10. Carmel River Basin Biogeographic Population Group

"Assessment at the group level indicates a priority for securing inland populations in southern Coast Ranges and Transverse Ranges, and a need to maintain not just the fluvial-anadromous life-history form, but also lagoon-anadromous and freshwater-resident forms in each population."

NOAA Fisheries Technical Recovery Team
Viability Criteria for South-Central and Southern California, 2007

10.1 LOCATION AND PHYSICAL CHARACTERISTICS

The Carmel River Basin BPG is one of the smallest of the four BPGs in the SCCCS Recovery Planning Area (Figure 10-1). The main axis of the Carmel River watershed is 28 miles long. In contrast, the main axis of the neighboring Interior Coast Range BPG region is over 180 miles long.

Carmel River – Above Los Padres Dam

The Carmel River Basin BPG drains the eastern slopes of the northern Santa Lucia Range and the western slopes of the Sierra de Salinas in northwestern Monterey County (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service and National Marine Fisheries Service 2008a, 2008b).

The Carmel River flows into the Pacific Ocean at Carmel Bay, just south of the Monterey Peninsula. This BPG shares some physical characteristics with the Interior Coast Range BPG, such as general northwest-southeast watershed orientation, landform evolution largely controlled by tectonic activity associated with the San Andreas Fault, and a highly dissected watershed. However, the Carmel River watershed also exhibits several distinguishing characteristics which sets it apart from the other watersheds and warrants its inclusion as a separate BPG. Beginning in its headwaters in the Santa Lucia Mountains, the Carmel River flows

through a several distinctive coastal habitats, starting in a mixed conifer forest, descending into montaine chaparral and oak woodlands, and in the lower elevations to coastal sage scrub and coastal prairie, terminating in coastal dunes at its mouth.

Unlike the other watersheds within the SCCCS Recovery Planning Area which are either dominated by either chaparral/oak woodland (Interior Coast Range BPG) or coniferous vegetative cover (Big Sur Coast), the Carmel contains significant elements of both. Additionally, unlike the other watersheds of the Big Sur BPG to the south, the lower reaches of the Carmel River have an alluvial character similar to the Pajaro and the Salinas watersheds, though it is considerably smaller than the neighboring Salinas River watershed, but larger than any of the systems within the Big Sur BPG.

Carmel River between Los Padres and San Clemente Dams

The mainstem of the Carmel River functions as the conduit connecting the ocean and estuary to extensive steelhead spawning and rearing habitats in the upper watershed.

There are seven major tributaries to the Carmel River (see Figure 10-1). The Carmel River watershed is relatively steep and most of the upper tributaries are naturally perennial (Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b, Carmel River Coalition 2007, Carmel River Conservancy 2004, Smith *et al.* 2004, Philip Williams & Associates 1992).

The Carmel River Estuary is one of the largest estuaries along the South-Central Coast and contains a variety of estuarine habitats, including deep-water, permanently flooded and tidally influenced mudflat habitats that support a wide diversity of aquatic species. The estuary is seasonally closed to the ocean by a sandbar which results in extensive inundation of the surrounding low-lying coastal plain at the mouth of the Carmel River. Upstream base flows of the Carmel River, in combination with periodic tidal inundation of the estuary, create seasonal brackish water conditions. The sandbar is naturally eroded on the seaward side by long-shore currents and winter wave action and over-topped and breached by storm related Carmel River flow.

Carmel River Estuary

Average annual precipitation in this region is relatively low and shows high spatial variability. In general, the coastal regions and higher elevations receive higher amounts of precipitation.

