MONTEREY PENINSULA
WATER MANAGEMENT DISTRICT

2016-2017 ANNUAL REPORT
(July 1, 2016 - June 30, 2017)

for the

MPWMD MITIGATION PROGRAM

A report in compliance with the

MPWMD WATER ALLOCATION PROGRAM
FINAL ENVIRONMENTAL IMPACT REPORT
(originally certified in November 1990)

Prepared by MPWMD Staff
April 2018

2016-2017 ANNUAL REPORT
MPWMD MITIGATION PROGRAM
WATER ALLOCATION PROGRAM EIR

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MPWMD MITIGATION PROGRAM
WATER ALLOCATION PROGRAM ENVIRONMENTAL IMPACT REPORT

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
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I. EXECUTIVE SUMMARY

INTRODUCTION AND BACKGROUND:

In April 1990, the Water Allocation Program Final Environmental Impact Report (EIR) was prepared for the Monterey Peninsula Water Management District (MPWMD or District) by J.L. Mintier and Associates. The Final EIR analyzed the effects of five levels of annual California American Water (CAW or Cal-Am) production, ranging from 16,744 acre-feet per year (AFY) to 20,500 AFY. On November 5, 1990, the MPWMD Board certified the Final EIR, adopted findings, and passed a resolution that set Option V as the new water allocation limit. Option V resulted in an annual limit of 16,744 AFY for Cal-Am production, and 3,137 AFY for non-Cal-Am production, with a total allocation of 19,881 AFY for the Monterey Peninsula Water Resource System (MPWRS). The MPWRS is the integrated system of water resources from the Carmel River Alluvial Aquifer and Seaside Groundwater Basin that provide the Monterey Peninsula community's water supply via the Cal-Am water distribution network.

Even though Option V was the least damaging alternative of the five options analyzed in the Water Allocation Program EIR, production at this level still resulted in significant, adverse environmental impacts that must be mitigated. Thus, the findings adopted by the Board included a "Five-Year Mitigation Program for Option V" and associated mitigation measures.

In June 1993, Ordinance No. 70 was passed, which amended the annual Cal-Am production limit from 16,744 AF to 17,619 AF, and the non-Cal-Am limit from 3,137 AF to 3,054 AF; the total production limit was increased from 19,881 AF to 20,673 AF per year due to new supply from the Paralta Well in Seaside. In April 1996, Ordinance No. 83 slightly changed the Cal-Am and non-Cal-Am annual limits to 17,621 AF and 3,046 AF, respectively, resulting in a total limit of 20,667 AFY. In February 1997, Ordinance No. 87 was adopted to provide a special water allocation for the planned expansion of the Community Hospital of the Monterey Peninsula, resulting in a new Cal-Am production limit of 17,641 AFY; the non-Cal-Am limit of 3,046 AFY was not changed. These actions did not affect the implementation of mitigation measures adopted by the Board in 1990.

The Five-Year Mitigation Program formally began in July 1991 with the new fiscal year (FY) and was slated to run until June 30, 1996. Following public hearings in May 1996 and District Board review of draft reports through September 1996, the Five-Year Evaluation Report for the

1991-1996 comprehensive program, as well as an Implementation Plan for FY 1996-1997 through FY 2000-2001, were finalized in October 1996. In its July 1995 Order WR 95-10, the State Water Resources Control Board (SWRCB) directed Cal-Am to carry out any aspect of the Five-Year Mitigation Program that the District does not continue after June 1996. To date, as part of the annual budget approval process, the District Board has voted to continue the program. The Mitigation Program has accounted for a significant portion of the District's annual budgets in terms of revenue (derived primarily from a portion of the MPWMD user fee on the Cal-Am bill) and expenditures. It should be noted that this fee was removed from Cal-Am's bill in July 2009, resulting from actions subsequent to a California Public Utilities Commission ruling regarding a Cal-Am rate request. Cal-Am continued to pay the Carmel River Mitigation Program fee under a separate agreement with MPWMD through June 2010. The District and Cal-Am have negotiated an annual funding agreement that funded part of the 2016-2017 mitigation program. In April 2017, the MPWMD resumed collection of its user fee from Cal-Am ratepayers. The District's other revenue sources were used to fund the remainder of the program.

The California Environmental Quality Act (CEQA) (Pub. Res. Code 21081.6) requires that the MPWMD adopt a reporting or monitoring program to insure compliance with mitigation measures when implementing the Water Allocation Program. Findings Nos. 387 through 404 adopted by the Board on November 5, 1990 describe mitigation measures associated with the Water Allocation Program; many entail preparation of annual monitoring reports. This 2016-2017 Annual Report for the MPWMD Mitigation Program responds to these requirements. It covers the fiscal year period of July 1 through June 30. It should be noted that hydrologic data and well reporting data in this report are tabulated using the water year, defined as October 1 through September 30, in order to be consistent with the accounting period used by the SWRCB.

This 2016-2017 Annual Report first addresses general mitigation measures relating to water supply and demand (Sections II through XI), followed by monitoring related to compliance with production limits, drought reserve and supply augmentation (Sections XII through XV), followed by mitigations relating to specific environmental resources (Sections XVI through XIX). Section XX provides a summary of costs for the biological mitigation programs as well as related hydrologic monitoring, water augmentation and administrative costs. Section XXI presents selected references.

Table I-1 summarizes the mitigation measures described in this report. In subsequent chapters, for each topic, the mitigation measure adopted as part of the Final EIR is briefly described, followed by a summary of activities relating to the topic in FY 2016-2017 (July 1, 2016 through June 30, 2017, unless otherwise noted). Monitoring results, where applicable, are also presented. Tables and figures that support the text are found at the end of each section in the order they are introduced in the text.

ACCOMPLISHMENTS:

Many activities are carried out as part of the MPWMD Mitigation Program to address the environmental effects that community water use has upon the Carmel River and Seaside

Groundwater Basins. Highlights of the accomplishments in FY 2016-2017 for each major category are shown in **Table I-2**.

OBSERVED TRENDS, CONCLUSIONS AND/OR RECOMMENDATIONS:

The following paragraphs describe observed trends (primarily qualitative), conclusions and/or recommendations for the mitigation program. General conclusions are followed by a summary of selected Mitigation Program categories.

General Overview

Overall, the Carmel River environment with respect to riparian vegetation, river flow, and aquifer levels is in better condition today than it was in 1990 when the Allocation Program EIR was prepared. This improvement is evidenced by increased riparian habitat and higher water tables in the Carmel Valley alluvial aquifer. However, the steelhead fishery was rebounding until the onset of the 2012-2015 drought. During and after the drought, steelhead numbers declined to levels similar to those seen in previous droughts. Then in 2017, with abundant winter rains, adult steelhead were observed in the system and the District did not have to rescue juvenile steelhead in the mainstem of the Carmel River. However, rescues were carried out in the tributaries.

The comprehensive MPWMD Mitigation Program is an important factor responsible for this improvement. Direct actions such as fish rescues and rearing, and riparian habitat restoration literally enable species to survive and reproduce. Indirect action such as conservation programs, water augmentation, ordinances/regulations and cooperative development of Cal-Am operation strategies result in less environmental impact from human water needs than would occur otherwise. The District's comprehensive monitoring program provides a solid scientific data baseline, and enables better understanding of the relationships between weather, hydrology, human activities and the environment. Better understanding of the MPWRS enables informed decision-making that achieves the District's mission of benefiting the community and the environment.

It is acknowledged that there are other important factors responsible for this improved situation. For example, since Water Year (WY) 1991, the Carmel River has received normal or better runoff in 17 out of 26 years. Actions by federal resource agencies under the Endangered Species Act (ESA) or the SWRCB under its Order WR 95-10 and follow-up orders have provided strong incentive for Cal-Am and other local water producers to examine and amend water production practices to the degree feasible, and for the community to reduce water use. Except for one year in 1997, the community has complied with the production limits imposed on Cal-Am by the SWRCB since Order 95-10 became effective in July 1995.

Despite these improvements, challenges still remain due to human influence on the river. The steelhead and red-legged frog remain listed as threatened species under the ESA. At least several miles of the river still dry up in most years, harming habitat for listed fish and frog species. The presence of the one existing dam, flood-plain development and water diversions to meet

community and local user needs continue to alter the natural dynamics of the river. Streambank restoration projects may be significantly damaged in large winter storm events, and some people continue to illegally dump refuse into the river or alter their property without the proper permits. Thus, the Mitigation Program (or a comprehensive effort similar to it) will be needed as long as significant quantities of water are diverted from the Carmel River and people live in close proximity to it.

Water Resources Monitoring Program

Streamflow and precipitation data continue to provide a scientific basis for management of the water resources within the District. These data continue to be useful in Carmel River Basin planning studies, reservoir management operations, water supply forecast and budgeting, and defining the baseline hydrologic conditions of the Carmel River Basin. Also, the District's streamflow monitoring program continues to produce high quality and cost-effective data.

There is limited storage of surface water on the Carmel River. Los Padres Reservoir, completed in 1948, holds 1,667 AF of storage (without flashboard), based on 2017 survey data. In addition, San Clemente Reservoir (SCR), completed in 1921, was removed in the fall of 2015 by order of the Department of Water Resources (DWR) due to seismic safety concerns.

Groundwater levels, and consequently groundwater storage conditions, in the Carmel Valley Alluvial Aquifer have maintained a relatively normal pattern in recent years, in contrast to the dramatic storage declines that were observed during the prolonged 1987-1991 drought period. The relatively stable storage in the Carmel Valley alluvial aquifer in recent years is attributable to a combination of periods of more favorable hydrologic conditions and the adoption of improved water management practices that have tended to preserve higher storage conditions in the aquifer. In WY 2017, Carmel Valley alluvial aquifer storage increased compared with recent years as this year was classified as "extremely wet."

In contrast, storage conditions in the coastal portion of the Seaside Groundwater Basin have not been stable in recent years, in particular with respect to the deeper Santa Margarita aquifer, from which over 80 percent of the Cal-Am production in the Seaside Basin is derived. This downward trend in water levels reflects the changed production operations in the Seaside Basin stemming primarily from changed practices after SWRCB Order 95-10. The increased annual reliance on production from Cal-Am's major production wells in Seaside, along with significant increases in non-Cal-Am use, have dramatically lowered water levels in this aquifer, and seasonal recoveries have not been sufficient to reverse this trend.

To address this storage depletion trend, the District initiated efforts in the 2000-2001 timeframe to prepare a Seaside Basin Groundwater Management Plan in compliance with protocols set by the State of California (AB 3030, as amended by SB 1938). This process was superseded by litigation filed by Cal-Am in August 2003, requesting a court adjudication of water production and storage rights in the Seaside Basin. The District participated in all litigation proceedings as an intervening "interested party". The Superior Court held hearings in December 2005 and issued a final adjudication decision in March 2006, which was amended through an additional court filing in February 2007. The final decision established a new, lower "natural safe yield"

for the Basin of 3,000 AFY, and an initial Basin "operating safe yield" of 5,600 AFY. Under the decision, the operating safe yield would be reduced by 10% every three years until the operating safe yield matches the natural safe yield of the Basin in 2021. The Court also created a nine-member Watermaster Board (of which the District is a member) to implement the Court's decision. With the triennial reductions in operational yield required by the Seaside Basin Adjudication Decision, water levels have not been declining as fast as previously observed.

One of the means that could potentially mitigate this observed storage depletion trend is a program that the District has been actively pursuing since 1996 -- the Seaside Basin groundwater injection program (also known as aquifer storage and recovery, or ASR). ASR entails diverting excess water flows (typically in Winter/Spring) from the Carmel Valley Alluvial Aquifer through existing Cal-Am facilities and injecting the water into the Seaside Groundwater Basin for later recovery in dry periods.

The primary goal of the MPWMD ASR Project is better management of existing water resources and production facilities to help reduce impacts to the Carmel River, especially during the dry season. The projects are viewed as being complementary to other larger, long-term water augmentation projects that are currently being pursued for the Monterey Peninsula. These projects, also known as Phase 1 and 2 ASR projects, entail a maximum diversion of 2,426 AFY, and 2,900 AFY respectively from the Carmel River for injection. The combined average yield for both projects is estimated at about 2,000 AFY. The operation of the Phase 1 and 2 ASR Projects result in reduced unauthorized pumping of the Carmel River in Summer/Fall and increased storage in the Seaside Basin, which are both considered to be environmentally beneficial.

The ASR water supply efforts in 2016-2017 included: (1) continued work with regulatory and land use agencies on expansion of the Phase 1 Santa Margarita ASR site; (2) completion of the utility water system for the Phase 2 ASR Project at the Seaside Middle School site; (3) coordination with Cal-Am and other parties to construct the necessary infrastructure for the ASR project expansion; and (4) continued implementation of a Memorandum of Understanding (MOU) with Cal-Am on operation and maintenance at the ASR facilities.

Groundwater quality conditions in both the Carmel Valley Alluvial Aquifer and Seaside Basin have remained acceptable in terms of potential indicators of contamination from shallow sources such as septic systems. There have been no identifiable trends indicative of seawater intrusion into the principal supply sources the coastal areas of these two aquifer systems to date.

Steelhead Fishery Program

Two major factors continue to effect adult steelhead this reporting year: the five-year California drought that ended in late 2016 and the removal of ninety-year-old San Clemente Dam. The removal of the dam allows unrestricted access to many additional miles of mainstem and tributary habitat. Additional work completed in summer of 2016 removed two other major barriers in the reach (Old Carmel Dam and Sleepy Hollow Ford) allowing fish unobstructed passage below LPD both upstream and downstream for the first time since the 1890's. Large quantities of sand released from the San Clemente reach filled in many pools and runs during the

winter of 2017. It remains to be seen what effect this will have on adult spawning and juvenile rearing in the lower river.

One drawback to SCD's removal was the loss of the fish ladder with its associated fish counter, and the long-term data base on the number of returning adults. Without this counter we will have to rely on adult counts from LPD, the DIDSON camera, and redd surveys. Looking forward, important migration and life history data will be collected from the PIT tagging program currently being implemented by the District and NMFS on the Carmel River.

Previous redd surveys below SCD confirm that the spawning habitat in the lower river has improved considerably over the last 20 years and many adults now spawn there instead of the upper watershed. In addition, juvenile steelhead rescued by the District from the lower river that survive to adulthood may be more likely to return to the lower river to spawn rather than migrate upstream.

Variability of adult steelhead counts are likely the result of a combination of controlling and limiting factors including:

- the continued effects of the severe five-year drought on all steelhead life stages including adult steelhead, as migration is limited or blocked and spawning reaches dry early;

- adverse ocean conditions with increased water temperatures off the coast of California, and degraded ocean water quality likely affecting the abundance of food resources and possibly even the survival of returning steelhead;

- variable lagoon conditions, caused by artificial manipulation of the sandbar and/or naturally occurring periods of low winter flows; and

- low densities of juvenile fish affecting subsequent adult populations.

- **Juvenile Steelhead**

Long-term monitoring of the juvenile steelhead population at eleven sites along the mainstem Carmel River below LPD shows that fish density continues to be quite variable both year to year and site to site from less than 0.10 fish-per-foot (fpf) of stream to levels frequently ranging above 1.00 fpf, values that are typical of well-stocked steelhead streams. In this 2016-2017 reporting period, the average population density was much less than the long-term average of 0.71 fpf for the Carmel River, likely due to the recent drought, poor habitat conditions in the lower river, and low numbers of returning adults.

The variability of the juvenile steelhead population in the Carmel River Basin is directly related to the following factors:

Positive Factors:

- General improvements in streamflow patterns, due to favorable natural fluctuations, exemplified by relatively high base-flow conditions between 1995 and 2012 and the very wet conditions in 2017;

- District and SWRCB rules to actively manage the rate and distribution of groundwater extractions and direct surface diversions within the basin, coupled with changes to Cal-Am's operations at LPD, the increased availability of ASR water in the summer, and extensive conservation measures, all help provide increased streamflow below SCD;

- restoration and stabilization of the lower Carmel River's stream banks, providing improved riparian habitat (tree cover/shade along the stream, an increase in woody debris and the associated invertebrate food supply) while preventing erosion of silt/sand from filling gravel beds and pools;

- extensive juvenile steelhead rescues by the District over the last 28 years, now totaling 432,570 fish through 2017;

- rearing and releases of rescued fish from the SHSRF of 97,600 juveniles and smolts back into the river and lagoon over the past 21 years (16 years of operation), at sizes generally larger than the river-reared fish, which in theory should enhance their ocean survival.

Negative Factors:

- variable lagoon conditions, including highly variable water surface elevation changes caused by mechanical breaching, chronic poor water quality (especially in the fall), and predation by birds and striped bass;

- barriers or seasonal impediments to juvenile and smolt emigration, such as intermittent periods of low flow below the Narrows during the normal spring emigration season;

- spring flow variability such as low-flow conditions that could dewater redds prematurely or high flows that could either deposit sediment over redds or completely wash them out;

- occasionally elevated fall temperature and hydrogen sulfide levels below LPD, and the increase in sediment from the SCD removal project;

- the potential for enhanced predation on smolts and YOY migrating through the sediment field above LPD; and

- invasive species: striped bass have recently (2015) started migrating up the river from the lagoon (up to the San Clemente reach in 2017) and are likely preying on juvenile steelhead. New Zealand Mud Snails (NZMS) were first discovered during BMI surveys at Red Rock (mid-valley) in 2016 and now comprise up to 62% of the BMI in the lower

river. NZMS outcompete native invertebrates and are a poor food item themselves for steelhead.

District staff continues to provide technical expertise and scientific data to CAW engineers and environmental consultants, DWR/DSOD, CDFW, NMFS, U.S. Fish and Wildlife Service, and others involved in addressing the resource management issues associated with both LPD and the area influenced by the SCD Removal and Carmel River Reroute Project. District staff also continues to provide technical expertise and scientific data to California Department Parks and Recreation, Monterey County Water Resources Agency, Monterey County Public Works Department, California Coastal Commission, U. S. Army Corps of Engineers, Carmel Area Wastewater District, and other regulatory agencies and stakeholders involved in the management of the Carmel River, the Carmel River Lagoon and the barrier beach.

Riparian Habitat Mitigation

With the exception of the Rancho Cañada to Rancho San Carlos Road Bridge reach, the Carmel River streamside corridor has stabilized in nearly all reaches that were affected by a combination of increased groundwater extraction, extreme drought and flood events that occurred during the 1970s, 1980s and 1990s. Prior to the 2016-17 winter high flows, a complex channel had developed in the lower 16 miles of the river with improved steelhead spawning substrate, diverse habitat, and a richer riparian community. Areas with perennial or near perennial flow (upstream of Schulte Bridge) or a high groundwater table, such as downstream of Highway 1, experienced vigorous natural recruitment in the channel bottom, which has helped to stabilize streambanks and diversify aquatic habitat. Areas that continue to be dewatered annually have less significant growth.

In areas with perennial flow, natural recruitment has led to vegetation encroachment that, in some areas, may constrict high flows and threaten bank stability. MPWMD continues to monitor these areas closely and to develop a management strategy to balance protection of native habitat with the need to reduce erosion potential. Environmental review of proposed projects and the process of securing permits is quite complex and requires an exhaustive review of potential impacts.

The Soberanes fire in the summer of 2016 combined with the removal of San Clemente Dam and high flows in the winter of 2016-17 proved to be a combination of events that significantly changed the river downstream of the former dam site. Quantities of silt, sand, and debris that had not been seen in the alluvial reach since high flows in 1998 were carried down from the fire-scarred upper watershed into the active channel. Past similar events during 1978-1983 and 1993-1998 contributed to substantial destabilization of streambanks in the lower 15.5 miles of the river; however, the 2016-17 event comes after significant reductions in annual diversions have been made and after long reaches of the river have been actively restored or passively recovered. Thus streambank instability was limited to the area downstream of Rancho San Carlos Road.

The recovery of streamside areas subjected to annual dewatering requires monitoring. Plant stress in the late summer and fall is evident in portions of the river that go dry. In these areas, streambanks can exhibit unstable characteristics during high flows, such as sudden bank

collapse, because of the lack of healthy vegetation that would ordinarily provide stability. The drought that began with Water Year 2013 (beginning October 2012) and ended in Water Year 2016 is an ongoing concern because of the past history of channel erosion and bank instability after severe droughts in 1976-77 and 1987-1991. Impacts to streamside vegetation can manifest themselves for several years even after the end of a drought.

Based on annual cross-section work by CSUMB, several areas have experienced a filling in of pools with sand. Absent high flows like those that occurred in 2017, it is likely that he sand will be winnowed out and sent downstream over the next several years. When river flows drop in late spring or early summer of 2018, District staff will investigate the overall scour and deposition of the streambed and report on this in next year's mitigation report.

Restoration project areas sponsored by MPWMD since 1984 continue to mature and exhibit more features of relatively undisturbed reaches, such as plant diversity and vigor, complex floodplain topography, and a variety of in-channel features such as large wood, extensive vegetative cover, pools, riffles, and cut banks.

As cited in previous reports, the most significant trends continue to include the following:

- increased encroachment of vegetation into the active channel bottom that can induce debris blockage, bank erosion and increased risks during floods,
- effects to areas with groundwater extraction downstream of Schulte Road,
- channel changes and erosion due to new supply of sediment from upstream associated with high flows, San Clemente Dam removal, and the Soberanes Fire in Water Year 2017,
- healthy avian species diversity, and
- maturing of previous restoration projects.

