery Plans

1997 Ventura River Steelhead Restoration and Recovery Plan

In 1997, a Ventura River Steelhead Restoration and Recovery Plan (Entrix & Woodward Clyde 1997) was prepared on behalf of 10 different agencies with water supply, flood control, or public works responsibilities in the watershed. These agencies included Casitas Municipal Water District, City of San Buenaventura, Ventura County Flood Control District, Ventura County Transportation Department, Ventura County Solid Waste Management Department, Ojai Valley Sanitary District, Ventura River County Water District, Ojai Basin Ground Water Management Agency, Meiners Oaks County Water Districts, and Southern California Water Company. The plan was intended to assist the agencies in addressing steelhead issues and possible permitting requirements.

Several of the restoration and enhancement measures identified in the plan are now being implemented by the agencies. Much of the information developed for this plan was incorporated into the 2004 Draft Habitat Conservation Plan discussed next.

2004 Draft Habitat Conservation Plan

Habitat Conservation Plans (HCPs) are planning documents required as part of an application for an "incidental take" permit under section 10 of the federal Endangered Species Act. HCPs describe the anticipated effects of the proposed taking and how those impacts will be minimized or mitigated.

Definition: Take

"Take" is defined in the Endangered Species Act as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any threatened or endangered species. Incidental take permits authorize the incidental take (i.e., take that occurs incidentally during an otherwise lawful activity) of a listed species, such as steelhead.

In 2004, a draft HCP (Entrix & URS 2004) was prepared on behalf of 11 different cooperating agencies that operate or maintain facilities that could affect listed species or their habitats in the Ventura River watershed. These 11 agencies included: Casitas Municipal Water District, City of San Burenaventura, Meiners Oaks Water District, Ojai Basin Ground Water Management Agency, Ojai Valley Sanitary District, Southern California Water Company, Ventura County Environmental and Energy Resources Department, Ventura County Parks Department, Ventura County Transportation Department, Ventura County Watershed Protection District, and Ventura River County Water District.

The preparation of the HCP was to serve as the basis for an incidental take permit. The agencies anticipated that together the HCP and take permit would outline the limits within which they could continue to provide their services to the community in the watershed (Entrix & URS 2004). The 2004 draft HCP provides an extensive assessment of many different aspects of the Ventura River watershed. However, the HCP process was never completed. A series of factors caused the project to stall: key staff moved on, CMWD received and needed to respond to a separate Biological Opinion related to steelhead, and there were challenges working out the plan details with regulators (Karen Waln, 2014).

> Eleven different agencies within the Ventura River watershed were previously involved in a HCP planning process to address adverse environmental impacts to native species listed within the Federal Endangered Species Act (FESA). The HCP was to include individual environmental impact analyses for each of the eleven member agencies that would determine what mitigation efforts

and associated funding (as required per future Federal and State legislature), would be required by each entity.

The HCP has not progressed further than a 2004 Draft Report and was never released to the public.

—*2010 Ventura River and San Antonio Creek Watershed Sanitary Survey Update* (Kennedy/Jenks 2011)

2005 City of Ojai Urban Watershed Assessment and Restoration Plan

In 2005, the City of Ojai prepared a comprehensive assessment and restoration plan focused on steelhead habitat for the subwatersheds that drain through the city limits. The document provides a detailed characterization of streams, habitat conditions, and limiting factors, and identifies actions that can be taken to restore and enhance steelhead habitat conditions.

Provision of Water

Because steelhead are an endangered species, regulators have certain authorities to require that their needs be provided for, including the provision of water.

Any project in the watershed that requires a federal permit or involves federal funding has a "federal nexus," which grants NMFS the authority to place conditions on the project on behalf of steelhead. The Robles Diversion Facility is an example of a facility that has been so conditioned.

***O. mykiss* Mortality From Receding Flows, Ventura River**

Photo courtesy of Ojai Valley Land Conservancy

The need to provide water for steelhead has also been addressed in water quality regulations, which are structured to protect "beneficial uses" of state waters—the use of water by fish is considered a protected beneficial use.

Two reaches of the Ventura River—stretching from Camino Cielo Road below Matilija Dam to the river's confluence with Weldon Canyon, just north of Cañada Larga Creek—are on the Clean Water Act's Section 303(d) list of impaired waterbodies for pumping and water diversion because the lack of water in these reaches is believed to interfere with the migration of steelhead.

Regulators administering water rights in the state are also charged with protecting water as a "public trust" resource, and protecting the environment is included in this mandate.

On a case-by-case basis, water projects in the watershed have been required to reduce the amount of water withdrawn in order to provide for steelhead. See the discussion of "environmental water" in "3.4.3 Water Demands" for more details.

Removal of Barriers

A number of partial fish passage barriers have been removed in recent years.

- In 2006, the Robles Fish Passage Facility (described previously in this section) was completed to reestablish access to upstream steelhead habitat by providing access over the Robles Diversion Facility and restoring a portion of the flows necessary for fish to reach the Robles Fish Passage Facility.
- In 2010, a "fair weather crossing" (a road crossing that allows a waterway to run over a road) on Lion Canyon Creek, a major tributary of San Antonio Creek, was replaced with a bridge. This improved steelhead access to over nine miles of upstream habitat.
- In 2012, a bridge for pedestrians and bicyclists using the Ojai Valley Bike Trail was installed at the very end of San Antonio Creek, just before it merges with the Ventura River. The bridge replaced an old concrete crossing over some box culverts that frequently became plugged with woody debris during storms.
- In 2012, a fair weather crossing in lower San Antonio Creek at Old Creek Road was replaced with a multi-span bridge.
- In 2013, a clear span bridge was constructed on San Antonio Creek near the confluence with Stewart Canyon Creek, just south of the City of Ojai. The bridge replaced a fair weather crossing on private property.

The last four barrier removals are illustrated in "2.3.7 Healthy San Antonio Creek Campaign."

A major effort to remove Matilija Dam, which also addresses sediment transport issues, has been underway since the 1990s and is addressed in a separate section, "3.6.3 Matilija Dam."

Ojai Valley Land Conservancy owns three preserves—the Steelhead Preserve, the Confluence Preserve, and the Rio Vista Preserve—located around the river's confluence with San Antonio Creek, one of the most consistently wet locations on the river and very important habitat for steelhead.

Protection of Land

In addition to the considerable lands already protected by government agencies, the watershed is fortunate to have two land conservancies that continue to actively purchase and accept donations of land for protection in and adjacent to the Ventura River. Lands owned by these conservancies are held for conservation in perpetuity.

The Ojai Valley Land Conservancy (OVLC) owns four preserves on the Ventura River that together comprise 737 acres in the river or its floodplain and span a total of four miles of the river. Three of their preserves—the Steelhead Preserve, the Confluence Preserve, and the Rio Vista Preserve—are located around the river's confluence with San Antonio Creek, one of the most consistently wet locations on the river and very important habitat for steelhead. OVLC also owns a preserve near Camp Comfort on San Antonio Creek, another key location for steelhead.

Two preserves owned by the Ventura Hillsides Conservancy—the Willougby Preserve and Big Rock Preserve—are located in the lower Ventura River or its floodplain. These preserves together comprise 25 acres.

Habitat Restoration

Removal of the invasive plant *Arundo donax*, revegetation of streambanks, and removal of passage barriers (discussed previously in this section) are the primary steelhead habitat restoration efforts that have been implemented in the watershed. *Arundo*, or giant reed, limits steelhead habitat potential by reducing available surface water and thereby displacing beneficial native streamside vegetation and wildlife (VCWPD 2009a). About 270 acres of *Arundo* have been removed thus far. With the *Arundo* removed, native plants are able to return and provide shade and other ecosystem benefits. See "2.3.6 Arundo-Free Watershed Campaign" for more details on these projects.

A Special Opportunity in San Antonio Creek

San Antonio Creek provides some of the most important habitat currently accessible to steelhead, and steelhead surveys show that the lower reaches of the creek are being used. There is potential to expand and improve the quality of existing habitats with the addition of more rearing habitats, such as deep pools, removal of invasive plants, and revegetation of bare stream banks.

Scott Lewis, a CMWD fisheries biologist, made the following assessment (in an email correspondence) after studying steelhead throughout the watershed for over six years (Lewis 2013).

Based on our data collection over numerous years, San Antonio Creek appears to be the key spawning and rearing tributary for the steelhead population of the Ventura River basin. This is likely due to several reasons that I have discussed below.

Spawning Habitat: We conducted a stream habitat survey and documented that San Antonio Creek had significant amounts of spawning gravel. This is obvious even with a quick walk of the stream. The percentage of spawning gravel in San Antonio Creek is much greater than other parts of the basin. The percentage of total habitat with spawning gravel in San Antonio Creek was 33%, North Fork Matilija was 13%, and the mainstem Ventura River was 16%. It seems clear that no additional spawning gravel would be needed in San Antonio Creek. Additional data that we have collected supports this conclusion as well. The number of redds that we have counted over the last 5 years has shown that

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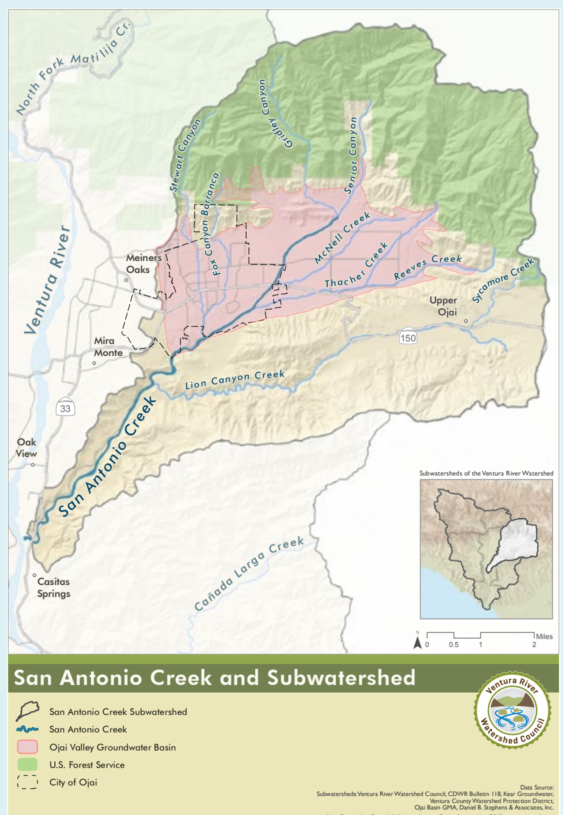


A Special Opportunity in San Antonio Creek *(continued)*

San Antonio Creek is the primary spawning area in the basin; as high as 90% and a mean of about 70% during the two peak years of total redds.

