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Middle Subbasin

The Middle Subbasin is the smallest of the subbasins, occupying twenty-six square miles. The watershed area is bracketed by the Escondido Canal diversion dam on the western side (the diversion is just downstream of the downstream subbasin boundary) and the Henshaw Dam on the eastern end (Figure 2). This subbasin includes the SLR River from RM 41, just upstream of the diversion, and all of its tributaries upstream to RM 50, Henshaw Dam. Stream elevations range from 1,700 feet in the western portion of the SLR River to approximately 5,000 feet in the headwaters of tributaries draining the eastern portion of Palomar Mountain. The elevation of the river at the base of the dam is approximately 2,700 feet. In general, precipitation increases in the higher elevations of the subbasin. Average yearly rainfall at Henshaw Dam is approximately 26 inches (based on data collected from 1948 to 2006) (http://www.wrcc.dri.edu/).

The Middle Subbasin assessment area is rural with no concentrated housing communities. It is predominantly composed of native habitats consisting of mixed sagebrush/chaparral in the lower elevations and hardwood forest/woodlands in the higher elevations. Ownership is split almost evenly between private ownership, La Jolla Band of Luiseño Indians Reservation, and US Forest Service (Cleveland National Forest). The western portion of the subbasin was greatly impacted by the 2007 Poomacha Fire as over 9,000 acres (90%) of the La Jolla Indian Reservation was burned, including the loss of 55 homes and displacement of 180 tribal members (http://www.lajollaindians.com/).

Prior to the completion of Henshaw Dam, the SLR River at the dam site was a perennially flowing river. According to historic USGS stream gauge data recorded from 1912 to 1922 at the present dam site, the river maintained minimum monthly summer flows of 1.4 cfs, while minimum monthly winter and spring flows averaged above 8 cfs (see Figure 5, p.11). Former California CDFG biologist, Gary Shaw, speculated that the river below the dam site "supported a minimum trout fishery" (Jones and Stokes Associates, Inc. 1976). Moreover, trout were first documented in the Upper Subbasin, headwaters of the SLR River as early as 1862 (Cooper 1874). This written documentation was well before the introduction of hatchery raised fish, indicating the movement of steelhead trout through the Middle Subbasin. Currently, the Escondido Canal diversion dam (RM 40) prevents passage into the Middle Subbasin. Additionally, a waterfall in the SLR River canyon (RM 39.5) and multiple partial fish passage barriers would also restrict steelhead from accessing the potentially suitable spawning and rearing habitat found in the Middle Subbasin.

Fish passage into the subbasin is only one of several problematic issues concerning the possibility of steelhead/trout successfully utilizing the Middle Subbasin. Water releases from the Henshaw Dam may not coincide with the freshwater life cycle stages of steelhead trout. The amount and timing of water releases by Henshaw Dam are based on water right agreements with the La Jolla Indians and the Rincon Band of Mission Indians, precipitation totals, as well as water supply needs of the City of Escondido. Altered hydraulic processes, poor to moderate instream habitat conditions, and numerous, exotic, predatory game fish all contribute to less than ideal conditions for steelhead trout production.

Rainbow trout were once stocked in the SLR River just downstream of Lake Henshaw and within the La Jolla Indian Reservation to accommodate a popular demand for recreational sport fishing opportunities in the region. The stocking of trout has ceased in recent years due to drought-like conditions and because of concerns of stocked rainbow trout competition and possible predation of the federally listed arroyo toad, *Bufo californicus.* No progeny from these trout were observed during CDFG 2007 electro-fishing sampling or while performing the habitat inventory in the upper five miles of the SLR River.

Hydrology

The Middle Subbasin comprises the La Jolla Amago CalWater Unit (Table 1). There are four named tributaries and a few named canyons (Figure 2) containing 41.0 permanent and intermittent stream miles in this subbasin. The vast majority of these tributaries are intermittent streams. The largest of the tributaries is Lusardi Canyon. Although this is a blue-line stream on USGS 7.5 Palomar Observatory and Mesa Grande quadrangles, in actuality, it is an intermittent stream with a small section of perennial flow. This discrepancy between what is delineated on quadrangle maps to current, typical stream flow conditions also applies to the other named tributaries in the subbasin. Wigham Creek and Cedar Creek are labeled as blue-line streams, but only contain year-round surface flows in portions of the creek. Nonetheless, these streams play an important role in maintaining or increasing surface flows in the mainstem.

While the Middle Subbasin does receive more precipitation than the Coastal and Southern subbasins, portions of the SLR River mainstem go dry in the summer unless flows are supplemented by water releases from the Henshaw Dam. Water releases, controlled by Vista Irrigation District (VID), can vary year to year, but typically occur in the spring and continue through mid to late summer. The amount of the release is usually dependent on the rainfall totals and amount of water stored in Lake Henshaw. In 2007, 24 cfs was released on April 27 and continued through late July (personal communication, Don Smith). Numerous wells, located throughout the subbasin as well as surface diversions provide water for anthropogenic uses. These wells and surface diversions reduce surface flow in the tributaries as well as in the mainstem and could lower the groundwater table. Tributary drainage areas within the subbasin range from less than one square mile (unnamed stream) to as large as the 26.5 square mile drainage area of the SLR River.

Table 1. Major streams in the Middle Subbasin.

Stream	Tributary to	River Mile	Drainage Area (square miles)	Stream Order	Permanent (miles) (in Subbasin)	Intermittent (miles)
SLR River	Pacific Ocean	40	26.45	2	10.0	0.0
Cedar Creek*	SLR River	42.5	2.96	Intermittent (1)	1.5	2.4
Lusardi Canyon*	SLR River	45	4.02	Intermittent (1)	0.9	3.5
Prisoner Creek*	SLR River	46	1.51	Intermittent	0.0	2.8
Wigham Creek*	SLR River	46.8	1.50	Intermittent (1)	1.2	0.4

* A portion of these creeks retains perennial flows during normal rain years with Cedar Creek generally containing the longest stream area with perennial flows.

Figure 1. Middle Subbasin from Henshaw Dam looking west.

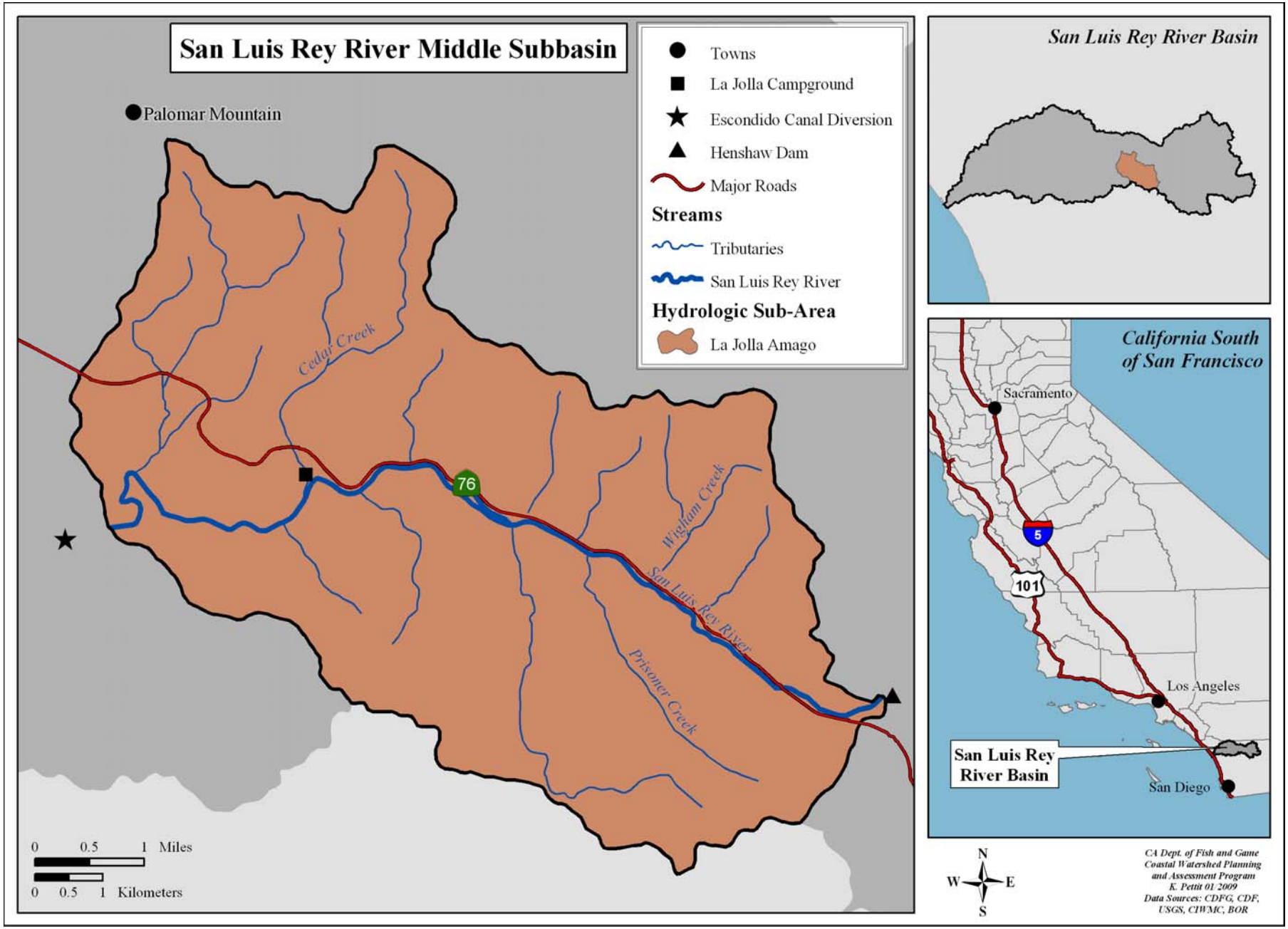


Figure 2. Middle Subbasin locator map and CalWater Unit.

Geology

During the Mesozoic Era the Farallon (oceanic) plate was subducting under the North American (continental) Plate. As the Farallon plate was plunged into the upper mantle it heated to the point where it began to melt. Some of this melt was lighter than the surrounding material and began to migrate upwards through the upper mantle and into the continental crust above it. As this magma reached the upper portion of the crust it intruded into sediments that had washed off of North America and it began to cool and crystallize. The heat of the magma, the thickness and pressure of the sediments, and compression generated by plate tectonics caused metamorphism forming metasedimentary rocks surrounding the magma that was slowly crystallizing into granite. The crystallizing mass of proto-granite was so vast that it underlaid most of what is now southern California. Massive intrusive igneous bodies of this size are classified as batholiths (bathos = depth, lithos = rock). This particular batholith is known as the Peninsular Range Batholith. Uplift of this region then brought the sedimentary rocks and portions of the buried batholith above sea level. Erosion occurring over millions of years gradually stripped most of the sedimentary rocks off of the batholith exposing the granitic mountains that we see today in this region. The Middle Subbasin is almost completely composed by these granitic rock types and in places has preserved remnants of the sedimentary rocks into which they intrude.

Weathering and erosion of these rock types has and is producing alluvium which is transported downstream or temporally stored in river terrace deposits and floodplains within this subbasin.

Compositional Overview

Rock Types

Mesozoic Granitic

Granitic rocks make up the majority of this subbasin. They occupy approximately 90% of its surface area. They are predominantly Cretaceous (154.5 million through 65.5 million years ago) in age. These rocks are very hard and resistant to erosion, however, they do tend to exfoliate to some extent in exposed surfaces and preferentially weather at structural joints. Over long periods of time granitic rocks tend to weather and become "soft" reducing their density, increasing their porosity, and making them much less resistant to erosion producing "decomposed granite." In more advanced forms, the minerals within the granite disaggregate and form "Arkosic Sand," which is highly susceptible to erosion, sliding, and fluvial transport.

Mesozoic Sedimentary

Mesozoic sedimentary rocks make up around 10% of the subbasin and consist mostly of siltstone, sandstone, and conglomerate and were deposited some 65.5 to 225 million years ago. The original deposition of the sediments that make up these rock types occurred in environments ranging from marine to terrestrial. Some of these rock types have subsequently undergone metamorphism especially in areas in contact with granitic rock types. These sedimentary rock types are generally more susceptible to erosion than granitic rock types.

Quaternary Alluvium

Alluvium covers less than 1% of the basin. It consists of unconsolidated sediments that range from clay to boulders. Alluvium is transported and deposited by the streams and makes up most of the bed and banks of the streams. Units of alluvium delineated by the geology map (Table 2) include sediment currently being acted upon by the streams and bank and flood-plain deposits occasionally acted upon by the streams. If the alluvium within the stream channel is of sufficient depth it can readily transport water via the subsurface pore-spaces allowing stretches of the stream to "run dry."

Table 2. Rock types in the Middle Subbasin.

Lithologic Unit	% Basin
Mesozoic Granitic	89.94
Mesozoic Sedimentary	9.61
Quaternary Alluvium	.07

Percent area of basin represents a rough approximation based on GIS mapping.