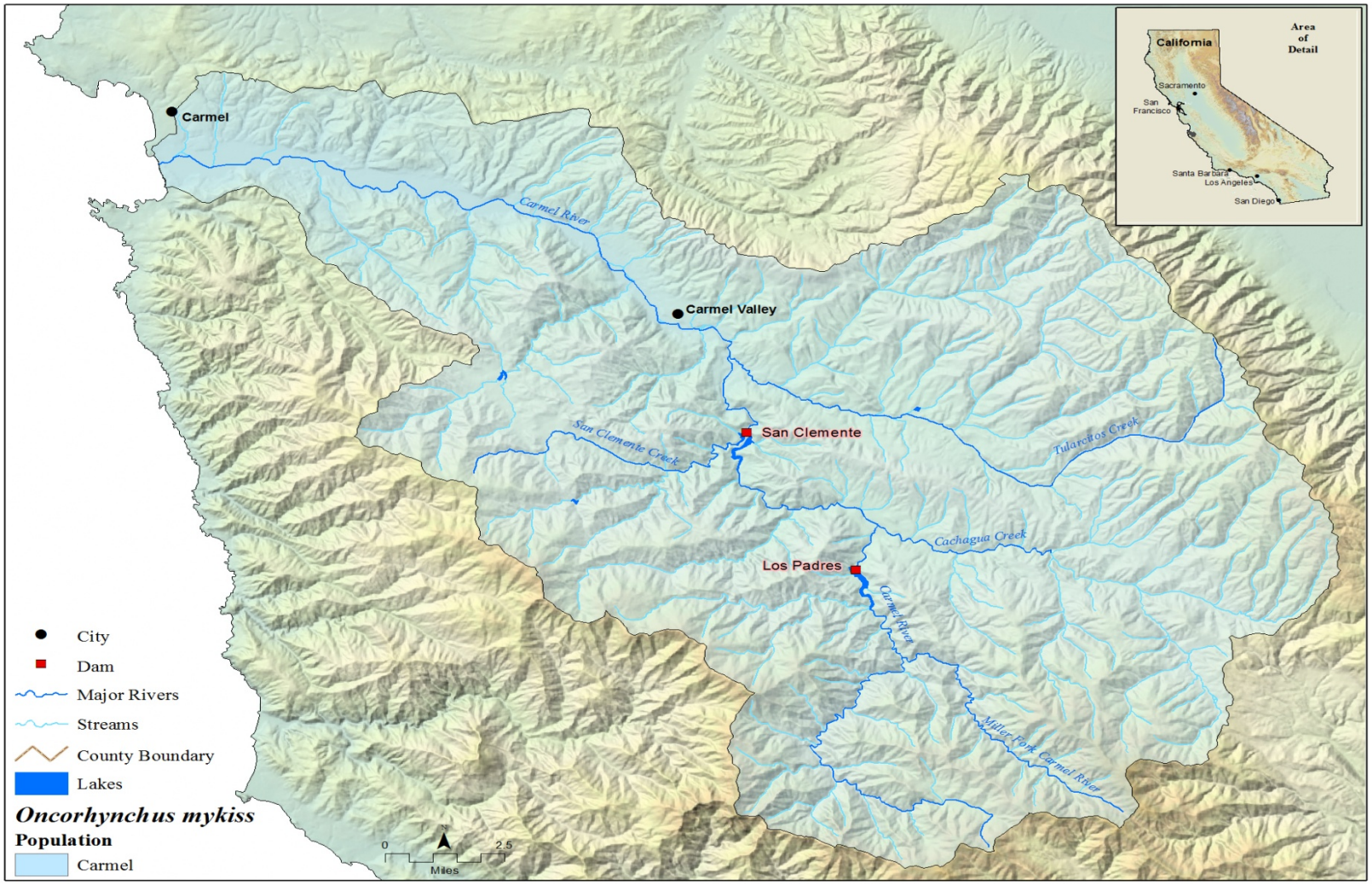

Figure 10-1. The Carmel River Basin BPG. This BPG is comprised of a single watershed (Carmel River).

10.2 LAND USE

Table 10-1 summarizes land use and population density in this region. Human population density is moderate to high and concentrated in the lower and middle portions of the Carmel Valley, including the towns of Carmel and Carmel Valley (March 2012, Palumbi 2011, Carmel River Watershed Council 2008, Chiang 2008, Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b, Carmel River Coalition 2007, Carmel River Watershed Conservancy 2004, Walton 2003, Stephenson and Calcarone 1999, Monterey Peninsula Water Management District 1987, 1983, Kondolf *et al.* 1987, Kondolf 1986, California Department of Water Resources 1978, Greene 1970). See Figure 10-2 for the pattern of federal and non-federal land ownership within the Carmel River watershed.

Carmel River - Golf Course Development

Population density averages 70 persons per square mile. Although less than four percent of the watershed is classified as urban, well over 50 percent of the watershed is privately-owned. The Carmel Valley, through which the mainstem of the Carmel River flows, is surrounded by extensive ranches and areas of rural residential land use. Less than one percent of the watershed is under cultivation.

Carmel River - Residential Development

There are four dams in the Carmel River watershed: Black Rock Creek Dam, Old Carmel River Dam, San Clemente Dam, and Los Padres Dam. Black Rock Creek Dam, constructed in 1925 on Black Rock Creek, a tributary to the Carmel River, is used for recreational purposes. The Old Carmel River, San Clemente and Los Padres Dams, were constructed on the mainstem Carmel River in 1880, 1921 and 1949, respectively, for municipal and agricultural water supply. Three of these facilities San Clemente, Old Carmel River, and Los Padres Dam have fish passage facilities designed to pass adult steelhead; additionally, smolt emigration facilities are being developed for the Los Padres Dam (California Department of Fish and Wildlife 2012a, California Department of Water Resources 1988, Monterey Peninsula Water Management District 2000, 1987, K. Urquhart personal communication).

Table 10-1. Physical and Land Use Characteristics of Watershed in the Carmel River Basin BPG.

PHYSICAL CHARACTERISTICS						LAND USE			
WATERSHED	**Area** (acres)[1]	**Area** (sq.miles)[1]	**Stream Length**[2] (miles)	**Ave. Ann. Rainfall**[3] (inches)	**Total Human Population**[4]	**Public Ownership***	**Urban Area**[5]	**Agriculture/ Barren**[5]	**Open Space**[5]
Carmel River	162,286	254	248	19.8	17,020	31%	4%	0.6%	95%

[1] *From: CDFFP CalWater 2.2 Watershed delineation, 1999 (www.ca.nrcs.usda.gov/features/calwater/)*
[2] *From: CDFG 1:1,000,000 Routed stream network, 2003 (www.calfish.org/)*
[3] *From: USGS Hydrologic landscape regions of the U.S., 2003 (1 km grid cells)*
[4] *From: CDFFP CalFire FRAP (http://cdf.ca.gov/data/frapisdata/select.sap)(migrated)*
[5] *From: CDFFP Multi-source land cover data (v02_2), 2002 (100 m grid cells) (http://frap.cdf.ca.gov/data/frapgisdata/select.asp)*
** Includes National Forest Lands and Military Reservations only; does not include State or County Parks (from: http://old.casil.ucdavis.edu/casil/gis.ca.gov/teale/govtowna/)*