Good Juvenile Growth Rates: Based on our snorkeling surveys over several years, the growth rate of steelhead in San Antonio Creek is better than else where in the basin. The warmer water and better primary production of San Antonio Creek provide abundant food resources that enables steelhead to grow faster and smolt primarily as 1+ [one year or older] fish. In North Fork Matilija for example, I think the majority of smolts are 2+ [two years or older] due to the lower water temperatures and primary production, and therefore lower growth rates. This faster growth rate in San Antonio Creek allows large numbers of smolts to migrate to the ocean following a wet year when adults (anadromous and resident) have successfully spawned.

Location of San Antonio Creek in Ventura Basin: The location of San Antonio Creek in the Ventura River basin has given steelhead a suitable spawning tributary for a large portion of each migration year. This is due to the confluence of San Antonio Creek being located at the downstream end of the Robles Reach. The Robles Reach is a wide alluvial section of the Ventura River that is composed of active wash deposits of unconsolidated silt, sand, gravel, and boulders (Tan and Jones 2006). Due to this type of channel morphology and geology, alluvial channels like the Robles Reach have high infiltration rates that cause channel surface flow to rapidly recede and cease shortly after storm events (Cooke et al. 1992). During a "wetter" year when steelhead adults have access to the upper basin and choose to migrate upstream to North Fork Matilija Creek, their passage window may be limited because of upstream channel characteristics. Probably most important though, during a "drier" year, the passage window can be nonexistent and San Antonio Creek or the mainstem Ventura River downstream of San Antonio Creek are the only spawning options. Smolts the following year many times will still have downstream passage, even in a dry year. The aforementioned faster growth rates then allows 1+ juveniles to smolt and leave for the ocean.

Hydrologic Characteristics: The San Antonio Creek drainage is one of the largest subbasins of the Ventura River, and given that the headwaters of San Antonio Creek has some of the higher elevations in the basin, it produces a significant amount of the total runoff (24% of total basin runoff at Foster Park). Much of this runoff infiltrates into the Ojai Valley groundwater basin that then sustains the lower 10 km of San Antonio Creek through dryer periods. The combination of San Antonio Creek's confluence location with more sustained stream flow gives steelhead adults and juveniles greater opportunity for success.

The Bottleneck: The limiting factor in San Antonio Creek is dry season rearing habitat. During a wet year, and especially after two back-to-back wet years, the rearing habitat can sustain good numbers of *O. mykiss*. However, during a dry year, and especially after back-to-back dry years, rearing habitat is diminished dramatically. From our recent electrofishing surveys over the last three months, most of the remaining fish have been found in pool habitat. The problem is that San Antonio Creek does not have very many pools relative to other tributaries like North Fork Matilija Creek. Based on our habitat surveys, the number of pools in San Antonio Creek was only 8/km and North Fork Matilija Creek had 29/km. Of those pools, the number that were deeper than 1 m was only 1/km for San Antonio Creek and 6/km in North Fork Matilija Creek. Our snorkel and electrofishing surveys have yielded proportionally higher numbers of *O. mykiss* in North Fork Matilija Creek after longer dry periods and supports the conclusion for the lack of pools in San Antonio Creek. During dry years, significant mortality occurs that diminishes the population of resident and juvenile *O. mykiss* that are producing, or will become, smolts to maintain the anadromous life history of adult steelhead.

3.6.2.4 Steelhead Surveys and Monitoring

This section summarizes some of the most significant recent or ongoing steelhead surveys and monitoring programs in the Ventura River watershed. There have been many other limited-term, or focused, monitoring efforts in the past. Some of these are referenced in "3.6.2.6 Key Data and Information Sources/Further Reading." Given the wide variation in streamflow and associated conditions from year to year, a considerable, long-term data set is needed to evaluate how those variations affect steelhead.

Casitas Municipal Water District

Steelhead Snorkel Survey, Casitas Municipal Water District, 2014
Photo courtesy of Lisa Brenneis

Casitas Municipal Water District (CMWD) conducts comprehensive annual steelhead monitoring and evaluation in conjunction with their operation of the Robles Fish Passage Facility. The facility became operational in 2006, and CMWD monitoring began in 2005. The specific monitoring and evaluation requirements are outlined in the Biological Opinion (BO) prepared by NMFS. The monitoring and evaluation are intended to achieve the objectives outlined in the BO. Some aspects of the annual monitoring could be discontinued in the future if it is determined that these objectives have been addressed.

CMWD's annual steelhead monitoring and evaluation include the following:

Robles Biological Opinion Monitoring and Evaluations

- **Upstream Fish Migration Impediment Evaluation.** Physical instream measurements are collected at selected channel features to evaluate flow releases from the Robles Fish Passage Facility.
- **Downstream Fish Passage Evaluation.** During smolt migration, when flows are sufficient, *O. mykiss* are trapped to collect biological and physical information to determine the success of migration through the Facility.
- **Downstream Fish Migration through the Robles Reach.** *O. mykiss* smolts with radio transmitters are monitored through the Robles Reach to determine rate and the success of migration.
- **Fish Attraction Evaluation.** Bank and snorkel surveys are conducted near the Robles Fish Passage Facility to evaluate the effectiveness of the facility in attracting steelhead to the fish ladder.
- **Fish Passage Monitoring.** The fish detector passively detects *O. mykiss* migrating through the Robles Fish Facility to monitor long-term migration trends.

Other *O. mykiss* and Environmental Studies

- ***O. mykiss* Presence/Absence Surveys.** Watershed-wide snorkel surveys are conducted year-round to provide relative abundance index counts of *O. mykiss* and long-term population trends.
- **Adult Index Spawning Surveys.** During the spawning season, biweekly surveys are conducted watershed-wide to identify redds and collect physical data to help understand spawning habitat selection characteristics and monitor long-term population trends.
- **Habitat Survey.** Stream habitat surveys have been completed within the watershed to provide baseline statistical data on the quantity and quality of habitat vital for monitoring and evaluation. Future repeated surveys will provide data on the environmental effects of the morphological changes to the stream channels.
- **Ventura River Estuary Monitoring.** Water quality, surface area, and sandbar status are monitored throughout the year to provide environmental and physical data to understand the function of the estuary for various life-history stages of steelhead.
- **Sub-surface Flow Monitoring.** Year-round monitoring of surface flow and groundwater interactions in key reaches of the watershed, including anadromous and resident locations, provides information on seasonal and long-term trends of perennial and ephemeral stream habitat.
- **Photographic Index Sites.** Stream channels throughout the watershed are photographed twice per year to document general changes in stream channel morphology, streamflow, and riparian zones.
- **Ambient Water Quality Monitoring.** Water quality data are collected watershed-wide by monthly grab samples and continuous water temperature and turbidity probes. These environmental data are integrated into the analysis of other aspects of the monitoring program. Parameters monitored on a monthly basis are temperature, pH, oxidation-reduction potential, dissolved oxygen, conductivity, total dissolved solids, salinity, and turbidity.

Post-Spawn Adult Steelhead, Casitas Springs Levee Pool

Photo courtesy of Mark Allen/Normandeau

O. mykiss Research

- **Population Structure.** Genetic information from rainbow trout and steelhead of the entire watershed is being analyzed to understand physical, environmental, and biological effects on the genetic structure of *O. mykiss* in the watershed.
- **Smoltfication Patterns.** Juvenile *O. mykiss* of varying life-history stages are being analyzed to determine the physical and physiological changes associated with smolting.

- **Juvenile Migration.** RFID (radio frequency identification) technology (or "tagging") is being utilized to determine smolt migration patterns of juvenile rainbow trout and steelhead.

CMWD's annual reports are available on the district's website at www.casitaswater.org/lower.php?url=annual-robles-monitoring-and-evaluation-reports.

Annual *O. mykiss* Distribution and Abundance Surveys

Steelhead Snorkeling Survey, Ventura River, 2008

Photo courtesy of Mark Allen/Normandeau

As part of the effort to remove Matilija Dam, steelhead habitat assessments were conducted in 2003 and 2004 on the Ventura River and Matilija Creek and its tributaries. These assessments were intended to assess the quantity and quality of habitat that could be made available to steelhead if the dam were removed.

To build on this dataset, and to assess the relationship between habitat quality and actual abundance of *O. mykiss*, annual *O. mykiss* distribution and abundance surveys were conducted from 2006 to 2012. These surveys were originally initiated and administered by the Ventura County Flood Control District (now the Ventura County Watershed Protection District), and have been initiated/administered by the Matilija Coalition and Surfrider Foundation in recent years.