Soils

The underlying bedrock is generally responsible for a soil's texture and erodability characteristics. The sediment contribution from soils found in the Middle Subbasin are dependent largely on slope, soil sediment size, consolidation, cohesion, compaction, the type and amount of vegetation cover, land use, and amount, intensity, and duration of local rainfall.

The majority of bedrock throughout the subbasin is composed of various granitic rock types producing associated soil types that are generally very well drained and is somewhat prone to erosion and transport by fluvial processes as well as wind. Soils with high sand and silt content are typically more susceptible to erosion than soils with high clay content which exhibit a greater degree of cohesion.

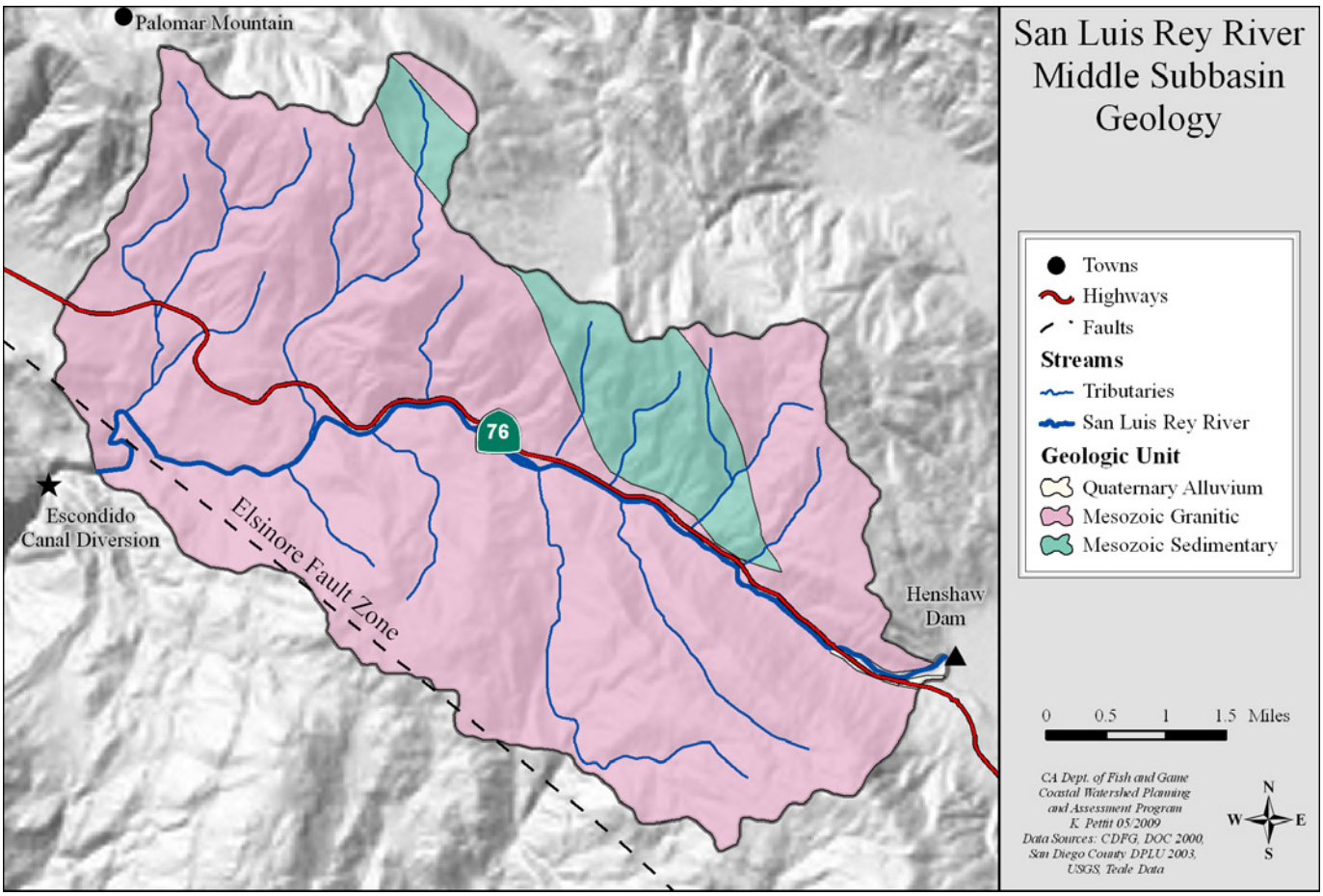


Figure 3. Geology of the Middle Subbasin.

Table 3. Soil types in the Middle Subbasin.

Soil Type	% of Upper Subbasin	Parent material
Hotaw-Crouch-Boomer (s1015)	63.23	weathered granite/metavolcanic
Tollhouse-Rock outcrop-La Posta	36.36	weathered granite/igneous
Tujunga-Salinas-Elder (s1001)	.41	weathered granite/sandstone-shale

Percent area of basin represents a rough approximation based on GIS mapping

Landslides

Like the other SLR River subbasins, the Middle Subbasin is partially mantled with unstable soils. Alluvial material is generally confined to the mainstem while the hillsides are often composed of granite, weathered granite, and sedimentary rock. Except for fresh granite, these rock types are susceptible to surface erosion, headward erosion, gullying, stream bank raveling, and landsliding. This area has undergone tectonic uplift leaving steep canyon walls above the streams. As tectonic forces push the land up gravity tries to pull it down and the result is usually landslides and rock falls. Landsliding is further exacerbated by seasonal rain storms. As the hillsides become saturated, pore pressure between grains becomes greater making them unstable and more prone to landsliding. These conditions can be exacerbated by moderate to extreme wildfires.

Earthquakes and Faults

The whole of the San Luis Rey River Basin is tectonically and seismically active, and the possibility of seismic activity occurring in this subbasin is similar to the entire southern California region. Due to active faults within this subbasin, such as the Elsinore Fault, as well as ones in close proximity, the subbasin has the potential for strong seismic movement. The Elsinore Fault Zone (currently established Alquist-Priolo Earthquake Fault Zone) runs northwest and cuts through the southwestern portion of this subbasin. The Elsinore Fault is one of the largest right-lateral strike-slip faults in southern California. It is related to translational plate boundary tectonics between the Pacific and North American plates. Although this fault has been one of the quietest in historic times, it is capable of producing earthquakes in the range of magnitude (M) 6.5 – 7.5. It has an average recurrence interval of approximately 250

years (http://www.data.scec.org/fault_index/elsfault.html). The southeastern extension of the Elsinore Fault Zone, the Laguna Salada Fault, located south of Interstate 8, ruptured in 1892 in a M 7 quake, but the main trace of the Elsinore Fault Zone has only seen one historical event greater than M 5.2. This was the area's earthquake of 1910, a M 6 shock near Temescal Valley, which produced no known surface rupture and did little damage (http://www.data.scec.org/fault_index/elsfault.html). Strong ground shaking generated by earthquakes can trigger rock falls and landslides that deliver large amounts of sediment to the streams. The 1994, Northridge earthquake (M 6.7) triggered an excess of 11,000 landslides in a 6,200 square mile area (USGS) in similar terrain.

Other than being able to trigger landslides, strike-slip faults can weaken bedrock, offset streams, and truncate and oversteepen certain topographic landforms thus enhancing erosion and transport of sediment to the streams. Due to the presence of these faults and potential for seismic activity, the California Division of Dam Safety in 1971 declared the Henshaw facility (dam) prone to failure and VID was required to permanently reduce the lake's capacity from 200,000 acre-feet to 50,000 acre-feet (Babbitt 1993).

The occurrence and movement of groundwater in the subbasin is also significantly tied to the occurrence of the Elsinore Fault Zone and adjacent joint systems. Groundwater aquifers on the La Jolla Indian Reservation are primarily found in fractured bedrock (Tierra Environmental Services 2006).

Wildfires

Wildfire can and frequently will increase the erodability of a region. As a fire moves through an area it is capable of burning off the duff layer that effectively armors the soil. It can also intensively dry the soil as well as destroy organic matter that helps to bind the soil together, leaving behind a loose, "hydrophobic" soil in its wake. During subsequent rain storms the soil's capacity to absorb water is greatly reduced and surface flows are proportionally increased. Wildfires can destroy woody debris strewn on hill slopes allowing for less resistance to the erosive power of surface runoff transporting increased amounts of sediment downstream. The propensity for debris flows is also increased following a wildfire on steep slopes which can block drainageways, destroy structures, strip vegetation, and deliver great amounts of sediment to the streams (Cannon et. al. 2004). Relatively hot fires may cause thermal expansion of individual minerals within the rock causing fracturing of its surface layers leading to enhanced erosion. Post-fire erosion potential has been estimated as moderate to high (Basin Profile, Table 5) for most of this subbasin (USGS). See Basin Profile, Fire History and Management (pp. 35-39) for a more detailed discussion.

The 2007 Poomacha Fire, which began in late October and continued until early November burned a large portion of the western Middle Subbasin, including 92% of the La Jolla Indian Reservation (http://www.wildfirelessons.net/Additional.aspx?Page=135) (Basin Profile, Figure 13). Within this subbasin the fire burned at a moderate to high level on the soil burn severity scale (State of California 2007); thus, when a major storm event hit the area in late November/early December of 2007, releasing large amounts of precipitation, many of these erosion potentials became a reality. Debris flows occurred in some of the tributaries to the SLR River, particularly those that flowed out of the Palomar Mountain region, which received the greatest rainfall totals and contain the watershed's highest post-fire erosion potential. See Basin Profile, Fire History and Management (pp.35-39) for further information concerning the Poomacha Fire.

Fluvial Geomorphology

The Middle Subbasin consists of a portion of the SLR River and its contributing tributaries between Henshaw Dam and the Escondido Canal diversion dam. On average this subbasin should act as both a sediment transport reach, delivering sediments to the lower basins, and a depositional reach, storing sediments in its floodplain. Because of the timing and amount of water released through the Henshaw Dam, this is not always the case. The slope of the mainstem was calculated to be 5% or less based on GIS mapping (Basin Profile, Figure 14). Sediment erodes from the steeper hillsides and is brought by tributaries to the mainstem.

The 2007 CDFG stream habitat inventories in the Middle Subbasin were limited to the upper half of the SLR River (above the La Jolla Indian Reservation). This survey area included approximately five miles of the river, which were divided into five reaches consisting of four 'B' and one 'C' Rosgen channel types (Table 4). Type B channel types are defined as moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools. The banks are usually stable (canyon walls) as well as the plan and profile. They have a moderate relief with moderate sinuosities and stable stream banks (Flosi, et al. 1998). Type C channels are characterized as being low gradient, meandering, point-bar, riffle/pool, alluvial channels with broad, well defined floodplains. This reach was the final reach leading up to Henshaw Dam and consisted of a predominantly dry channel.

Based on observed fish passage barriers and/or stream habitat conditions at the time of the survey, it seemed unlikely that other streams within the subbasin would be utilized by steelhead/trout; therefore, full habitat inventory protocols were not performed.

Table 4. Channel types in surveyed stream, Middle Subbasin.

Stream	Reach	Length (feet)	Channel Type
SLR River	1	14,429	B3
SLR River	2	764	B4
SLR River	3	1,370	B2
SLR River	4	6,079	B4
SLR River	5	3,202	C5

Reaches listed from west to east

Vegetation

Overall, the Middle Subbasin has remained relatively undisturbed as a majority of the land is still considered native habitat. The predominant vegetation cover type as described by the USFS CALVEG data is mixed sagebrush/chaparral, covering 53.97% of the Middle Subbasin (Figure 4 & Table 5). This cover type is primarily composed of the lower montane mixed chaparral vegetation type. Hardwood forest/woodland was the second most abundant cover type at 27.42%. These forest/woodlands consisted primarily of a variety of oak species, such as coast live oaks, canyon live oak, black oaks, and Engelmann oaks and were generally located in the mid to upper elevations or along drainages within the subbasin. Although, numerous oaks are also found on lower elevations within the La Jolla Indian Reservation. The Middle Subbasin contains the greatest percentage of hardwood forest/woodland (based on each subbasin's acre totals) out of the five subbasins. The remaining cover types composed a significantly smaller portion of the subbasin. Mixed conifer/woodland and herbaceous cover types each compose approximately 6% of the land in the subbasin. The herbaceous cover type is almost entirely made up of annual grass/forb alliance vegetation type. A portion of these acres are utilized for livestock grazing.

There is no significant urban/residential area in the Middle Subbasin. The majority of the residents are either La Jolla Indian tribal members or private residents on larger plots of land. With almost two-thirds of the Middle Subbasin being under ownership of Native Americans or the USFS, there is minimum potential of rapid expansion of residential or commercial development. There is also little agriculture, less than 1% of the total land in the subbasin, compared to the other subbasins. When considering land that has been designated as "herbaceous," this figure may rise slightly to account for acres developed for livestock grazing.

