A Case for the San Luis Rey River

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Appendix A

This note is submitted by members of the Trout Unlimited-San Diego chapter 920 in support of restoration efforts for the endangered steelhead trout in the San Luis Rey River in San Diego County. Acting under the umbrella of Trout Unlimited-National, we have worked in the San Luis Rey since April 2008 assessing water quality as a component of steelhead habitat, supported by funding from the California Dept. of Fish and Game and the Pacific States Marine Fisheries Commission. We seek here to condense data collected on the San Luis Rey and review recent guidelines from federal and state agencies that identify the San Luis Rey River as a high priority watershed for steelhead recovery. We highlight features of the San Luis Rey that are conducive to accomplishing the goal of restoring runs of steelhead in the context of urbanized Southern California.

Summary

It has been estimated that annual runs of steelhead at the southern part of their range in California have declined from 32,000-46,000 returning adults to less than 500 today[1]. Steelhead were present in the San Luis Rey River until the 1940s[2], but their population has declined to a currently negligible level.

However, the San Luis Rey River remains one of the best candidates for steelhead recovery on the South Coast. Reasons for optimism include not only the sporadic sightings of steelhead in the San Luis Rey in 2007[3], but also the continued existence of stream reaches with summertime water quality and stream temperatures that are suitable or almost suitable even without increased instream flows, self-reproducing populations of rainbow trout in the Pauma Creek tributary and the West Fork of the San Luis Rey River, and the recent discovery and

[1] Good, T. P., R. S. Waples & P. B. Adams. 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-NWFSC-66. 598 pp.
[2] Downie, S.T. and D. Kajtaniak. 2010. San Luis Rey River Watershed Assessment. Coastal Watershed Planning and Assessment Program. Department of Fish and Game. Basin Profile section, pg. 1.
[3] Ibid. p. 51

genetic documentation of steelhead juveniles in the adjacent Santa Margarita River drainage[4]. In addition, the water needed to dramatically improve instream flows is but a small percent of the basin's water budget. All of these facts confirm the potential for re-establishing a stable steelhead population in the San Luis Rey River. Long-term viability and the eventual delisting of the Southern California steelhead depend upon mitigating factors that limit steelhead survival there and implementing a plan of action that is reasonable in the context of an extensively urbanized Southern California.

Background

Steelhead (*Oncorhynchus mykiss)* have historically populated coastal watersheds throughout Southern California. A sharp decline in their population started in the mid-1900s, leading to the listing of the Southern California Coast steelhead as a federally endangered species in 1997 from the Santa Maria River at the north end to Malibu Creek, currently the southernmost known, self-sustaining steelhead population. Following steelhead sightings and genetic documentation in watersheds south of Malibu Creek, the geographic boundary was extended southward to the U.S.-Mexico border in 2002. The expanded region including San Diego County was included in the ESA listing in 2006.

Limiting factors to steelhead recovery are tightly linked to features of their life history as an anadromous species. Steelhead live for at least one year in freshwater as juveniles before migrating to the ocean where they feed and grow for several years before returning to freshwater to spawn. Most steelhead survive the spawning run, returning to the ocean and repeat the cycle to fresh water once or twice more in future years. In this pattern of existence, they require passage through the main stem of a river during periods of high flow in winter months, and they need year-round refuge areas in the main stem and particularly in tributaries, which are favored spawning and rearing sites. They also require adequate estuarine habitat for smoltification, preparing them for the transition between fresh and salt water. Steelhead migration distinguishes them from the rainbow trout resident in fresh water (also *O. mykiss*) and defines their two main needs for survival as a species: areas of year-round water of suitable quality for spawning and

[4] Rodney McInnis, Regional Administrator, National Oceanic and Atmospheric Administration. Letter of March 12, 2010 to William Berry, Resource Management Division Head, Camp Pendleton Marine Corps Base.

rearing, and seasonal passage to and from the spawning and rearing areas, typically in upstream reaches of the river or its tributaries.