Carmel River Erosion Protection and Restoration

With the exception of the channel area between the Via Mallorca Road bridge and the Rancho San Carlos Road bridge, streambanks in the main stem appear to be relatively stable during average water years with "frequent flow" storm events (flows with a return magnitude of less than five years). The program begun by MPWMD in 1984 (and later subsumed into the Mitigation Program) to stabilize streambanks appears to be achieving the goals that were initially set out, i.e., to reduce bank erosion during high flow events up to a 10-year return flow, restore vegetation along the streamside, and improve fisheries habitat.

Consistent with previous reports, it is likely that the following trends will continue:

- Local, State and Federal agencies consider the Carmel River watershed to be a high priority area for restoration, as evidenced by the interest in addressing water supply issues, the removal of San Clemente Dam, proposed projects in the lower Carmel River, and continued oversight with the management of threatened species. Stringent avoidance and mitigation requirements will continue to be placed on activities that could have negative impacts on sensitive aquatic species or their habitats.

- Activities that interrupt or curtail natural stream functions, such as lining streambanks with riprap, have come under increasing scrutiny and now require significant mitigation offsets. Approximately 35% to 40% of the streambanks downstream of Carmel Valley Village have been altered or hardened since the late 1950s. Activities that increase the amount of habitat or restore natural stream functions are more likely to be approved or funded through State and Federal grant programs.
- Additional work to add instream features (such as large logs for steelhead refuge or backwater channel areas for frogs) can restore and diversify aquatic habitat.
- Major restoration projects completed between 1987 and 1999 have had extensive and successful work to diversify plantings. However, maintenance of irrigation systems is ongoing and requires extensive work in water years classified as below normal, dry and critically dry.
- The channel will change due to a new supply of sediment coming from upstream of the old San Clemente Dam and additional sources of sediment associated with the Soberanes Fire of 2016.

Between the mouth of the river and Robinson Canyon Road bridge, many areas of the river appear to be deeper than at any previous time since measurements have been recorded (i.e., beginning in 1978), with many reaches showing several feet of downcutting. This trend, which was identified as a concern in the 1984 Carmel River Management Program EIR, appears to have accelerated in the period from 1998 to 2015. This was a period of exceptional stability (for the Carmel River) as streambanks hardened with structural protection over the past several decades resisted erosion and the force of the river during high flows was directed into the channel bottom. This condition has resulted in the undermining of rip-rap protection and bridge infrastructure in some reaches. To assess the impact of scour and degradation in the bottom of the channel, the District budgeted funds in Fiscal Year 2014-15 and carried out a thalweg survey (survey along the bottom of the channel) along a portion of the lower river. The survey was completed in 2015 and 2016 and will be compared to similar periodic surveys dating back to 1984. However, this trend will have to be looked at carefully because as of Water Year 2017 recent high flows have transported large amounts of sediment into the mainstem of the Carmel River.

In the spring of 2011, the river migrated into the north streambank downstream of the Rancho San Carlos Road Bridge. In the winter of 2017, during a series of high flows, erosion started taking place on the south side of the river. This reach has become unstable and the District is proposing a restoration project that would stabilize the streambanks in the summer of 2018. If no work to stabilize the streambank is carried out, it is likely that the river will continue to erode property along the southern and northern streambanks and there will be additional loss of mature riparian forest.

Eventually, without corrective measures to balance the sediment load with the flow of water or to mitigate for the effect of the downcutting, streambanks will begin to collapse and the integrity of bridges and other infrastructure in the active channel of the river may be threatened.

Vegetation Restoration and Irrigation

To the maximum extent possible, MPWMD-sponsored river restoration projects incorporate a functional floodplain that is intended to be inundated in relatively frequent storm events (those expected every 1-2 years). For example, low benches at the Red Rock and All Saints Projects have served as natural recruitment areas and are currently being colonized by black cottonwoods, sycamores and willows. In addition, willow and cottonwood pole plantings in these areas were installed with a backhoe, which allows them to tap into the water table. These techniques have been successful and have reduced the need for supplemental irrigation.

Channel Vegetation Management

Another notable trend relating to the District's vegetation management program was the widening of the channel after floods in 1995 and 1998. With relatively normal years following these floods, the channel has narrowed as vegetation recruits on the channel bottom and gravel bars. Current Federal regulations such as the Endangered Species Act (ESA) "Section 4(d)" rules promulgated by NOAA Fisheries to protect steelhead significantly restrict vegetation management activities. Because of these restrictions, the District can carry out activities only on the most critical channel restrictions and erosion hazards in the lower 15 miles of the river. In the absence of high winter flows capable of scouring vegetation out of the channel bottom, encroaching vegetation may significantly restrict the channel. As vegetation in the river channel matures in the channel bottom, more conflicts are likely to arise between preserving habitat and reducing the potential for property damage during high flows. MPWMD will continue to balance the need to treat erosion hazards in the river yet maintain features that contribute to aquatic habitat quality.

Permits for Channel Restoration and Vegetation Management

In 2012, MPWMD renewed its long-term permits with the U.S. Army Corps of Engineers and the California Regional Water Quality Control Board for routine maintenance and restoration work. In 2014, the District also renewed a long-term Routine Maintenance Agreement (RMA) with the California Department of Fish and Wildlife to conduct regular maintenance and restoration activities in the Carmel River.

Monitoring Program

Vegetative moisture stress fluctuates depending on the rainfall, proximate stream flow, depth to groundwater, and average daily temperatures, and tends to be much lower in above-normal rainfall years. Typical trends for a single season start with little to no vegetative moisture stress in the spring, when the soil is moist and the river is flowing. As the river begins to dry up in lower Carmel Valley (normally around June) and temperatures begin to increase, an overall increase in vegetative moisture stress occurs. For much of the riparian corridor in the lower seven miles of the Carmel River, this stress has been mitigated by supplemental irrigation, thereby preventing the die off of large areas of riparian habitat. However, many recruiting trees experience high levels of stress or mortality in areas difficult to irrigate. Riparian vegetation exposed to rapid or substantial lowering of groundwater levels (i.e., below the root zones of the

plants) will continue to require monitoring and irrigation during the dry season.

With respect to riparian songbird diversity, populations dropped after major floods in 1995 and 1998 because of the loss of streamside habitat. Since 1998, species diversity recovered and now fluctuates depending on habitat conditions. Values indicate that the District mitigation program is preserving and improving riparian habitat.

Strategies for the future

A comprehensive long-term solution to overall environmental degradation requires a significant increase in dry-season water flows in the lower river, a reversal of the incision process, and reestablishment of a natural meander pattern. Of these, MPWMD has made progress on increasing summer low flows and groundwater levels by aggressively pursuing a water conservation program, implementing the first and second phases of the Seaside Groundwater Basin Aquifer Storage and Recovery Project, and recommending an increase in summer releases from Los Padres Reservoir.

Reversal, or at least a slowing, of channel incision may be possible if the supply of sediment is brought into better balance with the sediment transport forces. Additional sediment from the tributary watersheds between San Clemente Dam and Los Padres Dam will pass into the lower river in the foreseeable future now that San Clemente Dam has been removed. District staff are already seeing signs of additional sediment in the Carmel River below Esquiline Road Bridge associated with high flows in Water Year 2017.

Over the long term, an increase in sediment supply could help reduce streambank instability and erosion threats to public and private infrastructure. However, reestablishing a natural supply of sediment and restoring the natural river meander pattern through the lower 15.5 miles of the Carmel Valley presents significant political, environmental, and fiscal challenges, and is not currently being considered as part of the Mitigation Program.

Integrated Regional Water Management (IRWM) Grant Program

The IRWM program promoted by the California DWR encourages planning and management of water resources on a regional scale and promotes projects that incorporate multiple objectives and strategies. In addition, the IRWM process brings stakeholders together and encourages cooperation among agencies in developing mutually beneficial solutions to resource problems.

MPWMD adopted the 2014 Update to the IRWM Plan for a region encompassing Monterey Peninsula areas within the District boundary, the area in the Carmel River watershed outside of the MPWMD boundary, Carmel Bay and the Southern Monterey Bay. The IRWM Plan combines strategies to improve and manage potable water supply, water conservation, stormwater runoff, floodwaters, wastewater, water recycling, habitat for wildlife, and public recreation.

Funding from the IRWM grant program and other programs requiring an adopted IRWM Plan

could provide the incentive to undertake a set of projects that would continue to improve the Carmel River environment and engage a larger number of organizations in helping to develop and implement a comprehensive solution to water resource problems in the planning region. The Monterey Peninsula region is expecting to take advantage of about $4.3 million from Prop 1 IRWM funds over the next several; years.

More information about the IRWM Plan and the group of stakeholders in the planning region can be found at the following web site:

http://www.mpirwm.org

Carmel River Lagoon Habitat

The District continues to support and encourage the ongoing habitat restoration efforts in the wetlands and riparian areas surrounding the Carmel River Lagoon. These efforts are consistent with goals that were identified in the Carmel River Lagoon Enhancement Plan, which was partially funded by the District. The District continues to work with various agencies and landowners to implement ongoing restoration of the Odello West property and future restoration of the Odello East property across the highway. Because of the restoration activities on the south side of the lagoon, the District has concentrated its monitoring efforts on the relatively undisturbed north side. Staff also continue to meet and discuss with other agencies the ongoing use of an existing CDPR agricultural well.

The District expanded its long-term monitoring around the lagoon in 1995 in an attempt to determine if the reduction in freshwater flows due to groundwater pumping upstream might change the size or ecological character of the wetlands. Demonstrable changes have not been identified. Because of the complexity of the estuarine system, a variety of parameters are monitored, including vegetative cover in transects and quadrats, water conductivity, and hydrology. It is notable that due to the number of factors affecting this system, it would be premature to attribute any observed changes solely to groundwater pumping. During the 23-year period to date, for example, there have been three ***Extremely Wet*** (1995, 1998, and 2017), two ***Wet*** (2005, 2006), five ***Above Normal*** (1996, 1997, 2000, 2010, and 2011), five ***Normal*** (1999, 2001, 2003, 2008 and 2009), two ***Below Normal*** (2004 and 2016), four ***Dry*** (2002, 2012, 2013, and 2015), and two ***Critically Dry*** (2007 and 2014) Water Year types in terms of total annual runoff. Thus, the hydrology of the watershed has been wetter than average 43% of the time, and at least normal or better 65% of the time during that 23 year period. However, monitoring in 2014 occurred during a Critically Dry Water Year that followed two consecutive Dry Water Years, and 2015 was the first time a fourth year of drought was ever monitored. Other natural factors that affect the wetlands include introduction of salt water into the system as waves overtop the sandbar in autumn and winter, tidal fluctuations, and long-term global climatic change. When the District initiated the long-term lagoon monitoring component of the Mitigation Program, it was with the understanding that it would be necessary to gather data for an extended period in order to draw conclusions about well production drawdown effects on wetland dynamics. It is recommended that the current vegetation, conductivity, topographical and wildlife monitoring be continued in order to provide a robust data set for continued analysis of potential changes around the lagoon. During this RY the District budgeted to reactivate the

CDPR lagoon water-quality profiler that has been out of service for four years, under an interagency MOU. However, repetitive failures of the vertical profiling controller, rendered the otherwise fully functioning water quality probe effectively useless. The District has budgeted for the replacement of the existing custom built profiler to be replaced with a stock one from Xylem/YSI. We intend to restore continuous data collection at the CAWD pipe site sometime during the next RY, pending acquisition and installation of the new profiling device.

Lagoon bathymetric cross sectional surveys, initially conducted in 1988, have been completed annually during the dry season since 1994. These data are useful in assessing changes in the sand supply within the main body of the lagoon and are necessary to answer to questions concerning whether or not the lagoon is filling up with sand, thus losing valuable habitat. As indicated in the survey plots, the sandy bed of the lagoon can vary significantly from year to year. Significant scour of sand occurred at the cross sections during WY 2017 compared to August 2016 conditions. Since 1994, an apparent trend of overall loss in sand volume appears to be emerging, as south bank substrate elevations are now at an historic low. The sand loss or down-cutting observed at the cross sections is consistent with the pervasive down-cutting that has occurred along the thalweg of the Lower Carmel River (LCR) upstream of the Highway 1 Bridge (HWY 1) for several miles, a trend believed to have begun in WY 2006 based on rating curve analysis at the HWY 1 site as well as physical field observation. In the recent "Critically Dry" years of WY 2007 and 2014 and "Dry" years of WY 2012 and 2013, no significant changes were documented compared to the respective prior years, thus it is concluded that substrate elevations at the cross sections generally do not change in these low-flow years, despite the regular occurrence of major lagoon mouth breaches in all of these years, except WY 2014. The "Extremely Wet" WY 2017 caused dramatic changes (scour) at the cross sections indicating that quantity of streamflow (peak flow and total volume) is likely the primary factor that controls significant substrate changes at the key cross sections.

Program Costs

Mitigation Program costs for FY 2016-2017 totaled approximately $2.17 million including direct personnel expenses, operating costs, project expenditures, capital equipment, and fixed asset purchases. The annual cost of mitigation efforts varies because several mitigation measures are weather dependent. Expenditures in FY 2016-2017 were $0.10 million less than the prior fiscal year due to decreases in Mitigation Program costs. However, the overall costs have remained constant (average of $2.3 million per year) for last five years. In the past, expenditures had trended upward due to expenditures for the Aquifer Storage Recovery (ASR) Project. ASR Project costs are no longer captured under Mitigation Program Costs. FY 2014-2015 expenditures were $2.30 million; and FY 2015-2016 expenditures were $2.27 million.

During FY 2016-2017, revenues totaled $3.15 million including mitigation program revenues, user fees, grant receipts, investment income and miscellaneous revenues. The Mitigation Program Fund Balance as of June 30, 2017 was $2,045,194.

Table I-1

SUMMARY OF COMPONENTS OF MPWMD MITIGATION PROGRAM
July 1, 2016 - June 30, 2017

WATER MANAGEMENT

- Monitor Water Resources
- Manage Water Production
- Manage Water Demand
- Monitor Water Usage
- Augment Water Supply
- Allocation of New Supply
- Determine Drought Reserve

STEELHEAD FISHERY

- Capture/Transport Emigrating Smolts in Spring
  -- Smolt rescues
  -- Pit tagging study
- Prevent Stranding of Fall/Winter Juvenile Migrants
  -- Juvenile rescues
  Rescue Juveniles Downstream of Robles del Rio in Summer
- Operate Sleepy Hollow holding/rearing facility
- Monitoring Activities for Mitigation Plan
  -- Juvenile population surveys
- Other Activities not required by Mitigation Plan
  -- Spawning habitat restoration
  -- Modify critical riffles

RIPARIAN VEGETATION AND WILDLIFE

- Conservation and Water Distribution Management
- Prepare/Oversee Riparian Corridor Management Plan
- Implement Riparian Corridor Management Program
  -- Cal-Am well irrigation (4 wells)
  -- Channel clearing
  -- Vegetation monitoring
  -- Track and pursue violations
  -- River Care Guide booklet
  -- CRMP Erosion Protection Program

LAGOON VEGETATION AND WILDLIFE

- Assist with Lagoon Enhancement Plan Investigations (See Note 1)
- Expand Long-Term Lagoon Monitoring Program
  -- Water quality/quantity
  -- Vegetation/soils
- Identify Alternatives to Maintain Lagoon Volume

AESTHETICS

- Restore Riparian Vegetation (see above)

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Note 1: Mitigation measures are dependent on implementation of the Lagoon Enhancement Plan by the California Department of Parks and Recreation, the land owner and CEQA lead agency. Portions of the Enhancement Plan have been implemented by CalTrans as part of a "mitigation banking" project.

Table I-2
Summary of MPWMD Mitigation Program Accomplishments: 2016-2017 Report

MITIGATION ACTION	MAJOR ACCOMPLISHMENTS
Monitor Water Resources	Regularly tracked precipitation, streamflow, surface and groundwater levels and quality, and lagoon characteristics between Los Padres Dam and the Carmel River Lagoon, using real-time methods at numerous data collection stations. Maintained extensive monitoring network, and continuous streamflow recorders below San Clemente Dam and other sites.
Manage Water Production	Developed and implemented multi-agency Memorandum of Agreement and quarterly water supply strategies based on normal-year conditions; worked cooperatively with resource agencies implementing the federal Endangered Species Act. Implemented ordinances that regulate wells and water distribution systems.
Manage Water Demand	A total of 2,509 conservation inspections were conducted in FY 2016-2017. An estimated 3.99 acre-feet (AF) of water were saved by new retrofits verified this year in these two categories. For FY 2016-2017, a total of 1,768 applications for rebates were received, 1,347 applications were approved with the use of the rebate refund, as described in Section VIII. As of June 30, 2017, a total of 90.319 AF of water remained available in the areas served by CAW, as described in Section IX. This includes water from pre- and post-Paralta Allocations and water added to a Jurisdiction's Allocation from Water Use Credit transfers and public retrofits.
Monitor Water Usage	Complied with SWRCB Order 95-10 for Water Year 2017.
Augment Water Supply	Long-term efforts to augment supply included: (1) Continued participation in the CPUC rate hearing process to review elements of the Monterey Peninsula Water Supply Project (MPWSP); (2) Participated in meetings intended to resolve concerns about MPWSP construction, operations, financing, management and oversight; (3) Participated on Technical Advisory Committee to the Monterey Peninsula Regional Water Authority; (4) Operated Aquifer Storage and Recovery (ASR) Phase 1 and 2 projects in WY 2017; (5) Held regular coordination meetings with Cal-Am regarding planned infrastructure upgrades to deliver water supply to the ASR project wells at full capacity; (6) Conducted additional work related to alternative desalination plant sites; (7) Provided

MITIGATION ACTION	MAJOR ACCOMPLISHMENTS
	technical support to the Monterey Regional Water Pollution Control Agency (MRWPCA) for the Groundwater Replenishment Project (GRP) and received presentations by MRWPCA; (8) Participated in CPUC hearing process on Cal-Am related rate requests. Other ongoing activities included: (1) Served as member of both the Seaside Basin Watermaster Board and as the Technical Advisory Committee; (2) Participation in a technical role regarding alternatives for Los Padres Dam and associated sediment management.
Allocate New Supply	Remained within Water Allocation Program limits.
Determine Drought Reserve	Rationing was not required due to maintenance of adequate storage reserve.
Steelhead Fishery Program	The surface flow dropped below 10 cfs at the Highway 1 Bridge June 3, 2016. In response to this decline, District staff began monitoring daily river conditions. Rescues began on June 13th and were conducted until September 2, 2016. Rescue operations occurred between Highway 1 Bridge (RM 1.0) and Cal-Am's Begonia iron treatment plant reach (RM 7.7), plus one day at the Los Padres smolt bypass outlet. During this period staff conducted 32 rescue operations over 6.7 miles, yielding a total of 670 steelhead, including: 425 young-of-the-year (YOY), 239 yearlings (1+), and 6 mortalities (0.89%. Since 1989, District staff has rescued 432,570 steelhead from drying reaches in the Carmel River watershed. Compared to previous rescue seasons, rescue totals in the 2016 and 2017 dry seasons were only 6% and 37% of the 1989-2017 average of 14,916, as described in Section XVI.
Riparian Habitat Program	Continued revegetation efforts at exposed banks with little or no vegetation located between Via Mallorca and Esquiline Roads; Contracted to collect channel profile data and limited cross section data from the Carmel River for use in maintaining a long-term record and comparing to the past and future data; Made public presentations showing MPWMD-sponsored restoration work over the past 26 years; Continued long-term monitoring of physical and biological processes along the river in order to evaluate the District's river management activities; Continued the annual inspections of the Carmel River from the upstream end of the lagoon to Camp Steffani; Walked the entire river to observe and record erosion damage, conditions that could cause erosion, riparian ordinance infractions, and the

MITIGATION ACTION	MAJOR ACCOMPLISHMENTS
	overall condition of the riparian corridor; Continued enforcement actions to address serious violations of District riparian ordinances; Carried out vegetation management activities; Developed an Integrated Regional Water Management Plan; Operated under Routine Maintenance Agreement with CDFW for MPWMD vegetation maintenance activities.
Lagoon Habitat Program	The District continues to support and encourage the ongoing habitat restoration efforts in the wetlands and riparian areas surrounding the Carmel River Lagoon. These efforts are consistent with goals that were identified in the Carmel River Lagoon Enhancement Plan, which was partially funded by the District. The District continues to work with various agencies and landowners to implement ongoing restoration of the Odello West property and future restoration of the Odello East property across the highway. The District also surveyed and analyzed four bathymetric transects, participated in interagency meetings regarding management of lagoon in winter storm events (see also steelhead efforts that benefit lagoon) and monitored lagoon stage.
Aesthetic Measures	See Riparian Habitat Program measures in Section XVII.

II. HYDROLOGIC MONITORING

The Water Allocation Program EIR concluded that Water Supply Option V would have less-than-significant impacts on the water resources in the Monterey Peninsula area, and that no mitigation measures were required. This conclusion was based solely on changes to the hydrologic regime and not on changes to water-dependent resources. Impacts on water-dependent resources (e.g., riparian vegetation and wildlife and steelhead fishery) due to changes in the hydrologic regime were identified as significant in the EIR. Implementation of the mitigation measures proposed for the impacts on these water-dependent resources are described in subsequent sections. It was suggested in the EIR that the District continue and expand its current monitoring programs to establish baseline conditions for assessment of long-term changes (Finding No. 381). Accordingly, the District currently maintains ongoing precipitation, streamflow, storage, water-level and water-quality monitoring programs. These programs and the activities to implement them for Water Year 2017 (October 1, 2016 through September 30, 2017), are summarized below.