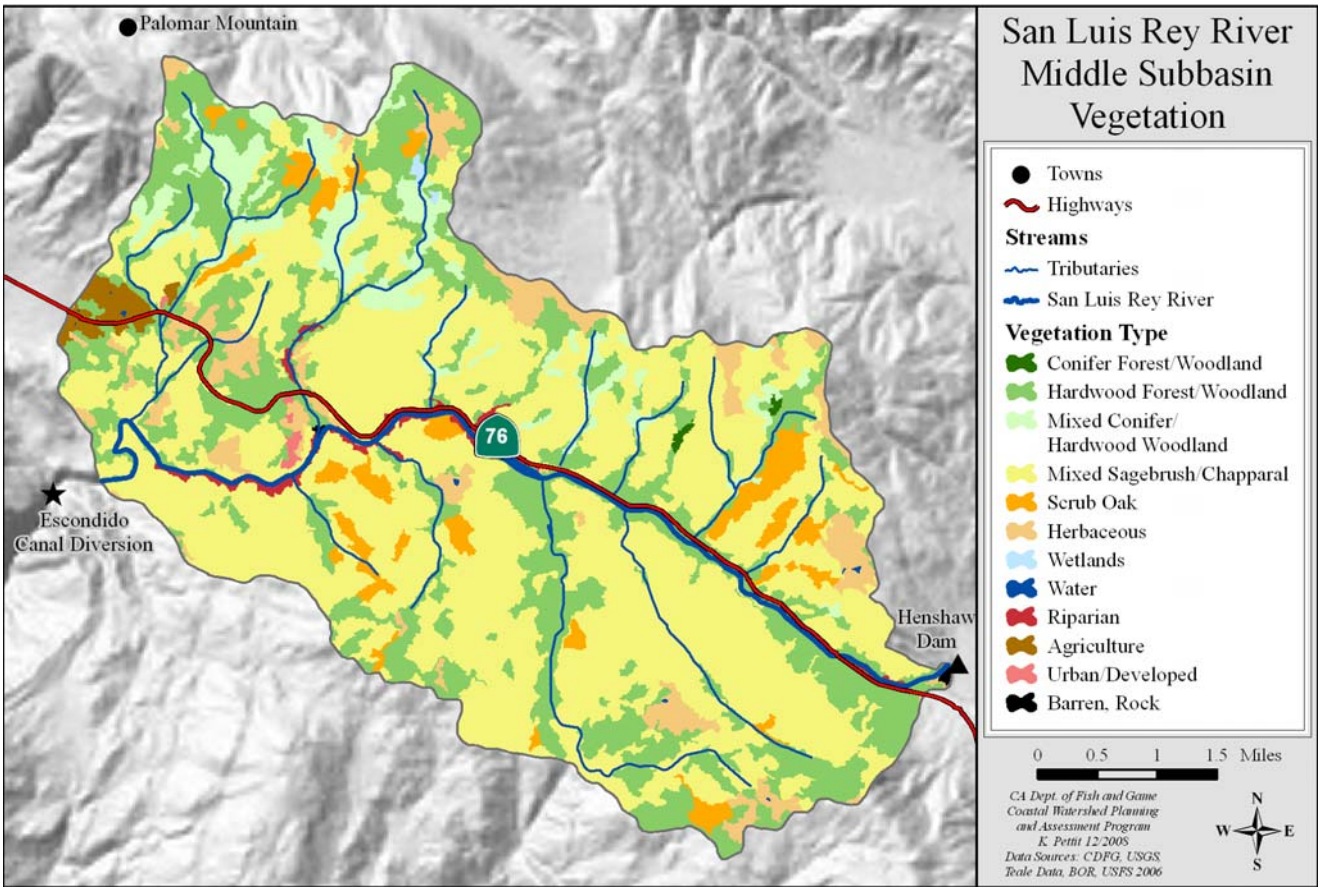


Figure 4. Vegetation of the Middle Subbasin.

Table 5. Vegetation of the Middle Subbasin.

Vegetative Cover Type	Percent of Basin	Primary Vegetation Type	Percent of Cover Type
Mixed Sagebrush/Chaparral	53.97	Basin Sagebrush	0.2
		Buckwheat	0
		California Sagebrush	4.1
		Ceanothus/Mixed Chaparral	0
		Chamise	11.8
		Lower Montane Mixed Chaparral	81.3
		Manzanita Chaparral	0
		Upper Montane Mixed Chaparral	2.4
		Southern Mixed Chaparral	0
		Other	0.1
Hardwood Forest/Woodland	27.42	Black Oak	15.5
		California Sycamore	0
		Canyon Live Oak	14.8
		Coast Live Oak	58.2
		Engelmann Oak	11.5
		Eucalyptus	0
		Interior Mixed Hardwood	0
		Non-native/Ornamental Hardwood	0
Mixed Conifer/Woodland	5.86	Bigcone Douglas - Fir	54.4
		Coulter Pine	25.4
		Mixed Conifer - Pine	0
		White Fir	20.2
		Nurseries	0
Herbaceous	5.82	Annual Grasses/Forb Alliance	97.3
		Non-Native/Ornamental Grass	0
		Perennial Grassses and Forbs	2.7
Scrub Oak	4.22	Scrub Oak	100
Riparian	1.27	Baccharis (Riparian)	0
		Fremont Cottonwood	0
		Riparian Mixed Hardwood	100
		Riparian Mixed Shrub	0
		Willow (Shrub)	0
Agriculture	0.91	Agriculture	100
		Orchard Agriculture	0
		Pastures and Crop Agriculture	0
Urban/Developed	0.16	Urban/Developed	100
Conifer Forest/Woodland	0.12	Bigcone Douglas-Fir	60.5
		Coulter Pine	39.5
		Mix Conifer – Fir	0
Wetlands	0.10	Wet Meadows	100

These statistics exclude the classification of water. Data from CALVEG & USFS.

Non-Native Plants

Unlike the Coastal and Southern subbasins, non-native, invasive plants are not problematic in the Middle Subbasin. Invasive plants have been found in relatively small numbers in a few locations and do not pose the threat of overtaking large areas of land/native habitats as is the case of the Coastal and Southern subbasins. Periwinkle (*Vinca major*), was the only invasive plant observed in significant numbers during the 2007 CDFG stream habitat survey along the SLR River in the Middle Subbasin.

Land and Resource Use

Historic Land Use

Prior to the settlement of Europeans, the Middle Subbasin was inhabited by the local Indian people, the Shoshoneans. These inhabitants of northern San Diego County were called Luiseños by Franciscan friars who named the San Luis Rey River.

The Luiseño people lived in small villages, mostly consisting of family members and relatives, near fresh water sources. While acorns from the numerous oaks in the area provided a staple for their diet, there was a variety of other food sources as well. Nearly all natural resources of the region were exploited by the Luiseño in a highly developed seasonal mobility system (Tierra Environmental Services 2006). Ample water supplies and favorable thermal zones found in the subbasin, coupled with a heavy growth of forest cover along the streams, provided both vegetal and animal food supplies. The Luiseño gathered seeds, roots, wild berries, wild grapes, and hunted deer, rabbits, wood rats, and game birds. At least two village sites were located within the subbasin; however, much of the eastern portion of the subbasin was unpopulated as village sites were more common along the western edge and more so in the Pauma Valley and Rincon area (True 1954).

The Spaniards were the first Europeans to arrive in the Basin in late 1760s. They entered in the Coastal Subbasin and began moving and settling throughout the basin. Most of these Spaniards survived through farming and hunting a variety of game. Prior to California becoming a state, a few early settlers were given grazing rights on large lots of land through enormous land grants, called ranchos, whose property rights were retained by the Mexican government. A few of these ranchos were located in the Middle Subbasin. Eventually, the ranchos were phased out by the late 1830s.

Homesteaders continued to slowly settle into the area and eventually the Luiseños Indians were forced off of their land, or portions of their land, and onto reservations. The La Jolla Indian Reservation was established in 1875, by executive order from President Ulysses S. Grant. This reservation, mostly in the western half of the subbasin, consists of 9,998 acres of federal land, with the SLR River cutting through its middle.

With the creation of the La Jolla Indian Reservation and land being designated as Cleveland National Forest, approximately two-thirds of the subbasin was set aside. Unlike other subbasins where mining, agriculture, and urbanization played a role in land use and development, the Middle Subbasin remained relatively undisturbed, containing large areas of native habitats.

Current Land Use

Current land use in the Middle Subbasin is limited by ownership designation and the relatively steep terrain. While land use by humans has less of an impact on the function of the natural systems when compared to other subbasins, nonetheless, it still plays a role in shaping the landscape and the natural resources contained in the subbasin.

Agriculture

Differing from the rest of the basin, agriculture plays a small role in shaping the landscape of the Middle Subbasin. With much of the subbasin designated as Cleveland National Forest or Indian Tribal Lands there is less area available for farming operations. The steep, rugged, relatively dry terrain also limits the potential for crop production. Agriculture, including herbaceous grasslands used in livestock production, accounts for only 5% of the land use in the Middle Subbasin.

Agriculture still plays a role by utilizing surface flows in tributaries to the SLR River and groundwater supplies. These agricultural water extractions place stress on the water demands of riparian plant species and could lessen the surface flows of streams in the subbasin, impacting the aquatic community.

Tribal Indian Lands

Almost a third of the Middle Subbasin is held in Indian Tribal Lands, primarily in the La Jolla Band of Luiseño Indians Reservation. This reservation includes 9,998 acres of federal land and around 702 enrolled tribal members (http://www.lajollaindians.com/). Most of the tribal lands are sparsely populated with single family dwellings. The forced compliance with the reservation system disrupted Luiseño social organization and settlement patterns, yet many aspects of the original Luiseño culture still persist today. While maintaining certain rituals and religious practices, traditional games, songs, and dances continue as well as the use of foods such as acorns, yucca, and wild game (Tierra Environmental Services 2006).

The La Jolla Indians had plans to develop a casino on their reservation, just off Highway 76, but have recently broken ties with the Nevada Gold & Casinos Inc. of Houston to develop and manage a $25 to $30 million gaming resort. The development of this casino will most likely have an impact on local water resources as demand for water consumption will only increase. In addition to a casino, future development plans include a golf course. While there is uncertainty when and if this golf course will be

developed, it is important to note the course would remove native habitats, displace wildlife, require large amounts of water, and contribute to water quality problems with the large amount of pesticide and fertilizers that go into the management of these large turf areas.

Urbanization

Most of the Middle Subbasin remains rural in nature with low-density housing and a few small-scale agricultural operations. No incorporated communities exist within the subbasin. The subbasin is a mix of La Jolla tribal members and private landowners, many of which have been long-time residents to the area.

Recreational

Almost one-third of the Middle Subbasin is held in US Forest Service lands that have recreational opportunities. Hunting, hiking, fishing, picnicking and other activities are available on these lands. The 2007 Poomacha Fire mostly avoided the Cleveland National Forest, and recreational areas in the forest were left relatively undisturbed.

Recreational opportunities also exist in the La Jolla Indian Reservation along the SLR River. The tribe has a campground adjacent to the river. This campground promotes fishing in the SLR River for warm-water game fish, such as bass and bluegill, and summer float tube trips are available during sufficient flow releases. Without a gaming casino, the campground and river setting provide important sources of income for the La Jolla Indian Tribe.

Fish Habitat Relationship

Fishery Resources

Historically, steelhead have not been documented in the SLR River within the Middle Subbasin. However, trout were documented in the Upper Subbasin, headwaters of the SLR River as early as 1862 (Cooper 1874). This observation of trout upstream, prior to any introduction of hatchery raised fish, would seem to signify that steelhead could have accessed the Middle Subbasin and utilized its habitat for spawning and rearing activities. Anecdotal and documented accounts of steelhead in the SLR River indicate a productive fishery in the lower to middle mainstem (below the Middle Subbasin) and in tributaries such as Pala and Pauma creeks.

Even though there has been a lack of focused surveys in the Middle Subbasin tributaries to record the potential presence of steelhead/trout, it seems unlikely that ocean run fish would have utilized far reaching habitats in these streams. These fish would have a difficult time entering and exiting some of these tributaries due to insufficient stream flows and natural and anthropogenic related fish passage barriers.

The Department initiated a yearly rainbow trout stocking program in the mid-1940s in the upper SLR River near the water release of Henshaw Dam and, periodically, downstream in the La Jolla Indian Reservation. This stocking program was intended to accommodate the strong demand for a recreational sport fishery for local San Diego County fishermen. The trout plants ranged from a high of 36,080 in 1955 and 39,040 in 1970 to a low of 845 trout in 2003 (See Basin Profile, “Stocking”); the last year the river was stocked. Although the river was somewhat recently stocked, there are no known populations of resident rainbow trout in the SLR River or its tributaries within the Middle Subbasin. CDFG and PSMFC fisheries biologists conducted electro-fishing surveys in the SLR River in the Cleveland National Forest during the early fall of 2007. This survey did not yield any trout or any other native fish species. Additionally, no trout were observed during the spring 2007 CDFG habitat inventory surveys.