The Southern California Steelhead Recovery Plan draft published in 2009 by the National Marine Fisheries Service, part of the National Oceanic and Atmospheric Administration, articulates recovery guidelines and designates the San Luis Rey as a high priority watershed. Under this Steelhead Recovery Plan, the goal is to "prevent the extinction of Southern California steelhead in the wild and ensure the long-term persistence of viable, self-sustaining, harvestable, interacting wild populations of steelhead distributed across the DPS [distinct population segment]"[5] by addressing factors limiting the species' ability to survive and reproduce in the wild. The immediate objectives are to increase steelhead abundance and to preserve the expression of all life-history strategies that steelhead utilize. To meet these objectives, the Steelhead Recovery Plan uses a Threat Assessment Process to identify, prioritize and compare threats among the watersheds in which the Southern California steelhead are native and to examine the possibilities for mitigation. As a result of this process, the Steelhead Recovery Plan categorizes the San Luis Rey River as a high priority, or Core 1 basin.[6]

The Steelhead Recovery Plan designation is further supported by the findings of another group of agencies that studied the possibilities for restoring steelhead in the San Luis Rey River. A collaborative field study conducted by the California Department of Fish and Game, Pacific States Marine Fisheries Commission and the Coastal Watershed Planning and Assessment Program records its findings in the San Luis Rey Watershed Assessment.[7] Threats to steelhead viability identified in the Assessment are similar to those identified in the Steelhead Recovery Plan, and include dewatering and inadequate stream flows in the main stem and tributaries, barriers to fish passage in the river, loss of estuarine habitat, and lack of suitable spawning gravels in the main stem and important tributaries. However, the natural climatic, hydrological, geological and ecological advantages cited in the Assessment indicate that these limiting factors

[5] National Marine Fisheries Service, National Oceanic and Atmospheric Administration, "Southern Steelhead Recovery Plan" Draft, July 2009, pg. 47.

[6] Ibid, pg. 62 and pg. 64 Table 6.1. Core 1 population designation is based on several factors, including "the intrinsic potential of the population in an unimpaired condition, the role of the population in meeting the spatial and/or redundancy viability criteria, the conditions of the population, the severity of threats facing the populations, the potential ecological or genetic diversity the watershed and population could provide to the species, and the capacity of the watershed and population to respond to the critical recovery actions needed to abate those threats. Core 1 populations form the nucleus of the recovery strategy…"

[7] Downie, S.T. and D. Kajtaniak. 2010. San Luis Rey River Watershed Assessment. Coastal Watershed Planning and Assessment Program. Department of Fish and Game.

can be successfully mitigated, making the San Luis Rey River a prime candidate for steelhead restoration.

Factors Affecting Steelhead Recovery in the SLR Basin

Increasing Water Flow in the San Luis Rey

The San Luis Rey watershed is a mixture of developed and wild land covering over 565 square miles (see Figure 1). The river flows from Palomar and Hot Springs Mountains in the Cleveland National Forest into the Pacific Ocean in the city of Oceanside. It has a single dam, forming Lake Henshaw, one of the larger reservoirs in the region. The Henshaw Dam was completed in 1922 to store water for irrigation and municipal uses and for potential regulation of flood stage water levels. From Lake Henshaw the main stem runs approximately 50 river miles to the ocean.[8]

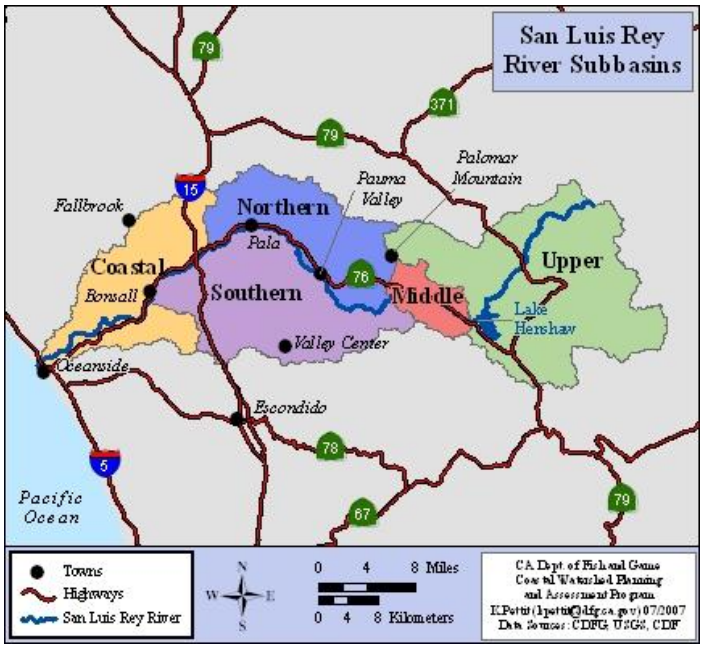

Figure 1A San Luis Rey Watershed in San Diego County,
large scale view showing sub-basins.