A. Precipitation Monitoring

Description and Purpose

During the period from October 1, 2016 through September 30, 2017, the District continued to process long-term precipitation records at Los Padres Dam (LPD) and at the former San Clemente Dam Site (SCDS) collected by California American Water (CAW). District staff also records precipitation at its Monterey office located at Ryan Ranch, and receives daily rainfall reports from the National Weather Service climate station at Monterey. In addition, real-time and historical rainfall data for the Monterey Peninsula area can be accessed via the Internet. These data support a variety of District programs, including erosion control, riparian vegetation management and identifying long-term precipitation trends and hydrologic-year conditions.

Implementation and Activities During 2016-2017

Work during this period involved continuing maintenance of the existing precipitation monitoring network. A summary of daily precipitation at SCDS during Water Year (WY) 2017 is shown in **Figure II-1**. The average annual recorded precipitation at this site for the period from 1922 through 2017 is 21.25 inches. In WY 2017, 32.25 inches of precipitation were recorded at SCDS, which is 152 percent of average.

Figure II-2 shows a comparison of WY 2017 rainfall at SCDS and the average monthly rainfall at this site. As indicated in **Figure II-2,** monthly rainfall was highlighted by an extremely wet (12.5 percent exceedance frequency) January and February with 11.44 and 9.27 inches of rainfall, respectively. The highest daily rainfall total was 5.35 inches recorded on February 21, 2017 as clearly shown in **Figure II-1.**

B. Streamflow Monitoring

Description and Purpose

Since its inception, the District has historically collected streamflow measurements at approximately 15 mainstem sites on the Carmel River and on 16 tributaries to the Carmel River. The District's current principal streamflow measuring sites within the Carmel River Basin (CRB) are shown in **Figure II-3**. Prior to 1991, the streamflow measurements were instantaneous measurements made by the current-meter method. In 1991, a concerted effort was made to upgrade the streamflow monitoring network as staff installed continuous recorders[1] at six selected tributary sites. Since that time, the District has continued to expand its streamflow monitoring network, which currently consists of 18 continuous-recording gaging stations.

Data collected at the District streamflow monitoring sites are analyzed for use in water-supply planning, fishery, riparian and erosion control programs. More specific uses of streamflow data include, but are not limited, to the items listed below:

- Defining the general hydrologic conditions in the basin
- Setting flow requirements for meeting aquatic life goals
- Monitoring compliance with minimum-flow requirements
- Forecasting water-supply availability
- Assessing and scheduling fish rescue activities
- Assessing effectiveness of riparian mitigations
- Evaluating surface and groundwater interaction
- Developing and calibrating hydrologic models
- Delineating and managing flood plains
- Evaluating and designing water-supply projects
- Providing data for forecasting floods and defining flood-recurrence intervals
- Assessing hydrologic impacts from water-development projects
- Supporting Aquifer Storage and Recovery (ASR) operations

Implementation and Activities During 2016-2017

During the 2016-2017 period, the District operated and maintained (O&M) 16 streamflow gaging stations within the CRB / District Boundary, and collected continuous water-level data at both Los Padres Reservoir and at the Carmel River Lagoon. In addition, instantaneous measurements of discharge were collected at the Carmel River above Los Padres Reservoir and Danish Creek sites on a monthly basis during the "dry season" which runs approximately from June through November. The District continuous recording gaging stations are listed below:

Tributary/other
Finch Creek
Cachagua Creek
Pine Creek
San Clemente Creek
Tularcitos Creek
Hitchcock Creek
Garzas Creek near Lower Garzas Canyon
Garzas Creek at Garzas Road
Potrero Creek
Robinson Canyon Creek
San Jose Creek
Arroyo del Rey at Del Rey Oaks

Mainstem
Carmel River below Los Padres Reservoir
Carmel River at Sleepy Hollow Weir
Carmel River at Don Juan Bridge
Carmel River at Highway 1 Bridge
Carmel River above Los Padres Reservoir (non-recording)

Continuous Water Level
Los Padres Reservoir
Carmel River Lagoon

Streamflow gaging station O&M at each of the above sites involves obtaining monthly discharge measurements, maintaining recording equipment, obtaining staff gage readings and occasional surveying. Subsequently, river/creek stage and discharge data are processed in-house utilizing Hydstra Time-Series Software (Kisters North America, Inc.), to produce continuous streamflow records for the sites. **Table II-1** summarizes the computed annual flows in acre-feet (AF) for the District sites for the WY 1992-2017 period. In addition, **Table II-1** includes annual flow values for the two mainstem sites operated by the U.S. Geological Survey (USGS) for the 1992-2017 period.

During the 2016-2017 period, District staff continued to maintain the existing streamflow monitoring network (network). Streamflow within the Carmel River Basin during WY 2017 was classified as "extremely wet", as further described below. Work within this period involved collecting numerous, routine streamflow measurements by the current meter method, in order to refine the stage/discharge relation at the gaging stations. In addition, several low-flow measurements were obtained at the sites utilizing a three-inch modified Parshall Flume.

Completion of Data Report Water Years 2009 – 2013

During Summer/Fall 2017, staff completed the *Carmel River Basin Surface Water Resources Data Report Water Years 2009 – 2013*, the fifth report in a series that begins with WY 1992. This report finalizes surface water data collection, processing and computation efforts completed by staff for the five year period and can be viewed at: http://www.mpwmd.net/environmental-stewardship/carmel-river-basin/surface-water-reports/

Automation of Streamflow Data on District Website

During the 2016-2017 period, District staff continued to maintain automated daily posting of real-time steamflow data to the District website for the following locations:

CR below Los Padres Reservoir
CR at Sleepy Hollow Weir
CR at Don Juan Bridge
CR at Highway 1 Bridge
Finch Creek at Hastings Reservation
Carmel River Lagoon

This automated process facilitates data dissemination which reduces the volume of data inquiries.

- **Summary of Streamflow Conditions --** Streamflow during WY 2017 within the CRB was classified as "extremely wet", defined as a year only exceeded in terms of runoff 12.5 percent of the time. The highest peak streamflow event of the year occurred on February 21, 2017 at 10,600 cfs, and 8,760 cfs at the District's Carmel River (CR) at Don Juan Bridge, and CR at Highway 1 Bridge gaging stations, respectively.

During WY 2017, 196,300 acre-feet (AF) of unimpaired runoff were estimated at the San Clemente Dam Site (SCDS). This total represents 287% of the average annual runoff (68,400 AF) expected at the SCDS.

C. Carmel River Lagoon Water-Level Monitoring

Description and Purpose

Since 1987, the District has monitored the level of surface water in the CR Lagoon. The water level is monitored with a continuous recorder located in the South Arm of the Lagoon that utilizes pressure transducer technology. The water-level data have been used, in part, to support technical studies for use by the Carmel River Steelhead Association, California Department of Parks and Recreation, California Coastal Conservancy, California Department of Fish and Wildlife, Monterey County Water Resources Agency (MCWRA), Monterey County Public Works Department (MCPWD) and MPWMD. In addition, the water-level data are monitored by the MCWRA via their ALERT system to enhance flood warning for residents located along the northern margin of the Lagoon and wetland.

Implementation and Activities During 2016-2017

During the 2016-2017 period, District staff continued to maintain the continuous water-level recorder located in the South Arm of the Lagoon, and a complete record of water-level readings (i.e., 15-minute intervals) was obtained. Staff continued to utilize the telecommunications capability established at the Lagoon gage in September 2007 to post

Lagoon water-level data on to the District's website. These continuous water-level data are automatically plotted and posted daily on the District website under the "Carmel River Lagoon Water Levels" as an 8-day plot that shows the past week's levels. Staff continued to maintain the monthly lagoon level plots that are available on the District website from WY 2006 to the present. This allows interested parties to access the data to view historical and recent water-level trends.

The first Lagoon mouth opening of WY 2017 occurred on December 19, 2016 **(Figure II-4)** under moderate river inflow conditions of approximately 90 cfs. On December 9, 2017 CR streamflow reached the District's CR at Highway 1 Bridge for the first time in WY 2017, as "no flow" was recorded October 1 through December 8. As seen in **Figure II-4**, the seasonal return of river inflow to the Lagoon, resulted in a steady rise in Lagoon water level. A more rapid rise in Lagoon level is seen beginning December 17 as Los Padres Reservoir filled and spilled December 16, further enhancing Lagoon inflow. Early on December 19, the Lagoon water surface reached a maximum level of approximately 11.4 feet (NGVD29) which overtopped the beach berm causing the resultant breach. Subsequent lagoon water-level fluctuations seen in **Figure II-4** during the remainder of December 2016 indicate several multi-day Lagoon closure, fill and breach cycles which are typical during wintertime with inflows of approximately 50 cfs.

U:\mpwmd\Allocation\Annual Mit. Report RY 2016\RY 2016 - Place Your Files Here\II Precipitation, Streamflow, Lagoon Water Level Monitoring\GJSection II hydrologic monitoring_GJ.docx

Figure II-1
San Clemente Reservoir Site Daily Rainfall: Water Year 2017

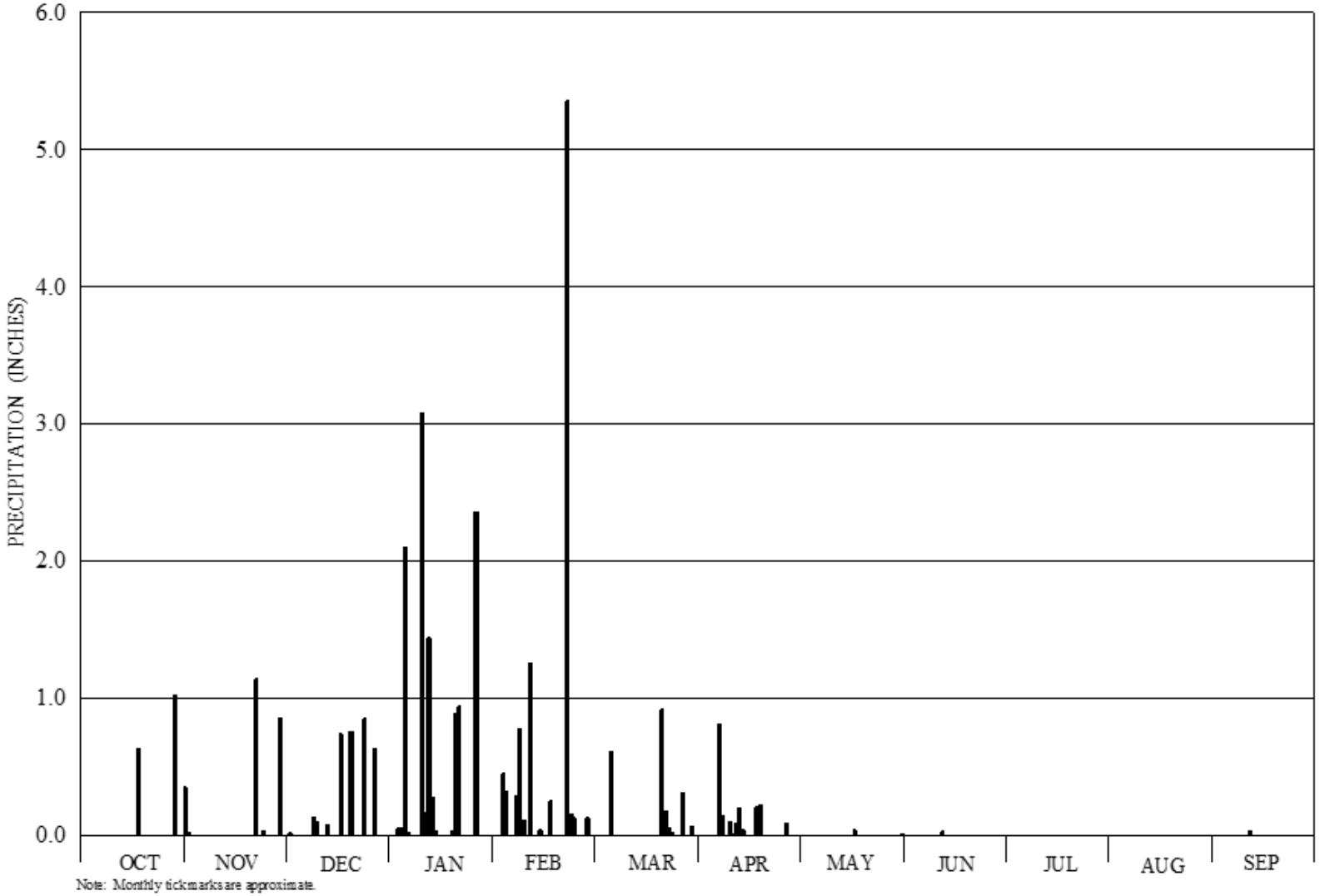


Figure II-2
Monthly Distribution of Rainfall at San Clemente Reservoir Site
Water Year 2017 Compared to 1922-2017 Long-Term Average