The surveys focused primarily on the Ventura River mainstem, Matilija Creek and its tributaries, and North Fork Matilija Creek. Sites below the dam are in the "anadromous zone" and sites above are in the "resident zone." Sampling in 2012 consisted of snorkel surveys and electrofishing at 14 study sites, as well as the Ventura River estuary. By sampling at the same locations over time these surveys helped to assess the natural variation in *O. mykiss* population characteristics (Tables 3.6.2.2.2 and 3.6.2.2.3), and to establish a more robust assessment of baseline population conditions prior to the anticipated removal of Matilija Dam.

The surveys, conducted by Normandeau Associates (formerly Thomas R. Payne & Associates) utilized a randomized survey design for assessing uncertainty in abundance estimates.

Fish were counted, measured (captured fish only), and categorized by size. Trends in fish size over time and space were analyzed and fish densities were correlated with habitat type (e.g., pools, riffles, flatwaters) and habitat characteristics (e.g., depth, velocity, cover). Habitat conditions such as streamflow and temperature were also recorded.

The habitat data collected in 2006, 2007, 2011, and 2012 were used to evaluate how well Habitat Suitability Index (HSI) scores produced by an existing Fish and Wildlife Service model (Raleigh et al. 1984) correlated with observed densities of *O. mykiss*. This led to the development of a revised model that better fit the observed fish densities and was more representative of conditions in the watershed, called the Southern Steelhead HSI model.

Abundance estimates over the years have displayed significant spatial and temporal variation in *O. mykiss* populations, with the highest abundance and densities consistently observed in the upper segment above Matilija Dam (resident rainbow trout only) and in the middle segment between Robles Diversion Dam and Matilija Dam (mixture of resident and anadromous *O. mykiss*). High densities of *O. mykiss* have been routinely observed in the upper North Fork and lower North Fork Matilija Creek study sites each summer (between 2006 and 2012), while *O. mykiss* have been absent or at very low densities in the lowermost Ventura River study sites and in regularly intermittent reaches (e.g., the Ventura River Preserve pools below the Robles Diversion and portions of San Antonio Creek).

These surveys have begun to reveal the dynamic nature of this fish population, which is constantly adapting to the extreme variability in rainfall from year to year.

The surveys are available at the www.matilijadam.org website.

California Department of Fish and Wildlife Surveys

The California Department of Fish and Wildlife began steelhead survey work in the watershed in 2013. This work involves counting steelhead adults and smolts and conducting spring spawning, rearing, and habitat surveys.

National Marine Fisheries Service Spawning Surveys

To better understand the ecology of spawning southern California steelhead, NMFS initiated the use of a standard spawning ground survey protocol in 2009/2010 to conduct redd counts in southern California coastal drainages where endangered steelhead populations exist. Surveys were conducted in the Ventura River watersheds after the first measurable precipitation on Dec 19, 2009, through May 28, 2010. Index reaches in the Ventura River watershed below Matilija Dam were surveyed twice a month. The findings from these early studies indicate that spawning is patchily distributed throughout the watershed and that the timing of redd construction is related to periods of elevated streamflow. The spawning surveys continued in 2011 and 2012. The data have not yet been published.

3.6.2.5 History of Steelhead and Fish Stocking

A comprehensive technical report on the history of steelhead and rainbow trout (going back to the Chumash era) in Santa Ynez River watershed in Santa Barbara County summarized the difficulties in describing the steelhead's past distribution and abundance in the area:

The dynamic nature of southern California aquatic ecosystems poses a challenge to reconstructions of past steelhead distributions and abundance.

> Although historical observations can provide important information on the historical geographic distributions of a species, they can suffer from limitations due to the resolution of the data (Hamilton et al. 2005; Adams et al. 2007). Some sources give precise locations, but these are relatively few in number and distributed unevenly throughout the historical record. Many sources offer only general impressions of areas where steelhead or rainbow trout were found, and are based on second-hand or inexpert observations.
>
> The dynamic nature of southern California aquatic ecosystems poses another challenge to reconstructions of past steelhead distributions and abundance. Habitat conditions in southern California's coastal streams may vary widely due to multiple factors, such as severe winter storms, droughts, the seasonal formation and breaching of river mouth sandbars, sediment inputs from post-wildfire erosion or debris flows, variable oceanographic conditions, climatic oscillations, and long-term climate changes (Davis et al. 1988; Florsheim et al. 1991; Keller et al. 1997; Spina and Tormey 2000). All of these perturbations and processes affect steelhead populations, which may have varied by two orders of magnitude annually owing to natural changes alone (Titus 1995a; Titus 2010).
>
> —*The History of Steelhead and Rainbow Trout (Oncorhynchus mykiss) in the Santa Ynez River Watershed, Santa Barbara County, California* (Alagona 2012)

Fish Stocking History

Records indicate that stocking of trout or steelhead took place in the watershed starting around 1882, reaching a peak around the 1920s, and continued into the 1970s (Bowers 2008; Entrix & URS 2004).

Another thorough source of information is *History of Steelhead and Rainbow Trout in Ventura County, Newsprint Accounts from 1870 to 1955* (Bowers 2008), compiled by a historian on behalf of United Water Conservation District, a water supplier in the neighboring Santa Clara River watershed. These newspaper accounts include many reports of fine trout fishing in the Ventura River going back to the 1870s. Below are several such reports.

> May 10, 1873 – *Ventura Signal*
> PERSONAL – On Saturday last our fellow townsmen, J.A. Corey and C.C. Wing, bade adieu to mackerel and molasses, harness leather and saddles, and in company with two or three others, took a trip to Wilcox's hot springs, in the Matiliha [*sic*] canon, returning Monday. They report Mr. Robert Lyon comfortably quartered in his new house, from which he expects to reach the springs as soon as his men get the road cleared—only a two or three day job. Kenneth Grant, of the firm of Grant & Bickford, has swung his hammock under the boughs of a live-oak, and idly swings all day in utter forgetfulness of furnace and wagon tires, gathering health and strength in the balmy air of that delightful place. The party caught some sixty fine trout in the Ventura River, in an hour's fishing.

> November 27, 1875 – *Ventura Free Press*
> Mountain trout are so plentiful in the San Buenaventura River that the water ditches leading from that stream are full of them. The reservoir on the hill back of town is full of these beautiful fish.

According to these newspaper accounts, the stocking of streams in California with hatchery fish started around 1878.

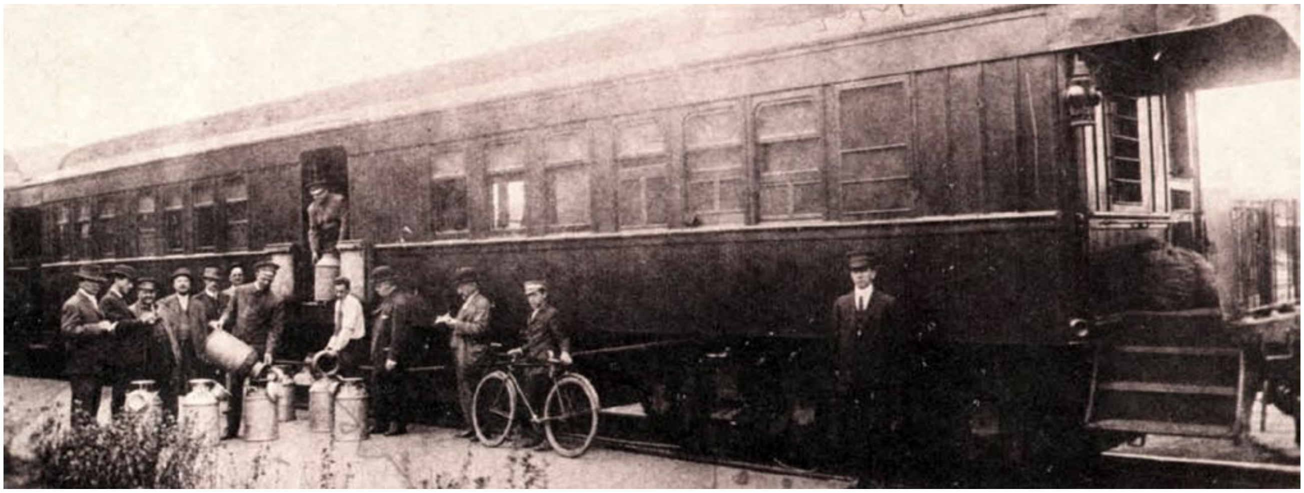
> February 23, 1878 – *Ventura Free Press*
> The Fish Commissioner of this State will in a week or two have some young trout from New Hampshire and fresh-water salmon from Maine, for distribution. …The fish are to be devoted to stocking public waters only. …This fish (salmon) is probably too large to thrive in our small streams, but some one ought to secure some of the trout.

The newspaper accounts also document early stocking of fish in the watershed in 1882:

> December 31, 1881 – *Ventura Free Press*
> FISH FOR ALL – A letter from Fish Commissioner Redding was sent to the San Jose Sportsman's Club and reprinted in the newspaper. The Fish Commissioner has ordered "a large quantity of Eastern trout eggs, land-locked salmon and white fish from the East…and will be ready for distribution the last of February or the first of March. …The Fish Commissioners are always very glad to assist in filling the streams in any county where there are sportsmen's clubs, who are giving some attention to the enforcement of the game laws, and who are doing what is equally important, creating public opinion in favor of preserving fish and game in the State." The editor of the Press inserted the comment, "Now, cannot the Ventura Sportsman's Club take steps to secure some of these fish for our two streams? What do you say, Mr. Secretary Granger? The price of transportation is the only expense in the matter."
>
> January 4, 1882 – *Ventura Free Press*
> The Ventura Rod and Gun Club bit at our suggestion like a hungry trout at a fly. Secretary Granger talked the matter up among the members, and the Club will secure from the Fish Commissioners enough young trout and white fish to thoroughly stock the head waters of our streams. It might be well to try a few land-locked salmon, though the rivers are probably too small for them. After procuring the fish, the next duty of the Club will be to see that they are protected during the close[d] season.
>
> July 1, 1910 – *Ventura Free Press*
> STREAMS TO BE WELL-STOCKED – Three-Quarter Million Trout for Southland. Allotment of Young Fish for Southland Waters Doubled by Fish Commission—Special Car to Be Sent Here in September to Supply Forty-seven Creeks.
>
> About 775,000 rainbow, Loch Leven and eastern brook trout are to be distributed in the streams of Southern California in September. M.J. Connell, Fish and Game Commissioner for the Southern District, has been notified that the fish will be shipped from the Sisson hatchery in the special fish car the latter part of August.
>
> The allotment made to the south this year is nearly twice as large as that of last year. Three years ago 250,000 small fish were sent south and last season the number was slightly over 400,000.