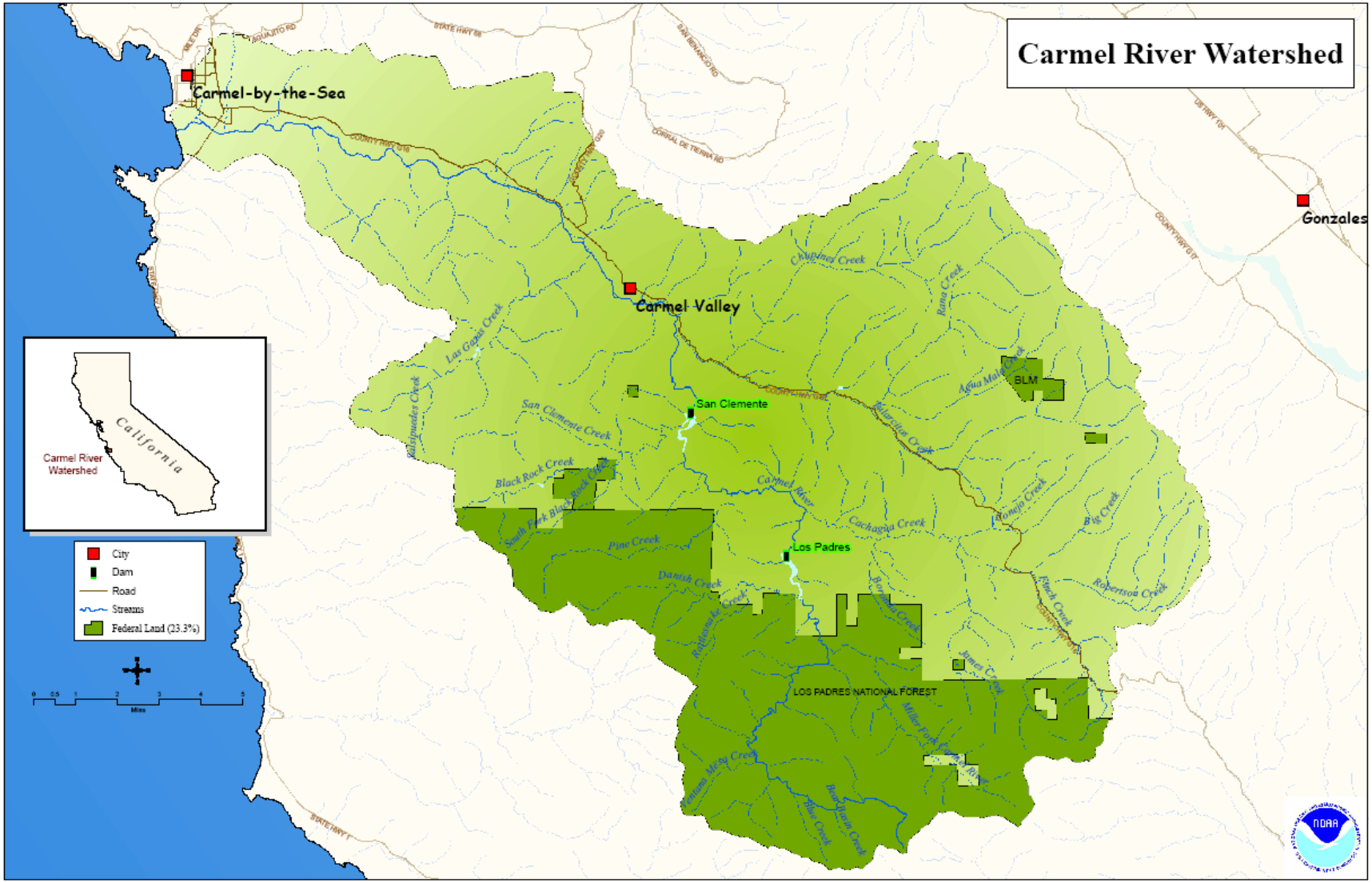

Figure 10-2. Federal and Non-Federal Land Ownership within the Carmel River Watershed.

10.3 CURRENT WATERSHED CONDITIONS

Watershed conditions in this BPG were assessed, with the focus on conditions most directly relevant to steelhead. A total of 30 indicators were used in the CAP Workbook analysis for this BPG. This analysis rated overall habitat conditions for anadromous *O. mykiss* in the Carmel River watershed as "Fair." However, approximately 33 percent of the indicators were impaired (fair condition) or severely impaired (poor condition) and these indicators repeatedly focused on lack of surface flows in the mainstem caused by water management activities (*i.e.,* dams, surface water diversions, and excessive pumping of groundwater). The historic distribution of useable spawning and rearing habitat within the Carmel River watershed has been constrained by the construction and operation of the Los Padres and San Clemente Dams, which have blocked or inhibited the natural pattern of up and downstream migration of adult and juvenile steelhead as well as altered the natural surface flow and reduced the recruitment of essential spawning gravels in the lower river (California Department of Fish and Wildlife 2011b, Hunt & Associates 2008a, Kier Associates and National Marine Fisheries Service 2008a, 2008b, Monterey Peninsula Water Management District 2000-2011, 1987, 1983, Casagrande 2006, Monterey Peninsula Water Management District and Carmel River Watershed Conservancy 2004, Carmel River Conservancy 2004, Stephenson and Calcarone 1999, Dettman and Kelley 1987, 1986, Kondolf 1987, 1986, Snider 1983, California Department of Water Resources 1978; see also, March 2012).