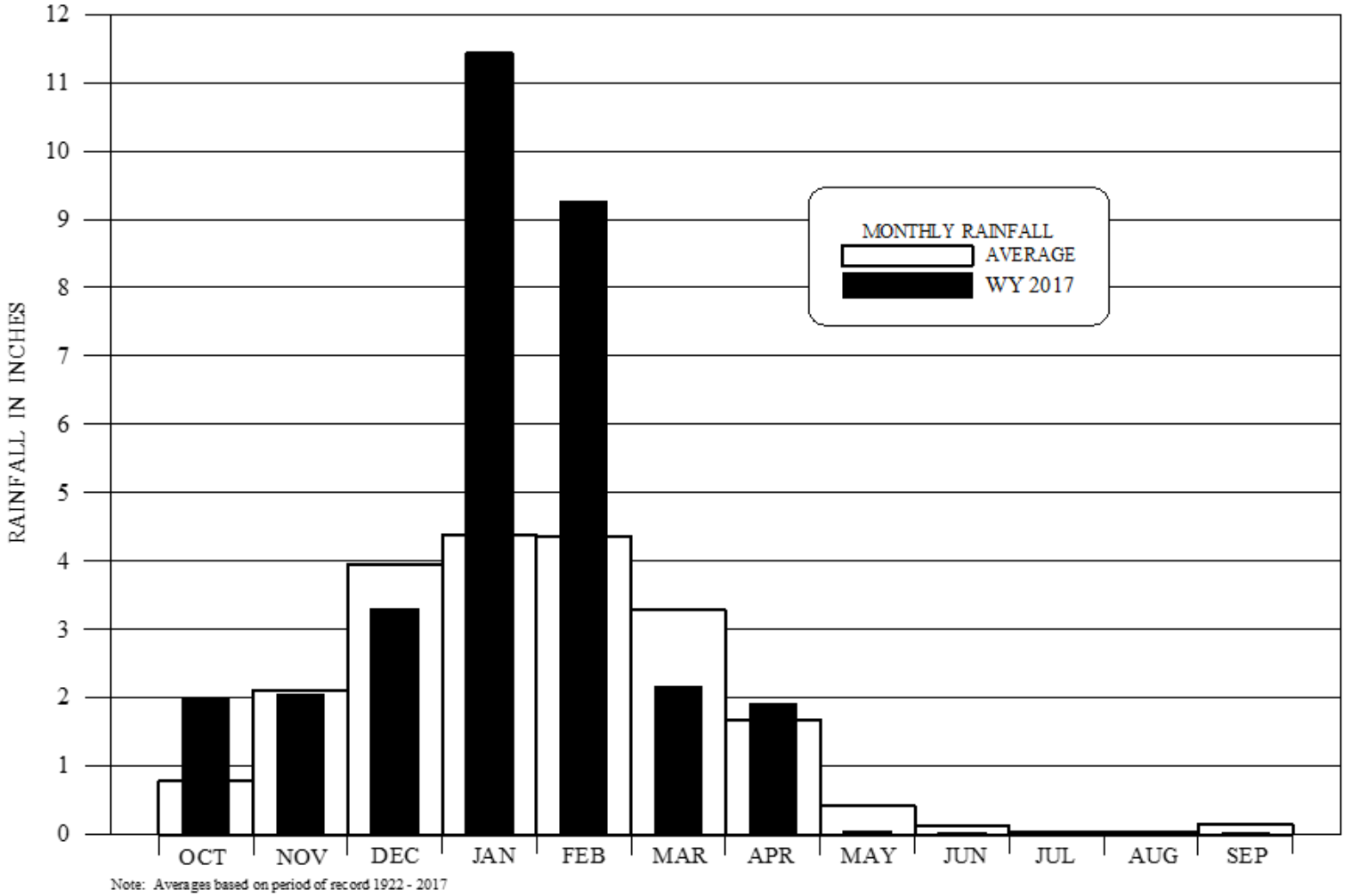


Figure II-3
Carmel River Basin Principal Streamflow Gaging Stations

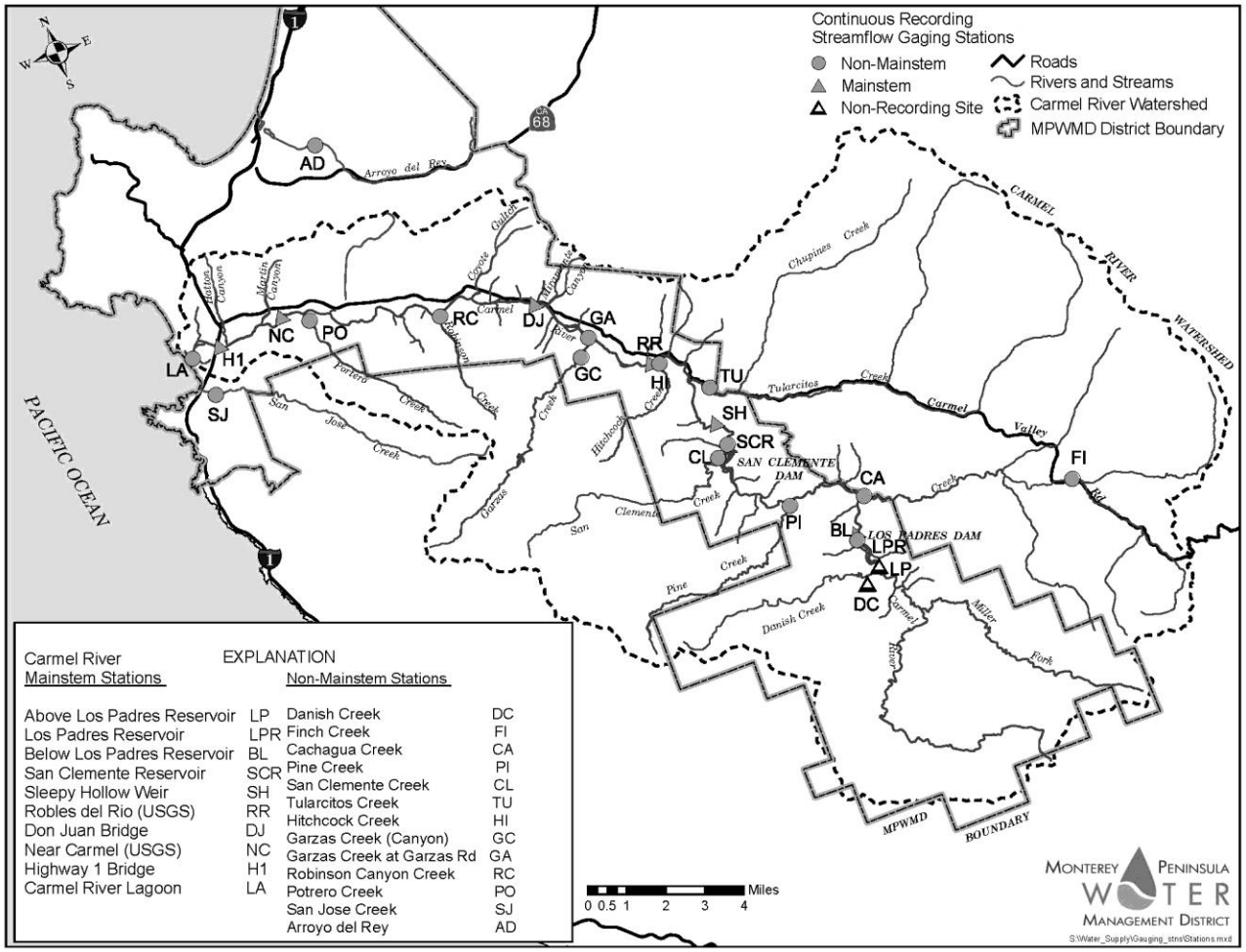


Figure II-4
Carmel River Lagoon Water Level

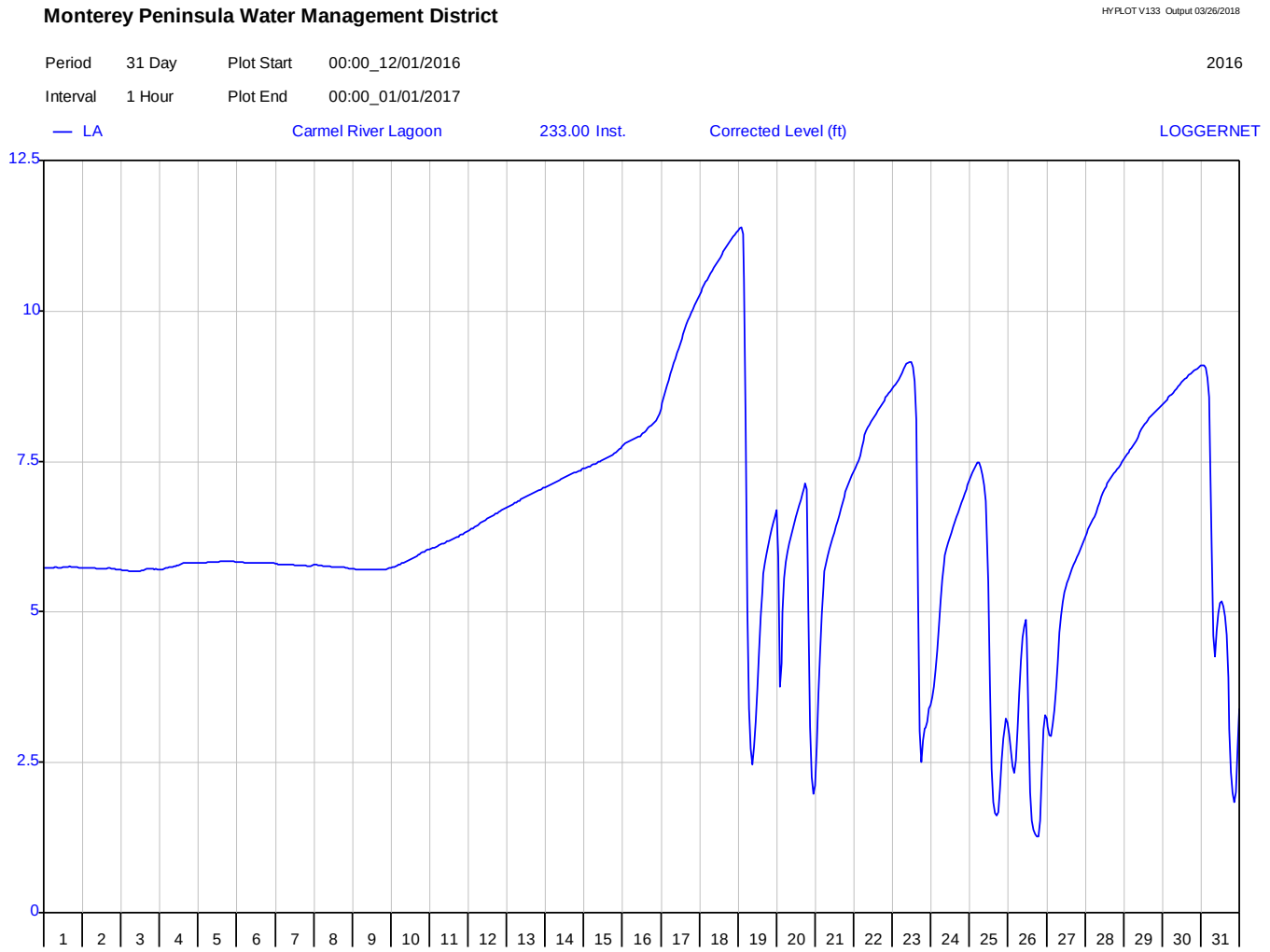


Table II-1

CARMEL RIVER BASIN - ANNUAL STREAMFLOW SUMMARY
WATER YEARS 1992 - 2017
(Values in Acre-Feet)

TRIBUTARY SITES	Drainage Area (Sq.Mi.)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
FINCH CREEK	22.1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	2860	3420	558	290	28	170	458	3,560
CACHAGUA CREEK	46.3	1,780	7,340	560	16,320	3,840	4,990	23,800	2,590	1,730	1,500	245	1,270	1,250	4,340	5,210	261	2,200	1,020	5,030	5,320	695	237	0	234	777	n/a
PINE CREEK	7.8	3,750	9,800	1,230	11,110	6,550	8,300	15,610	4,540	5,300	3,270	2,300	4,250	2,350	8,910	8,020	849	3,840	2,830	6,140	6,950	1,310	1,870	406	1,200	3,910	17,240
SAN CLEMENTE CREEK	15.6	5,450	17,070	1,820	20,580	9,310	14,100	33,380	7,130	9,830	5,340	3,270	5,850	3,720	16,330	13,720	1,360	5,520	4,270	9,950	12,950	1,970	2,570	469	1,670	7,300	n/a
TULARCITOS CREEK	56.3	635	3,220	444	5,100	1,650	2,450	22,610	3,810	2,450	1,490	630	552	503	1,000	2,480	503	917	405	1,140	1,430	451	327	94	n/a	n/a	n/a
HITCHCOCK CREEK	4.6	*	*	52	1,820	451	716	2,970	169	482	214	18	274	234	863	691	2	383	152	550	629	7	56	0	18	275	n/a
GARZAS CREEK	13.2	3,700	11,170	746	12,140	4,890	8,570	24,610	5,050	4,980	3,070	1,200	2,760	1,810	8,590	7,420	381	3,010	2,500	5,720	7,620	641	1,320	44	619	n/a	n/a
ROBINSON CANYON CR.	5.4	619	2,360	89	2,230	619	1,430	6,890	545	823	433	82	448	354	1,710	1,010	25	455	450	1,120	1,150	40	152	14	n/a	n/a	n/a
POTRERO CREEK	5.2	*	*	30	1,790	506	1,210	5,970	855	1,020	310	43	210	164	1,470	1,050	13	308	356	985	1,170	14	50	0	n/a	n/a	n/a
SAN JOSE CREEK	14.2	*	*	*	*	*	*	*	6,400	6,260	2,890	1,100	1,880	1,480	7,640	6,870	862	1,740	2,330	5,220	5,760	1,200	1,540	252	1,040	4,480	n/a
ARROYO DEL REY	13.8	*	*	*	*	*	*	*	*	*	*	*	392	376	1150	843	213	572	449	772	726	252	255	142	410	969	n/a
MAINSTEM SITES																											
CR AT ROBLES DEL RIO	193	38,240	109,000	11,800	155,000	75,210	99,340	250,300	54,640	76,750	47,180	31,850	60,560	38,060	114,400	110,100	12,220	49,080	45,930	104,500	108,900	20,750	31,970	6,410	23,360	48,690	200,300
CR AT DON JUAN BRIDGE	216	*	122,000	12,760	173,600	83,090	111,800	252,200	53,570	73,960	49,360	31,330	60,420	38,330	121,800	118,300	12,150	52,510	47,710	107,000	114,400	20,920	28,530	5,600	21,550	49,060	198,300
CR NEAR CARMEL	246	35,570	123,400	8,200	177,400	74,500	104,100	261,100	55,000	76,190	47,790	28,340	55,400	35,220	119,200	119,200	7,440	43,960	41,590	105,800	115,700	17,120	24,390	517	14,970	45,740	208,100
CR AT HIGHWAY 1 BRIDGE	252	*	123,000	7,410	179,500	83,430	112,000	280,900	50,810	72,660	42,860	24,860	52,000	30,300	115,200	115,000	6,470	42,520	39,170	102,700	111,300	16,300	23,410	26	13,420	44,730	201,300

Notes: 1. Carmel River (CR) at Robles del Rio and near Carmel sites are maintained by the USGS.
2. (*) No continuous stage data collected.
3. Streamflow sites listed in downstream order.
4. San Jose Creek and Arroyo Del Rey are outside the Carmel River Basin, but are shown for comparison.
5. WY 2014 - 2017 values are subject to revision.

III. Carmel River Surface-Water Quality Monitoring

Description and Purpose

This monitoring is used to help assess whether or not water-quality criteria for aquatic life are being met in various reaches of the Carmel River, and whether habitats for resources such as Carmel River steelhead (*Oncorhynchus mykiss*) and red-legged frogs (*Rana aurora draytonii*) are being sustained or impaired. Monitoring also provides District staff with a way of measuring trends over extended time periods. These data are used as an indicator of habitat quality, supports staff in recommending appropriate reservoir release schedules, and assists in determining timing of fish rescues.

Since 1991, surface-water quality data have been collected at three sampling stations along the Carmel River on a semi-monthly basis. The locations of the sampling stations are as follows: (1) below Los Padres Reservoir (BLP) at River Mile (RM) 25.4, (2) below San Clemente Reservoir at the Sleepy Hollow Weir (SHW) at RM 17.1, and (3) at the Carmel River Lagoon (CRL) at RM 0.1. River miles are measured from the mouth of the Carmel River. District staff also continued its profiling of the lagoon on a monthly basis. Monitoring at these specific stations gives District staff information on the quality of water released from the reservoir, quality conditions in the main-stem river, and the quality in the lagoon.

District staff also monitors river temperatures continuously at six locations within the Carmel River Basin (**Figure III-1**). The objective is to document the temperature regime in different stream reaches and to determine whether water-quality criteria for maximum stream temperatures are exceeded. In addition, these data allow District staff to monitor changes in the thermal regime of the river over time.

Implementation and Activities During 2016-2017

District staff carried out a semi-monthly surface water quality sampling program for the Reporting Year (RY) 2017 (July 1, 2016 to June 30, 2017); data were collected for the following chemical and physical parameters (units in parentheses): temperature (°F), dissolved oxygen (mg/L), carbon dioxide (mg/L), pH, specific conductance (uS/cm), salinity (ppt), and turbidity (NTU). The emphasis for this suite of parameters is on the suitability for rearing juvenile steelhead. In addition, continuous recording temperature data loggers (Optic StowAway temperature data loggers from the Onset Computer Corporation) were deployed at six locations on the Carmel River (**Figure III-1**), as follows:

1.	ALP	Above Los Padres Reservoir	(RM 27.0)
2.	BLP	Below Los Padres Reservoir	(RM 25.4)
3.	ASC	Above San Clemente Reservoir	(RM 18.5)
4.	SHW	Sleepy Hollow Weir	(RM 17.1)
5.	GAR	Garland Park	(RM 10.8)
6.	SAL	South Arm Lagoon	(RM 0.1)

The District continued its vertical profiling program on the Carmel River Lagoon, on a monthly basis during RY 2017 (see plots in **Appendix III-1**). The suit of parameters that were measured is depth, temperature, dissolved oxygen, and salinity. Vertical profiling helps better understand seasonal changes in the limnological cycles, such as stratification, internal mixing, community respiration, and how that relates to available habitat for steelhead.

The following paragraphs describe the results of the water quality monitoring efforts:

- **Carmel River Lagoon--** The water-temperature monitoring station for the Carmel River Lagoon is located in the south arm of the lagoon on the Carmel Area Wastewater District (CAWD) effluent discharge pipe. This site measures continuous surface water temperatures. This station was vandalized and the sensor stolen, resulting in a loss of most of the reporting year's data. During RY 2017, 16% of the data is available. This data is from July 1, 2016 to August 30, 2016 and are shown in **Figure III-2**. The maximum water temperature observed was 76.4°F, occurring on July 9, 2016. The overall average water temperature was 69.6°F and the maximum daily average temperature was 73.4°F. Constant water temperatures over 68°F are considered stressful for steelhead (Brungs and Jones, 1977). Average daily surface water temperatures over 68°F occurred 49 times. This represents 80% of the time during the limited sampling period. Surface water-quality data collected at the CRL station, which is located on the south side of the main body of the lagoon, are listed in **Table III-1**. The minimum dissolved-oxygen measurement recorded during surface water quality sampling was 8.0 mg/L. The pH measurements ranged from 7.5 to 8.0. Carbon dioxide measurements ranged from 0 to 15 mg/L. The conductivity measurements ranged from 102 to 14,888 uS/cm. The surface salinity ranged from 0.1 to 10.1 ppt. The conductivity and salinity are highly variable at the lagoon due to tidal influences and river inflows. The turbidity measurements ranged from 0.6 to 38.5 NTU during the sampling period.

- **Carmel River Lagoon Vertical Profile -** Vertical profiling helps staff understand the seasonal changes in water quality that occurs in the lagoon throughout the water column over time. In the beginning of the sampling period, July 2016, the lagoon was closed off to the ocean, with surface inflow rapidly declining. In July and August the Odello channel was exhibiting supersaturated dissolved oxygen readings at the surface, due to the high rates of photosynthesis from the abundant aquatic vegetation that has established there. This supersaturation can redistribute steelhead that were inhabiting that area, essentially reducing the available rearing habitat in the lagoon. Water temperatures continued to be in or close to stressful ranges from July through August, but by September had returned to an adequate range. Fall is also the time of year that tidal wave over-wash from large swells start to enter the lagoon, reducing water temperatures and increasing salinity. These over-wash events create a stratified layer of freshwater on top and salty water on the bottom. This began to occur in September, when the deep sample sites of the main body and south arm started to stratify. By November this stratification had intensified. The

top layer is adequate for steelhead rearing, but the bottom layer is inadequate habitat, because of the high salt concentration and the low dissolved oxygen. During the winter and early spring months the lagoons water level is dynamic, because of the openings and closures initiated by river inflow fluctuations. The lagoon tends to de-stratify in most locations, because of mixing due to an increase in river inflow. This season experienced a normal winter start, where adequate inflow to de-stratify the lagoon occurred in mid-December. In April, the lagoon started to stratify in the deepest locations as strong ocean swells brought in ocean water. By the end of June, the lagoon was still cycling open and closed and inflow was reduced to approximately 30 cubic-feet-per-second (cfs). The lagoon did not close for the season until mid-July 2017.

- **Garland Park--** Water temperature for the Garland Park (GAR) station is shown in **Figure III-3**. High flows observed in the Carmel River during the reporting period displaced the water temperature sensor located at this site, resulting in lost data. The sampling period with reliable data for this station was July 1, 2016 to August 30, 2016. During this period, maximum annual water temperature was 64.5°F, occurring on July 9, 2016. The overall average water temperature during this period was 60.6°F. Maximum daily average water temperature was 61.8°F, occurring on July 9, 2016. Daily average water temperatures were within adequate range for steelhead rearing during the sampling period.

- **Sleepy Hollow Weir--** Water temperature for the Sleepy Hollow Weir (SHW) station is shown in **Figure III-4**. The data recorders sampling period was July 1, 2016 to June 30, 2017. The maximum annual water temperature was 74.0°F, occurring on June 22, 2017. The overall average water temperature during the sampling period at this station was 57.2°F. The maximum daily average water temperature was 68.9°F, occurring on June 19, 2017. Constant water temperatures over 68°F are considered stressful for steelhead (Brungs and Jones, 1977). Average daily water temperatures over 68°F occurred 4 times or 1.1% of the sampling record. The Water-quality data collected at this station are listed in **Table III-2.** The dissolved-oxygen measurements recorded ranged from 9.4 to 13.8 mg/L. Carbon-dioxide measurements ranged from 0 to 5 mg/L. The pH measurements ranged from 7.5 to 8.0. The conductivity measurements ranged from 109 to 273 uS/cm and the turbidity measurements recorded were between 0.2 to 23.5 NTU.

- **Above San Clemente Reservoir--** Water temperature for the Above San Clemente (ASC) station is shown in **Figure III-5**. High flows observed in the Carmel River during the reporting period displaced the water temperature sensor located at this site, resulting in lost data. The sampling period with reliable data for this station was July 1, 2016 to August 30, 2016. During this period, maximum annual water temperature was 65.9°F, occurring on July 4, 2016. The overall average water temperature during this period was 61.2°F. Maximum daily average water temperature was 63.7°F, occurring on July 5, 2016. Daily average water

temperatures were within adequate range for steelhead rearing during the sampling period.

- **Below Los Padres Reservoir--** Water temperature for the Below Los Padres (BLP) station is shown in **Figure III-6**. The data recorders sampling period was July 1, 2016 to June 30, 2017. The maximum annual water temperature observed was 70.9°F, occurring on August 28, 2017. The overall average water temperature observed at this station during the sampling period was 57.7°F. The maximum daily average water temperature at this station was 69.1°F, occurring on June 30, 2017. Constant water temperatures over 68°F are considered stressful for steelhead (Brungs and Jones, 1977). Average daily water temperatures over 68°F occurred 8 times, representing 2.2% of the time during the sampling period and is directly related to reservoir water levels and releases. Water quality data collected at this station are listed in **Table III-3**. Water quality at this station is highly influenced by reservoir water quality and release location. The dissolved oxygen measurements recorded ranged from 7.9 to 13.3 mg/L. Carbon dioxide measurements ranged from 0 to 5 mg/L. The pH measurements ranged from 7.5 to 8.0. The conductivity measurements ranged from 101 to 263 uS/cm and the turbidity measured at this station ranged from 0.7 to 19.0 NTU.

- **Above Los Padres Reservoir--** Water temperature for the Above Los Padres (ALP) station is shown in **Figure III-7**. High flows observed in the Carmel River during the reporting period displaced the water temperature sensor located at this site, resulting in lost data. The sampling period with reliable data for this station was July 1, 2016 to September 1, 2016. During this period, maximum annual water temperature was 65.2°F, occurring on July 30, 2016. The overall average water temperature during this period was 61.2°F. Maximum daily average water temperature was 63.4°F, occurring on July 30, 2016. Daily average water temperatures were within adequate range for steelhead rearing during the sampling period.

CONCLUSIONS AND/OR RECOMMENDATIONS:

During this winter the Carmel River basin accumulated over 32.2 inches of rain, as measured by the San Clemente Dam rain gage. This translated into flows that had not been observed since 1998. The water year (WY) was characterized as “extremely wet”. A peak flow of 8,760 cfs was observed at the MPWMD Highway One gage on February 21, 2017. Water temperature loggers above Los Padres Reservoir blew out in the extreme flows, but the data that had been collected was through the summer months (July through September) and this data showed that water temperature was adequate during these typically warm months. Water released from Los Padres Reservoir during the reporting year was adequate for steelhead rearing most of the season, water temperatures were near stressful range during June 2017. This potently reduced growth rates or displaced fish to other sections of river that had more favorable conditions. Water quality

conditions at the sampling sites around the former San Clemente Reservoir and down in the lower river were adequate for steelhead rearing during most of the sampling period.

Water quality conditions in the Carmel River Lagoon during the summer through fall were commonly within stressful ranges and likely decrease growth and survival rates of rearing steelhead. This is mainly caused by a lack of river inflow and variability in tidal influences. These factors can dramatically change the water quality dynamics in the lagoon depending on their outcomes. Stratification occurs when high tidal over wash enters the lagoon, creating a fresh and salt layer. Typically the salt layer has suboptimal water quality conditions for fish rearing. During the summer, aggressive growth of aquatic vegetation was observed in the Odello channel, which caused diurnal variability in dissolved oxygen. Suboptimal dissolved oxygen measurements were observed in summer season and likely displacing steelhead and reducing the amount of habitat they can rear in. Water temperatures were commonly at or near stressful levels for rearing steelhead during the summer, but by the fall period had decreased to suitable ranges. Salinity readings were only in stressful ranges during the fall and early winter, when wave over wash enters the lagoon and little to no freshwater input is occurring, causing stratification of the fresh and salt layers. Overall, the biggest water quality threats to steelhead rearing in the lagoon continues to be the high water temperatures observed in the summer and the seasonal stratification, causing fish to be displaced and reducing the amount of habitat available for favorable rearing.