R.W. Requa is in charge of the fish car. The fish allotted to Southern California are to be distributed in forth [forty]-seven streams, as follows:

…Ventura county: Ventura River, Coyote Creek, San Antonio, Matilija and north fork, See-Saw [Sisar], Santa Paula, Santa Clara and Sespe.



Fish Car Train Delivers Hatchery Fish in Milk Cans
Photo courtesy of US Fish & Wildlife Service

Since stocking first began in the 1880s, more than one million *O. mykiss* have been stocked in the Ventura River watershed (Lewis 2014). Similar stocking took place in the Santa Clara River, Santa Ynez River, and other southern California coastal streams. Table 3.6.2.5.1 provides a perspective on the number of steelhead fry produced by state fisheries in the early years of stocking.

Since stocking first began in the 1880s, more than one million O. mykiss *have been stocked in the Ventura River watershed (Lewis 2014). Similar stocking took place in the Santa Clara River, Santa Ynez River, and other southern California coastal streams.*

October 15, 1915 – *Ventura Free Press*
ANOTHER BIG TROUT SHIPMENT COMING –The second big shipment of young trout for the Ventura county streams will arrive on October 21st and 22nd at which time Game Warden Barnet will received [receive] from the state hatcheries 100,000 steelhead, 75,000 of which he will place in the Ventura river and the remaining 25,000 will be planted in the Sespe.

Table 3.6.2.5.1 Output of State Hatcheries before 1911

Year[1]	No. of Steelhead Trout Fry Produced by State Hatcheries
1902	301,000
1903	120,000
1904	90,00
1905	108,000
1906	243,000
1907	352,000
1908	170,000
1909	517,000
1910	667,880

1. Prior to 1902 eggs and fry were produced by the U.S. Fish Commission.

This table includes only steelhead and does not include rainbow trout produced in hatcheries.

Source: Kentosh, 2008.

The *Draft Ventura River Habitat Conservation Plan* (Entrix & URS 2004) provides a summary of stocking in the watershed and known numbers of fish; this summary is replicated in "4.4 Appendices." Based on this summary, the peak stocking occurred in the 1930s and 1940s, with most of the fish coming from hatcheries in northern California, and some coming from neighboring watersheds. Stocking of fish in the watershed, except for in Lake Casitas, was discontinued in the 1990s.

Native Steelhead—From the Hatchery?

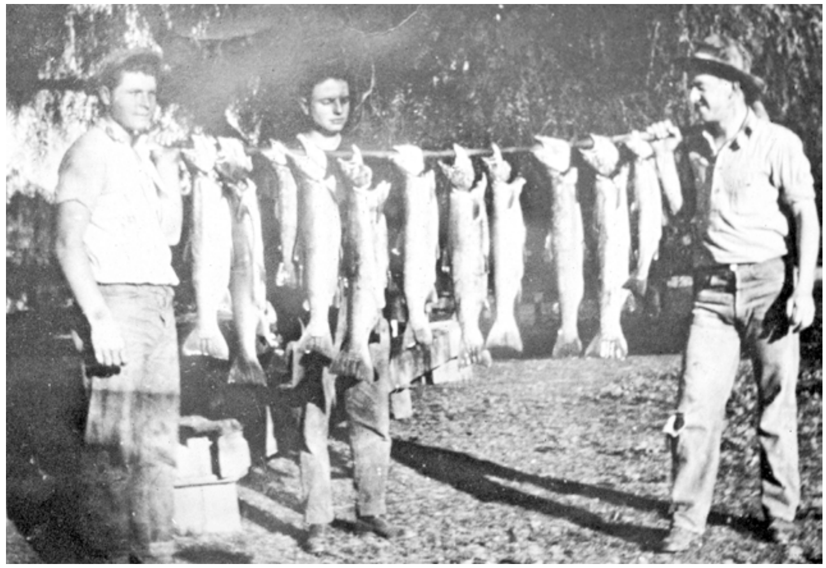
The extent to which fish stocking influenced the number of fish returning to spawn in the watershed in the past is a point of controversy, which cannot now be definitively settled.

On the one side, it is argued that estimates of the historical numbers of spawning fish were significantly exaggerated because fish stocking resulted in unnaturally high populations. One of the most often cited "population estimates" was based on a one-day field trip report where no adult steelhead were even observed or counted. If the reported populations never existed naturally, however, would recovery have been initiated?

On the other side, it is argued that the rate of survival of a naturally spawned and reared *O. mykiss* to an adult returning mature steelhead is quite low (about 2–3%). Even if the survival rate of hatchery steelhead was comparable—which would not be the case because of the trauma of capture, transport, and stocking, not to mention the competition from native fish—the number of fish surviving to adulthood would not likely increase the natural run-size appreciably. Furthermore, recent genetic research seems to indicate that hatchery fish genes have not appreciably influenced the native fish stock: present day populations are dominated by ancestry of indigenous southern coastal steelhead (Capelli 2014; Girman & Garza 2006).

Ventura River Steelhead, Tico Crossing, 1920

Photo courtesy of Mark Capelli



Sport fishing was an important local industry in the Ventura River watershed until the late 1940s:

> Welch, writing in *California Fish and Game* (1929) reports that prior to the establishment of a daily limit, it was not unusual for a fisherman to take from 100 to 300 trout from a California coastal stream. The *Ventura Signal* (1878) reported three fishermen taking 463 trout in the lower reaches of the Ventura River in a single day.
>
> A number of hotels on Santa Clara Street in San Buenaventura catered to out-of-town fishermen, while the elaborate Anacapa Hotel, formerly situated on the corner of Main and Palm Streets, reserved the ground floor during the trout season for fishing guests. Post cards depicting local fishermen with their steelhead catches were printed in the hopes of attracting tourists. Several sporting goods stores (*Star-Free Press*, 1948; Marcus, 1973) sponsored annual steelhead fishing contests as late as 1948. Census checks have shown 259 fishermen on the opening day of the winter steelhead fishing season along the five mile stretch open to steelhead fishing between Foster Park and the ocean.
>
> —*The Ventura River Recreational Area and Fishery: A Preliminary Report and Proposal* (VCFGC 1973)

On May 8, 1946, staff from the California Division of Fish and Game made a field inspection to the watershed to assess steelhead spawning areas and sport trout fishing in association with the proposed construction of Matilija Dam. The field inspection report does not document actual observations of adult steelhead, but does offer a population estimate based on personal observations and interviews with long-time residents. The report states that "at least 50 percent of the fish entering the Ventura River eventually enter the main Matilija to spawn. In normal years this represents a minimum of 2000 and 2500 adult spawning steelhead in the 12 mile area." (Clanton & Jarvis 1946) From this report comes the commonly cited statistic that the watershed historically supported 4,000 to 5,000 adult steelhead.

A year later, in March of 1947, a fisheries biologist with the California Department of Fish and Game, Bureau of Fish Conservation, walked the Ventura River and counted adult steelhead. "The river was checked from the mouth to the Foster Park bridge, which seems to be the upper limit of steelhead movement this season, due to low water conditions." (Evans 1947) The biologist counted 250 to 300 adult steelhead in this reach. He noted, "In a dry year, such as this, there is an estimated maximum of 2 miles of fairly suitable spawning area below Foster Park bridge. This might support a maximum total of 1000 spawning adult steelhead."

An extended dry period began in the watershed in 1945. Although intermixed with some wet years, the 20-year period from 1945 to 1965 is considered the longest dry period on record. These dry conditions spurred development of water supply projects. Matilija Dam was completed in 1947 and the Casitas Dam was completed in 1959. Similar dams and diversions were constructed during this period throughout the region. The dry conditions, together with the construction of water supply projects that altered natural flow regimes and restricted access to upstream spawning and rearing habitats, are credited with causing a dramatic decline in steelhead numbers in the area.

Young Fisherman with String of Trout, Foster Park, 1979. When steelhead became endangered in 1997, it became illegal to fish for or otherwise harm any *O. mykiss* below impassible upstream barriers, such as Matilija Dam.
Photo courtesy of Mark Capelli

3.6.2.6 Key Data and Information Sources/ Further Reading

Below is a summary of some of key documents that address steelhead in the watershed. See "4.3 References" for complete reference citations.