In 1995, in response to groundwater withdrawals drying up portions of the lower river, the California State Water Resources Control Board (CSWRCB) ordered a 70% reduction in Carmel River Diversions. In 1998 the CSWRCB determined that the waters of the Carmel River had been fully appropriated between May 1 and December 31, and all new water right permits issued by the SWRCB must meet instream flow requirements for steelhead. Finally, the SWRCB has issued a Cease and Desist Order in 2009, to reduce diversions (*i.e.,* groundwater pumping) to meet the SWRCB's 1995 and 1998 orders by 2017 (California State Water Resources Control Board 2009, 1998, 1995).

The mainstem contains significant spawning habitat and functions as the conduit connecting the ocean and estuary to extensive spawning and rearing habitats in the upper watershed. The steelhead migration corridor through the lower mainstem of the Carmel River is frequently restricted was a result of excessive groundwater extractions, resulting in low flows and disconnection between the estuary and upstream habitats.

Carmel River – Carmel River Valley

In extreme drought conditions (such as 1987-1991), the failure of the sandbar at the river's mouth to breach, prohibits steelhead from entering the Carmel River as well as escapement of juveniles (Monterey County Peninsula Water Management District 1991-2013). Farther upstream, San Clemente and Los Padres dams (while equipped with fish passage facilities) impede access to the majority of the spawning and rearing habitat of the Carmel River watershed (National Marine Fisheries Service 2002, 2001). Additionally, the two dams impede

the downstream transport of sediment necessary to maintain suitable steelhead spawning and rearing habitat in the middle reaches and lower reaches of the Carmel River, and can act as refugia for non-native warm water species (D. W. Alley & Associates 1998, 1997b, 1992b, Dettman 1993, 1989, D. W. Kelley & Associates 1996, 1987, 1984, 1982, Dettman and Kelley 1987, 1986).

A significant portion of the lower Carmel River below San Clemente Dam has been developed for residential and commercial uses. As a result, the mainstem and related floodplain have been altered by bank protection for flood control purposes, thus adversely affecting steelhead habitats, including the related riparian corridor. (Kondolf 1986).

Carmel River Estuary – Residential Encroachment

The Carmel River Estuary also received a low rating. While the existing estuary has undergone substantial restoration and still contains valuable rearing habitat, at least 33% of the original estuary has been eliminated due to encroachment from residential development, transportation corridors (Highway 1), and recreational development (Carmel Beach State Park). Additionally, reduced flows due to the groundwater extractions and surface diversions and artificial sandbar breaching reduce water levels and encroaching development has reduced estuarine functions, including juvenile steelhead rearing potential. (Anderson *et al*. 2008, California Department of Parks and Recreation 2008, Carmel River Coalition 2007, Perry *et al.* 2007, Casagrande 2006, 2003, Larson *et al.* 2006, Watson and Casagrande 2004, Hagar 2003, D. W. Alley & Associates 1997b, Kitting 1990, Dettman 1984).

Carmel River Estuary – Artificial Breaching

The Carmel River watershed is the only watershed within the SCCCS Recovery Planning Area which has a relatively long-term (20+ years) time-series for adult steelhead runs; this monitoring is conducted principally at the San Clemente and Los Padres Dams. Over the last 20 years (1993-2013) the adults recorded at these two facilities (combined) averaged about 500 adults, though the variation from year to year, can vary by orders of magnitude (see Figures 10-3 and 10-4 below). During the 2011 - 2012 season 470 adults were reported at the San Clemente Dam, and 174 adults at the Los Padres dam. During the most recent 2012-2013 season 249 adults were reported at the San Clemente Dam and 65 adults were reported and the Los Padres Dam. These observed adults, however, do not represent all the steelhead that may have entered the Carmel River system but did not reach the trapping facilities, and were therefore not observed; some un-detected adults may have spawned in the mainstem and tributaries below these dams or emigrated back to the ocean without spawning (Monterey Peninsula Water Management District 1991-2013).