About 10 river miles below Lake Henshaw is the Escondido Canal diversion that draws virtually all of the river flow into the adjacent Escondido Creek watershed. For about 20 river miles below the diversion, the San Luis Rey River is mainly dry except during major winter rains. In this area, the riverbed runs through predominantly agricultural and rural areas. The river

[8] This and other distances were calculated using the ruler utility in Google Earth.

flows again perennially starting about 20 miles inland (near Interstate 15) due to contributions from run-off, ground water, and tributaries. The river is fed throughout its course by numerous tributaries, most of which are seasonal. Taken as a whole, the San Luis Rey collects the largest share of the run-off from the Palomar and Hot Springs mountains, the higher elevations receiving an annual rainfall around 45 inches, far above the coastal average of 12 inches. Relative to other Southern California rivers, the San Luis Rey watershed has capacity to produce and carry an abundance of water, and that fact is one of the clearest justifications for its classification as a Core 1 watershed for steelhead recovery.

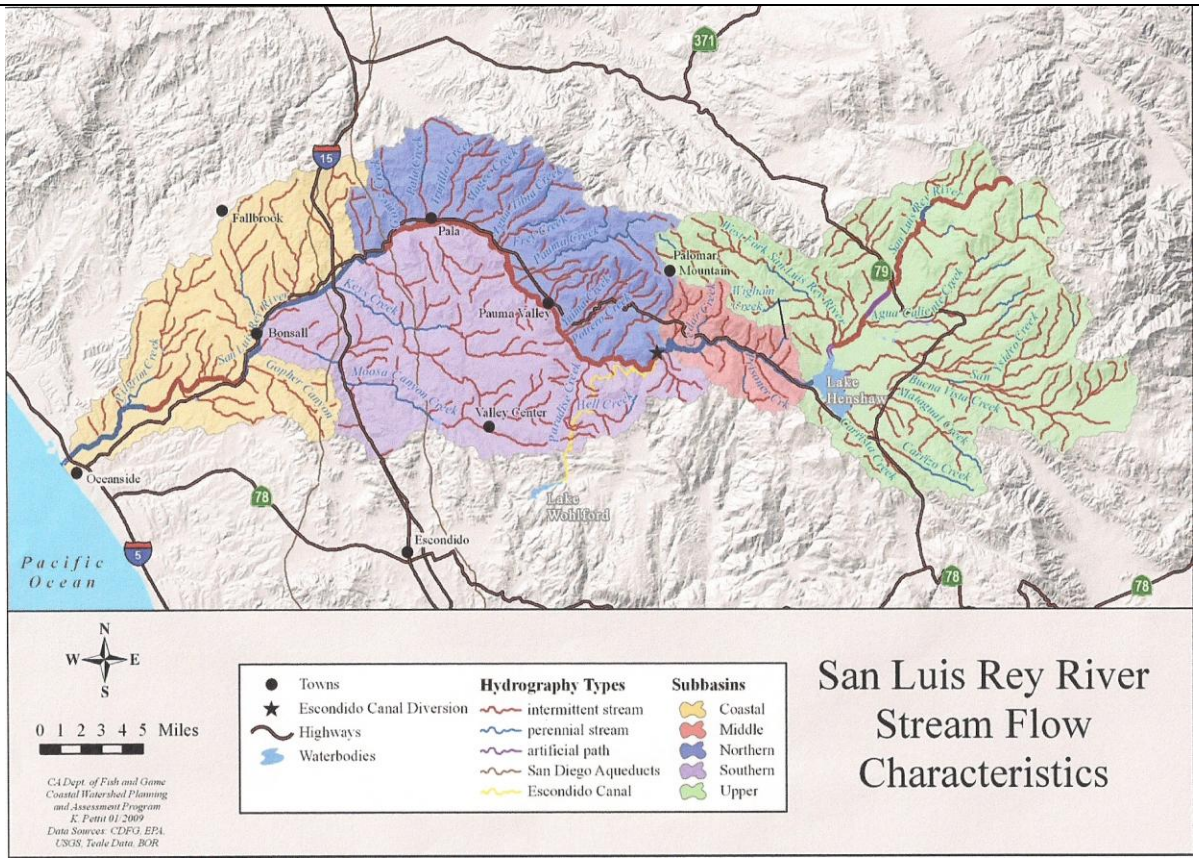

Figure 1B:. San Luis Rey River stream flow characteristics showing perennial and dry regions of the main stem and location of Lake Henshaw and Escondido Diversion Canal. From Downie and Kajtaniak (2010) San Luis Rey River Watershed Assessment, Basin Profile section, pg. 11.

In the San Luis Rey River, as in many other Southern California rivers and streams, a principal limiting factor to steelhead restoration is reduced instream water flow. Low water flow disrupts passage of fish through partial migration barriers, reduces the quantity and quality of dry season rearing habitat, and exacerbates problems of water quality. Increased concentrations of

salt, total dissolved solids (TDS), sediments, and nutrients such as phosphates and nitrates due to low water flow correlate with decreased gravels for spawning and reduced dissolved oxygen levels, a key factor in steelhead viability. In our trips to assess water quality, we have been struck by fact that even in low water flows, the characteristics of the water are nearly at the level needed for steelhead reproduction. Defects of water quality and water quantity, which are recognized as threats to steelhead recovery, can be reduced or eliminated by increasing water flow and implementing better management practices in agriculture and urban uses.

Feasibility of higher instream flows.