Assessment of Steelhead Habitat in Upper Matilija Creek Basin. Stage One: Qualitative Stream Survey (Thomas R. Payne 2003)

Assessment of Steelhead Habitat in the Ventura River/Matilija Creek Basin. Stage Two: Quantitative Stream Survey (Thomas R. Payne 2004)

City of Ojai Urban Watershed Assessment and Restoration Plan (Magney 2005)

Draft Biological Opinion for US Army Corps of Engineers Permitting of the City of Ventura's Foster Park Well Facility Repairs on the Ventura River (NMFS 2007)

Draft Environmental Impact Statement/Environmental Impact Report for the Matilija Dam Ecosystem Restoration Project (USACE 2004)

Field Inspection Trip to the Matilija-Ventura Watershed In Relation to the Construction of the Proposed Matilija Dam (Clanton & Jarvis 1946)

History and Status of Steelhead in California Coastal Drainages South of San Francisco Bay (Titus et al. 2010)

History of Steelhead and Rainbow Trout in Ventura County: Newsprint from 1872 to 1954, Volume I (Bowers 2008)

History of Steelhead and Rainbow Trout in Ventura County, Volume II (Kentosh 2008)

Matilija Dam Ecosystem Restoration Feasibility Study Final Report (USACE 2004b)

Population Structure and Ancestry of *O. mykiss* Populations in South-Central California Based on Genetic Analysis of Microsatellite Data (Girman and Garza 2006)

Preliminary Hydrogeological Study, Surface Water/Groundwater Interaction Study, Foster Park (Includes steelhead habitat assessment) (Hopkins 2010)

Preliminary Hydrogeological Study, Surface Water/Groundwater Interaction Study, Foster Park (Includes steelhead habitat assessment) (Hopkins 2013)

Progress Report for the Robles Diversion Fish Passage Facility (CMWD 2008, CMWD 2010). Progress reports are also available on CMWD's website for the years 2005, 2006, 2007, 2009, 2010, 2011, 2012, and 2013.

Acronyms

BO—Biological Opinion

BPG—Biogeographic Population Groups

cfs—cubic feet per second

CMWD—Casitas Municipal Water District

DPS—distinct population segment

ESA—Endangered Species Act

ESU—Evolutionary Significant Unit

HCP—Habitat Conservation Plan

HIS—Habitat Suitability Index

NMFS—National Marine Fisheries Service

OVLC—Ojai Valley Land Conservancy

SCS—Southern California Steelhead

TRT—Technical Recovery Team

Removing Matilija Dam: Opportunities and Challenges for Ventura River Restoration (Capelli 2004)

Report on the Environmental Impacts of the Proposed Agreement Between Casitas Municipal Water District and the City of San Buenaventura for Conjunctive Use of the Ventura River – Casitas Reservoir System (Includes steelhead habitat assessment) (EDAW 1978)

Robles Fish Passage Facility Biological Opinion (NMFS 2003)

Robles Fish Passage Facilities Biological Opinion, Q & A (NMFS 2003a)

Senior and Gridley Canyons Steelhead Habitat Assessment -2007 Reconnaissance Level Survey (CMWD 2007)

Southern California Steelhead Recovery Plan (NMFS 2012)

Southern Steelhead Resources Evaluation: Identifying Promising Locations for Steelhead Restoration in Watersheds South of the Golden Gate (Becker et al. 2010)

Steelhead (*Oncorhynchus mykiss*) Habitat Characterization of Portions of Upper San Antonio Creek, Senior Creek, Gridley Creek and Ladera Creek, Ventura County, California (Padre 2010)

Steelhead of the South-Central/Southern California Coast: Population Characterization for Recovery Planning (Boughton et al. 2006)

Steelhead Population and Habitat Assessment in the Ventura River/ Matilija Creek Basin, 2006 (Thomas R. Payne 2007)

Steelhead Population and Habitat Assessment in the Ventura River/ Matilija Creek Basin, 2007 (Thomas R. Payne 2008)

Steelhead Population Assessment in the Ventura River/Matilija Creek Basin, 2008 Summary Report (Thomas R. Payne 2009)

Steelhead Population Assessment in the Ventura River/Matilija Creek Basin, 2009 Data Summary (Thomas R. Payne 2010)

Steelhead Population Assessment in the Ventura River/Matilija Creek Basin, 2010 Data Summary (Normandeau 2011)

Steelhead Population Assessment in the Ventura River/Matilija Creek Basin, 2011 Data Summary (Normandeau 2012)

Steelhead/Rainbow Trout Resources of Ventura County (CEMAR 2014)

The History of Steelhead and Rainbow Trout (*Oncorhynchus mykiss*) in the Santa Ynez River Watershed, Santa Barbara County, California (Alagona 2012)

The San Antonio Creek Watershed: An Agricultural and Rural Residential Land Protection Study (NRCS 2010)

The Ventura River Recreational Area and Fishery: A Preliminary Report and Proposal (VCFGC 1973)

Ventura County, Ventura River, Steelhead Situation (Evans 1947)

Ventura River Habitat Conservation Plan - Draft (Entrix & URS 2004)

Ventura River Steelhead Restoration and Recovery Plan (Entrix & Woodward Clyde 1997)

Ventura River Steelhead Survey (Capelli 1997)

Ventura Watershed Analysis (Chubb 1997)

Gaps in Data/Information

A formal on-the-ground assessment of current barriers in the watershed is needed.

3.6.3 Matilija Dam Ecosystem Restoration Project

"Is the Matilija Dam ever going to come down?" may be the most common question raised in public discussions about the Ventura River watershed. The short answer is: We're working on it.

Taking down a dam is no small undertaking. The effort to remove Matilija Dam—now called the Matilija Dam Ecosystem Restoration Project (MDERP)—is a complex, multi-stakeholder undertaking that started in the 1990s and continues today.

This section provides a brief overview of the MDERP effort. The MDERP's website, www.Matilijadam.org, contains current information, along with comprehensive background and historical information, meeting presentations, photos, and more. See also "3.2.3 Geomorphology and Sediment Transport" and "3.6.2 Steelhead" for discussions on topics relevant to the Matilija Dam.

Aerial View of Matilija Dam and Reservoir

Photo courtesy of Ventura County Watershed Protection District

In 1947, Matilija Dam was constructed at the lower end of Matilija Creek to provide water storage and flood control. The reservoir was originally built to hold 7,000 acre-feet of water; but sediment from the highly erosive mountains along Matilija Creek rapidly accumulated behind the dam. The reservoir's capacity, as of 2004, was estimated at less than 500 acre-feet—7% of its original capacity. The reservoir's capacity was displaced by almost seven million cubic yards of sediment. If the dam still stands in 2040, the reservoir will likely be completely full of sediment (USACE 2004a).

Matilija Dam no longer provides significant water storage or flood control functions, and blocks the passage of endangered southern California steelhead to prime spawning habitat above the dam. The dam has altered the flow of sediment downstream, diminishing the amount of sand replenishing local beaches.

The dam, which has been plagued with structural integrity issues since construction began, also poses a safety risk. The dam height has been lowered twice to address safety concerns.

Matilija Dam Notches. The top of the dam was notched in 1965 and again in 1978 to address safety concerns, including strain on the dam from water stored behind the dam and deteriorating concrete. The original dam height was 198 feet and is now 168 feet (USACE 2004). In 2011, someone painted a huge pair of scissors and a long dotted line on the face of the dam.

Sampling Barge on Matilija Reservoir, 2001. Drilling, coring, and sample collection was conducted from a barge on the reservoir to obtain subsurface data and sediment samples.
Photo courtesy of US Bureau of Reclamation

Methane Gas Eruption During Drilling, 2001. During sampling, some drill holes encountered methane gas pockets below the water, which caused sediment "geysers" and turbulent boils in the water. The methane is produced by rotting vegetation.
Photo courtesy of US Bureau of Reclamation

The following excerpt from a 2014 report summarizes the overall project and its current status:

> Since its construction in 1947, the 168-foot high, arched concrete Matilija Dam has blocked the transport of an estimated 6,800,000 cubic yards (cy) of fine and coarse sediment from naturally moving downstream to the ocean. This has resulted in loss of the reservoir's original function of water storage for agricultural needs, and limited flood control, loss of downstream sand and gravel sized materials necessary to promoting habitat for a variety of wildlife species, loss of sediment needed to maintain beaches at Surfer's Point, and increased erosion of the Ventura River streambed. The dam, with its non-functioning fish ladder, also prevents southern steelhead from reaching upper Matilija Creek, which prior to dam construction, was the most productive spawning and rearing habitat in the Ventura River system. Without dam removal, an estimated total of 9,000,000 cubic yards of sediment will be trapped behind the dam before the natural full annual sediment load of Matilija Creek begins to be carried over the dam in approximately 2040. While such a scenario would eventually begin to address sediment deprivation of the downstream reaches, leaving the dam in place would not address fish passage beyond the dam and impacts to upstream habitat.
>
> In the early 2000's, Ventura County Watershed Protection District (VCWPD) and the US Army Corps of Engineers (USACE), evaluated several alternatives for dam removal and published a Final Environmental Impact Statement/Environmental Impact Report (EIS/R, USACE 2014 [2004]). They arrived at a preferred alternative (Alternative 4b) that involved slurrying an estimated 2,100,000 cy of fine sediment from the reservoir area just upstream of the dam to a downstream disposal location, removing the dam in one season, excavating a channel through the remaining coarse sediment, and protecting the lower seven feet of the channel banks with soil cement to allow 10-year and greater storm events to remove the accumulated sediments above the seven-foot level. At some future date, the soil cement would be removed, allowing the remaining accumulated sediment to be flushed through the river system.
>
> Subsequently, in 2009 and 2010, the Matilija Dam Fine Sediment Study Group (FSSG) was convened and temporary upstream disposal of the fine sediment was considered to address concerns over cost and constructability of the downstream disposal options for the fine sediment.

VCWPD has since contracted with URS and Stillwater Sciences (the Consultant Team) to evaluate a range of concepts including those documented in previous documents, concepts developed by the FSSG, and new concepts. A short list of six initial options was identified and is screened (in this report) based on selected key criteria. Following the screening process, up to four alternatives will move forward into the evaluation phase, which would use a wide range of criteria to compare the selected alternatives.

—*Matilija Dam Removal, Sediment Transport, and Robles Diversion Mitigation Project: Draft Initial Options Screening Report* (URS and Stillwater 2014)

Surfrider Foundation Bumpersticker Advocating for Matilija Dam Removal, 1995. In the 1990s, Surfrider Foundation's Ventura chapter began urging the County of Ventura to remove the dam.