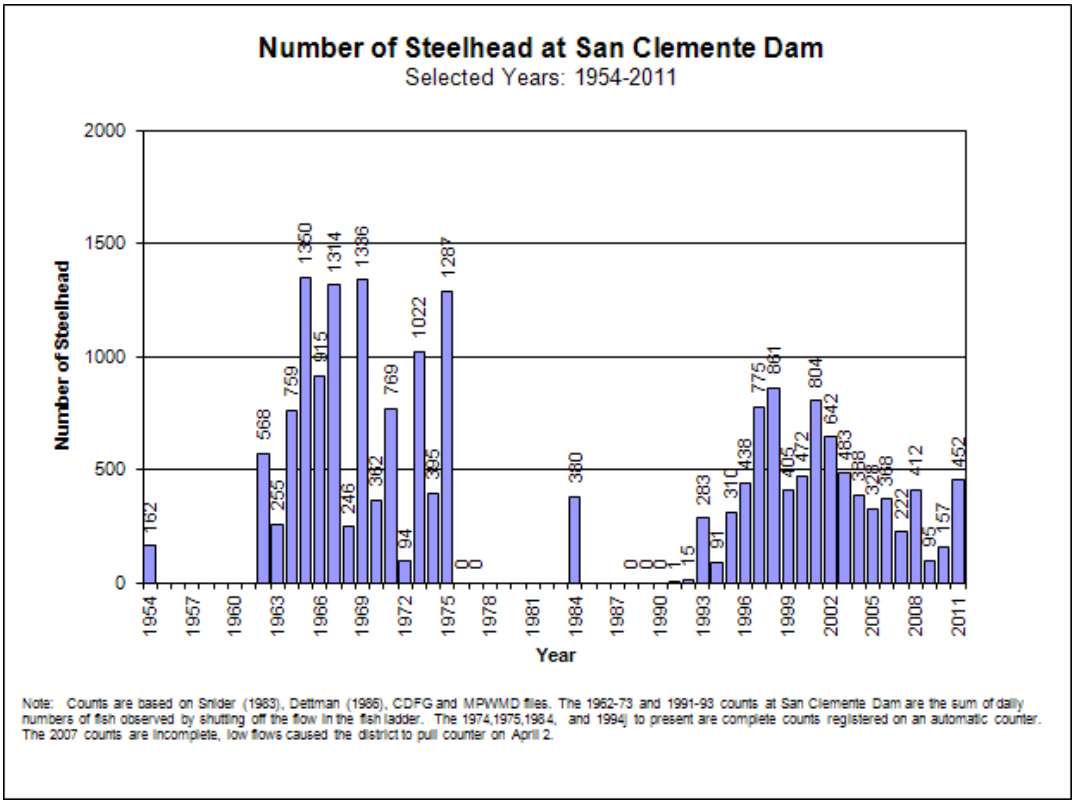

Figure 10-3. Steelhead Counts at San Clemente Dam: 1954 - 2011 (Monterey Peninsula Water Management District).

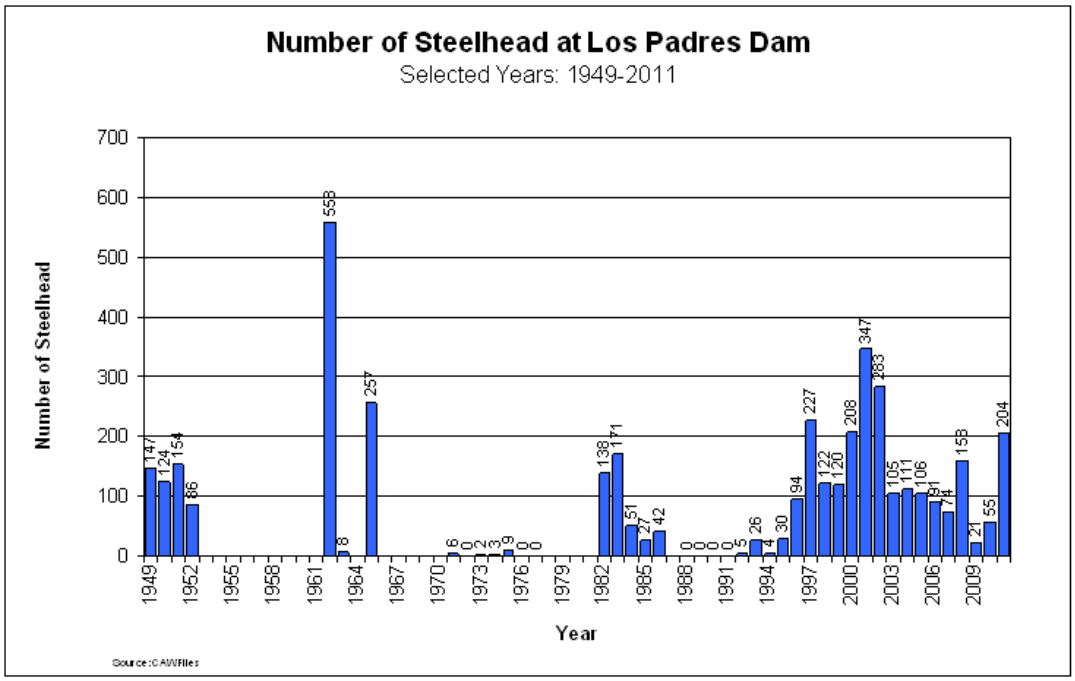

Figure 10-4. Steelhead Counts at Los Padres Dam: 1949 - 2011 (Monterey Peninsula Water Management District).

Native non-anadromous *O. mykiss* populations, while not usually a major proportion of the entire *O. mykiss* population, persist in the mainstem and most of the tributaries above and below these dams. However, during drought conditions such as those that persisted from 1987 through 1991, potentially anadromous juvenile *O. mykiss* could not emigrate out of the watershed and were forced to complete their lifecycle within the river. These fish, as well as others annually rescued from drying reaches of the lower Carmel River are reared in off-channel facilities at the Sleepy Hollow Rearing Facility, operated as part of the Monterey Peninsula Water Management District's Steelhead Rearing Program. These efforts have contributed to the maintenance of the anadromous fraction of the *O. mykiss* population while longer-term recovery and management actions are being developed (Monterey Peninsula Water Management District 2010a, 2010b, 2000-2011, 1988).