The San Luis Rey River is a Core 1 priority river despite the fact that much of the water is presently diverted to urban and rural interests in the adjacent Escondido Creek watershed. The diversion effectively dewaters the riverbed for 20 miles downstream, except for a three mile stretch at approximately river mile 36.5 to 39.5. Thus, this stretch of river is predominantly dry for most of the year, except after major rain events. Before the diversion was built, the river in this stretch ran perennially, sustained vigorous riparian habitat, and supported a steelhead run. The Escondido Canal diversion, operated by the Vista Irrigation District, carries almost all of water from the upper reaches of the river away to Lake Wohlford in the adjacent Escondido Creek drainage.

The presence of the diversion and of other existing users of water raises the question of whether water flows needed by steelhead can ever be realized in the river. The answer has three parts: the quantity needed by steelhead, the total available quantity, and water rights issues. The first two issues are considered here, in which we ask whether increased flows are feasible in a technical sense. We approach the feasibility question with caution because hydrology is complicated and the water law of California can produce anomalous incentives for water users. Nevertheless, a rough calculation shows that the water needed for steelhead recovery is at most a small part of the water budget of the San Luis Rey and its diverters. We start by considering the needed water and continue by considering the sources.

The needed flows can be estimated using the historical flows that supported steelhead. As reported in the SLR Watershed Assessment, data from 1912 to 1922 at the site of the present Henshaw dam, the upstream end of the area that is now of interest in steelhead recovery, show

monthly minimums of 1.4 cubic feet per second (CFS) in summer and 8 CFS in winter[9]. Average flows were greater in winter, some months reaching a monthly average of 240 CFS. This analysis focuses on the minimums. The 1.4 CFS at the dam site is similar to measurements taken 25 miles downstream at Wilderness Gardens, near Pala (see Figure 1), in the now-dry stretch of the river. Minimum summer flows measured from 1909 to 1915 in that location were 1.5 CFS[10], suggesting that water from the upstream site was not entirely lost into the ground, and supporting historical accounts of extensive riparian habitat in that area. Based on other research described in the SLR Watershed Assessment, it is unquestionable that the San Luis Rey was perennial and that steelhead entered, spawned, grew, and exited from the river in that era[11].

For purposes of the present rough calculations, let the standard for nine months of the year be a minimum flow of 1.5 CFS at Wilderness Gardens. Allowing for fifty percent losses to wells and minor diversions, this translates to 3 CFS *at the diversion*. During the three winter months the minimum would be 8 CFS *at the diversion*. Averaged over the year, that works out to $.25 \bullet 8 + .75 \bullet 3 = 4.25$ CFS.