3.6.3.1 Matilija Dam Ecosystem Restoration Project Highlights

When the Matilija Dam Ecosystem Restoration Feasibility Study was completed in 2004, it was one of the largest dam removal studies in the country. The study presented a number of alternative approaches to removing the dam and restoring the habitat, and selected a recommended approach.

The ecosystem restoration objectives of the study were to:

- Improve aquatic and terrestrial habitat along Matilija Creek and Ventura River and restore fish passage.
- Restore natural processes to support beach sand replenishment.
- Enhance recreational opportunities.

The study identified several key constraints that later influenced the formulation and evaluation of various alternatives, including:

- Maintaining the current level of flood protection along the Ventura River downstream of Matilija Dam.
- Limiting adverse impacts to normal water supply quantity, quality, and timing of delivery to Casitas Reservoir via Robles Diversion Dam.
- Limiting impacts to water quality in Lake Casitas resulting from the release of the fine sediments trapped behind Matilija Dam (USACE 2004b).

The most challenging dam removal issue is management of the 6.8 million cubic yards of sediment behind the dam. The preferred alternative in the MDERP feasibility study outlined a two-part strategy for managing the sediments: four million cubic yards of mixed fine and coarse sediments would be contoured within the dam basin area to allow for natural transport to the ocean and beaches in flood events; and the two million cubic yards of fine silts and clay closest to the dam would be slurried in a pipe to various locations downstream of the Robles Diversion to avoid impacting water diversions to Lake Casitas.

The most challenging dam removal issue is management of the 6.8 million cubic yards of sediment behind the dam.

After years of effort and lobbying by the County of Ventura, the MDERP was officially authorized by Congress in 2007, with a budget of $144.5 million. In addition to the federal government's contribution, the project was expected to require about $55 million from state and local sources, primarily from bonds issued by the state.

The Players

The Matilija Dam Ecosystem Restoration Project (MDERP) is a joint effort between the Ventura County Watershed Protection District (VCWPD), which is the owner of the dam, and the U.S. Army Corps of Engineers (USACE). The MDERP is a federal project under the authority of the USACE, and VCWPD is the local sponsor. The California Coastal Conservancy and the U.S. Bureau of Reclamation are also key players on the management team. The Bureau of Reclamation has technical responsibility for project hydrology, hydraulics, and sediment modeling; the California Coastal Conservancy has been the primary local funding agency. The MDERP has a large stakeholder group—including many federal, state, and local agencies and organizations—that has guided the project from the beginning. The main stakeholder group is now called the Design Oversight Group (DOG).

Matilija Dam Design Oversight Group

Photo courtesy of Paul Jenkin

Table 3.6.3.1.1 Matilija Dam History

Year	Event
1946	June 18 – Dam construction began. The original reservoir was designed to hold 7,000 acre-feet of water.
1947	Mr. Harold E. Burket, architect, warned County Supervisors of alkali-reactive aggregate.
1947	Dam construction was completed at a cost of $682,000. A report estimated that it would be 39 years before siltation would eliminate capacity. The County sued the engineers for cost overruns and lost.
1949	A major fish kill occurred behind dam due to stagnant, hot water conditions in the reservoir.
1952	The reservoir filled.
1959	Casitas Municipal Water District assumed responsibility of dam operations.
1964	Dam removal was proposed. Bechtel Corp. Safety study condemned dam and presented removal as an option.
1965	Bechtel Corp. estimated dam removal cost at $300,000. To address safety concerns, the County elected instead to notch dam (remove a section 30 feet deep and 285 feet wide) to reduce reservoir capacity to 65%, relieving strain while allowing the dam to remain in place.
1973	A study on littoral processes highlighted the impact of the dam to beaches. The United States Forest Service estimated the sediment contribution of Matilija's dammed watershed to be 116,000 cubic yards per year—sediment that should be contributed to beaches, but is not.
1970s	Ed Henke, who'd grown up along the Ventura River, began to lobby for the dam's demolition.
1978	The dam was notched a second time (358 feet wide).
1995	The local chapter of the Surfrider Foundation began campaign promoting dam's removal.
1997	The southern California steelhead was designated as an endangered species in California.
1998	The County resolved to remove the dam. A study on dam removal began.
2000	A Bureau of Reclamation Appraisal Study was completed. Secretary of the Interior Bruce Babbitt visited a demonstration project at the dam.
2000	Matilija Coalition was formed to bring together the interests of local non-government organizations.
2001	The Matilija Dam Ecosystem Restoration Study was initiated by the Ventura County Watershed Protection District (owner of the dam) and the US Army Corps of Engineers.
2004	Consensus was reached by all stakeholders on preferred project points.
2004	The Matilija Dam Ecosystem Restoration Feasibility Study was completed. At the time, it was one of the largest dam removal studies in the country. The reservoir's capacity was estimated at 500 acre-feet, 7% of its original capacity. The study presented a number of alternative approaches to removing the dam and restoring the habitat, and selected a recommended approach.
2004	Ventura County Board of Supervisors approved the Final EIR/EIS.
2004	US Army Corps of Engineers Chief's Report sent to Assistant Secretary of the Army.
2005	The Design Phase of the Matilija Dam Ecosystem Restoration Project was initiated by the Ventura County Watershed Protection District and the US Army Corps of Engineers.
2007	After years of effort and lobbying by the County of Ventura, the MDERP was officially authorized by Congress, with a budget of $144.5 million. In addition to the federal government's contribution, the project was expected to require about $55 million from state and local sources, primarily from bonds issued by the state.
2007	MDERP Project Component: *Arundo donax* removal was initiated on 1,200 acres above and below dam. Retreatments are scheduled through 2025.
2010	The Design Oversight Group formed a Fine Sediment Study Group.

Table 3.6.3.1.1 Matilija Dam History *(continued)*

Year	Event
2011	MDERP Project Component: Ventura River Parkway Trailhead was installed on the Ventura River Preserve at Old Baldwin Rd. Included new trailhead parking areas, trail enhancement, and public outreach. Fulfilled MDERP recreation goals.
2011	The Fine Sediment Study Group Final Report was completed. (August)
2011	A Technical Advisory Committee (TAC) was formed to address the data and research needs related to the sediment management issue. (October)
2013	A consultant team was selected to complete several studies the TAC deemed necessary to resolve the sediment management issue and reduce the cost of the project. (June)
2014	The consultant contract started. (February)
2015	The consultant studies are due early in 2015.

Source: Matilijadam.org; VCWPD 2014f; Jenkin 2013

Problems: Costs and Stakeholder Acceptability

After project design was underway, the USACE calculated that slurrying the 2 million cubic yards of sediment would cost about twice as much as the estimate from the feasibility study. Local residents adjacent to certain proposed storage areas expressed concern about the impacts from the downstream storage areas.

These issues led to the concept of the upstream storage area (USA) alternative, wherein the fine sediment would be permanently sequestered within Matilija Canyon. However, a number of stakeholders found the USA alternative unacceptable due to the permanent impacts to the canyon.

Stakeholder support of the approach to managing fine sediments was essential, so the project team orchestrated a facilitated group called the Fine Sediment Study Group, which met several times in 2010 and 2011. From this effort, a Technical Advisory Committee (TAC) formed to address the data and research needs related to the sediment management issue.

The TAC began work in 2011. In February 2014, a consultant team began work on several studies the TAC deemed necessary to move forward. These studies will focus on methods to remove the dam that will allow for the natural transport of all sediment from behind the dam, while minimizing impacts to Robles Diversion. The studies will develop methods to offset any residual impacts to Robles Diversion.

In February 2014, a consultant team began work on several studies deemed necessary to move forward. These studies will focus on methods to remove the dam that will allow for the natural transport of all sediment from behind the dam, while minimizing impacts to Robles Diversion.

Mitigation

Before Matilija Dam can be removed, several projects must be implemented to accommodate changes downstream expected to result from the dam's removal. Much of this mitigation is related to flooding. Projects include the redesign and improvement of two bridges to increase hydraulic capacity, improvements to the Robles Diversion and Fish Passage Facility, installation of two contingency water wells in the City of Ventura's Foster Park well field, and the redesign of two existing levees as well as a new levee. Figure 3.6.3.1.1 shows the location of key MDERP design features, most of which are mitigation measures. Table 3.6.3.1.2 summarizes the project's flood-related mitigation measures.

Figure 3.6.3.1.1 Matilija Dam Ecosystem Restoration Project Design Features Map

Source: USACE 2004b

Table 3.6.3.1.2 Matilija Dam Removal Downstream Flood Mitigation Measures

Location	Mitigation	Justification
Matilija Hot Springs	Buy-out	Proximity of Hot Springs site to dam and channel, narrowness of Matilija Canyon, and limited flood conveyance area create high risk from sediment-laden flows in event of a very large storm event and limit the effectiveness of any structural protection.
Camino Cielo	Properties buy-out	Proximity of six residential tracts to dam and channel, and narrowness of canyon create high risk from sediment-laden flows in event of a very large storm event and limit the effectiveness of any structural protection.
Camino Cielo Bridge	Improve conveyance Remove and replace at new location; restore channel width at original location	Existing low flow crossing (concrete box culvert) exacerbates constricted channel. Removal of bridge and restoration to original channel width will improve conveyance and prevent backwater effects. New bridge with higher deck at a wider channel section is justified because bridge is sole ingress\egress for remaining Camino Cielo residential tracts not impacted by potential flooding.
Meiners Oaks	Construct new (east) levee/floodwall	Flood protection less costly than real estate acquisition. Number of structures already prone to flooding under existing conditions would increase. Dam removal would result in a water depth increase of at least 2 ft. Confinement by levee at lower end necessitates continuation of protection upstream.
Live Oak	Raise existing (west) levee	Flood protection less costly than real estate acquisition. Constricted nature of channel and expected rise in water surface in high flow events upstream of Santa Ana bridge necessitates levee raising. Confinement by levee at lower end necessitates continuation of protection upstream.
Santa Ana Bridge	Improve conveyance by widening channel and extending bridge length	Existing bridge creates severe constriction and channel is incapable of passing a 100-yr discharge with additional sediment-laden flows. Due to constricted channel upstream of bridge, current sediment removal maintenance efforts will need to continue in addition to channel widening for a limited distance (500 ft) upstream of bridge.
Casitas Springs	Raise existing (east) levee	Flood protection less costly than real estate acquisition. Number of structures already prone to flooding under existing conditions would increase. After dam removal, water depth would increase by at least 2 ft.