10.4 THREATS AND THREAT SOURCES

Information identified in the CAP Workbooks on habitat and land-use indicators for the Carmel River Basin BPG was supplemented by additional information developed since the preparation of the CAP Workbooks and incorporated into the threats assessment. However, the underlying threat sources that determined the poor to very poor conditions of approximately one-third of those indicators repeatedly pointed to a limited number of anthropogenic causes, including: passage barriers caused by excessive surface and groundwater diversions; passage impediments caused by dams; loss or degradation of spawning substrates below both Los Padres and San Clemente Dams as a result of sediment trapped behind the dams and water management practices, including substantial groundwater use for golf course irrigation; agriculture, urban development. Residential and commercial development and stream bank modifications for flood protection have constricted the lower floodplain of the river. Artificial breaching of the sandbar (both the timing and location) to alleviate flooding of adjacent encroaching residential development has reduced and degraded steelhead rearing habitat within the Carmel River Estuary. Watershed developments have increased erosion and fine sedimentation, particularly in the lower mainstem of the Carmel River, but also within some tributaries, and have contributed to habitat degradation of spawning and rearing habitats (ESA PWA 2012, California Department of Fish and Wildlife 2011b, Monterey Peninsula Water Management District and Carmel River Watershed Conservancy 2004, Monterey Bay National Marine Sanctuary Advisory Council 2003, Dettman 1993, 1989, 1984, Dettman and Kelley 1987, 1986, D. W. Alley & Associates 1998, 1997b, 1992b, D. W. Kelley & Associates 1996, 1987, 1984, Kondolf and Curry 1984, Hecht 1984, Stone 1971, Zinke 1971, U.S. Army Corps of Engineers 1967).

Carmel River - San Clemente Dam

A pervasive threat to anadromous *O. mykiss* throughout the Carmel River Basin BPG are impediments to upstream and downstream fish passage, either in the form of dams and surface water diversions, or excessive groundwater extraction that creates dry stream reaches (Table 10-2), and connectivity with the Carmel River Estuary. Several miles of the mainstem Carmel River below San Clemente Dam that would otherwise have perennial surface flows frequently dry up or are reduced to isolated

pools by late spring and early summer, primarily due to surface and subsurface water withdrawals. Annual fish rescue and relocation efforts (including relocation to the estuary) are intended to deal with this situation on an interim basis (with rescued fish reared and subsequently released from the Sleepy Hallow Rearing Facility located downstream of the San Clemente Dam). Spawning habitat in the mainstem below the Los Padres and San Clemente Dams has been degraded since 1921 by the retention of spawning gravel and the consequent armoring of the stream bed with large cobbles and boulders downstream of the dams.

As noted above, the Los Padres Dam and San Clemente Dams have also constrained the natural movement of steelhead, both upstream migrating adults and downstream emigrating juveniles, as well as deprived downstream reaches of the Carmel River of significant sediment (and large woody debris) necessary to sustain productive steelhead spawning and rearing habitat. The approved removal of San Clemente Dam will restore volitional access to 25 miles of spawning and rearing habitat, the majority of which is in tributaries between San Clemente Dam and Los Padres Dam (Capelli 2007, Entrix 2006, Raines *et al*. 2002, Monterey Peninsula Water Management District 2000, R2 Resource Consultants 2000, D. W. Alley & Associates 1998, 1992b, D. W. Kelley & Associates 1996, 1987, 1984, 1982, Dettman 1993, 1989, 1984).

See Figure 10-4 for an overview of the dams and other fish passage impediments within the Carmel River Basin BPG, but note the status of fish passage impediments is in flux, with old impediments being removed or modified, while new impediments may be installed, or discovered through updated inventories; a current list of fish passage impediments can be found on the California Department of Fish and Wildlife website:
http://www.cafishpassageforum.org/

Carmel River - Los Padres Dam

Surface and groundwater extractions artificially modify the pattern of sandbar formation and natural breaching at the estuary. The sandbar is also breached artificially for flood control and by people recreating on the beach, which causes premature draining of the estuary, and can also affect surrounding groundwater levels which help maintain summer water levels in the estuary; these artificial breachings can result in the loss of important juvenile steelhead rearing habitat, as well as the flushing of rearing juveniles to the ocean (California Department of Parks and Recreation 2008, Watson and Casagrande 2004, National Marine Fisheries Service 2002, Dettman 1984, U.S. Fish and Wildlife Service 1980).

The presence of exotic fish species, particularly striped bass (*Marone saxatilis*), has the potential to prey upon and compete with *O. mykiss* and require further monitoring and evaluation of their impacts on steelhead and steelhead habitat. A related potential issue is the expansion of some marine mammal populations (*e.g.*, California sea-lions *Zalophus californianus*) which may prey upon steelhead, particularly when steelhead are temporarily concentrated in enclosed areas, making them more vulnerable to predation. However, this issue has not been the subject of any systematic investigation within the SCCCS DPS and its significance is therefore unknown. Marine mammals are protected under the Marine Mammals Protection Act of 1972 (MMPA), and their management is subject to the

provisions of the MMPA (National Marine Fisheries 2011, Steele and Anderson 2006, Middlemas *et al*. 2005, Hinton 2003, Yurk and Trites 2000, Fresh 1997, United State General Accounting Office, 1993, Lowry and Folk 1987, DeMaster *et al.* 1985, Seagers *et al*. 1985).