Figure III-1
Temperature and Semi-Monthly Water Quality Monitoring Locations in the Carmel River Basin During RY 2017

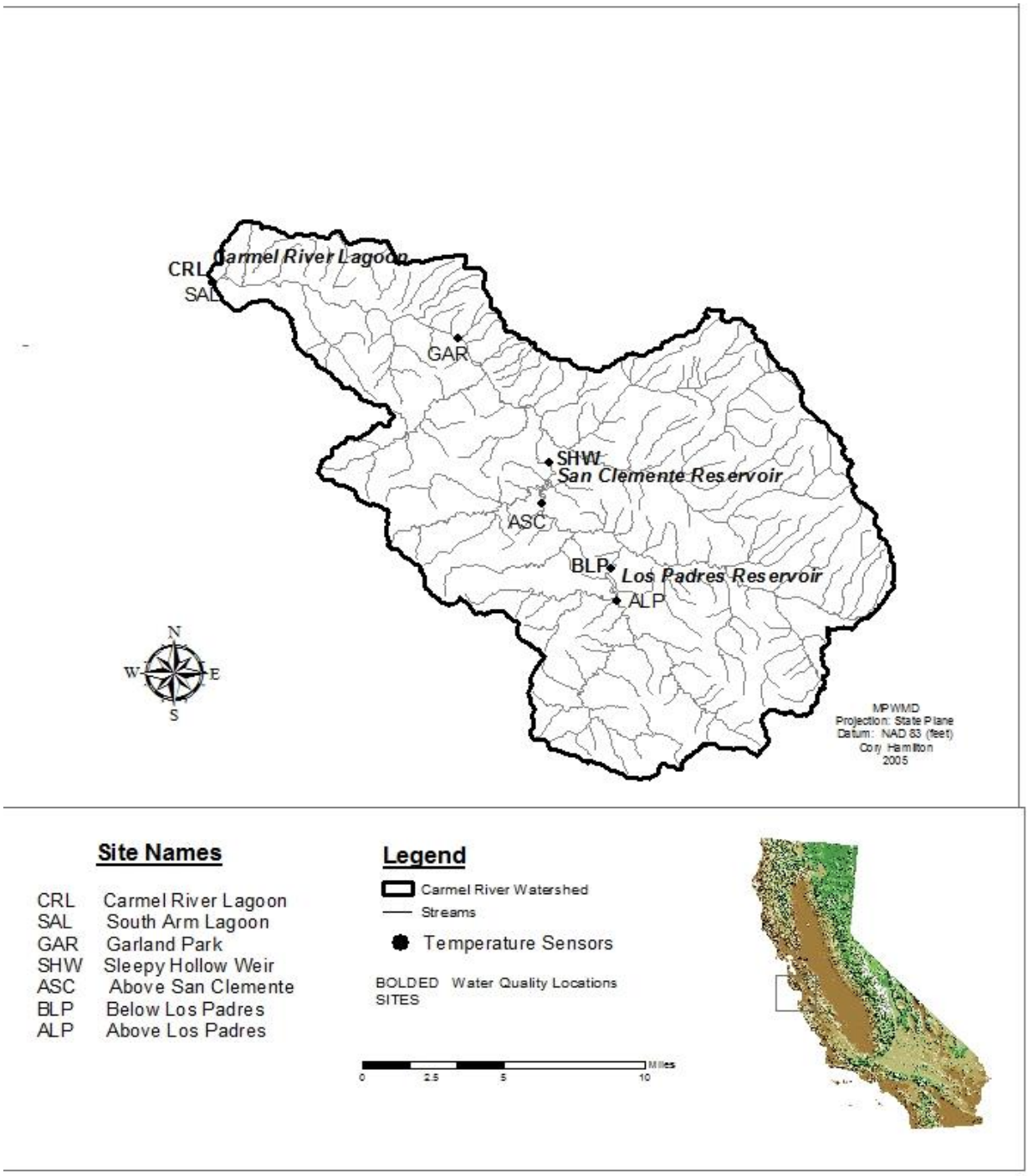


Figure III-2
Daily temperatures recorded from a continuous temperature data logger at the South Arm Lagoon (SAL) station during RY 2017

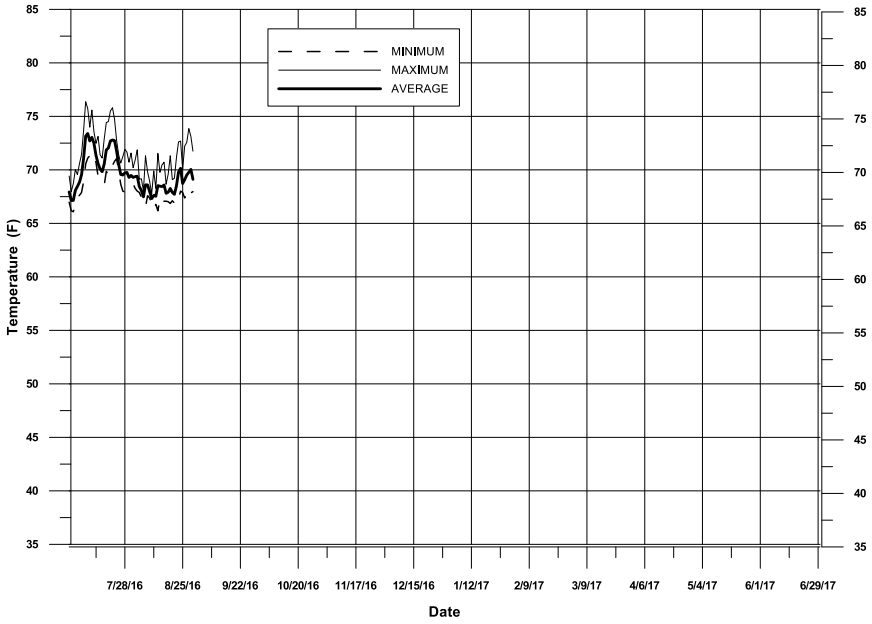


Figure III-3
Daily temperatures recorded from a continuous temperature data logger at the Garland Park (GAR) station during RY 2017

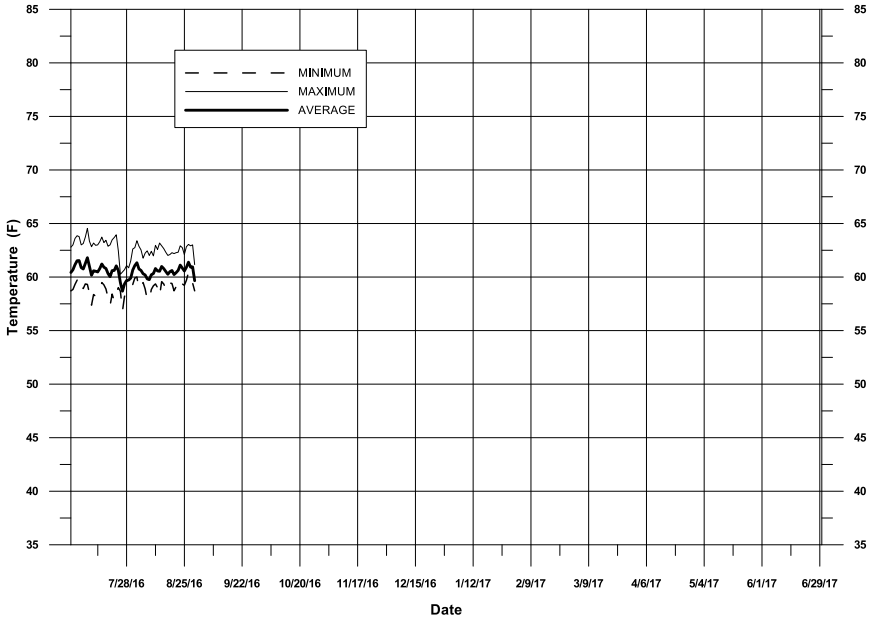


Figure III-4
Daily temperatures recorded from a continuous temperature data logger at the Sleepy Hollow Weir (SHW) station during RY 2017

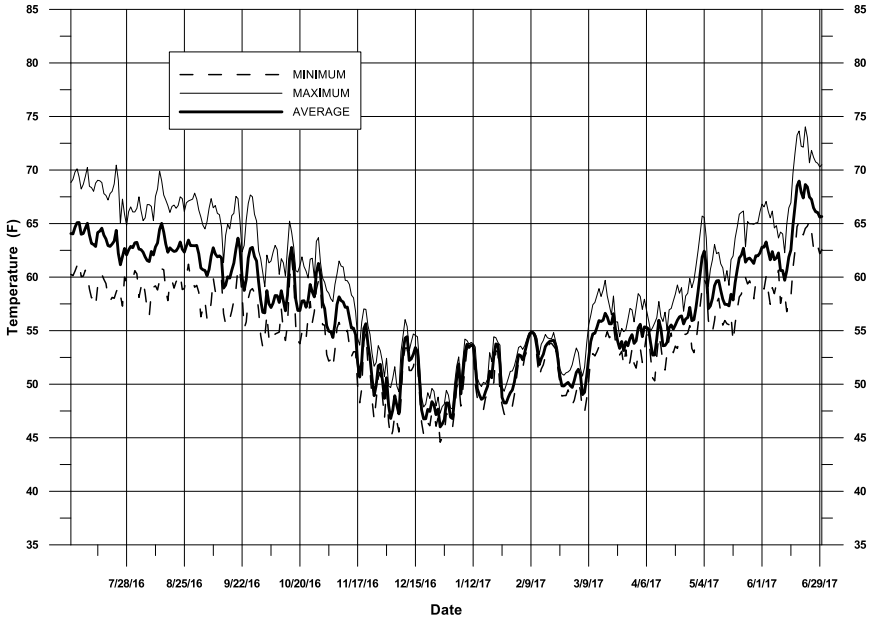


Figure III-5
Daily temperatures recorded from a continuous temperature data logger at the above San Clemente (ASC) station during RY 2017

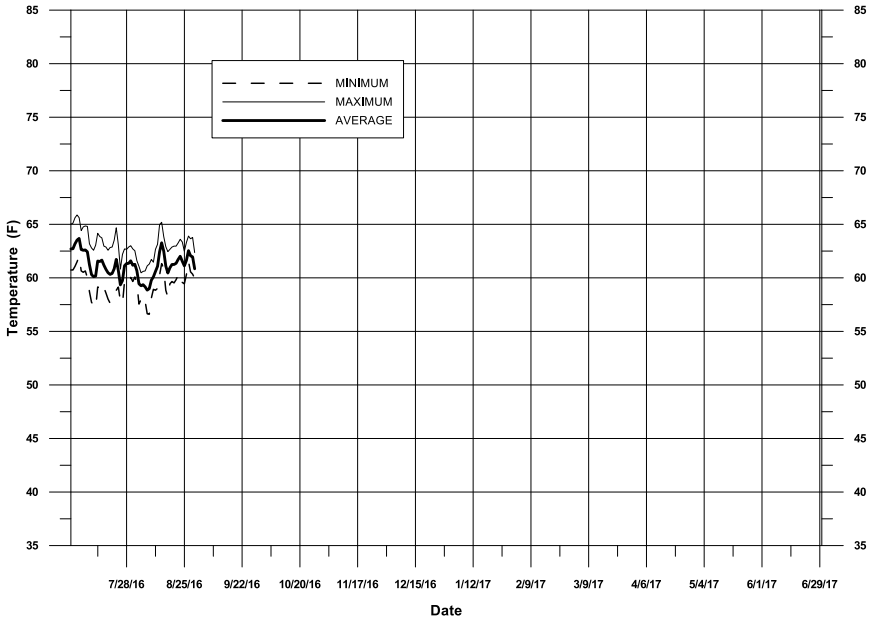


Figure III-6
Daily temperatures recorded from a continuous temperature data logger at the Below Los Padres (BLP) station during RY 2017

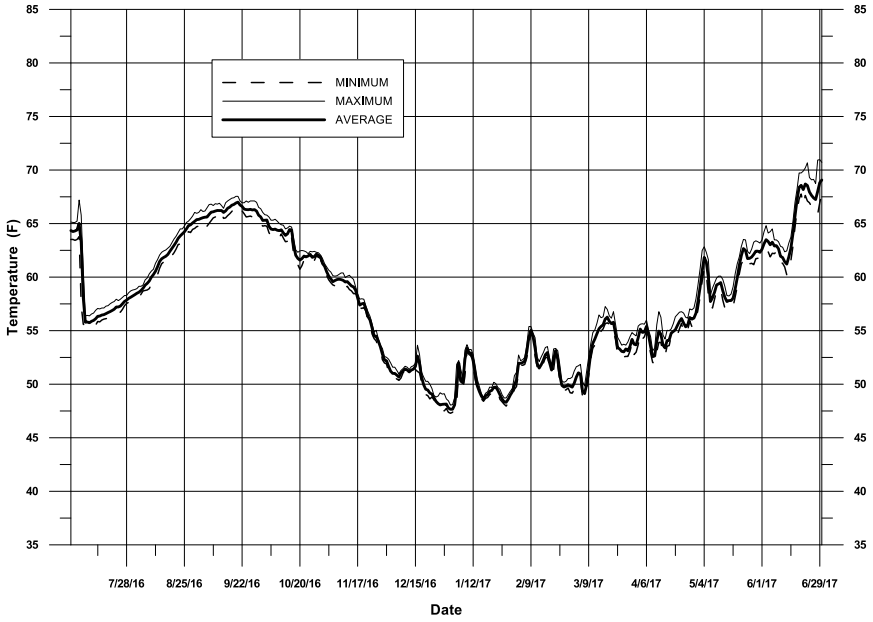


Figure III-7
Daily temperatures recorded from a continuous temperature data logger at the Above Los Padres (ALP) station during RY 2017

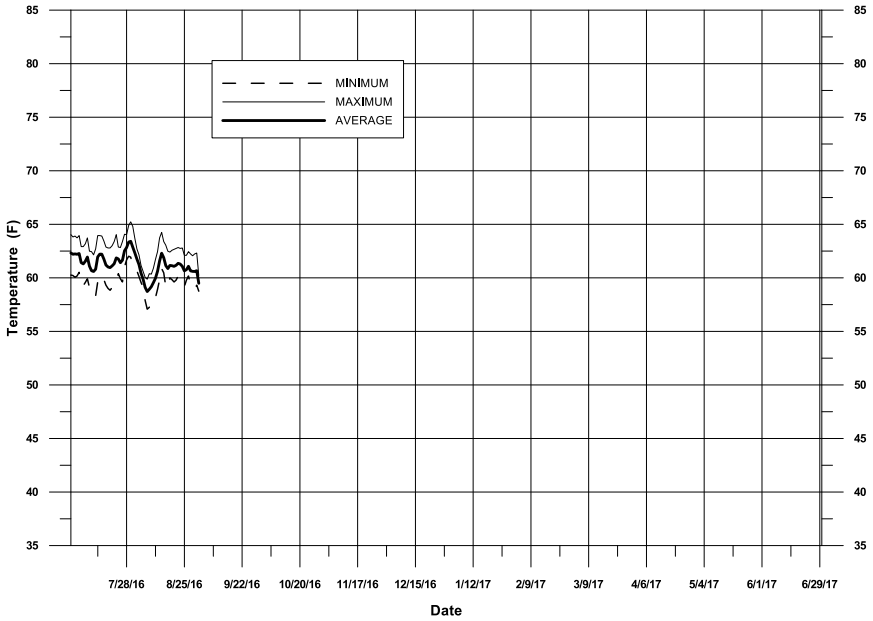


Table III-1
Water quality data collected by MPWMD during RY 2017 at Carmel River Lagoon (CRL) site.

Date	Time 24 Hr	Temperature (F)	Dissolved Oxygen (mg/L)	Carbon Dioxide (mg/L)	pH	Conductivity (uS/cm)	Nacl (ppt)	Turbidity (NTU)
05-Jul-16	1230	68.2	10.3	5	8.0	1884	1.1	1.2
25-Jul-16	1300	68.7	9.1	10	8.0	2281	1.3	1.5
16-Aug-16	1330	68.8	11.4	0	8.0	2335	1.3	1.3
29-Aug-16	1000	68.5	10.0	10	8.0	2313	1.3	2.1
26-Sep-16	1400	68.3	10.0	10	8.0	4610	2.7	0.7
14-Oct-16	1307	65.9	8.0	15	8.0	14888	10.1	2.9
13-Dec-16	1230	56.1	9.5	10	8.0	2233	1.5	1.6
29-Dec-16	1250	49.4	12.2	10	8.0	109	0.7	0.6
14-Jan-17	1247	50.1	12.3	5	8.0	243	0.2	25.6
26-Jan-17	934	47.6	13.3	5	8.0	157	0.3	26.6
11-Feb-17	1653	54.7	11.5	5	8.0	102	0.1	28.9
25-Feb-17	1430	51.4	11.7	5	8.0	283	0.2	38.5
09-Mar-17	1303	55.1	11.5	5	8.0	265	0.2	6.2
26-Mar-17	1500	56.3	11.3	5	8.0	109	0.2	3.7
06-Apr-17	1330	55.8	N/A	10	8.0	465	3.5	4.4
20-Apr-17	1316	59.4	N/A	5	8.0	552	0.3	3.2
04-May-17	1232	62.6	9.4	5	7.5	359	0.2	1.7
18-May-17	1335	62.7	9.9	5	7.5	527	0.3	1.0
01-Jun-17	1404	68.6	9.0	5	8.0	601	0.3	0.8
15-Jun-17	1345	66.9	9.4	5	8.0	5444	3.2	1.4
Minimum		47.6	8.0	0.0	7.5	102	0.1	0.6
Maximum		68.8	13.3	15.0	8.0	14888	10.1	38.5
Average		60.3	10.5	6.8	8.0	1988	1.5	7.7

Table III-2
Water quality data collected by MPWMD during RY 2017 at Sleepy Hollow Weir (SHW) station.

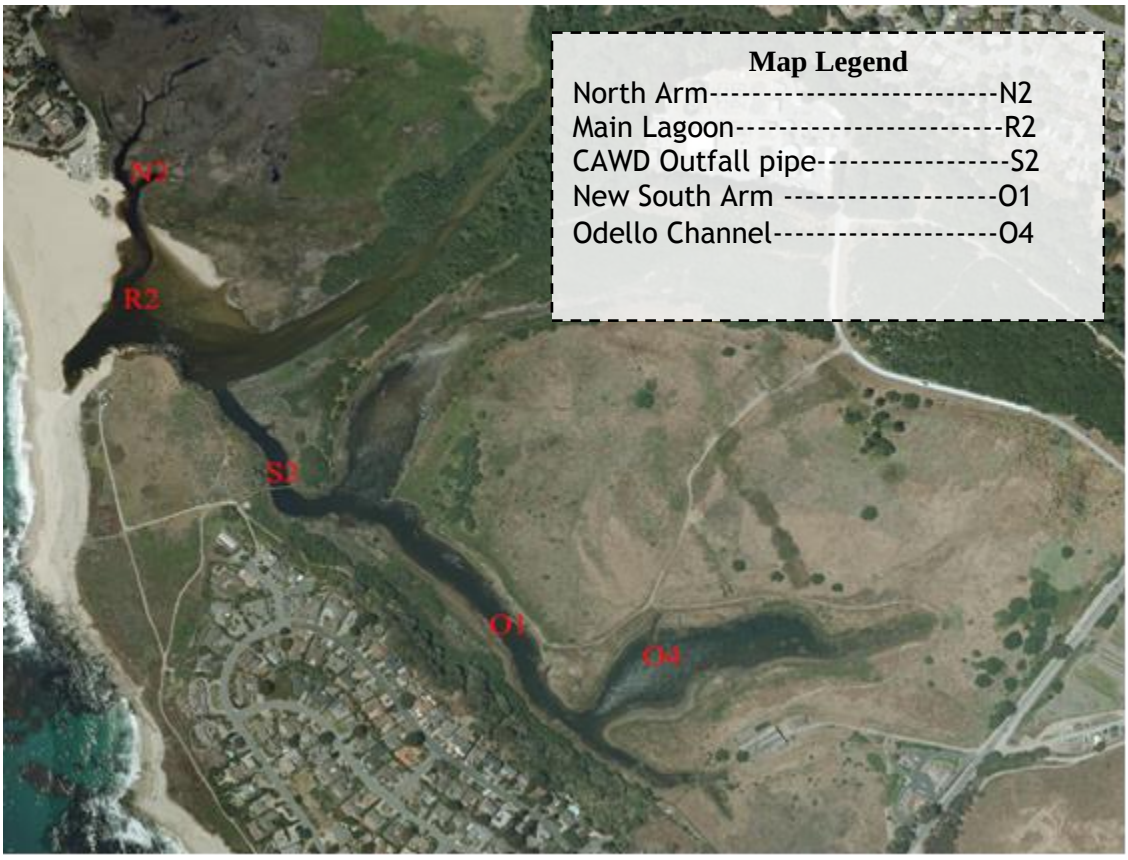
Date	Time 24 hr	Temperature (F)	Dissolved Oxygen (mg/L)	Carbon Dioxide (mg/L)	pH	Conductivity (uS/cm)	Turbidity (NTU)
05-Jul-16	1045	62.0	11.3	5	8.0	256	1.2
25-Jul-16	915	58.2	10.7	5	8.0	247	1.6
16-Aug-16	1215	60.0	11.1	0	8.0	260	1.2
29-Aug-16	1315	62.6	10.7	0	8.0	273	1.3
26-Sep-16	1200	59.9	11.3	5	7.5	273	0.4
14-Oct-16	1100	56.3	11.4	0	7.5	260	0.2
13-Dec-16	1100	51.7	12.4	5	8.0	192	1.2
29-Dec-16	1115	45.8	13.8	5	8.0	115	0.5
14-Jan-17	1119	49.4	13.0	5	8.0	109	23.5
26-Jan-17	1050	48.3	13.1	5	8.0	120	13.4
11-Feb-17	1459	53.4	12.0	0	8.0	120	11.5
25-Feb-17	1230	50.5	12.7	5	8.0	113	11.6
09-Mar-17	1132	53.0	12.4	5	8.0	164	1.6
26-Mar-17	1325	53.9	12.1	0	8.0	155	1.3
06-Apr-17	1151	54.7	N/A	0	8.0	175	1.1
20-Apr-17	1152	55.9	N/A	5	8.0	163	0.9
04-May-17	1104	62.2	10.0	5	7.5	183	0.8
18-May-17	1212	58.7	10.4	5	7.5	187	0.7
01-Jun-17	1302	65.1	9.4	5	7.5	219	0.4
15-Jun-17	1223	64.0	9.4	5	7.5	223	0.6
MINIMUM		45.8	9.4	0.0	7.5	109	0.2
MAXIMUM		65.1	13.8	5.0	8.0	273	23.5
AVERAGE		56.3	11.5	3.5	7.9	190	

Table III-3
Water quality data collected by MPWMD during RY 2017 at Below Los Padres (BLP) station.