Source: Matilija Dam Ecosystem Restoration Feasibility Study, Section 4 (USACE 2004b)

Arundo donax control in Matilija Creek and the Ventura River was identified as a key component of ecosystem restoration in the MDERP. *Arundo*, also called giant reed, is a highly invasive non-native riparian plant. As part of the MDERP, the watershed's largest *Arundo* removal project started in 2008 on Matilija Creek and the upper Ventura River. The VCWPD removed 200 acres of *Arundo* in a 1,200-acre area. Other invasive plants were also removed as part of this project, including Peruvian pepper tree, tamarisk, Spanish broom and castor bean.

Figure 3.6.3.1.2 shows the areas of *Arundo* infestation above and below Matilija Dam prior to removal. This project has been very successfully implemented, as witnessed by the numbers and variety of native animals returning to the treated areas. Ongoing treatment and monitoring is planned for many years to come.

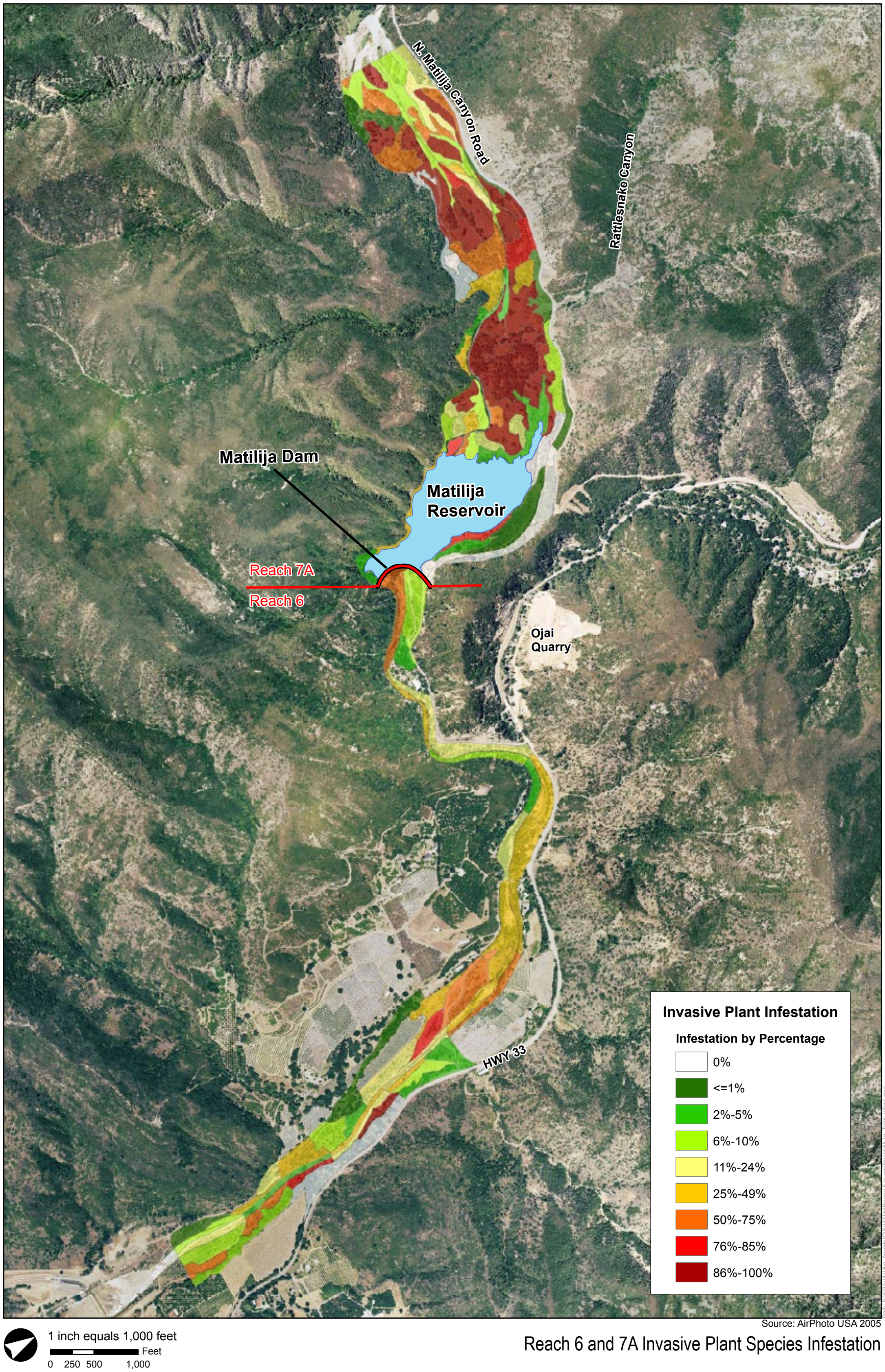


Figure 3.6.3.1.2 Map of *Arundo donax* Infested Areas Prior to Removal Efforts

Source: VCWPD and Ecosystems Restoration 2007

3.6.3.2 Key Data and Information Sources/ Further Reading

Below is a summary of some of key documents that address the Matilija Dam Ecosystem Restoration Project. See "4.3 References" for complete reference citations. See also www.matilijadam.org.

Draft Environmental Impact Statement/Environmental Impact Report for the Matilija Dam Ecosystem Restoration Project (USACE 2004)

Hydrology, Hydraulics and Sediment Studies of Alternatives for the Matilija Dam Ecosystem Restoration Project (USBR 2007)

Matilija Dam Ecosystem Restoration Feasibility Study Final Report (USACE 2004b)

Matilija Dam Ecosystem Restoration Project brochure (VCWPD 2014f)

Matilija Dam Ecosystem Restoration Project: Fine Sediment Study Group Final Report (Selkirk 2011)

Matilija Dam Removal, Sediment Transport, and Robles Diversion Mitigation Project: Draft Initial Options Screening Report (URS and Stillwater 2014)

Matilija Dam Giant Reed Removal Plan (VCWPD and Ecosystems Restoration 2007)

California River Parkways Trailhead Project, Initial Study (Aspen 2010)

Acronyms

cy—cubic yards

DOG—Design Oversight Committee

FSSG—Fine Sediment Study Group

MDERP—Matilija Dam Ecosystem Restoration Project

TAC—Technical Advisory Committee

USA—Upstream Storage Area

USACE—United States Army Corps of Engineers

VCWPD – Ventura County Watershed Protection District

3.6.4 Access to Nature

Healthy natural landscapes provide important ecosystem services, but these landscapes also provide equally important social and cultural benefits. The opportunity to spend time in nature adds value to life in ways that may be difficult to quantify—aesthetic, recreational, therapeutic, and spiritual—but are no less real. The Ventura River watershed's natural landscapes have long been valued by residents and visitors for such reasons.

Everybody needs beauty as well as bread, places to play in and pray in, where nature may heal and give strength to body and soul. —*John Muir*

The opportunity for people to enjoy natural landscapes firsthand can also serve to help protect those landscapes. People tend to protect what they enjoy, care about, and feel a connection with. Understanding the natural environment, and its important ecosystem services (e.g., cleaning water, cycling nutrients, controlling floods), provides further motivation to support and protect natural landscapes.

Mom and Daughter Enjoying Ventura River
Photo courtesy of Lynn Malone

People tend to protect what they enjoy, care about, and feel a connection with.

There are numerous opportunities for people come into contact with natural landscapes in the watershed, as over half of the land is in protected status—much of it in a relatively natural state. It is a recreation destination for hikers, walkers, bikers, surfers, campers, fishermen, boaters, backpackers, equestrians, and birders, as well as artists, spiritual seekers, and students of natural history.

The Ventura River watershed has three distinct landform zones: the mountains and foothills of the Transverse Ranges, the broad valley floors, and the coastal zone. The natural habitats and terrain, and the ways that people interact with them, are different in each zone.

The watershed's steep mountains are largely contained within Los Padres National Forest, where the trails are often steep, the views always spectacular, and most of the camping opportunities are backcountry. Aquatic habitats here are riparian corridors of young tributaries of the Ventura River—a number of which flow year round in many years.

The flatter foothills and valley floors have more easily accessible, family-oriented recreation opportunities. Trails are generally flatter, camping opportunities are car-accessible, and parks and preserves are available in some areas for convenient daily use. Aquatic habitats here are larger and include key drainages like San Antonio Creek and the Ventura River, man-made Lake Casitas, and natural and restored wetland habitats. Many of these habitats offer excellent birding and wildlife viewing.

Native Plant Viewing, Matilija Wilderness

Photo courtesy of Michael McFadden

The coastal zone also has readily accessible recreation opportunities. Trails are paved along the beachfront and estuary and unpaved on the sandy and cobble-strewn delta, camping is car-accessible, parks and preserves provide access and amenities, and the vast Pacific Ocean offers spectacular views and a playground for a host of sports. In addition to habitats in coastal waters, aquatic habitats here include the Ventura River estuary—an exceptional biological resource and a great location for birding and wildlife viewing.