The spread of other exotic, and invasive species, including plant species, continues to increase with the increasing human population and related changes in land uses within the Carmel River BPG; the early detection, rapid response to, and preferably prevention of, these introductions is an important component in any comprehensive steelhead recovery effort within the Carmel River Basin BPG.

Carmel River Estuary.

Finally, because the lower Carmel River runs through a populated suburban area, with a long angling tradition, taking adult steelhead illegally through poaching is a threat that has been recognized by resource agencies and conservation organizations, particularly during low flow periods when adult fish may be most vulnerable to being trapped in shallow pools with limited opportunities for escape.

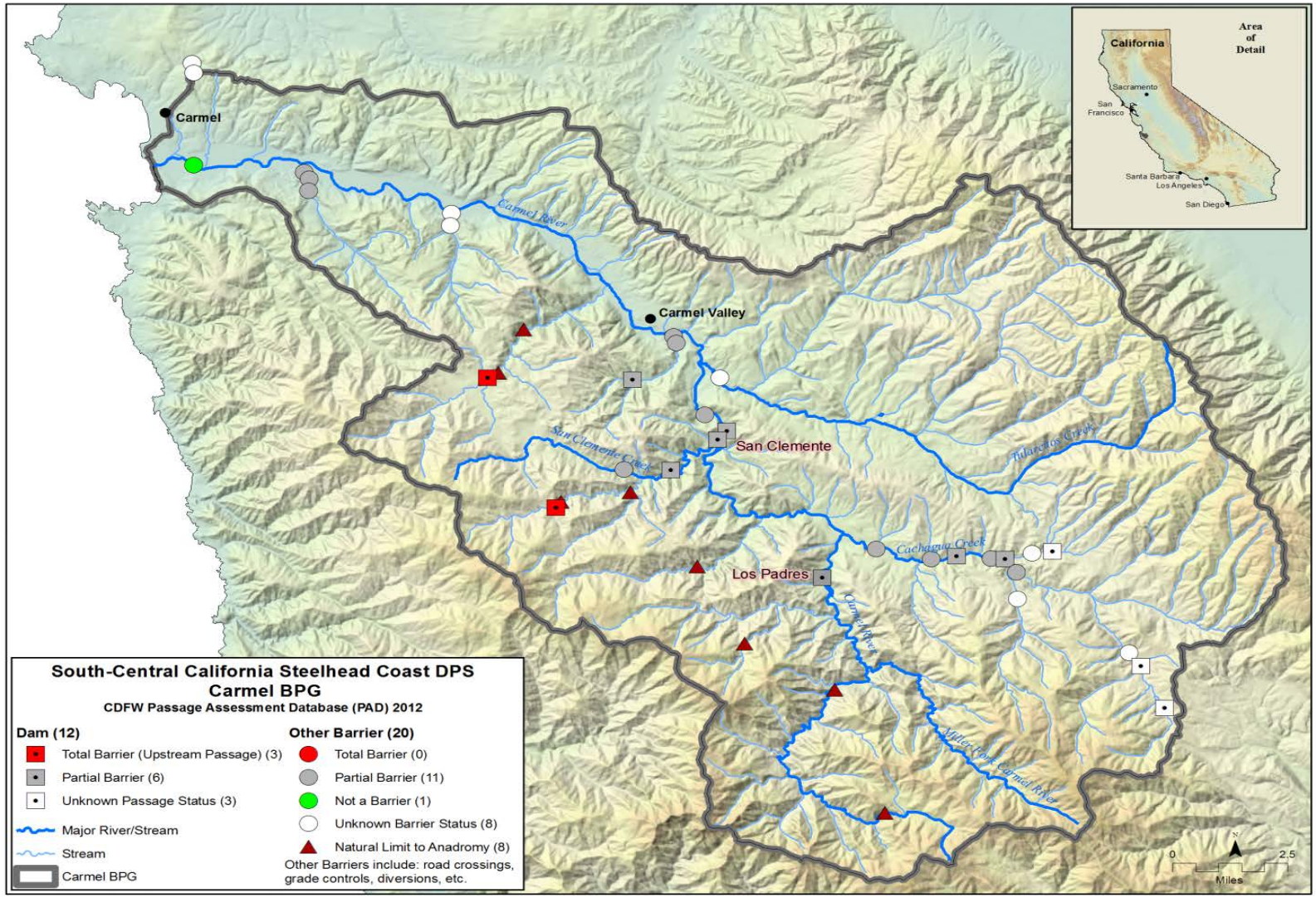

Figure 10-5. Major Fish Passage Impediments, Carmel River Basin BPG. Note: the status of fish passage impediments is in flux, with existing ones being removed or modified, while new ones may be installed, or discovered through updated inventories; a current list of fish passage impediments can be found on the California Department of Fish and Wildlife website: http//www.cafishpassageforum.org/

Table 10-2. Threat source rankings in the Carmel River Basin BPG (see CAP Workbooks for details).