Warm-water game fish, which are most likely carried downstream from Lake Henshaw, now populate the river. Largemouth bass, bluegill, green sunfish, brown and black bullhead, channel catfish, common carp, and western mosquito fish were either captured or observed during electro-fishing and habitat inventory surveys. Some pools contained large numbers (>40) of these fish. The frequency and occurrence of the fish was generally greater near the dam, on US Forest Service and VID property. Largemouth bass and bluegill were observed in the La Jolla Campground, and there was evidence of recent fishing activities.

Habitat Overview

Historic Conditions

A report by Jones and Stokes (1976) for the U.S. Fish and Wildlife determined that prior to the completion of Henshaw Dam the upper SLR River maintained perennial flows. This report, which assessed the effects of altered streamflows on fish and wildlife in California, based its findings on data recorded at a formerly operating USGS stream gauge located at the present dam site. This gauge recorded stream flow data from October 1912 to September 1922. During this period, minimum monthly summer flows averaged above 1.4 cfs, while minimum monthly winter and spring flows averaged above 8 cfs (Figure 5). Mean monthly flows were much greater and reached as high as 254 cfs during the winter months. The report briefly describes the instream channel conditions prior to the completion of the Henshaw Dam and the effects the dam had on the channel morphology and the

associated riparian vegetation in the Middle Subbasin:

> *Historically the fluctuation of instream flows maintained a well defined stream channel . . . . After the dam was completed and impoundment of all flood flows the riparian vegetation began encroaching into the stream channel. This encroachment along with the accumulation of sedimentation has resulted in a major reduction of fishery habitat. At the present time the river below Henshaw Dam supports very few fish and may not support any at all.*

Similar to the other subbasins, there has been a limited amount of coordinated stream surveys performed in the Middle Subbasin. The majority of the stream surveys performed in the Middle Subbasin only described general weather and habitat conditions at the time of trout releases into the SLR River; therefore, aside from the Jones and Stokes report, historic stream habitat conditions are relatively unknown.

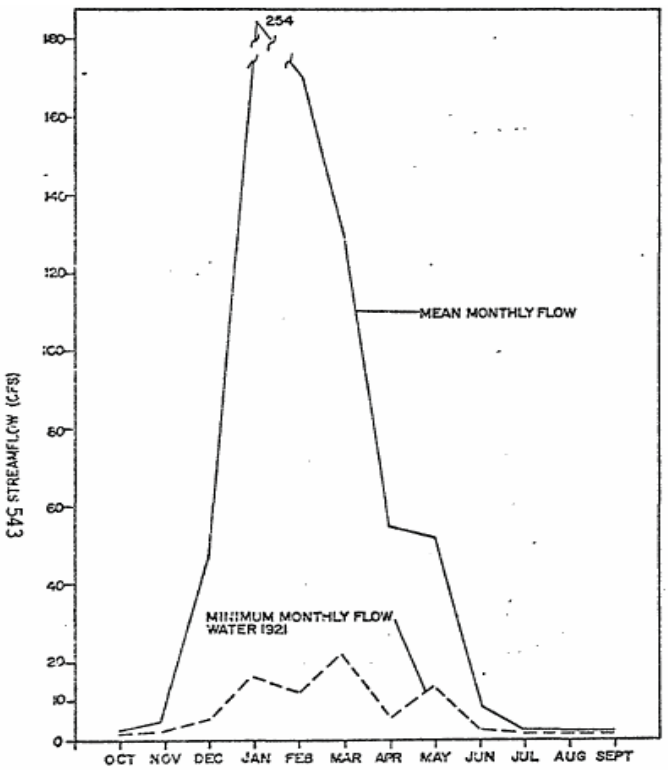


Figure 5. SLR River streamflow conditions from October 1912 to September 1922 at present site of Henshaw Dam (Jones and Stokes 1976).

Current Conditions

Stream habitat inventories conducted by CDFG/PSMFC fishery crews in the Middle Subbasin were limited to the SLR River from Henshaw Dam downstream to the La Jolla Indian Reservation (Figure 6). This approximately 5-mile stretch of river consisted of property within the Cleveland National Forest, VID, and several large private landowners. The survey was divided into 5 reaches of various lengths (Table 4). At the time of the survey, mid to late April 2007, flows were approximately 1cfs, except for reach 5 (uppermost reach) which contained sections of dry stream channel. All of the surveyed area began above the current accessible habitat for steelhead, but the survey provided an important snapshot of the current habitat conditions. Aside from its potential to support fisheries resources, the four-mile stretch of riparian habitat along the SLR River below Henshaw Dam supports the largest southwestern willow flycatcher (federally listed) population in southern California (Stephenson and Calcarone 1999). In general, the surveyed area was not affected by the 2007 Poomacha Fire; however, downstream in the La Jolla Indian Reservation, large portions of the reservation and surrounding land were consumed by the fire. Within the burned area, the riparian along the SLR River burned at a moderate intensity with patches of high severity (State of California 2007). The effects of the fire contributed a significant amount of debris and sediment into some of the streams in the western portion of the subbasin.

During the mainstem survey three tributaries, Wigham Creek, Prisoner Creek, and an unnamed left bank tributary just downstream of Prisoner Creek contained flowing water and were examined for general habitat suitability. Based on observed fish passage barriers and/or stream habitat conditions at the time of the survey, it seemed unlikely that these streams would be utilized by steelhead; therefore, full habitat inventory protocols were not performed. Wigham Creek was inaccessible beyond 0.1 stream miles due to a raised culvert below Highway 76; Prisoner Creek contained a large natural bedrock chute that appeared impassible, also 0.1 miles upstream of its confluence with the SLR River. Other tributaries in the subbasin were not surveyed due to the absence of surface flows or denied landowner access permission.

Stream habitat inventory methods were conducted on the SLR River according to methods determined in the *California Salmonid Stream Habitat Restoration Manual* (Flosi, et al. 1998). Analysis of the SLR River includes the following:

- Canopy Density;
- Habitat Type Categories;
- Pool Characteristics;
- Pools by maximum depth;
- Pool shelter;
- Cobble Embeddedness.

Table 6. Middle Subbasin streams surveyed by CDFG in 2007.

Stream	Year o f Survey	Survey Length (Miles)	Percent of Permanent Stream Surveyed within Subbasin	Number of Reaches
San Luis Rey River	2007	4.89	50	5
Wigham Creek*	2007	0.2	0	1
Prisoner Creek*	2007	0.2	0	1
Unnamed left bank tributary*	2007	0.2	0	1

* Full habitat inventories were not performed on these tributaries

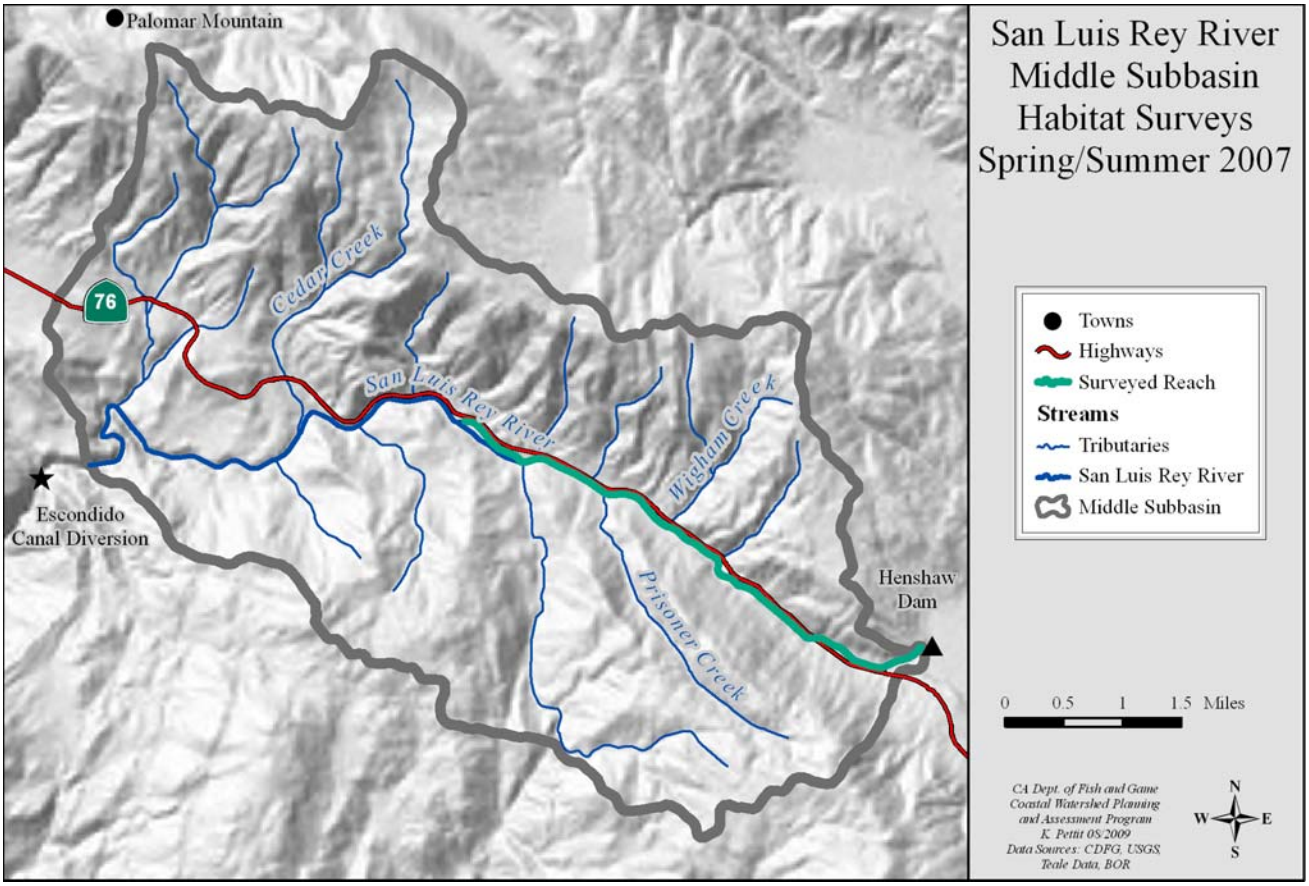
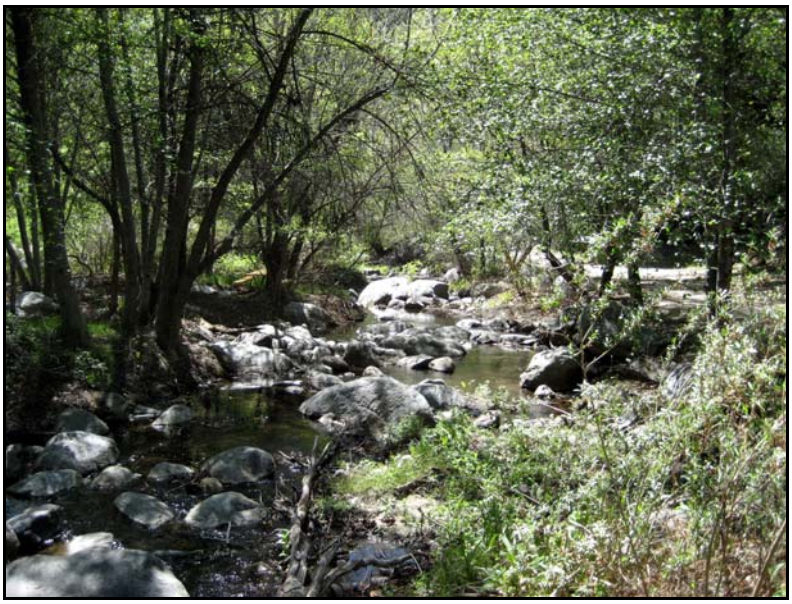


Figure 6. SLR River Middle Subbasin Habitat Surveys Spring/Summer 2007.



View of typical habitat in the SLR River within the Middle Subbasin. Photo taken spring of 2007.

Canopy Density

Significance: Streamside canopy density is a measure of the percentage of wetted stream that is shaded by riparian tree canopy. Stream water temperature can be an important limiting factor of salmonids, and tree canopy provides shade to reduce direct sun light from increasing water temperatures. Moreover, near-stream forest density and composition contribute to microclimate conditions that help regulate air temperature, which in turn, influence stream water temperature. Riparian vegetation also bind the stream bank soil and provide resistance to the erosive forces of water, functions as the base of the food chain for biological stream life, helps store water along the stream corridor during the raining season for slow release to the stream in drier seasons, and creates desired complex instream habitat by providing woody debris to streams (Riley 1998). Generally, canopy density less than 50% by survey length is below target values and greater than 80% fully meets target values.

Findings: Canopy density measurements in the SLR River obtained suitable values, greater than 70% canopy, on all but the final reach, reach 5 (Figure 7 & Figure 8). The overall Middle Subbasin EMDS canopy density condition truth score is suitable. There is a downward trend in canopy density going from high canopy density in the western reaches to a low canopy density on the eastern most reach, reach 5. The entire canopy cover was composed of deciduous trees, mostly of alders, willows, and oaks.