The supply side of the water budget starts with groundwater. In the best available estimate, water availability as natural safe yield for San Luis Rey is 32,400 to 35,400 acre-feet/year (AFY), of which we focus on the midpoint, 33,900 AFY[12]. Add to that the 16,000 AFY contributed by the supplemental Colorado River water to the Native American Bands in the San Luis Rey from the amended Settlement Act of 2000. That brings the total of water in the budget to 49,900 AFY.

To complete the comparison of resources and requirements, a flow of one CFS over a year is 723.97 acre-feet. The required flow of 4.25 CFS is then equivalent to 3076.86 AFY. This amount is 6.2 % of the total water budget. A further consideration is that the water used to maintain instream flows would benefit other water users. Irrigators and consumers along the course of the river would inevitably get some benefits and the city of Oceanside would receive substantial benefits in its effort to improve water quality and counteract salt water intrusion into the water table. Given that TDS levels are an important consideration in watershed management,

[9] Downie, S.T. and D. Kajtaniak. 2010. San Luis Rey River Watershed Assessment; Basin Profile section p. 12.
[10] Ibid. pgs. 12 and 14.
[11] Assessment, Basin Overview, pp. 51, 57, and Northern Subbasin, p. 16.
[12] San Diego Groundwater Basin Report, Chapter IV (2007), http://www.mwdh2o.com/mwdh2o/pages/yourwater/supply/groundwater/PDFs/SanDiegoCountyBasins/SanDiegoCountyOverview.pdf.

and that the San Luis Rey has been listed as a 303(d) impaired water body since 2002 due to exceeding the TDS Basin Plan Objectives, better management practices and increased water flow through the San Luis Rey are desirable from both a biological and an economic perspective. In summary, the water needed for steelhead restoration is about 6 percent of the water budget of the San Luis Rey watershed, a figure neither overwhelming nor impossible to contemplate in itself, and one that leaves out of account a significant range of benefits for watershed residents.

Water that would be in the San Luis Rey now flows to two water companies that are operators of the diversion and other facilities constituting the Escondido Water Project. At an operational level, water from the river is 18% or 19% of total water deployed by the two companies, a relatively small percentage of their overall water demand. The main supplier of water to these entities is the California Water Project. Modest decreases in water from the San Luis Rey could be recovered, wholly or in part, by bringing on line the unused capacity for water reclamation in the City of Escondido, or in many other ways.

Barriers to steelhead passage

Physical barriers to fish passage are a second major obstacle to steelhead recovery. Barriers can fragment fish populations and prevent access to suitable spawning sites upstream. Partial barriers preclude fish passage at normal water levels and are usually culverts, dirt road crossings, or large boulders buttressing overhead bridges. Complete barriers preclude fish passage even under high water flow, and are generally man-made concrete structures associated with major road arteries or dams, or large boulders and natural waterfalls in the riverbed. The San Luis Rey River is fortunate in this regard, having relatively few complete barriers, mostly in the upper sections of the river and tributaries, and some minor partial barriers in the lower main stem.

For instance, the first partial barrier is located about six miles upstream at the Douglas Bridge crossing in Oceanside. This barrier consists of a large collection of boulders across the riverbed below the bridge, and is navigable to fish during higher flows in winter at a time they would be utilizing the river for migration (see Figure 2). It is impassable during low water flow, and rearranging the boulders would be a matter of a few hours or days with standard earth-moving equipment. Of the 25 barriers documented in the SLR Watershed Assessment below

Lake Henshaw in the main stem[13], eleven are partial barriers which could be modified at relatively low cost. Two additional partial barriers of concern are the Cole Grade Road crossing at river mile at 30.6 and the Pauma Valley Country Club river channelization at river mile 32.7 that would make fish passage difficult under low and moderate water flow conditions.