THREAT SOURCES*	WATERSHED
	Carmel River
Dams and Surface Water Diversions	
Groundwater Extraction	
Urban Development	
Levees and Channelization	
Culverts and Road Crossings (Other Passage Barriers)	
Recreational Facilities	

Key: Threat cell colors represent threat rating from CAP Workbook: Red = Very High threat; Yellow = high threat; Light green = Medium threat; Dark green = Low threat

**Note The ranking for each threat source reflects its significance for the basin as a whole, but does not necessarily indicate it occurs in every part of the watershed (e.g., urban development , levees and channelization, and culverts and crossing are generally restricted to the lower portions of the watershed). Also, agricultural development was not identified during the CAP Workbook analyses as one of the top five threats in this watershed, but agricultural development in the middle reaches of the Carmel River, and within some tributaries could be a significant threat to this population.*

10.5 SUMMARY

Dams and diversions (including groundwater extractions) on the Carmel River have had the most severe adverse impacts on steelhead populations in this BPG by reducing access to upstream spawning and rearing habitats and altering the magnitude, and timing of flows necessary for immigration of adults and emigration of juveniles. While considerable planning has been conducted for the removal of both the Old Carmel River and San Clemente Dams, similar investigations have not yet been initiated for the Los Padres Dam, and are essential for the future removal or modification of this facility. Urban and agricultural developments within the Carmel River watershed are also significant threats. For example, residential development around the estuary and along some reaches of the lower mainstem has encroached on and degraded estuarine and riparian habitats, and generated pressure to artificially breach the sandbar to reduce flooding of residential properties. Generally, road density, population density, and fire frequency are relatively low; however these factors can be expected to increase in the future.

Because the mainstem of the Carmel River is the conduit that connects upstream spawning and rearing habitat with the ocean, recovery actions in this watershed should focus on reducing the severity of anthropogenic impacts stemming from the construction and operation of dams (*e.g.,* San Clemente and Los Padres Dams) and groundwater extractions along the mainstem in order to promote connectivity between the ocean and estuarine habitats, as well as to maintain spawning and rearing habitat in the mainstem itself. Additionally, degraded estuarine conditions stemming from filling, artificial sandbar manipulation, and both point and non-point waste discharges, should be further evaluated and addressed. Table 10-3 summarizes the critical recovery actions needed within the Core 1 population of the Carmel River Basin BPG.

The threat sources discussed in this chapter are the focus of a variety of recovery actions to address specific stresses associated with these threats. Spatial and temporal data acquired on specific indicators associated with sources of threats or stresses, such as water temperature, pH, nutrients, *etc.,* are generally inadequate to guide specific recovery actions. This type of data should be the subject of site-specific investigations in order to refine the recovery actions or to target additional recovery actions as part of any recovery strategy for the Carmel River Basin BPG.

Carmel River Steelhead – c. 1980s (Courtesy Monterey Peninsula Water Management District)

Management of the Carmel River steelhead population will require additional investigations of the population structure and distribution throughout the watershed; these studies should include, but not be limited to, the relative productivity of the various tributaries, how these subpopulations contribute to the diversity of the overall population, and the use of the estuary by steelhead, particularly rearing juveniles. The Los Padres Dam is an important part of a regional water supply system, and its removal or modification will require additional studies, and must take into account its existing and future functions. Additionally, as noted previously, restoring access to habitats above anthropogenic barriers, will, entail controlling or

eliminating non-native species that have become established in artificial reservoirs above dams. However, the full removal of dams and associated reservoirs would eliminate refugia habitat favorable to many freshwater non-native species of fishes. In some cases, restoration of habitat conditions (*e.g.,* riparian cover, instream habitat complexity, including adequate spawning substrate) may also be necessary.

Table 10-3 below highlights critical recovery actions for the Carmel River Basin BPG. The following Table 10-4 identifies a full suite of recovery actions necessary to recover this population and prioritizes recovery actions in the Carmel River Basin BPG; this table also provide provisional cost estimates for implementing such actions in five year increments, and where applicable extended out to 100 years, though many of the recovery actions can and should be achieved within a shorter period (Hunt & Associates 2008a 2008b, Kier Associates and National Marine Fisheries Service 2008a, 2008b).

Table 10-3. Critical recovery actions for Core 1 populations within the Carmel River Basin BPG.

POPULATION	CRITICAL RECOVERY ACTIONS
Carmel River	Develop and implement operating criteria to ensure the pattern and magnitude of groundwater extractions and water releases, including releases from San Clemente and Los Padres Dams, provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Remove or physically modify San Clemente, Los Padres, and Old Carmel River Dams* to provide natural rates of steelhead migration to upstream spawning and rearing habitats; passage of smolts and kelts downstream to the estuary and ocean; and restoration of spawning gravel recruitment in the lower mainstem. In the interim ensure provisional fish passage of both adult and juvenile *O. mykiss* around Los Padres, San Clemente and Old Carmel River Dams, seasonal releases from San Clemente and Los Padres Dams, and the provision of spawning gravel and large woody debris within the lower mainstem to support all *O. mykiss* life-history phases, including adult and juvenile migration, spawning, and incubation and rearing habitats. Identify, protect, and where necessary, restore estuarine habitats by providing supplemental water to the estuary and management of artificial breaching of the river's mouth.

* Note: Prior to the removal or modification of these dams appropriate investigations and environmental review should be completed to address regional water supply and environmental issues, including, but not limited to any effects on the existing steelhead resources of the Carmel River watershed.