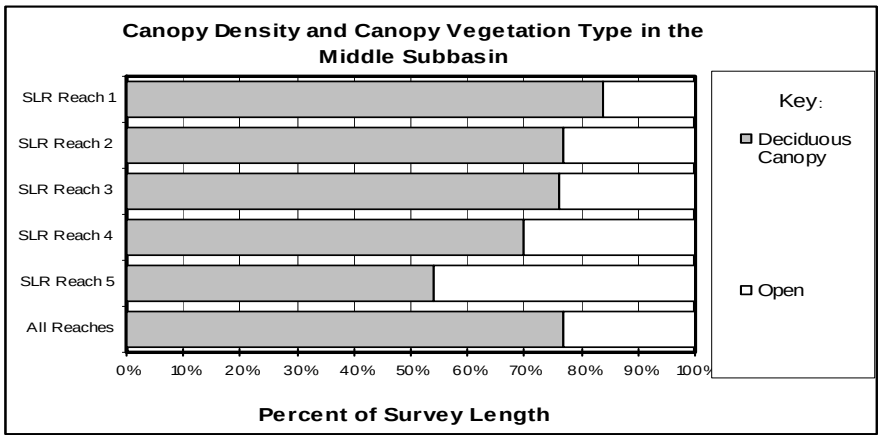


Figure 7. The relative percentage of deciduous canopy vs. open canopy on the surveyed reaches of the SLR River.

Averages are weighted by unit length to give the most accurate representation of the percent of a stream under each type of canopy. SLR River reaches are listed from west to east within the watershed.

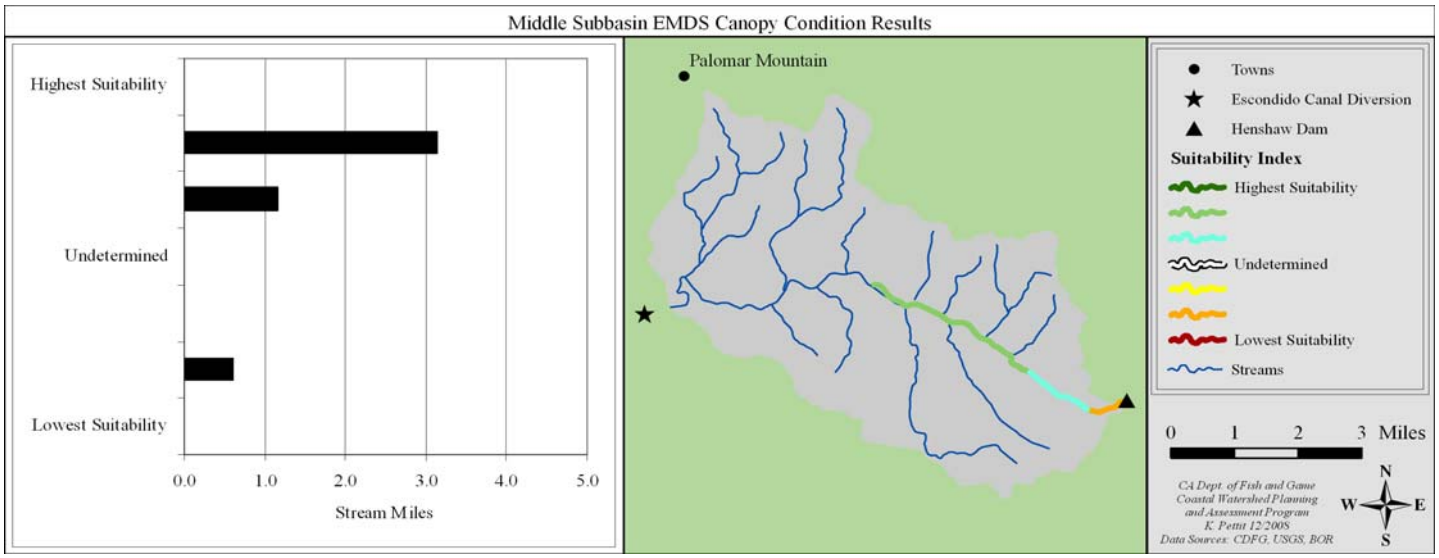


Figure 8. EMDS canopy results for the SLR River, Middle Subbasin by surveyed stream miles.

Habitat Categories

Significance: Productive anadromous streams are composed of a balance of pool, riffle, and run habitats and each plays an important role in salmonid habitat. Pools are not only the preferred habitat for yearling and older juvenile steelhead, but also provide important resting areas during adult winter/spring migration. Looking cumulatively at pool, riffle, and run relationships helps to characterize the status of these habitat types and also provides a measure of stream habitat diversity and suitability for fish. A pool: riffle ratio of approximately 1:1 is suggested as a desirable condition for most wadeable, anadromous, fish bearing streams, but it is not applicable for evaluating salmonid suitability of all stream reaches and channel types (Rosgen 1996). However, pool:riffle:run relationships showing an over abundance of riffles or runs may indicate aggraded channel conditions or lack of scour objects needed for pool formation. Additionally, pool frequency by percent length is preferable to pool frequency by occurrence because the latter may give a false impression of health if there are numerous, shallow, short pools as a result of aggradation (NMFS and Kier 2008).

Findings: Overall, pools occupied only 23% of the total habitat inventory (Table 7), which is much lower than the targeted value and is an indication of poor stream habitat diversity. Reach 3 was the only reach that had a similar percent of total pools and percent of pools for the total survey length, indicating that pool size was appropriate for the channel width. The remaining reaches had a disproportional percent of pool occurrence when compared to the total percent of pool length for the reach. This would tend to indicate that pools in this reach are short and most likely shallow, lack complex instream habitat and may not provide adequate protection from predators, such as the warm-water gamefish present throughout the surveyed area. Only the relatively short reaches 2 and 3 contained the desired amount of pool habitat (approximately 42%) based on stream length.

Table 7. SLR River–percent occurrence and percent by length of pool, run, riffle, and dry habitats.

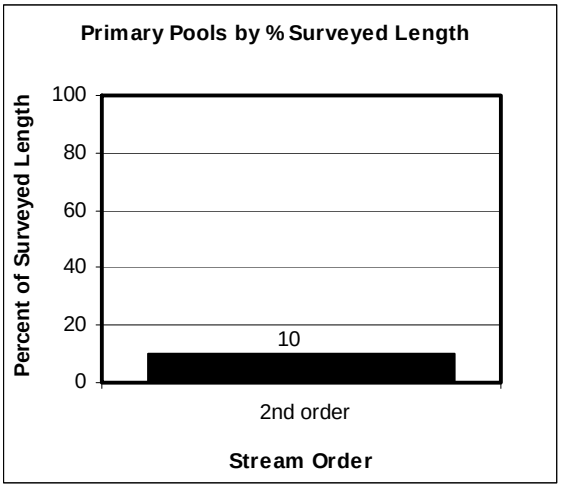
Stream	Stream Order	Survey Length (Miles)	Pool, Riffle, Run Percent Occurrence	Pool:Riffle:Run Percent Total Length	Dry Percent Total Length
SLR River Reach 1	2	2.73	31:26:43	20:22:58	0
SLR River Reach 2	2	0.14	50:7:43	38:3:59	0
SLR River Reach 3	2	0.26	49:7:44	44:10:46	0
SLR River Reach 4	2	1.15	36:34:30	26:24:50	0
SLR River Reach 5	2	0.61	34:10:46	20:4:61	15
Total	**2**	**4.89**	**32:22:42**	**23:19:54**	**4**

Pool Depth

Significance: Pool depth and frequency are fundamental attributes of channel morphology and are largely dependent on the presence of large roughness elements such as boulders, bedrock, rootwads, and small and large woody debris in addition to channel type, stream gradient, sinuosity, and channel width. Evaluating the amount of deep pool habitat in a stream reach helps assessment of important channel characteristics for steelhead. Deep pools provide escape cover from high velocity flows, hiding areas from predators, and ambush sites for taking prey. Greater pool depth provides more cover and rearing space for older age (1+ and 2+) steelhead juveniles and creates better shelter for migrating and spawning adults. Generally, a stream reach should have 35 – 50% of its length in primary pools to be suitable for salmonids. SLR River was evaluated as a second order stream. First and second order streams are comprised of primary pools that are greater than 2.0 feet deep. The EMDS model based it suitability ratings on pools greater than 2.49 feet, with a slight consideration (weight) given to pools greater than 2-feet deep.

Pool Depth Cont.

Findings: None of the reaches surveyed in the mainstem met target values for pool habitat and depth with only 10% of surveyed reaches being composed of primary pools (Figure 9). Reach 3 had the most primary pools by survey length, with 40.2%; reach 4 was a distant second with 22.7% (Table 8). The remaining reaches contained less than 8% primary pools by survey length. Reach 3 was the only reach that met EMDS suitability ratings (Figure 10). The lower number of pools indicates a disruption to channel forming processes such as insufficient stream flows to assist in the pool forming and pool scouring processes and elevated levels of stored sediments.



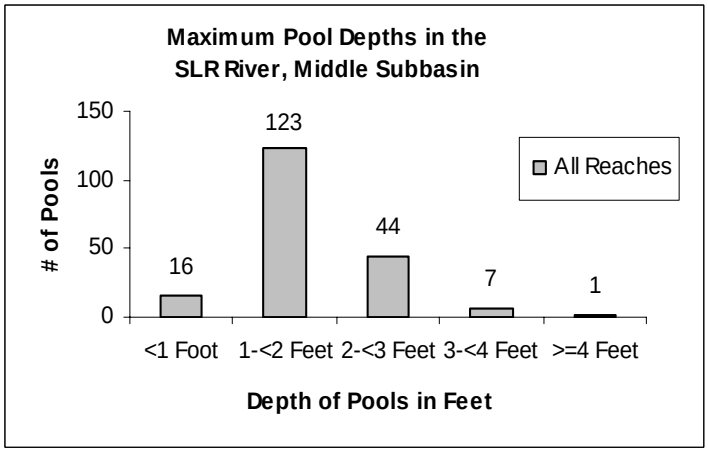


Figure 9. Percent of primary pools and number of pools by maximum depth in the SLR River, Middle Subbasin.

Primary pools are pools greater than 2 feet deep in 1st and 2nd order streams

Table 8. Percent length of a survey composed of pools in the SLR River, Middle Subbasin.

Stream	Stream Order	Percent all Measured Pools by Survey Length	Percent Pool of Depth 2.0-2.49 feet by survey length	Percent Pools of Depth 2.5–2.9 feet by Survey Length	Percent Pools of Depth >3 feet by Survey Length	Percent Pools Within Target Range (>2.0 feet) by Survey Length
SLR River Reach 1	2	20.1	4.4	3.0	0	7.4
SLR River Reach 2	2	37.6	0	6.1	0	6.1
SLR River Reach 3	2	43.6	0	24.7	15.5	40.2
SLR River Reach 4	2	26.7	6.3	14.8	1.6	22.7
SLR River Reach 5	2	20.2	5.5	1.1	0	6.6

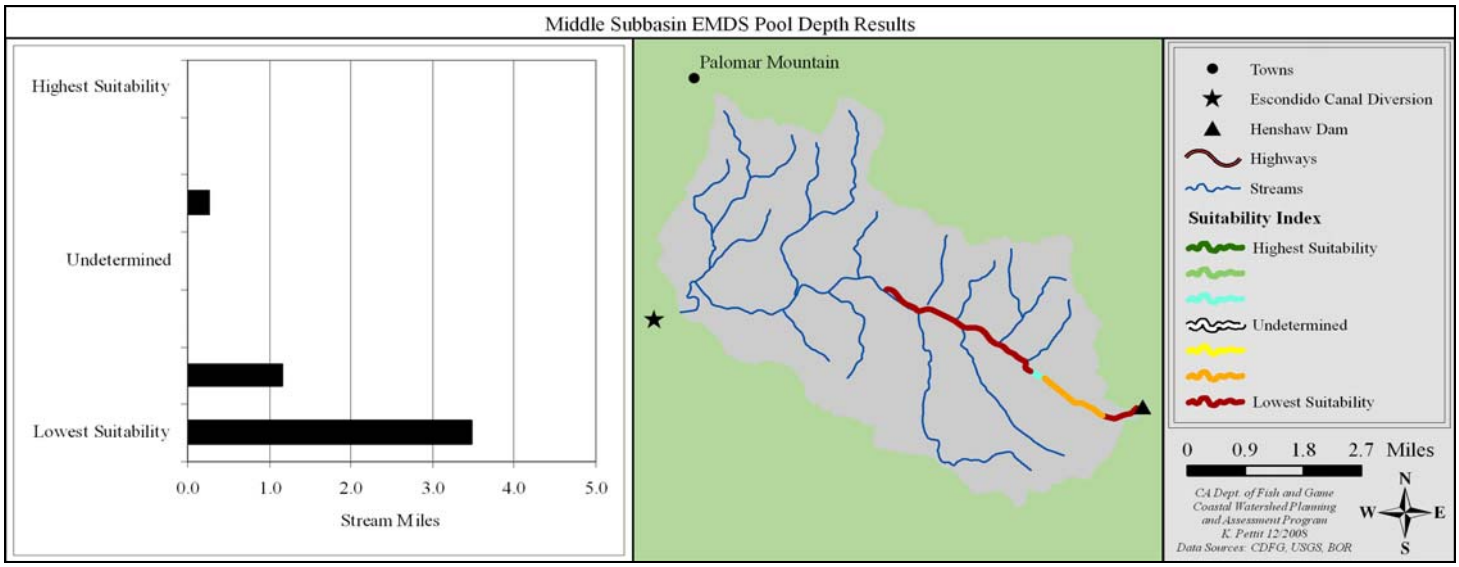


Figure 10. EMDS pool depth results for the SLR River, Middle Subbasin by surveyed stream miles.