Figure 2. San Luis Rey River at Douglas Bridge crossing six miles upstream of river mouth in Oceeanside
Low flow (partial barrier to fish passage, July 2008; left panel);
Medium flow (March 2008; middle panel;
High flow (January 2010; right panel)

The barrier of greatest significance in terms of access to spawning grounds and rearing habitat is a bridge on Highway 76 over Pauma Creek. This tributary currently sustains a healthy and substantial rainbow trout population, demonstrating its value as trout habitat. Stream reaches that can support the resident form of *O. mykiss* (rainbow trout) year round are also generally suitable for the anadromous form of *O. mykiss* (steelhead) if the fish have access to and from the ocean. The bridge at the lower end of Pauma Creek as it crosses Hwy 76 precludes passage of fish upstream even in exceptionally rainy years, and modifying it would open access for the steelhead to excellent spawning and rearing habitat. Removal coupled with increased flow in the main stem would dramatically improve the prospects for steelhead recovery.

Current river conditions

Water quality

Increased water quantity and improved water quality are related aspects of long-term steelhead survival. Increased flows promote hydro connectivity, create deeper pools, flush out sediment, increase dissolved oxygen, reduce TDS levels, and support a healthy vegetation mix, all of which will positively impact overall steelhead habitat. Data from ongoing water chemistry analysis at

[13] Downie, S.T. and D. Kajtaniak. 2010. San Luis Rey River Watershed Assessment. Coastal Watershed Planning and Assessment Program. Department of Fish and Game. Basin Profile section, p. 65-67.

multiple sites in the San Luis Rey River by the City of Oceanside and County of San Diego as part of the SLR Watershed Urban Run-off Management Program[14], and by the Trout Unlimited-San Diego Chapter[15], shows that the water quality parameters of primary concern are salinity, TDS and especially in summer and fall, levels of dissolved oxygen.

Water temperature

Continuous water temperature data logging in the San Luis Rey demonstrates that even now, water temperature in the main stem and tributaries of the San Luis Rey is not prohibitive for steelhead survival. Water temperature loggers deployed in 2008 and 2009 by the Trout Unlimited – San Diego Chapter at seven dispersed sites recorded water temperature hourly each day for months spanning April through October. Data from these devices showed that water temperatures are generally below 25°C even during summer months[16]. This upper limit of water temperature is consistent with data from Spina et al.[17] who found that juvenile steelhead in Southern California streams maintained normal behavior at temperatures ranging from 17.4°C to 24.8°C, well above temperatures at which steelhead are viable in Northern California[18].

Non-native vegetation

The Army Corps of Engineers has undertaken an eight-year San Luis Rey Flood Control Project to remove the extensive spread of the non-native plant *Arundo donax* in the lower seven miles of the River (see Figure 3). *Arundo* removal will increase flows of ground and surface water and improve riparian habitat in part because *Arundo* consumes about three times as much water as native vegetation.[19] Improved riparian habitat confers additional benefits of increased bank stabilization, increased groundwater storage during rains, enhanced filtration of urban

[14] San Luis Rey Watershed Urban Runoff Management Program Reports (2008, 2006, 2003). Prepared by City of Oceanside, City of Vista, County of San Diego for California Regional Water Quality Control Board. On-line access at http://www.projectcleanwater.org/pdf/wurmp/slr_wurmp_2008.pdf
[15] Trout Unlimited – San Diego Chapter, San Luis Rey Water Quality Interim Report, online access at www.goldenstateflycasters.org, conservation section; data on pp. 20-37, discussion on pp. 85-94.
[16] Ibid. data pp. 45-67; discussion pp. 85-88.
[17] Spina, A. (2007) Thermal ecology of juvenile steelhead in a warm-water environment. *Environ Biol Fish* **80** (1) p. 23-34.
[18] Preliminary Draft Environmental Assessment (APDEA) (2007) FERC Project Nos. 2085, 2175, 67 and 120. "Attachment 1: Trout Temperature Requirements (Literature Review); Prepared by the S. California Edison Co.
[19] Ibid. Basin Profile section, p. 31.

runoff contaminants, and restoration of a single river channel conformation, all factors encouraging to the interests of steelhead.