The watershed provides many opportunities for people of all ages to enjoy the outdoor environment; however, one area in particular is underserved: the City of Ventura's Westside. This community, located near the bottom of the Ventura River, has the highest population density and lowest median household income in the watershed. In this area, Highway 33 freeway and Ventura Levee block both access to and views of the river. Much of the river bottom, floodplain, and adjacent lands in the stretch of river below Foster Park is privately owned, and few people have the opportunity to experience it. The lower end of this stretch, near the estuary, has had a long history of heavy use by transient individuals for camping. This has further dissuaded community members in this area from utilizing the river for recreation (though this situation is now getting better). Improving the limited access to the river in this area is a priority for many stakeholders.

Ventura's Westside community, located near the bottom of the Ventura River, has the highest population density and lowest median household income in the watershed. In this area, Highway 33 freeway and Ventura Levee block both access to and views of the river.

In providing access to nature, another consideration is the means by which people are able to get access. Is a car required? Is parking available? Is there a bus stop nearby? Bike racks? Are there access options for those using wheelchairs or who are otherwise less mobile? Are the needs of young and old considered? Is there a staging area for horse trailers? Access opportunities that serve all sectors of the community and all means of mobility are desired. In this regard, access opportunities for those traveling by bus or bicycle have been identified as deficient.

This section catalogs and describes the watershed's nature-based recreation facilities and activities in two sections:

- "3.6.4.1 Inventory of Nature-Based Recreation Facilities and Activities," organizes and describes facilities and activities by type; key data are summarized in tables.
- "3.6.4.2 Nature Access by Area," organizes and describes facilities and activities by location; the watershed is divided into seven different detail maps for a closer look at opportunities by area.

It should be noted that the information presented in this section is limited to those opportunities provided by public agencies and nonprofit organizations. There are also many nature-based recreation opportunities provided by privately owned facilities.

3.6.4.1 Inventory of Nature-Based Recreation Facilities and Activities

The watershed benefits from the many organizations committed to providing the public with access to nature and nature-based recreation opportunities. Federal, state, and local agencies, along with land conservancies, maintain and make available to the public significant natural land resources. Public recreational facilities are provided by six public agencies and two nonprofit organizations: the United States Forest Service, California State Parks, County of Ventura, City of Ojai, City of Ventura, Casitas Municipal Water District, Ojai Valley Land Conservancy, and Ventura Hillsides Conservancy.

Increased public access to natural landscapes provides many benefits, but also brings increased trash, erosion, animal waste, vandalism, fires, and other impacts to natural resources. The costs to monitor and correct these impacts are an ongoing consideration for organizations providing nature-based public access.

Los Padres National Forest Sign, Highway 33

Nature Appreciation

Although not explicitly described in this section as an "activity," nature appreciation—connecting with the beauty and wonder of the natural world—may be at the heart of the instinct to spend time in nature for many people. The approach to nature appreciation is personal—some do it with silence, some paint or write poetry, some observe birds. Nature appreciation is also intangible—its value cannot be quantified in a table in this plan. Nonetheless, few question the deep value of the opportunity to appreciate nature.

Most of the public access opportunities in the watershed are free, so data quantifying public use of trails and recreation areas are limited. This makes it hard to track recreation use patterns such as use of recreational facilities by residents versus tourists. Facilities with fees include Lake Casitas, campgrounds, and county parks.

Los Padres National Forest

Los Padres National Forest (LPNF) covers 69,062 acres within the watershed—most of the northern half. The Matilija Wilderness, a federally designated wilderness area, covers 23,477 acres of this land. Sixteen miles of Matilija Creek have been nominated for Wild and Scenic River designation (USACE 2004). The National Forest System lands within the watershed are located in the Ojai Ranger District.

Recreation opportunities in Los Padres National Forest include hiking, car camping, backpacking, fishing, hunting, bicycling, horseback riding, paragliding, hang-gliding, and wildlife viewing

Much of the LPNF land in the watershed comprises relatively undisturbed natural habitat. Recreation opportunities include hiking, car camping, backpacking, fishing, hunting, bicycling, horseback riding, paragliding, hang-gliding, and wildlife viewing.

The LPNF has many access points that allow visitors to explore its different landscapes. There are nine different trailheads within or leading to the LPNF. Fire breaks and other "unofficial" trails are also commonly used for recreation. Many of these trails provide relatively easy access to a wilderness experience close to urban areas. Highway 33 travels through the LPNF providing for scenic automobile, motorcycle, and bicycle touring.

The LPNF has two car-accessible campgrounds. Wheeler Gorge and Holiday Group Campgrounds are operated by a concessionaire and fees are collected by a campground host. (See "Campgrounds and Recreation Areas" below.) The Wheeler Gorge Visitor Center is located across the highway from Wheeler Gorge Campground. A number of backcountry campgrounds are also located in the LPNF within the watershed.

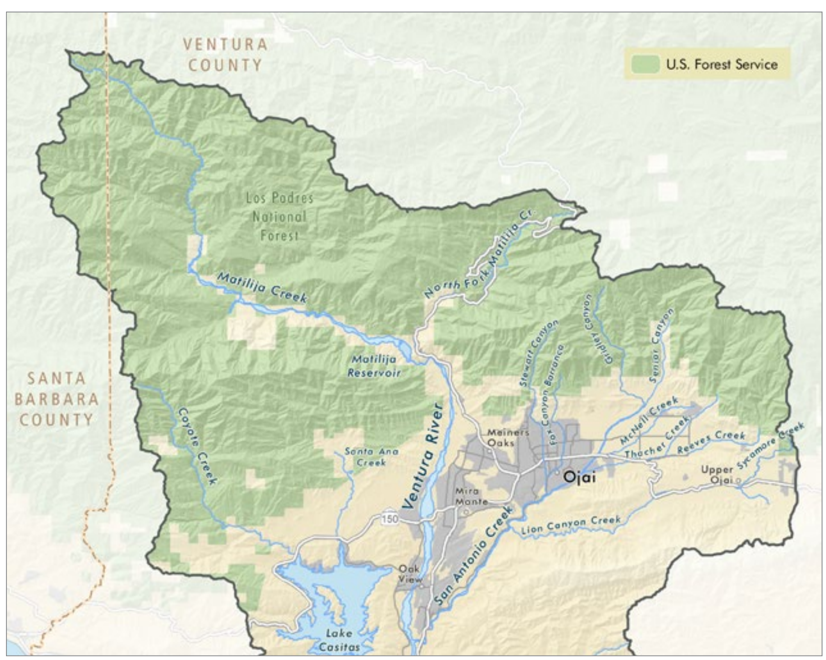


Figure 3.6.4.1.1 Los Padres National Forest Area Map

Except for Wheeler and Holiday Gorge Campgrounds, admission to the LPNF within the watershed is free. Purchase of a United States Forest Service (USFS) Adventure Pass is not required, except for car access to Nordhoff Ridge Road. Management of the LPNF is directed by the Los Padres Land Management Plan, which was revised in 2005 (USFS 2005a).

Recreation facilities at Lake Casitas include over 400 campsites including RV sites, showers, restrooms, 10 picnic areas, 11 playgrounds, special event areas, a water park, two boat ramps, boat rentals plus boat and trailer storage, a hiking/biking trail, a store, a café, and a radio-controlled airplane landing strip.

Lake Casitas Recreation Area

Aside from the LPNF, Lake Casitas Recreation Area (LCRA) is the largest outdoor recreational facility in the watershed. The LCRA includes Lake Casitas (2,700 acres) and the surrounding parkland (almost 400 acres). It is surrounded by thousands of acres of protected open space. All of the recreation area land lies along the north shore of the lake. No body contact with lake water is allowed as a water quality protection measure.

The LCRA provides a variety of recreation opportunities. Facilities include over 400 campsites including RV sites, showers, restrooms, 10 picnic areas, 11 playgrounds, special event areas, a water park, two boat ramps, boat rentals plus boat and trailer storage, a hiking/biking trail, a store, a café, and a radio-controlled airplane landing strip (CMWD 2005; URS 2010).

Lake Casitas Recreation Area Sign

Rowing is popular on the lake. The Lake Casitas Rowing Association provides recreational and competitive rowing training to youth and adults in the community.

The lake provides excellent opportunities for viewing wildlife, especially birds, which have come to depend on the lake's open water, protected bays, vegetated shallows, and freshwater marsh habitats. Lake Casitas is used by many resident and migratory birds, and is a very popular birding destination. The California Audubon Society recognizes Lake Casitas as one of 147 "Important Bird Areas" in the state—areas that provide essential habitat for breeding, wintering, and migrating birds (Audubon 2014). The lake hosts some species that occur nowhere else inland in Ventura County.

Fishing from a Dock, Lake Casitas
Photo courtesy of Fred Rothenberg

The lake is also well-known for its fishing, which takes place from docks, boats, and the shore. Lake Casitas is a warm water fishery that includes bass (primarily largemouth), catfish, sunfish, and crappie. These non-native species, introduced when the lake was formed, now have self-sustaining populations (Cardno-Entrix 2012).

Management of the LCRA is guided by the Lake Casitas Final Resource Management Plan/Environmental Impact Statement (URS 2010).

Local land conservancies own and manage 1,953 acres of publicly accessible natural open space lands, with the Ventura River Preserve comprising 1,583 of these acres.

Preserves

The Ojai Valley Land Conservancy (OVLC) and Ventura Hillsides Conservancy (VHC) are both actively acquiring and managing land, providing educational information and interpretive opportunities, and establishing new trails and access points in the watershed. Together, these conservancies own and manage 1,953 acres of publicly accessible natural open space lands, with the Ventura River Preserve comprising 1,583 of these acres. These lands are located close to urban population centers, providing convenient access to natural landscapes.