Pool Shelter

Significance: The pool shelter rating is a relative measure of the quantity and percent composition of small woody debris, root wads, boulders, undercut banks, bubble curtains, and submersed or overhanging vegetation in pool habitats. These elements serve as complex instream habitat with protection from predation, rest areas from high velocity flows, and separate territorial units to reduce density related competition. Shelter ratings of 100 or less indicate that shelter/cover enhancement should be considered. Large woody debris generally does not play a significant role in the habitat functions concerning steelhead/trout in southern California rivers and streams; therefore, its presence/absence is not relevant in this assessment.

Findings: Pool shelter ratings for surveyed reaches of the SLR River in the Middle Subbasin were all well below the target value of 100 (Figure 11) and every reach except reach 5 had poor EMDS suitability ratings (Figure 14). There were only a few pools located throughout the survey that had a shelter rating greater than 100. The overall pool shelter rating for the entire survey area was only 29 (Figure 12).

In addition to shelter complexity rating, instream shelter composition, divided into eight cover types, was also collected during habitat inventories (Figure 13). Boulders (19.8%) followed by small woody debris (18.0%) are the dominate cover types in the subbasin. Undercut banks and terrestrial vegetation were also a significant cover type representing over 17.6 and 16.1% of the cover in pools respectively. Aquatic vegetation and root mass played a lesser role in providing potential shelter cover in pools. Large wood debris and whitewater were almost completely absent from pools in the subbasin.

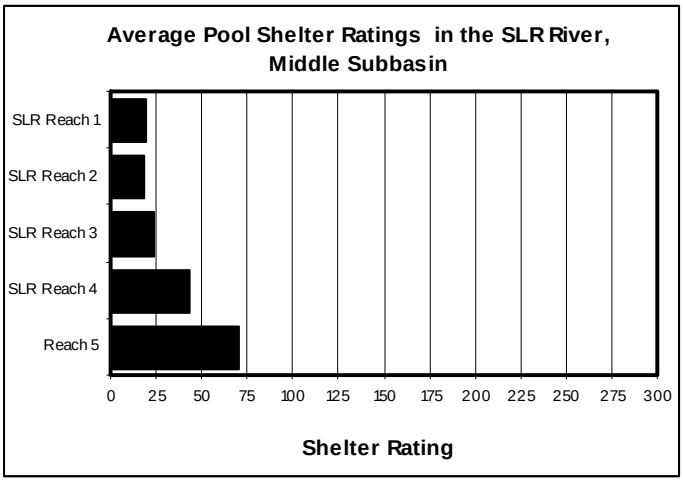


Figure 11. Average pool shelter ratings from CDFG stream surveys in SLR River in the Middle Subbasin.

Stream reaches are listed from west to east.

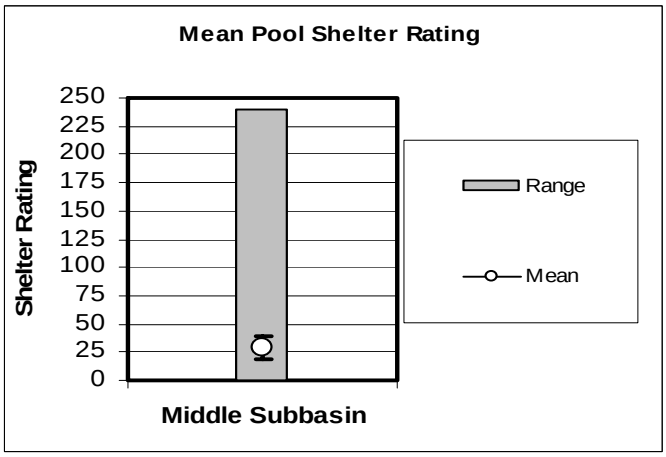


Figure 12. Pool shelter in the SLR River, Middle Subbasin.

Error bars represent the standard deviation. The percentage of shelter provided by various structures (i.e. undercut banks, woody debris, root masses, etc.) is described and rated in CDFG surveys.

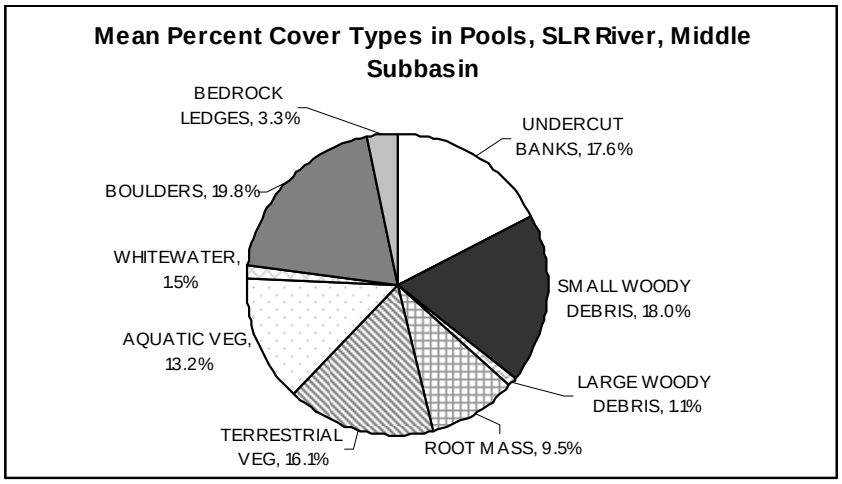


Figure 13. Mean percent of shelter cover types in pools for surveyed reaches of the SLR River in the Middle Subbasin.

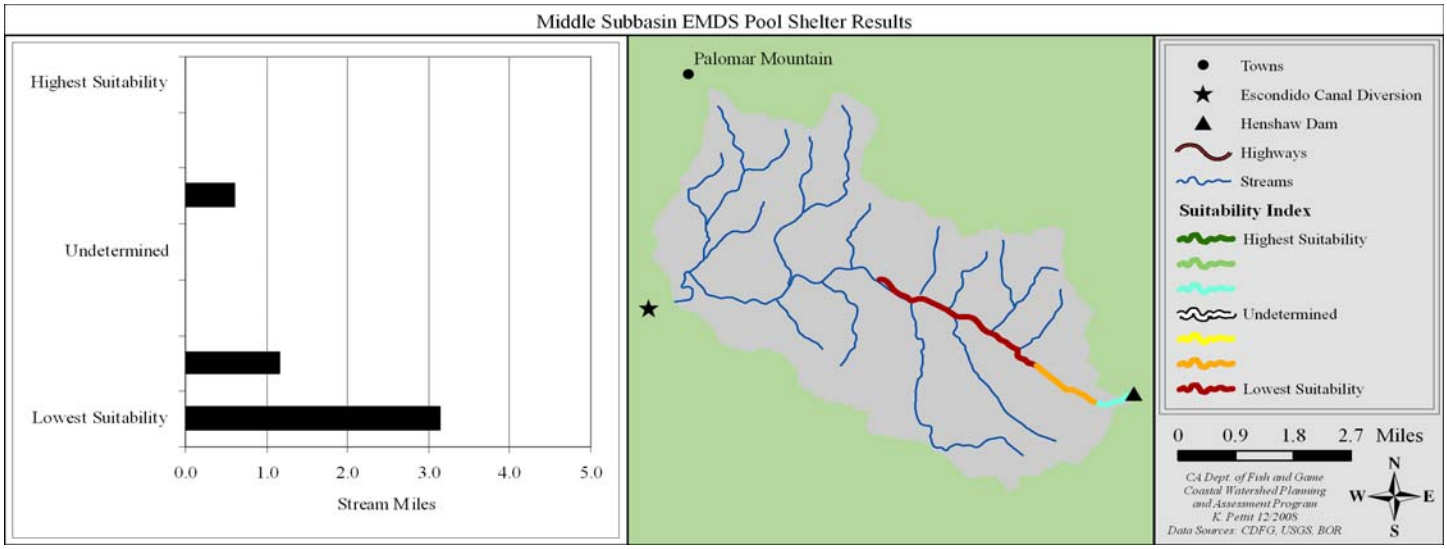


Figure 14. EMDS pool shelter results for the SLR River, Middle Subbasin by surveyed stream miles.

Cobble Embeddedness

Significance: Salmonid spawning depends heavily on the suitability of spawning gravel; fine sediments decrease successful spawning and incubation. Cobble embeddedness is the percentage of an average sized cobble piece at a pool tail-out that is embedded in fine substrate. Category 1 is 0-25% embedded, category 2 is 26-50% embedded, category 3 is 51-75% embedded, and category 4 is 76-100% embedded. Generally, cobble embeddedness of 0-25% is considered good quality for spawning (Flosi et al. 1998). Excessive accumulations of fine sediment (>50%) reduce water flow (permeability) through gravels in redds which may suffocate eggs or developing embryos. Excessive levels of fine sediment accumulations over gravel and cobble substrate also may alter insect species composition and food availability for growing fish. Consequently, cobble embeddedness categories 3 and 4 are not within the fully supported range for successful use by salmonids. Category 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations. Southern California steelhead also utilize riffles as potential spawning grounds. This survey methodology, which measure only pool tail-outs, did not take this into account and thus did not record/evaluate these areas.

Findings: The SLR River possessed suitable spawning gravels for less than 13% of the surveyed area and exhibited ideal spawning conditions, 0-25% embedded, in only 1% of the total surveyed area (Figure 16). A little over half of the pool tail-outs were considered unspawnable due to the presence of inappropriate substrate (s) at the pool tail-out. These figures led to poor EMDS scores for the entire reach (Figure 14). Reach 3 contained the only significant percentage of category 1 spawning gravels as well as a small percent of category 2. Additional suitable spawning gravels were observed in numerous riffles throughout the surveyed area but were not measured or accounted for the purpose of this survey.

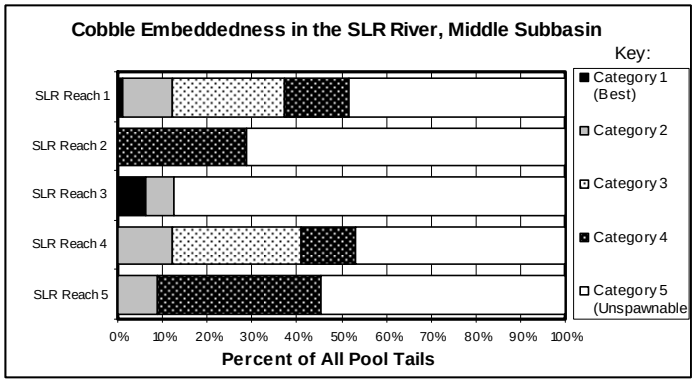


Figure 15. Cobble embeddedness categories as measured at every pool tail crest in the SLR River, Middle Subbasin.

SLR River stream reaches are listed in from west to east in the Subbasin.

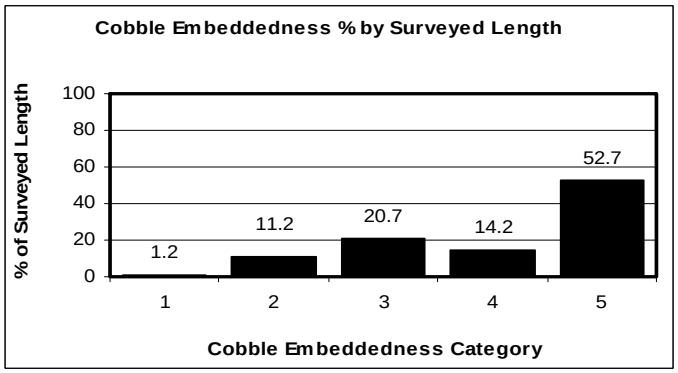


Figure 16. Cobble Embeddedness in the SLR River, Middle Subbasin.

Cobble Embeddedness was measured only in pool tail-outs and did not take into account that steelhead may spawn in riffle habitat.