Figure 3. San Luis Rey River at Murray Bridge/College Avenue in Oceanside; 8 mi upstream of river mouth

Upper panels: low flow conditions showing effect of *Arundo donax* removal; May 2007
Left upper panel, looking downstream from bridge, before *Arundo* and non-native vegetation removal;
Right upper panel, looking upstream from bridge, after recently removed *Arundo*

Lower panels: high flow conditions showing longer term effect of channel integrity upon *Arundo* removal at Murray Bridge; January 2010
Left lower panel: looking downstream from bridge
Right lower panel: looking upstream from bridge after *Arundo* removal (almost 3 yrs post removal)

Water flow measurement

A central issue in determining water flow is adequate measurement at key points in the San Luis Rey River. There is currently only one continuously functioning water flow gauge on the river, located near its entry into the ocean at the City of Oceanside. Multiple stakeholders would benefit from an earnest effort to quantify river flow by expanded monitoring. This could be done by placing at least two real-time sensors at strategic and publicly inaccessible locations

(e.g. below where Pauma Creek enters the San Luis Rey, and downstream of the proposed Gregory Landfill site) to record water flow rate and select water quality parameters. The value of such a sensing system is exemplified by the REMOT sensing system in the adjacent Santa Margarita River, which is operated by the Santa Margarita Ecological Reserve and San Diego State University, and supported by NOAA and the UCSD Supercomputing Center. The REMOT system relays water quantity and quality via satellite in real time, reflecting the technical capabilities of the 21st century.

Other projects as models for success

Increasing water flow and modification of barriers are reasonable actions that can be undertaken in the San Luis Rey River to meet the objectives of steelhead recovery efforts. Increasing steelhead numbers in the San Luis Rey also benefits nearby watersheds designated as critical habitat in the San Juan Hydrologic Unit primarily in Orange County, containing San Juan Creek, Trabuco Creek and San Mateo Creek. A draft Steelhead Recovery Plan for San Juan and Trabuco Creek watersheds has been prepared by the environmental consulting firm CDM in collaboration with the Trout Unlimited-South Coast Chapter, and a substantial fish passage project is underway near the mouth of Trabuco Creek to increase access to upstream spawning and rearing areas.

Conservation interests have had some notable successes in negotiating increased instream flows. Recovery of spawning habitat for the cutthroat trout in the headwaters of the North Fork of the Blackfoot River in Montana involved donation of capital improvements to privately-owned irrigation facilities, creative leasing of water for the trout, and pride in ownership by landowners that outweighed their wariness of outside interference.[20] The Klamath Basin Restoration Agreement in Northern California is a well known recent example of progress in protecting salmon and steelhead through complex agreements that balance of needs of many -- in this case more than 28 -- interested parties including tribal representatives, cities and counties, environmentalists, fishermen, farmers, and other private interests.[21] The case of the Carmel River in Northern California shows that success is still possible when steelhead numbers are severely depleted. In the early 1990's adult steelhead populations dropped to a handful and then

[20] Blackfoot River Water Lease Agreement at http://www.perc.org/articles/article886.php
[21] Klamath Basin Restoration Agreement Summary at http://www.edsheets.com/Klamathdocs.html

rebounded when water conditions were improved, achieving 400-800 spawning adults since 1997 and stabilizing after the upward trend during the recovery stage[22].

Conclusion

Restoring steelhead runs in the San Luis Rey River depends mainly on restoring instream flows in the reach from the diversion to a point twenty miles downstream where the river is today perennial. Restoration is feasible in the sense that it will not require the dissolution of any businesses or communities, and perhaps will not even increase the price of water to current users. Additionally, modification of fish passage barriers is needed to facilitate the movement of adult and juvenile steelhead. A critical question is whether the needed streamflows can be negotiated through some combination of persuasion, negotiation, regulatory mandate and outright purchase. Water quality at the moment is already suitable or close to suitable for steelhead in some parts of the river, and additional year-round stream flows are expected to yield notable improvements in water quality. The beneficiaries of increased instream flows include the communities and farms through which the river flows, the agencies with a stake in improving water quality, and future residents of the San Luis Rey River.

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[22] Monterey Peninsula Water Management District & Carmel River Watershed Conservancy (2004) Environmental and Biological Assessment of Portions of the Carmel River Watershed, Monterey County, California. Executive Summary, p. 4 at http://www.mpwmd.dst.ca.us/programs/river/watershed_assessment/Summary.pdf