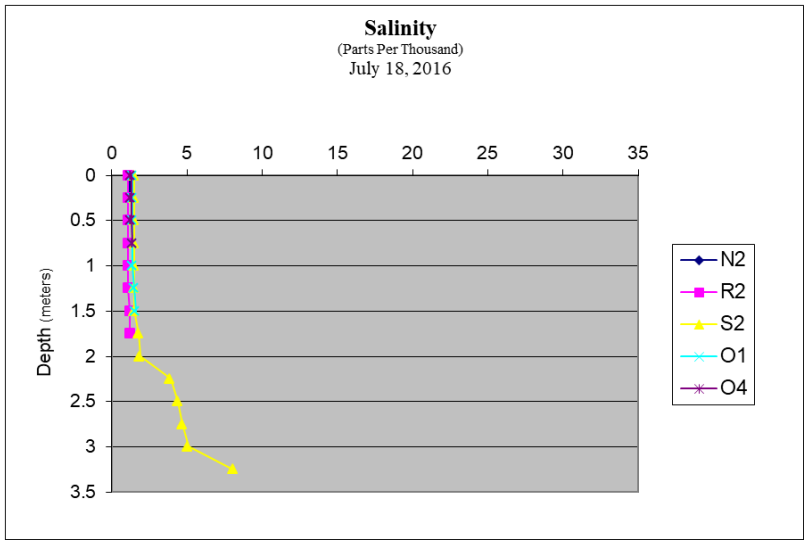
Date	Time 24 hr	Temperature (F)	Dissolved Oxygen (mg/L)	Carbon Dioxide (mg/L)	pH	Conductivity (uS/cm)	Turbidity (NTU)
05-Jul-16	930	64.0	9.1	5.0	8.0	217	5.8
25-Jul-16	1100	57.4	9.5	5.0	7.5	197	4.0
25-Jul-16	906	60.9	9.5	5.0	8.0	223	1.8
16-Aug-16	1100	62.0	8.4	5.0	7.5	230	1.1
29-Aug-16	1200	65.5	7.9	5.0	7.5	251	2.5
26-Sep-16	1030	66.5	9.1	5.0	7.5	263	3.7
14-Oct-16	1200	64.4	9.5	5.0	8.0	262	4.0
13-Dec-16	930	51.2	12.3	5.0	8.0	198	1.4
29-Dec-16	945	47.7	12.9	5.0	8.0	148	0.9
14-Jan-17	934	49.5	13.0	5.0	8.0	101	19.0
26-Jan-17	1215	48.4	13.3	5.0	8.0	113	11.5
11-Feb-17	1345	53.0	12.8	5.0	8.0	112	8.1
25-Feb-17	1050	49.5	12.9	0.0	8.0	118	9.1
09-Mar-17	1025	51.2	12.8	5.0	8.0	148	1.8
26-Mar-17	1100	52.7	12.5	0.0	8.0	140	1.3
06-Apr-17	1027	54.5	NA	5.0	8.0	161	1.3
20-Apr-17	1041	54.3	NA	0.0	8.0	151	1.2
04-May-17	1000	61.9	10.0	0.0	7.5	178	0.7
18-May-17	1105	58.3	10.5	0.0	7.5	176	0.9
01-Jun-17	1149	63.2	9.6	5.0	7.5	202	0.9
15-Jun-17	1122	63.2	9.0	0.0	7.5	210	2.1
MINIMUM		47.7	7.9	0.0	7.5	101	0.7
MAXIMUM		66.5	13.3	5.0	8.0	263	19.0
AVERAGE		57.1	10.8	3.6	7.8	181	

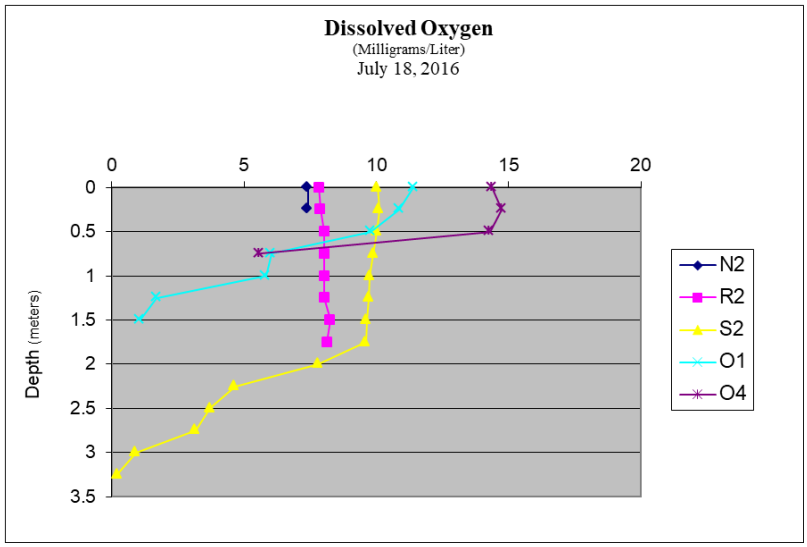
Appendix III-1

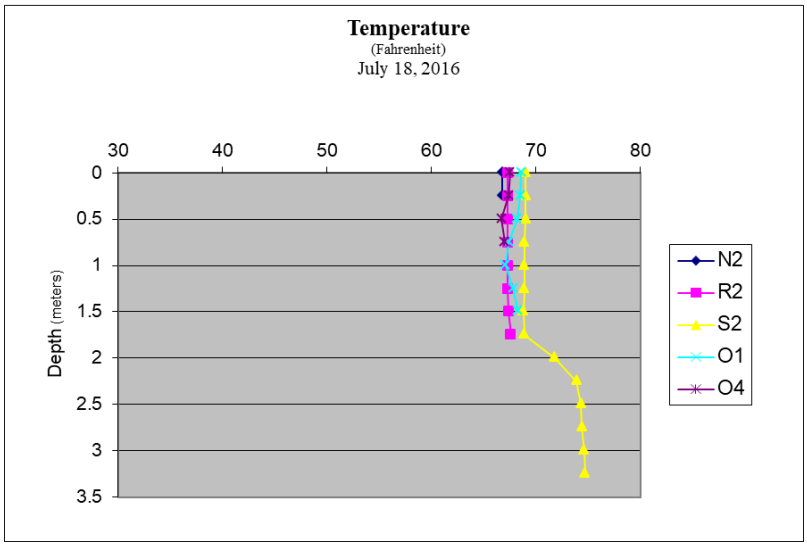
Carmel River Lagoon Profiles.
Salinity (ppt), Dissolved Oxygen (DO), Temperature (degrees F).
July 2016 – June 2017



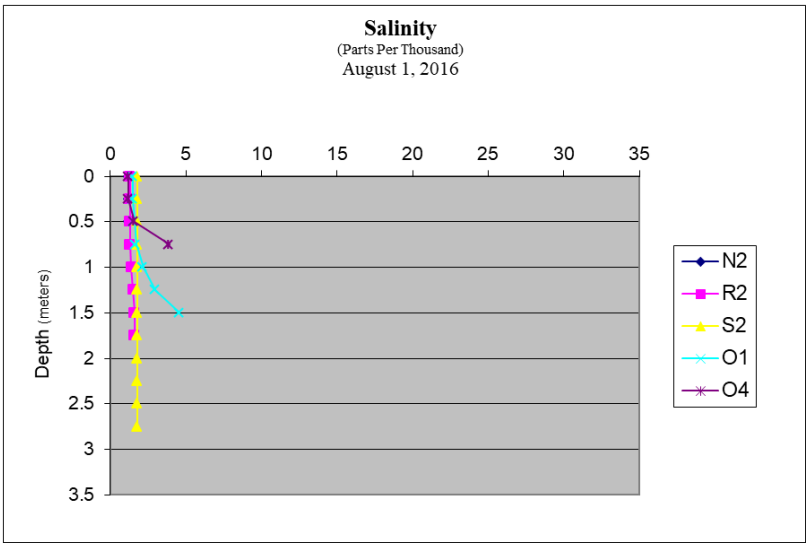
July 2016

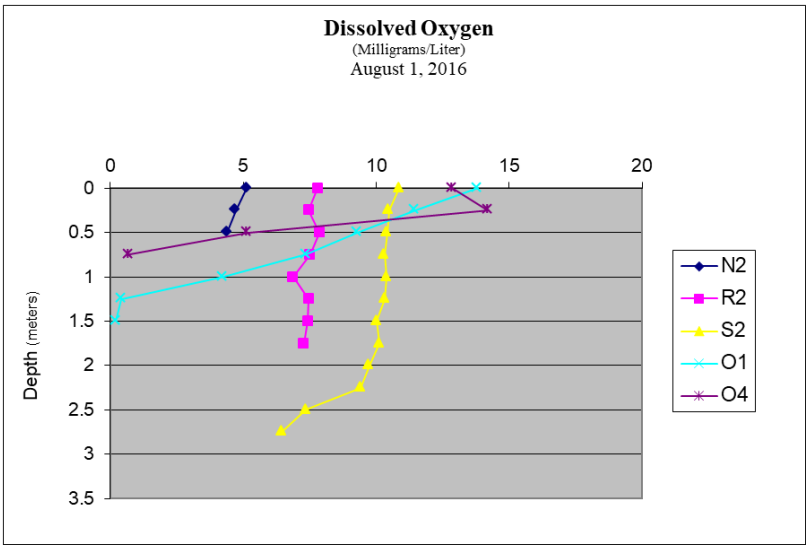

Salinity
(Parts Per Thousand)
July 18, 2016
0
5
10
15
20
25
30
35
0
0.5
1
1.5
2
2.5
3
3.5
Depth (meters)
N2
R2
S2
O1
O4

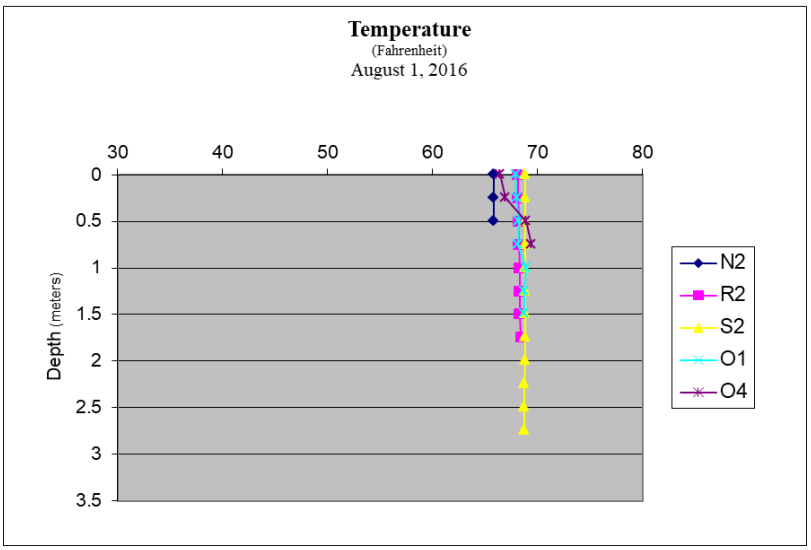

Dissolved Oxygen
(Milligrams/Liter)
July 18, 2016
0
5
10
15
20
0
0.5
1
1.5
2
2.5
3
3.5
Depth (meters)
N2
R2
S2
O1
O4


Temperature
(Fahrenheit)
July 18, 2016
30
40
50
60
70
80
0
0.5
1
1.5
2
2.5
3
3.5
Depth (meters)
N2
R2
S2
O1
O4

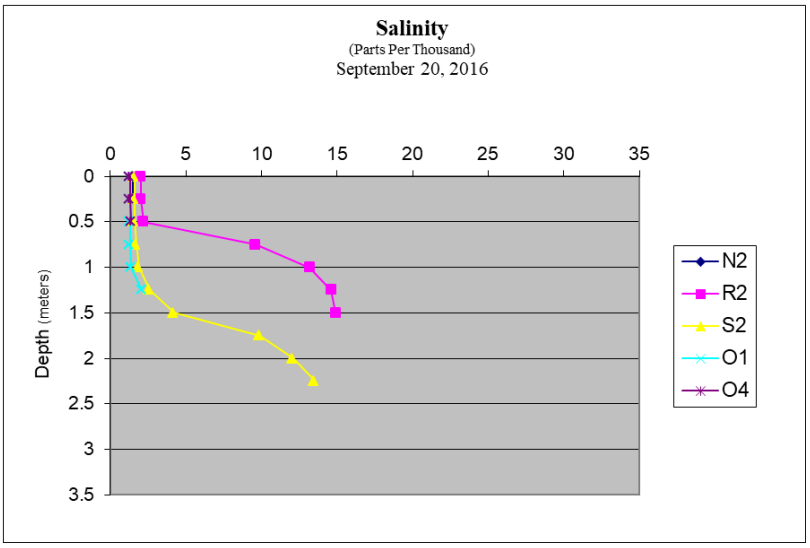
August 2016

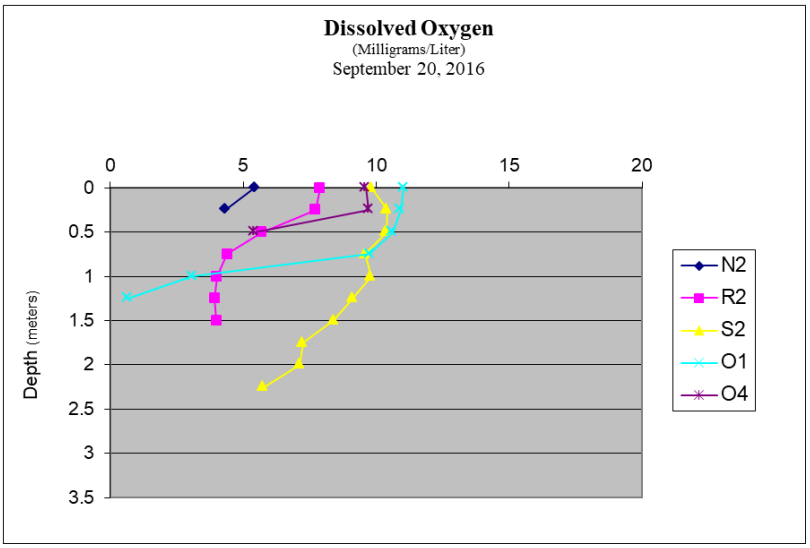

Salinity
(Parts Per Thousand)
August 1, 2016
0
5
10
15
20
25
30
35
0
0.5
1
1.5
2
2.5
3
3.5
Depth (meters)
N2
R2
S2
O1
O4

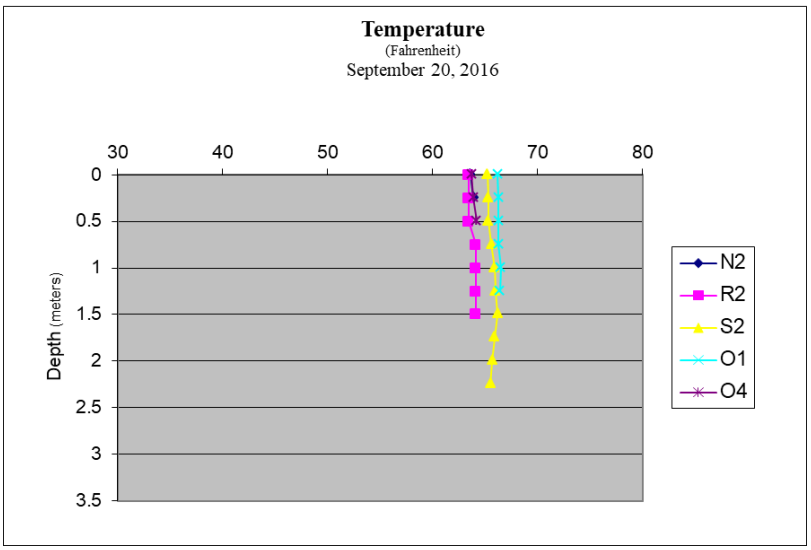

Dissolved Oxygen
(Milligrams/Liter)
August 1, 2016
0
5
10
15
20
0
0.5
1
1.5
2
2.5
3
3.5
Depth (meters)
N2
R2
S2
O1
O4


Temperature
(Fahrenheit)
August 1, 2016
30
40
50
60
70
80
0
0.5
1
1.5
2
2.5
3
3.5
Depth (meters)
N2
R2
S2
O1
O4

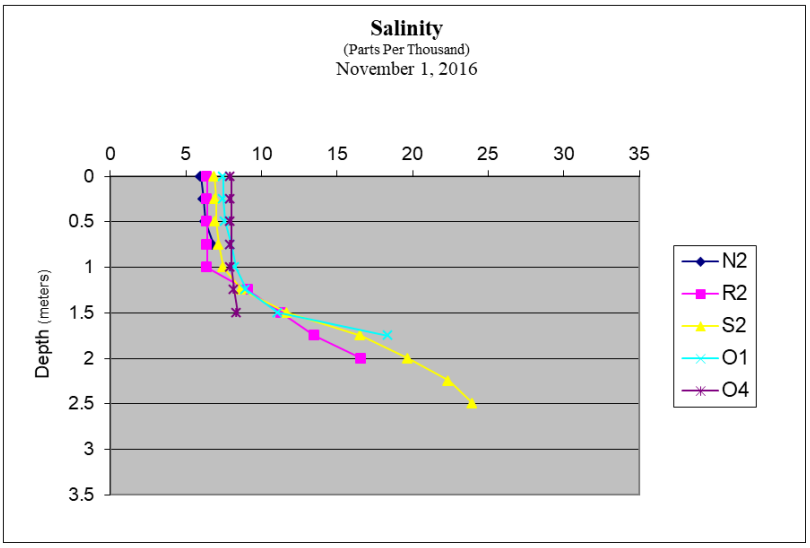
September 2016

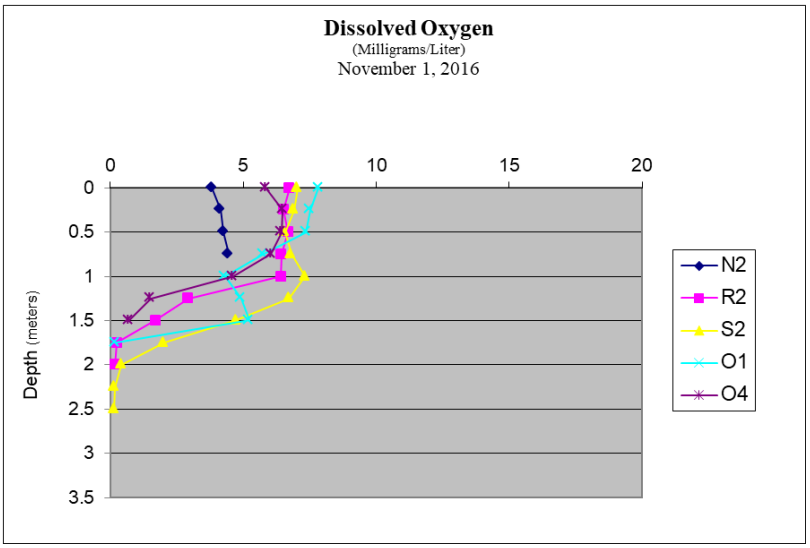


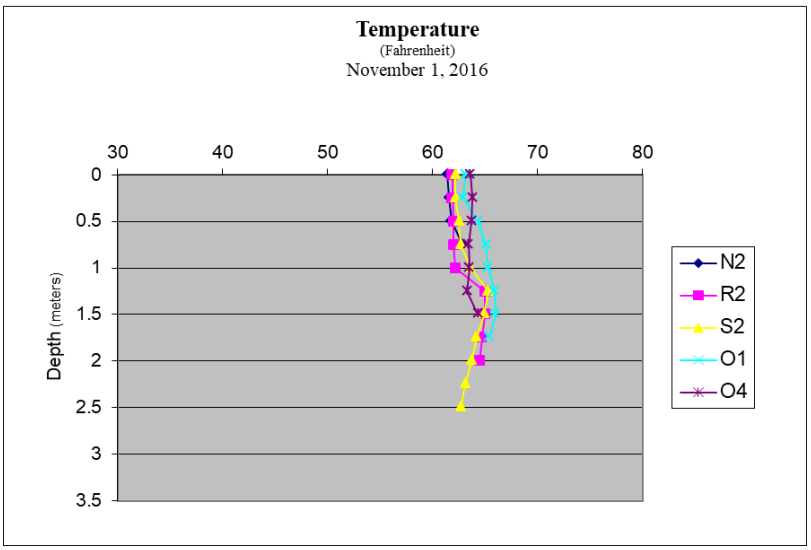




November 2016







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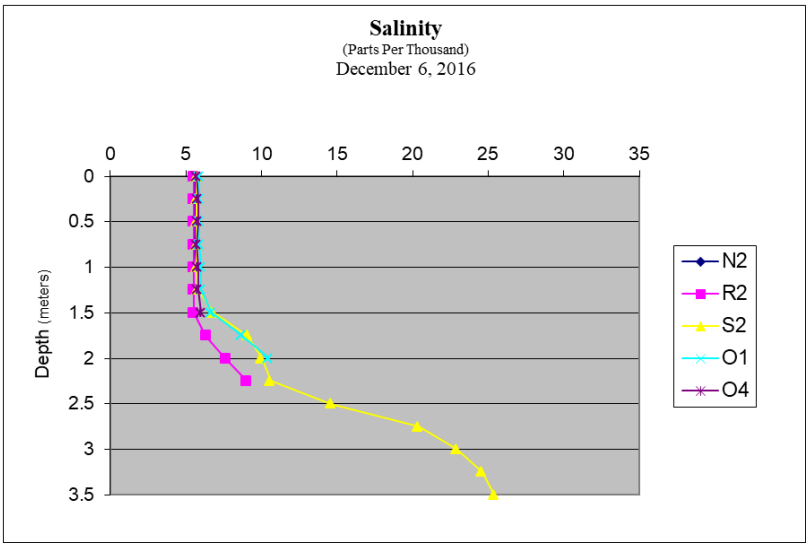