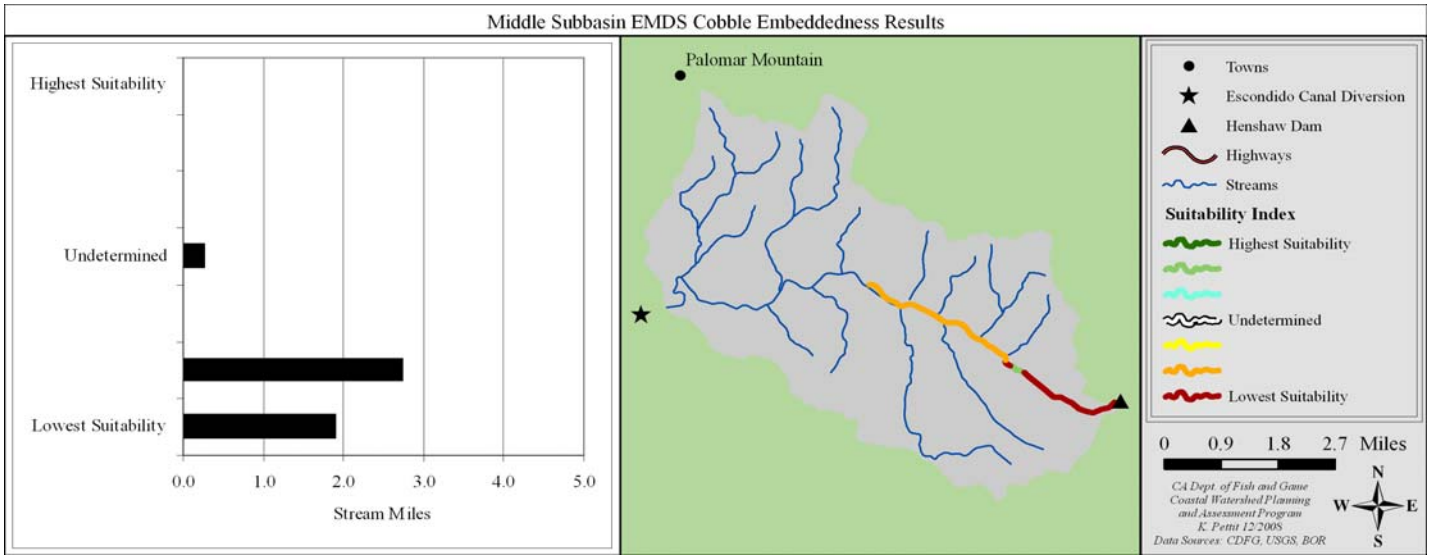


Figure 17. EMDS cobble embeddedness results for the SLR River, Middle Subbasin by surveyed stream miles.

Habitat Discussion and Conclusions

In the spring of 2007, CDFG/PSMFC fisheries crews performed stream habitat inventories in the mid to upper portion of the SLR River within the Middle Subbasin. This habitat inventory cover almost 5 stream miles, represented about half of the SLR River in the subbasin. A presence/absence electrofishing survey was also conducted in late September of 2007. Other streams were examined to determine general habitat suitability conditions, but these streams contained fish passage barriers near their confluence with the mainstem; therefore, full stream inventories were not performed. Prior to these stream inventories, historic stream habitat conditions were limited to stocking and angling reports that contained very general information on overall conditions. These descriptions do not offer enough information to qualify previous stream conditions. Generally, older stream surveys, at the minimum, can provide a snapshot of the conditions at the time of the survey, but a literature review could not find any such historic surveys.

Steelhead trout access to the subbasin is currently blocked at the Escondido Canal diversion dam (RM 40). Access is also restricted downstream due to the altered flow regime and its impact on downstream fish passage barriers, including a natural waterfall at RM 39.5; this waterfall has an overall height of 50 feet, but is broken up into a series of steps, with the largest lowermost step approximately 13 feet, and a narrow steeped crevasse above the first step extending to the top of the waterfall (M. Capelli, personal communication 2010). (See Figure 9, p.16 in the Southern Subbasin section for a photo of this description.) The river could potentially provide important spawning and rearing habitat for steelhead/trout, but would require extensive mitigation of the natural and man-made barriers. Additional habitat in tributaries appears to be limited. Currently, natural and man-made barriers inhibit fish passage into some of these streams.

Since the completion of the Henshaw Dam in the early 1920s, the river has experienced a reduction in peak flows associated with runoff. Reduction of the large flushing flows has resulted in the encroachment of vegetation into the stream and a buildup of fine sediments. While these changes may have benefited the canopy cover of the river, which met canopy target values with the exception of the upper reach, the remaining instream habitat conditions were adversely impacted. Surveyed reaches fell below EMDS target values and were evaluated as unsuitable for salmonids for pool quality, pool depth, pool shelter, and cobble embeddedness habitat characteristics. These poor conditions would likely be limiting factors to salmonid production. The 2007 Poomacha Fire contributed fine sediment into tributaries and the SLR River in the western half of the Middle Subbasin's, which most likely exacerbated the high levels of sediment and fines already present in the river.

Water temperature measurements were suitable at the time of the surveys, but more long term data is needed to determine water temperature suitability. High water temperatures and low dissolved oxygen levels could be limiting factors to salmonid production in the SLR River. Stream temperature data loggers, deployed in the spring of 2008 in the SLR River, will provide some insight to stream temperatures during the temperature extreme period.

During the one day, presence/absence survey, which

was conducted in two separate reaches (one reach on U.S. Forest Service proper and the other one approximately one mile downstream), only non-native species were observed. Warm water game fish, such as largemouth bass, bluegill, green sunfish, brown and black bullhead were captured in the upper reach and are most likely abundant in the river. These fish are washed down from Lake Henshaw during flow releases. Western Mosquitofish was the only fish species caught in the lower reach. Although trout were released as recent as 2003, none were observed. Downstream of the surveyed areas, largemouth bass were also observed in the SLR River within the La Jolla Indian campground and evidence of recreational fishing was present. If trout were ever provided access to this subbasin, these warm water game fish would most likely predate on all early life cycle stages of trout.

Table 9. EMDS reach condition results for the Middle Subbasin.

Stream	Year	Canopy	Pool Quality	Pool Depth	Pool Shelter	Embeddedness
SLR River Reach 1	2007	+++	---	---	---	--
SLR River Reach 2	2007	++	--	---	---	--
SLR River Reach 3	2007	++	-	+	---	++
SLR River Reach 4	2007	+	--	--	--	---
SLR River Reach 5	2007	--	-	---	+	---
Middle Subbasin		++	--	--	--	--

Key: +++ = Highest Suitability U= Insufficient Data or Undetermined - - - = Lowest Suitability

Stream Habitat Improvement Recommendations

In addition to presenting habitat condition data, all CDFG stream inventories provide a list of recommendations that address those conditions that did not reach target values presented in CDFG's *California Salmonid Stream Habitat Restoration Manual* (Flosi et al. 1998) and in *NMFS's Guide to reference values used in south-central/southern California coast steelhead conservation action planning workbooks* (2008) (see the Current Conditions pp. 14-18). Stream habitat improvement recommendations were developed based on results from stream surveys conducted along potential salmonid bearing stream reaches in 2007. Although the SLR River in the Middle Subbasin is above limits of anadromy due to the Escondido Canal diversion dam (RM 40), the CDFG surveyed and analyzed the data in order to assess the quality and quantity of the stream habitat available in the subbasin. Because the tributaries in the subbasin were not accessible to fish or could not be surveyed due to landowner access issues (Cedar Creek), these creeks were not included in stream habitat improvement recommendations.

In order to compare mainstem recommendations within the subbasin, the recommendations of each reach were collapsed into five target issue categories: surface stream flow, fish passage, riparian/water temperatures, instream habitat, and sediment delivery (Table 10). These target issues were then paired with the appropriate recommendation category. For example, the target issue "Instream Habitat" was divided into the recommendation categories of: Pool, Cover, and Spawning Gravels. CDFG/PSMFC biologists selected and ranked habitat improvement recommendations based on survey inventory results collected in the SLR River. The top three recommendations of each reach are considered to be the most important, and are useful as a standard example of the stream. When examining recommendation categories by number of reaches, the most important target issue in the Middle Subbasin is stream flows, as they have been greatly reduced, altering important stream channel forming processes. The diminished surface flows have degraded the following instream habitat factors: pool frequency, pool depth, and spawning gravels. Initiating pulse flows strong enough to move fine sediments through the river and recruit larger substrate for spawning would also benefit pool enhancement and formation. High priority should be given to restoration projects that emphasize sediment reduction and pool formation. Most fish passage problems were seasonal migration barriers due to natural causes such as a bedrock chute or a waterfall. Water temperatures were not monitored during the high temperature extreme period of the summer months and thus data is limited for evaluation considerations.

Table 10. Recommendation categories based on Basin target issues.

Basin Target Issue	Related Table Categories
Surface Stream Flow	Stream Flow
Fish Passage Barriers	Fish Passage
Riparian/Water Temperature	Canopy/Temperature
Instream Habitat	Pool/Cover/Spawning Gravels
Sediment Delivery	Bank/Roads/Livestock

Table 11. Occurrence of stream habitat inventory recommendations for surveyed reaches of the SLR River, Middle Subbasin.

Stream	Survey Length (feet)	Stream Flows	Fish Passage	Riparian/Water Temps		Instream Habitat			Sediment Delivery		
				Temp	Canopy	Pool	Cover	Spawning Gravel	Bank	Livestock	Roads
SLR Reach 1	14,429	1	5	unk		2	4	3			
SLR Reach 2	764	1	5	unk		2	4	3			
SLR Reach 3	1,370	1	5	unk		2	1	4			
SLR Reach 4	6,079	1	3	unk		2	5	4			
SLR Reach 5	3,202	1	3	unk	4	2		5			

Unk = Conditions Unknown

Restoration Projects

Restoration projects within the subbasin have been limited to those performed by local landowners, the Cleveland National Forest Service, and the La Jolla Indian Tribe. Even though trout were recently stocked in the subbasin there is little evidence that habitat improvement projects occurred in the river. Reviewing the CalFish website (CalFish is a multi-agency program for collecting, standardizing, maintaining, and providing access to quality fisheries data and information for California), it did not list any agency or organization funded stream restoration projects in the subbasin.

Projects that have occurred or are currently underway that have improved stream habitat conditions or contributed to the monitoring of the stream habitat conditions include the following:

- Spring to December 2008 water temperature monitoring by NMFS in the SLR River within the Cleveland National Forest proper;
- Spring 2008 to December 2009 water chemistry analysis and bioassessment by Trout Unlimited in conjunction with the San Diego Coastkeeper in SLR River in Cleveland National Forest proper;
- The La Jolla Indian Tribe has an on-going water resource monitoring program that monitors and records rainfall, stream flow, groundwater levels, and water quality parameters for all Reservation streams and wells (L. Musick, , personal communication 2009);
- Water quality control via animal waste improvement projects;
- Watershed education in classrooms, including SLR River site visits, trout rearing and release in the SLR River.

Information on other watershed stream restoration projects can be found on CalFish (www.calfish.org) or on the Natural Resources Project Inventory online database (www.ice.ucdavis.edu/nrpi/).

Refugia Areas

The interdisciplinary team identified and characterized refugia habitat in the Middle Subbasin by using professional judgment and criteria developed for southern coastal watersheds. The criteria included measures of watershed and stream ecosystem processes, the presence and status of fishery resources, stream flows, agriculture and other land uses, land ownership, potential risk from sediment delivery, water quality, and other factors that may affect refugia productivity. The team also used results from information processed by the EMDS at the stream reach scale.

The most complete data available in the Middle Subbasin was for the SLR River, which was surveyed by CDFG/PSMFC during the spring of 2007. Steelhead habitat conditions in the Middle Subbasin on surveyed streams are generally rated as low potential/low quality refugia. Wigham Creek and Prisoner Creek were the only other tributaries examined in the subbasin. Habitat inventories were not performed on these creeks because they both contained fish passage barriers within 400 feet of their confluence with the SLR River. Wigham Creek had a bedrock chute that appeared to be impassible, unless extremely high flows allowed fish to swim up the chute, but this seemed unlikely. Prisoner Creek was impassible at the Highway 76 road crossing as a large culvert was situated four and half feet above the wetted channel with no significant jumping pool. Moreover, fish would most likely not be able to swim through the culvert based on its angle and the flow velocities it creates. Other tributaries such as Cedar Creek were not surveyed and habitat conditions are relatively unknown. A literature review did not contain any references to steelhead/trout in any tributaries within the subbasin. Further field studies are needed to determine the habitat suitability and limiting factors for steelhead/trout production in these streams if fish passage improvement projects were to occur. The following refugia area rating table summarizes subbasin salmonid refugia

conditions.

Table 12. SLR River and tributary salmonid refugia ratings in the Middle Subbasin..