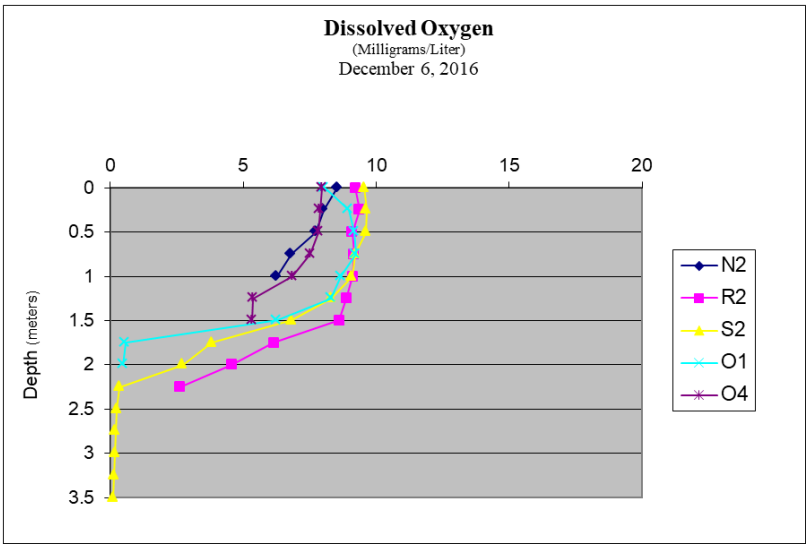

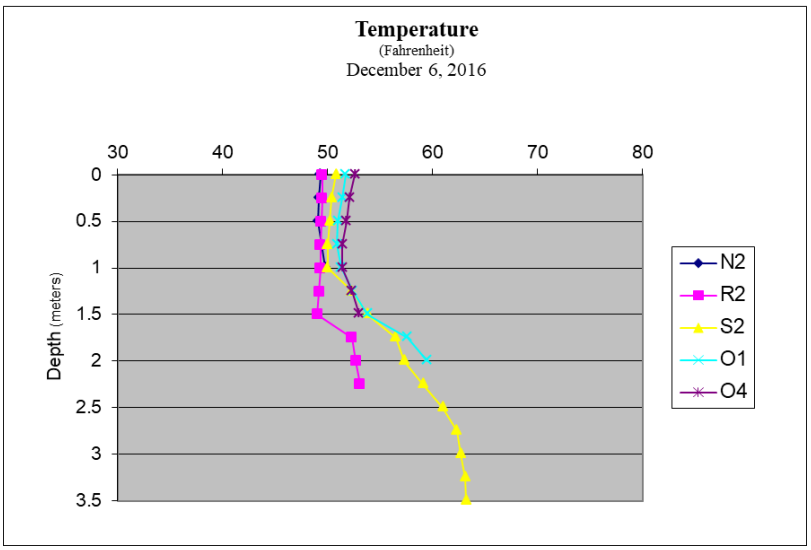

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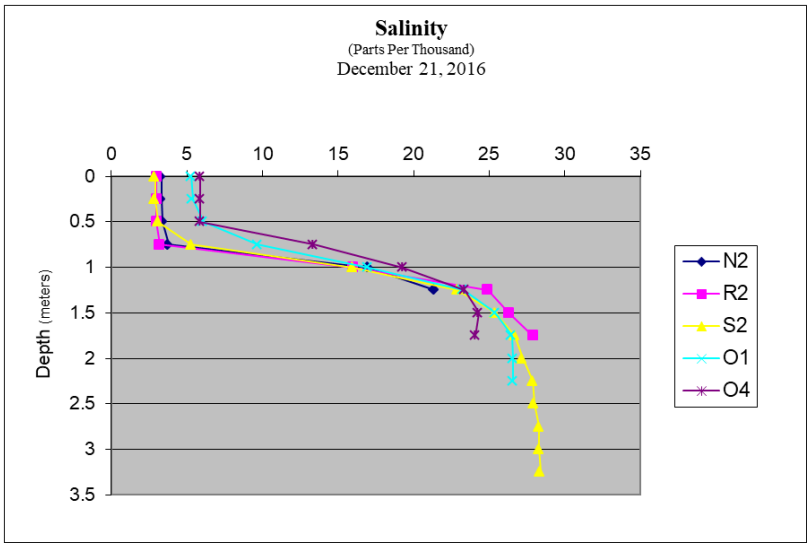
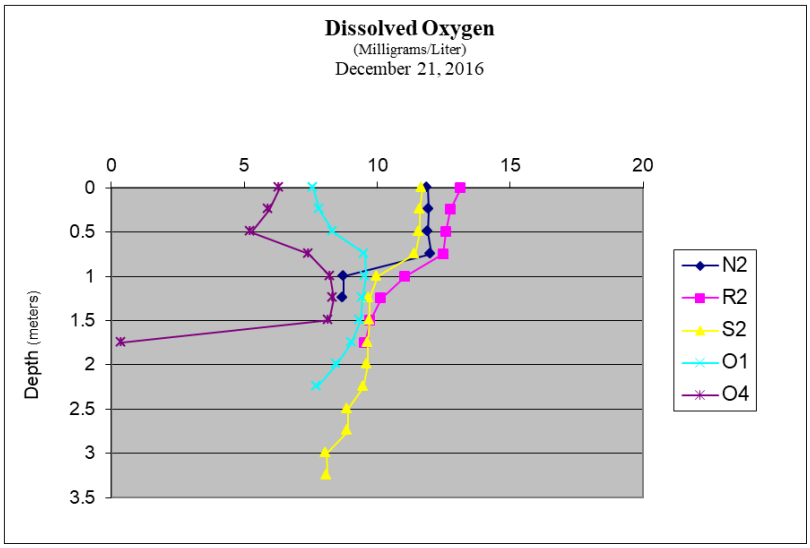
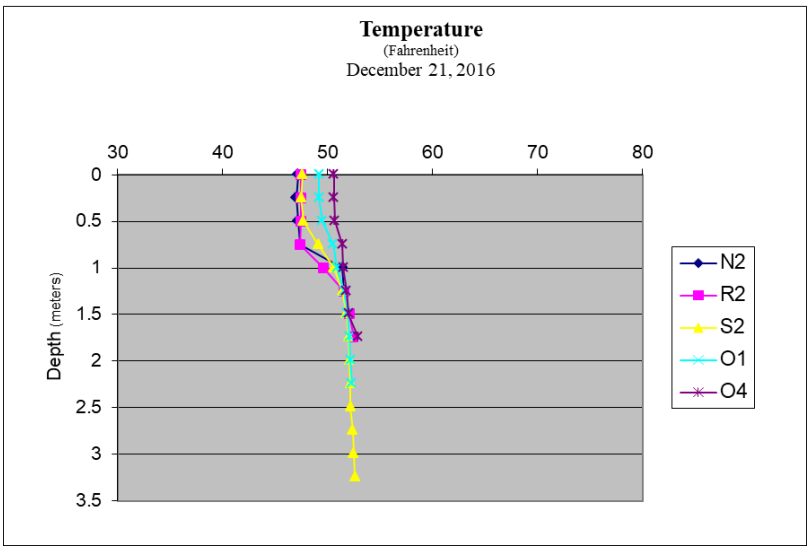
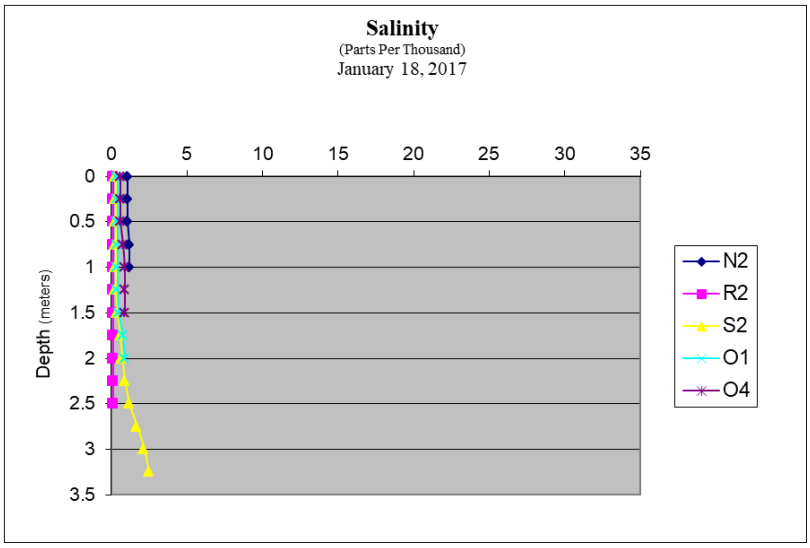
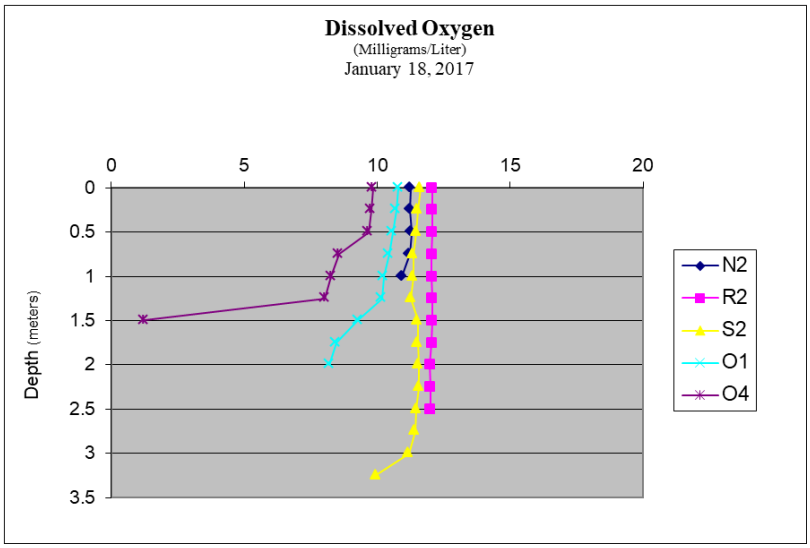


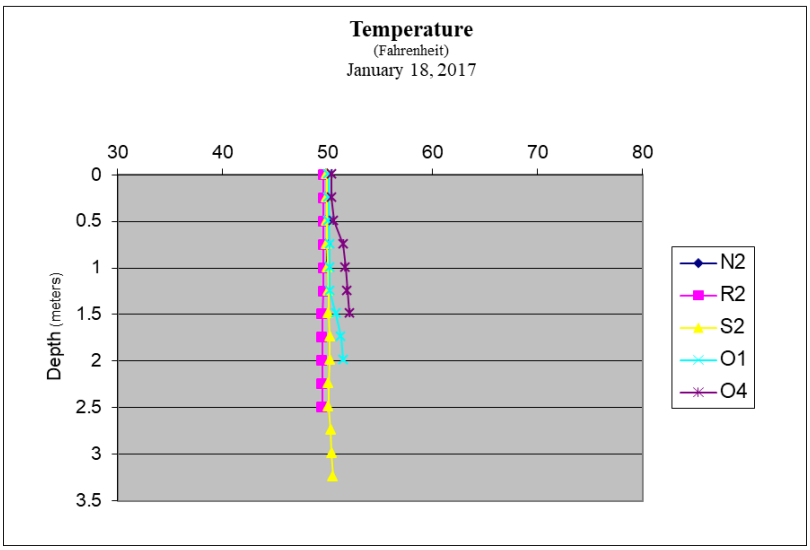




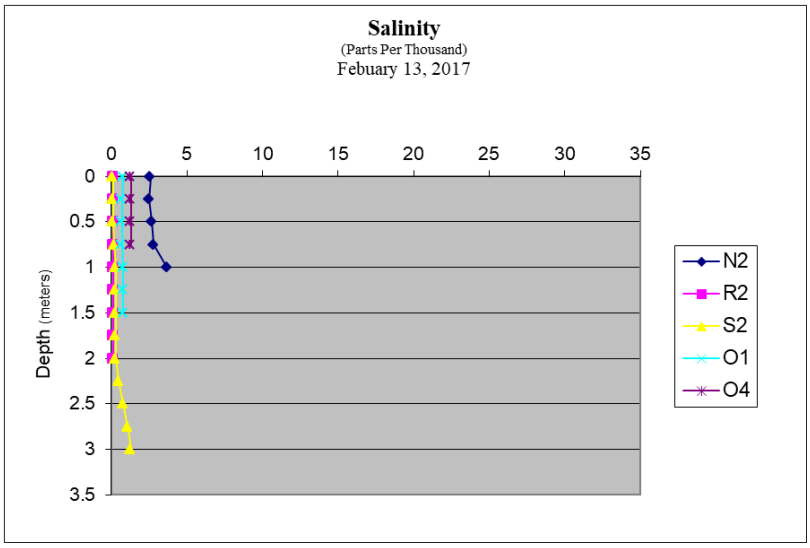
January 2017

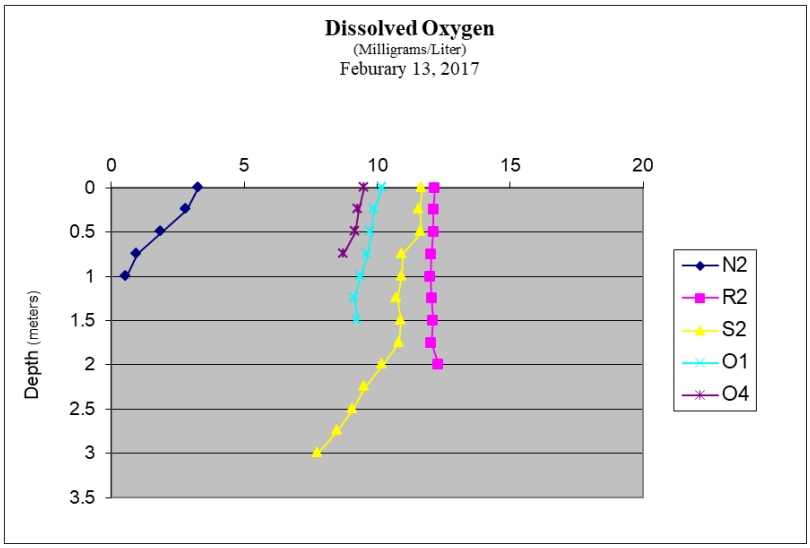


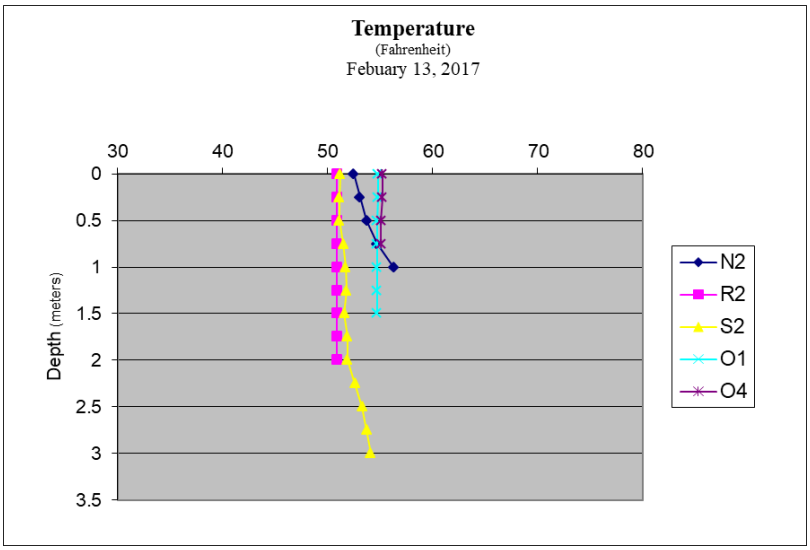




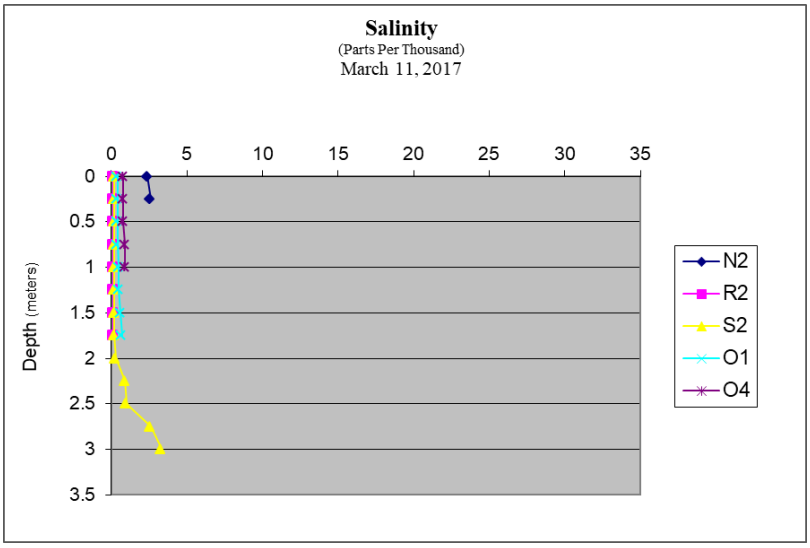
February 2017

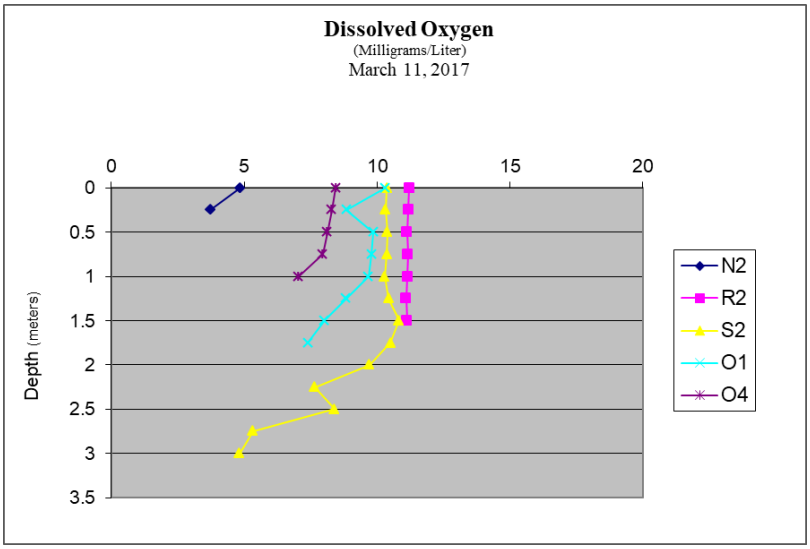


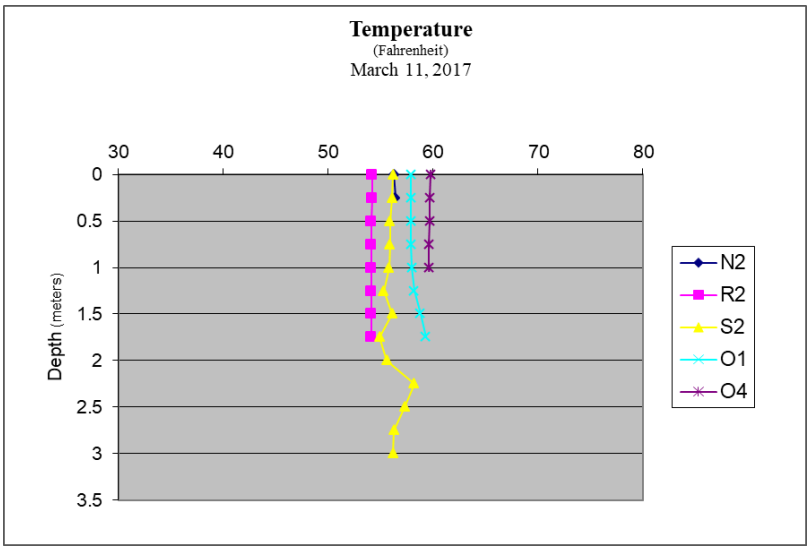




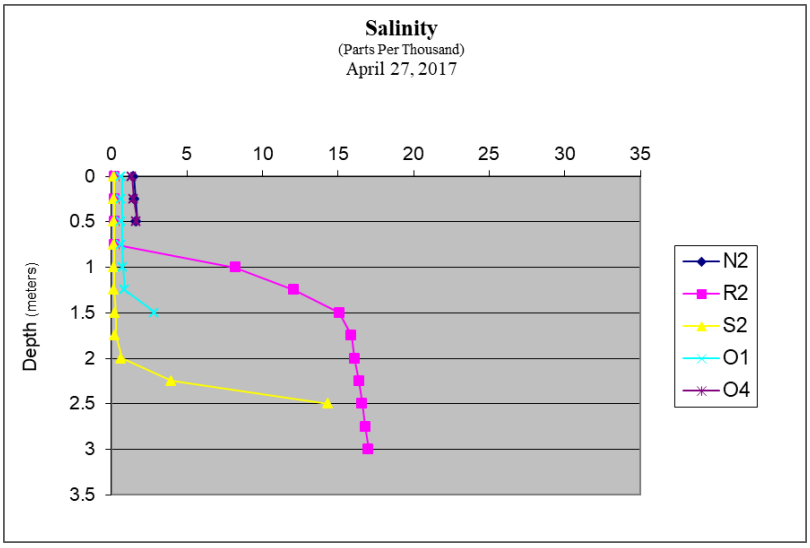
March 2017

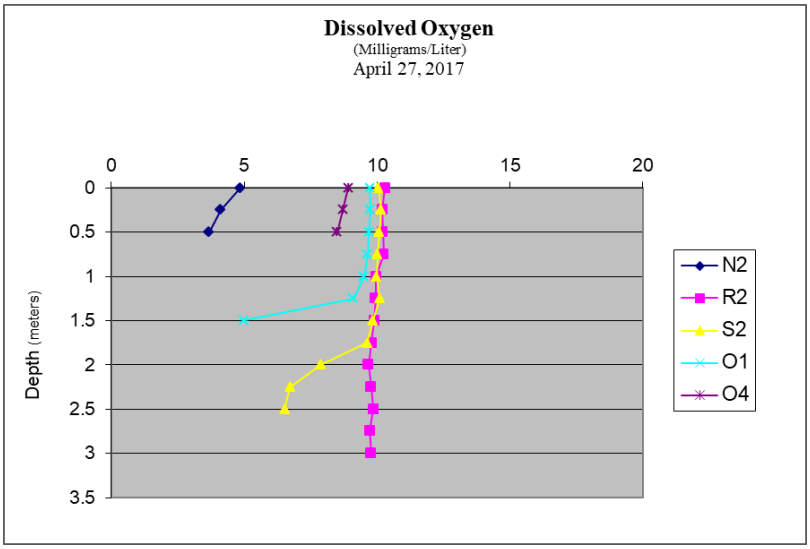

Salinity
(Parts Per Thousand)
March 11, 2017
Depth (meters)
0
5
10
15
20
25
30
35
0
0.5
1
1.5
2
2.5
3
3.5
N2
R2
S2
O1
O4