Stream	Refugia Categories				Other Categories		
	High Quality	High Potential	Medium Potential	Low Quality/Low Potential	Passage Barrier Limited	Critical Contributing Area	Data Limited
SLR River				X	X		X Needs survey
Cedar Creek							X Needs survey
Wigham Creek				X	X		
Prisoner Creek				X	X		

Key Subbasin Issues

- Southern California steelhead are currently blocked from accessing potentially suitable habitat in the Middle Subbasin due to the Escondido Canal diversion dam (RM 40) and by the altered flow regime coupled with the natural barriers in the SLR River canyon;
- The regulated timing, duration, and amount of flow releases from Henshaw Dam are likely not conducive to the lifecycle requirements of salmonids;
- Warm water game fish present in the river would pose a major threat to the successful completion of the early lifecycle stages of steelhead/trout;
- The decreased magnitude and frequency of flood flows has resulted in the buildup of fine sediments and decreased size and number of pools.

Responses to Assessment Questions

What are the history and trends of the sizes, distribution, and relative health and diversity of salmonid populations in the subbasin?

Findings and Conclusions

- Southern California Coast Steelhead (DPS) are federally listed as endangered;
- Historically, it is unknown if steelhead inhabited the SLR River in the Middle Subbasin. Trout were first observed in the Upper Subbasin, headwaters of the SLR River, in 1862 (Cooper 1874); therefore, considering the sustained surface flows prior to the completion of the Henshaw Dam and Escondido Canal diversion, it seems possible that steelhead could have migrated upstream of the natural waterfall barriers present with the SLR River canyon and inhabited the Middle Subbasin;
- Currently, steelhead trout are absent from the subbasin. Steelhead trout access to the subbasin is currently restricted due to the altered flow regime and downstream fish passage barriers, including the Escondido Diversion dam and a natural waterfall at RM 39.5;
- In order to accommodate a strong demand for a recreational fishery, rainbow trout were stocked in the SLR River from the mid-1940s until 2003. Generally, these trout were stocked in the SLR River within the Cleveland National Forest proper and in the vicinity of the La Jolla campground. There was no record of these planted trout spawning in the river and producing a progeny.

What are the current salmonid habitat conditions in the Middle Subbasin? How do these conditions compare to desired conditions?

Findings and Conclusions:

<u>Flow and Water Quality:</u>

- The regulated timing, duration, and amount of flow releases from Henshaw Dam is not necessarily

conducive to the lifecycle requirements of salmonids;

- When water is not released from Henshaw Dam during periods of low flow, water temperatures and water quality are adversely affected. In addition to areas of the river going dry, stream water temperature increases could spur algal growth, which in turn, depletes the dissolved oxygen content, and the overall water quality may deteriorate;
- The decreased magnitude and frequency of flood flows has resulted in the encroachment of vegetation into the stream, a buildup of fine sediments, and limited pool habitat;
- Commercial groundwater harvesting near the headwaters of Cedar Creek removes tens of thousand of gallons of groundwater daily, reducing the amount of water flowing into Cedar Creek and thus into the SLR River.

Erosion/Sediment:

- High amounts of fine sediment were observed throughout the surveyed area in shallow pools, pool tail-outs, and riffle habitats;
- Soils (and bedrock) in streams of the Middle Subbasin are prone to erosion, and slides and streambank failures have been observed to contribute fines to the streams.

Riparian Condition/Water Temperature:

- Streamside tree canopy providing shade over the water was generally suitable for the surveyed area. In addition to shrub and trees, some additional stream shade may be provided by areas where canyon walls are in close proximity to the river;
- The 2007 Poomacha Fire burned the riparian habitat along the SLR River (western portion of subbasin) at a moderate severity with patches of high burn severity. During a post-fire visit to the Escondido Canal diversion dam, the riparian along the river appeared to be intact, but most of the surrounding hillsides were burned and moderately to highly denuded of vegetation;
- Water temperature data collected by CDFG during spring habitat inventories indicate suitable stream temperatures. However, these data are limited, and therefore inconclusive;
- NMFS employed a data temperature logger in the SLR River in the Cleveland National Forest proper during the spring of 2008 and will monitor the temperature extreme period during the summer and early fall months.

Instream Habitat:

- Limited suitable spawning and rearing habitat were present in the SLR River within the surveyed area. Deep complex pools are lacking in the river as all of the reaches received poor EMDS ratings in pool quality, pool depth (except reach 3), and pool shelter;
- The relatively high embedded substrate observed from pool tails and the relative shallow pools are indicative of the lack of significant stream flows to scour deeper pools and remove excessive fine sediments;
- Warm water game fish were present throughout much of the surveyed area. If trout were provided access these fish would likely predate on the various lifecycle stages of trout;
- Tributary habitat was inaccessible due to fish passage barriers, but appeared to be limited even above these barriers.

Gravel/Substrate:

- Suitable salmonid spawning areas were available but limited in the subbasin. High embeddedness levels in pool tail-outs potentially limit successful egg incubation and the development and emergence of salmonid fry;

- The post-fire effects of increased sediment input in the western half of the subbasin most likely resulted in buried spawning gravels that will require another series of storms in order to flush out these fine sediments and restore suitable spawning grounds.

Refugia Areas:

- Salmonid habitat conditions in the Middle Subbasin are generally rated as low quality/low potential refugia. The subbasin is currently inaccessible to steelhead. Numerous downstream fish passage barriers would need to be modified in order to allow trout to have access to the area;
- The habitat that is currently present is generally of poor quality; however, with seasonally appropriate flow releases from Henshaw Dam that would allow proper hydrologic processes to occur, the subbasin's habitat suitability for trout could greatly increase;
- Limited suitable habitat exists in the tributaries that were examined and are currently contain fish passage barriers near their confluences with the SLR River (see below).

Barriers:

- In addition to the natural waterfalls in the SLR River canyon and the Escondido Canal diversion dam located in the Southern Subbasin, several natural waterfall and bedrock chute barriers also occur in the SLR River in the Cleveland National Forest proper. These are partial, low flow barriers and under the right flow conditions, may be passable;
- Wigham Creek is impassible at Highway 76, approximately 300 feet upstream of its confluence with the SLR River, as a culvert is perched four and half feet above a shallow pool;
- Prisoner Creek contains a long, steep bedrock chute near its confluence with the SLR River that would seem impassible to fish.

What are the impacts of geologic, vegetative, fluvial, and other natural processes on watershed and stream conditions?

Findings and Conclusions:

- Severely erodible soils comprise 95% of the watershed and slides from the stream banks and roads have been observed to contribute fines to the stream;
- Weathering of the granitic rocks has created younger unconsolidated sediments that are very susceptible to enhanced erosion and mass movement such as landslides and debris flows;
- The Middle Subbasin is in a potentially seismically active area as several faults cut through this basin, including the Elsinore Fault Zone. Powerful seismic events, especially when coupled with significant storm events, can trigger large landslides and mudflows increasing sediment delivery to the streams and altering their hydrologic condition;
- Uplift has increased the erosion potential of the area;
- Reduction of peak flows associated with runoff has resulted in the encroachment of vegetation into the streambed and a buildup of fine sediments;
- The combination of the high burn severity of the 2007 Poomacha Fire followed by significant rainfall events caused large debris flows in portions of the western Middle Subbasin. These debris flows were composed of highly mobilized ash, sediment, and woody debris. Water quality and aquatic biota downstream of the burn areas were adversely affected by the fire and subsequent rainfall events.

How has land use affected these natural processes?

Findings and Conclusions:

- Henshaw Dam has altered the natural hydrologic processes of the SLR River. A reduction of peak flows has resulted in the encroachment of vegetation into the streambed, buildup of fine sediments, limited

cobble and gravel recruitment, and reduced the river's scouring capabilities (i.e. pool formation);

- The timing of flow releases does not necessarily mimic natural flow conditions and would not coincide with a steelhead lifecycle;
- Water extraction by commercial groundwater harvesting and numerous wells in the subbasin may reduce water available to riparian species and overall surface flows in tributaries and in the SLR River.

Based upon these conditions, trends, and relationships, are there elements that could be considered to be limiting factors for steelhead production?

Findings and Conclusions:

- Based on available information for the Middle Subbasin, it appears that salmonid populations are limited by:
  - Steelhead trout currently do not have access into the subbasin due to the Escondido Diversion dam. Additional partial fish passage barriers exists in the Southern Subbasin that would hinder the potential for steelhead to access the Middle Subbasin;
  - The disruption of hydrologic connectivity and the natural hydrologic processes that are altered by the Henshaw Dam and the Escondido Canal diversion. The altered flow regime has a direct impact on fish passage within the subbasin as well as downstream;
  - Limited stream flows;
  - High levels of fine sediments in streams due to the 2007 Poomacha Fire;
  - The limited amount of areas in the river providing suitable spawning gravel;
  - The lack of deep, complex pools;
  - Presence of predatory warm water gamefish;
  - Potentially high water temperatures and poor water quality issues;
  - Limited access and available habitat in the subbasin's tributaries.

What watershed and habitat improvement activities would most likely lead toward more desirable conditions in a timely, cost effective manner?

Barriers to Fish Passage

Streams:	Recommended Actions XXX: Highest Priority		
	Continue efforts to identify and alleviate fish passage impediments at culverts or other public or private road crossings.	Research the feasibility of creating fish passage around the Escondido Canal diversion dam.	Improve fish passage by removing structures on private lands that are currently partial barriers.
SLR River	X	XX	X

Flow and Water Quality

Streams:	Recommended Actions XXX: Highest Priority		
	Insure that water diversions used for domestic or irrigation purposes bypass sufficient flows to maintain all needs of fishery resources. Considering purchasing water rights if necessary to accomplish this.	When appropriate, allow flushing flow releases to mimic natural hydrologic processes that occurred before the completion of the dam.	Remove and prevent excessive agricultural runoff contributions to Lake Henshaw, which in turn affects water quality in the SLR River.
SLR River	X	XXX	XX

Erosion and Sediment Reduction

Streams:	Recommended Actions XXX: Highest Priority			
	Continue to identify and reduce sources of sediment delivery to stream channels	Re-vegetate exposed stream banks and/or install structures to	Build livestock exclusionary fencing along creeks and create offsite	Install instream structures that enhance natural sorting of spawning gravels.

	from road systems.	increase bank stability.	watering areas.	
SLR River	X	X	-	-

Riparian and Instream Habitat

	Recommended Actions XXX: Highest Priority			
Streams:	Increase depth, area or shelter complexity in pools, by adding boulders or if possible woody debris.	To increase the number of pools, design and install pool forming structures.	Efforts to eradicate warm-water gamefish should be undertaken if fish passage is provided into the subbasin.	Consider planting barren nearstream areas with willow, cottonwood, or sycamore trees to increase streamside shade canopy and allow for woody recruitment.
SLR River	-	-	XX	-

Education, Research, and Monitoring

	Recommended Actions XXX: Highest Priority			
Streams:	Continue, expand, or develop education programs concerning water conservation, water quality, and importance of watershed/riverine ecosystems.	Research methods to prevent or inhibit warm water game fish from entering the SLR River from Henshaw Dam.	Conduct further habitat surveys and/or presence/absence surveys in the lower to middle sections of the SLR River.	Water quality and temperature monitoring should be conducted over several years to characterize conditions in streams.
SLR River	XX	XX	XX	XX

Subbasin Conclusions

The Middle Subbasin has remained mostly undisturbed and retains large areas of native habitat; however, Henshaw Dam has altered the natural flow regime of the SLR River has adversely affected the stream habitat conditions. The timing, duration, and magnitude of flow releases are controlled by water rights and the amount of water stored in Lake Henshaw. The existing seasonal flow releases are not necessarily conducive to the steelhead/trout freshwater lifecycle.

The Middle Subbasin is not accessible to steelhead/trout. Numerous downstream fish passage barriers, including the Escondido Canal diversion dam would require mitigation for steelhead to access the Middle Subbasin. The altered flow regime has impacted fish passage downstream of the Middle Subbasin. Natural waterfalls in the SLR River canyon would restrict steelhead trout upstream movement during most flow conditions.

Current instream habitat conditions in the SLR River are limited. The reduction of large flushing flows due to Henshaw Dam has led to an excess in fine sediments, filled in pool habitat, limited new cobble recruitment, and allowed for the encroachment of streamside vegetation. The 2007 Poomacha Fire most likely only exasperated these conditions in the western half of the subbasin by contributing large amounts of fine sediments. Warm water game fish are most likely established throughout the subbasin in the SLR River and continue to enter the system during flow releases from the dam. These fish would present a predatory problem for the early to mid-lifecycle stages of juvenile trout. In the surveyed area, tributary habitat was very limited as a result of fish passage barriers. It is unknown if suitable habitat exists in any of the lower tributaries within the subbasin.

While some suitable habitat could be available for steelhead/trout in the Middle Subbasin within the SLR River, utilizing restoration opportunities in the lower watershed and in the Northern Subbasin streams would be a more effective means in the immediate future in helping re-establishing steelhead populations in the SLR Basin. Nonetheless, allowing large flushing flows from Henshaw Dam would benefit the instream habitat and riparian conditions in the Middle Subbasin. Allowing these flows to pass through the Escondido Canal diversion dam would further improve trout migration, instream habitat and riparian areas downstream. If restoring steelhead populations is a goal, then sufficient river flows are required to allow steelhead opportunities to successfully complete all phases of its lifecycle.