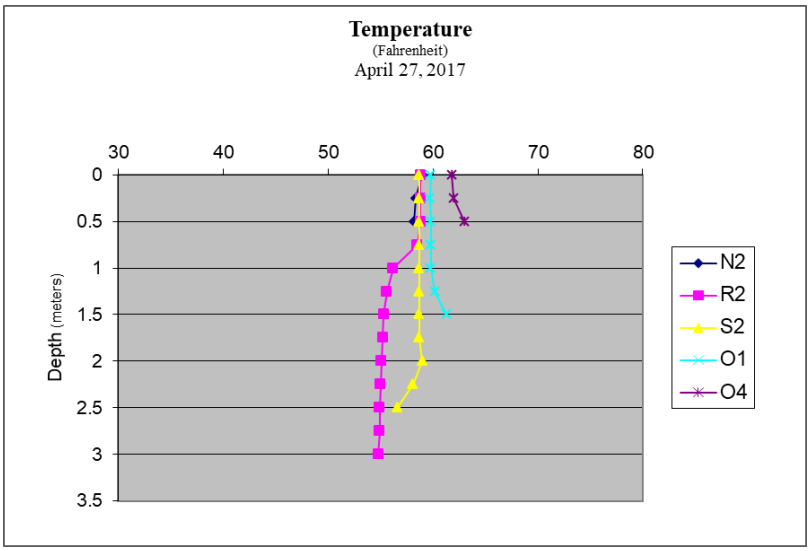

Dissolved Oxygen
(Milligrams/Liter)
March 11, 2017
Depth (meters)
0
5
10
15
20
0
0.5
1
1.5
2
2.5
3
3.5
N2
R2
S2
O1
O4


Temperature
(Fahrenheit)
March 11, 2017
Depth (meters)
30
40
50
60
70
80
0
0.5
1
1.5
2
2.5
3
3.5
N2
R2
S2
O1
O4

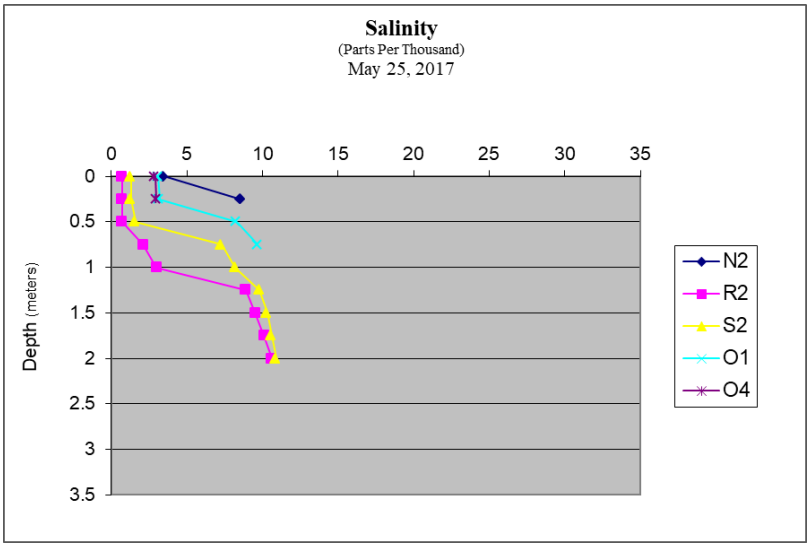
April 2017

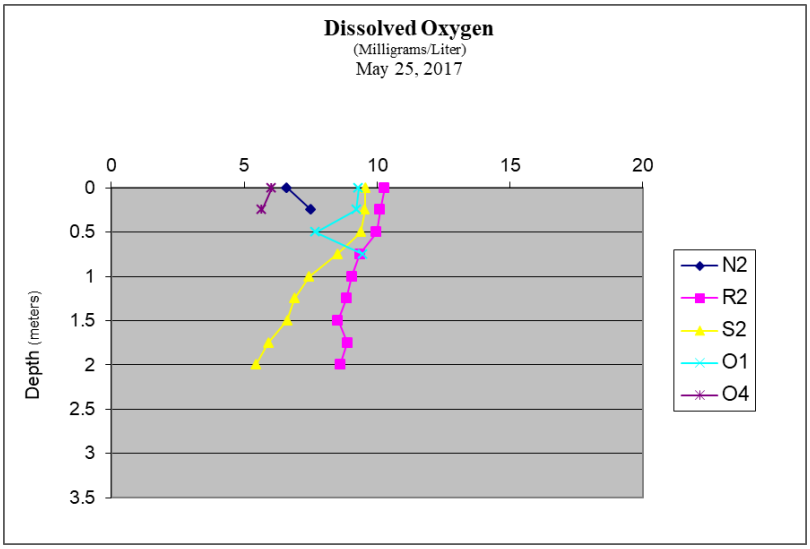

Salinity
(Parts Per Thousand)
April 27, 2017
Depth (meters)
0
5
10
15
20
25
30
35
0
0.5
1
1.5
2
2.5
3
3.5
N2
R2
S2
O1
O4

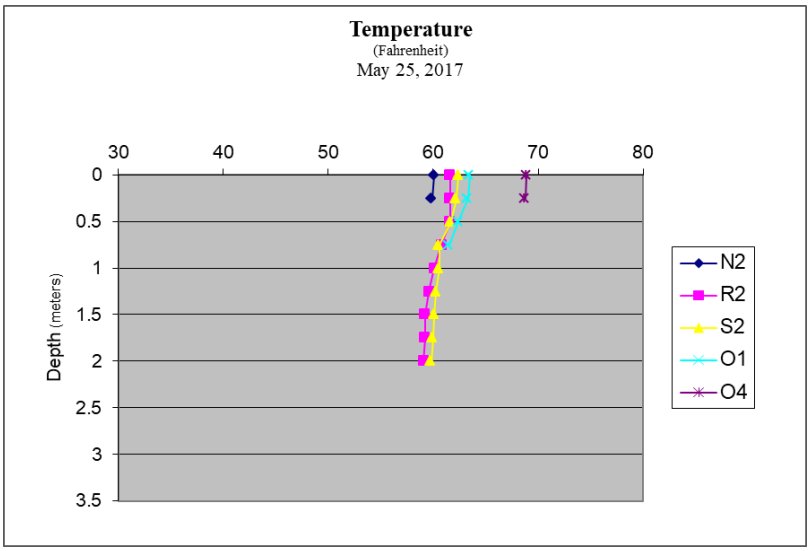

Dissolved Oxygen
(Milligrams/Liter)
April 27, 2017
Depth (meters)
0
5
10
15
20
0
0.5
1
1.5
2
2.5
3
3.5
N2
R2
S2
O1
O4


Temperature
(Fahrenheit)
April 27, 2017
Depth (meters)
30
40
50
60
70
80
0
0.5
1
1.5
2
2.5
3
3.5
N2
R2
S2
O1
O4

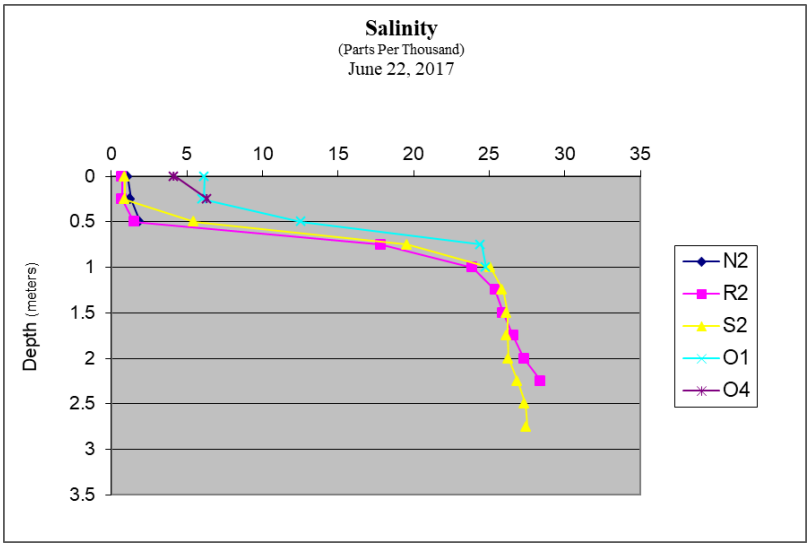
May 2017

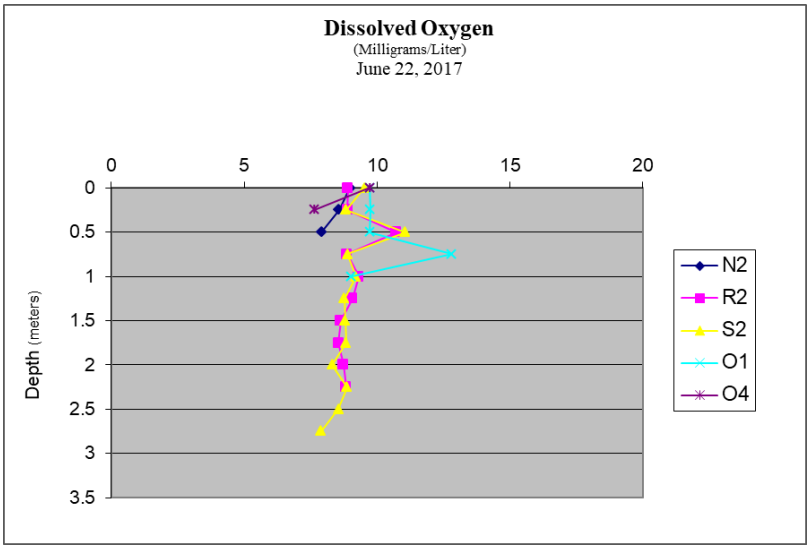

Salinity
(Parts Per Thousand)
May 25, 2017
Depth (meters)
0
5
10
15
20
25
30
35
0
0.5
1
1.5
2
2.5
3
3.5
N2
R2
S2
O1
O4

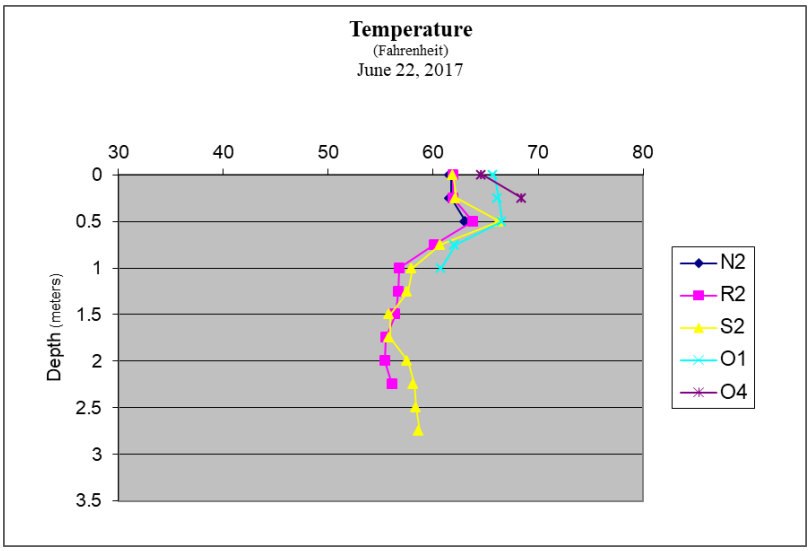

Dissolved Oxygen
(Milligrams/Liter)
May 25, 2017
Depth (meters)
0
5
10
15
20
0
0.5
1
1.5
2
2.5
3
3.5
N2
R2
S2
O1
O4


Temperature
(Fahrenheit)
May 25, 2017
Depth (meters)
30
40
50
60
70
80
0
0.5
1
1.5
2
2.5
3
3.5
N2
R2
S2
O1
O4

June 2017


Salinity
(Parts Per Thousand)
June 22, 2017
0
5
10
15
20
25
30
35
0
0.5
1
1.5
2
2.5
3
3.5
Depth (meters)
N2
R2
S2
O1
O4


Dissolved Oxygen
(Milligrams/Liter)
June 22, 2017
0
5
10
15
20
0
0.5
1
1.5
2
2.5
3
3.5
Depth (meters)
N2
R2
S2
O1
O4


Temperature
(Fahrenheit)
June 22, 2017
30
40
50
60
70
80
0
0.5
1
1.5
2
2.5
3
3.5
Depth (meters)
N2
R2
S2
O1
O4

IV. GROUNDWATER MONITORING

A. Groundwater-Level Monitoring

Description and Purpose

The District maintains a groundwater-level monitoring program in the Carmel Valley Aquifer and the Seaside Groundwater Basin. The data collected as part of this program are used to support a variety of programs including: (a) storage monitoring, (b) compilation of annual and long-term well hydrographs, (c) water-table contour mapping, (d) Carmel River Management Program, (e) Seaside Basin Watermaster Program, and (f) other special projects. The monitor-well measurements are stored in a database developed by the District to facilitate data entry, access and manipulation of the water-level data. In addition, groundwater-level measurements are collected on a regular basis by California American Water (Cal-Am) from each of their production wells, and these measurements are also utilized in the District's program. The District also participates in the cooperative California Statewide Groundwater Elevation Monitoring (CASGEM) program administered by the California Department of Water Resources (http://www.water.ca.gov/groundwater/casgem/).

Implementation and Activities During 2016-2017

- **Carmel Valley Aquifer --** The District's monitor well network in the Carmel Valley Aquifer consists of dedicated monitor wells and producer production wells, and currently totals approximately 50 water-level monitoring wells. During this period, the wells were measured on a monthly basis, and these measurements were used to compute end-of-month storage volume estimates for the aquifer. In addition, more frequent monitoring of selected wells was conducted during winter storm events to more closely monitor aquifer recharge.

Figure IV-1 is a typical hydrograph from the lower Carmel Valley, showing groundwater-level fluctuations at the Rancho Cañada West monitor well (River Mile [RM] 2.13) and the Rio North monitoring well (RM 1.65) compared with mean daily streamflow in the Carmel River at Highway 1 (RM 1.09). The Rancho Cañada West monitor well is located about one mile downstream (i.e., westerly) of the farthest downstream Cal-Am production well in Carmel Valley, the Cañada well, and approximately 1,350 feet from the river channel. As shown on this figure, the groundwater elevation decreased approximately one foot between the beginning of October 2016 and the end of November 2016, but recovered nearly nine feet from December 2016 till the beginning of March 2017 due to recharge during a winter that was characterized as Extremely Wet. Following the drop in runoff after the peak event in late February, water elevation in this well dropped about four feet during March 2017, and then gradually declined through the remainder of WY 2017. At the end of WY 2017 (i.e., September 30, 2017), the groundwater elevation in this well was nearly the same as the start of the WY.

The Rio North well is approximately 790 feet from the river channel. At this location, the magnitude of seasonal water-level fluctuation was approximately six and a half feet. In WY 2017, runoff caused a bump in groundwater elevation in the Rio North well from between the beginning of November 2016 and the end of November 2016, followed by an attenuated decline through to the end of the WY. At the end of WY 2017 (i.e., September 30, 2017), the groundwater elevation in this well was also nearly the same as the start of the WY.

During the October 2016-September 2017 period, the monitoring data indicated that overall groundwater storage in the Carmel Valley Aquifer increased slightly in WY 2017. In the river reach between San Clemente Dam and the Narrows (i.e., aquifer subunits 1 and 2), the minimum storage estimate was 93% in October 2016, increasing to the maximum storage estimate of 98% of capacity at the end of March 2017. Similarly, in the river reach from the Narrows to the Carmel River Lagoon (i.e., aquifer subunits 3 and 4), the minimum storage estimate was 87% in October 2016, increasing to the maximum storage estimate of 98% of capacity at the end of March 2017.

- **Seaside Groundwater Basin --** In the Seaside Basin, monthly water-level measurements were collected from 20 monitor wells in the Seaside Coastal Subareas, and four were monitored in the Seaside Inland Subareas. An additional 29 wells in the Seaside Inland and Laguna Seca Subareas were monitored on a quarterly schedule during the year. These additional wells are a combination of active or inactive production wells, and dedicated monitor wells.

Figure IV-2 shows water-level data available from representative wells in the coastal portion of the Seaside Basin monitor well network. This graph shows the water-level elevations in the two principal aquifer zones, the shallower Paso Robles Formation and the deeper Santa Margarita Sandstone, at both upgradient (Site FO-07) and downgradient (Site PCA East) locations from the Paralta production well, the largest capacity Cal-Am well in the coastal area. The graph illustrates the more dominant effect that production from the coastal Seaside Basin wells has had on water levels in the Santa Margarita Sandstone. The graph also illustrates the effect of changed water-supply practices resulting from SWRCB Order WR 95-10. Under the Order, Cal-Am was directed to maximize production from its Seaside Basin sources as a means to reduce production and associated impacts from the Carmel River system. This increased pumping resulted in a declining trend in Santa Margarita aquifer water levels, which are currently below sea level over a large area in the coastal portion of the basin. Seasonal recoveries associated with short-term reduced wintertime production and District aquifer storage and recovery (ASR) injection operations have not been sufficient to reverse the observed long-term downward water-level trend. However, the water-level responses in the Santa Margarita Aquifer at these locations indicate a lessening of the seasonal decline during WY 2017. The recovery of groundwater elevations in the deeper (Santa Margarita) wells seen in the graph is attributable to the District's ability to inject more water during a year that was characterized as Extremely Wet. Additional information on the ASR program is available on the District website. Discussion of the Seaside Basin ASR Projects is included in Section XV.

B. Groundwater-Quality Monitoring

Description and Purpose

The District maintains an ongoing groundwater-quality monitoring program for the two principal groundwater sources within the District: (a) the Carmel Valley alluvial aquifer, and (b) the coastal subareas of the Seaside Groundwater Basin. The purpose of the program is threefold:

(1) to characterize the quality of water in the aquifers,
(2) to detect groundwater contamination from septic systems or other sources in the shallow zones of the Carmel Valley aquifer, and
(3) to monitor sea-water intrusion potential in the coastal portions of the Carmel Valley aquifer and Seaside Basin.

The District has maintained a groundwater-quality monitoring program for the Carmel Valley aquifer since 1981, and for the Seaside Basin since 1990. The District's program is in addition to the extensive water-quality monitoring that is conducted by Cal-Am at its production wells. The District manages all well construction, maintenance, and field-sampling activities associated with the program. Water samples are analyzed at Monterey Bay Analytical Services. The Monterey County Health Department, Cal-Am, and the Monterey County Water Resources Agency have also provided assistance with this program in the past. Collection of the water-quality data is intended to detect problems before they can affect the community's water supply.

Implementation and Activities During 2016-2017

The sampling schedule for Carmel Valley is normally staggered, with Upper Valley wells (i.e., upgradient of the Narrows) sampled in Spring and Lower Valley wells (i.e., downgradient of the Narrows) in Fall, to coincide with the historically higher nitrate concentrations in these respective areas. Collection of samples from the Seaside Basin monitor wells is conducted once per year in Fall, coinciding with the historically low water levels in the basin at that time of the year. Additionally, since 2014, samples were collected quarterly from six wells closest to the coast in the Seaside Basin monitoring network by District staff in cooperation with the Seaside Groundwater Basin Watermaster.

● **Carmel Valley Aquifer –** Groundwater-quality data were collected from six of the network of seven monitor wells in the Carmel Valley aquifer in November 2017. One of the seven wells in lower Carmel Valley was not sampled earlier because it was submerged under high water in the Carmel River Lagoon during the sampling period. Another well that had historically been sampled during this period was destroyed by flooding in March 2011 when the river scoured away the south end of the Carmel River State Beach parking lot. The locations of these sampling points are shown in **Figure IV-3** and **Figure IV-4**. The results indicated that, in general, there were only minor changes

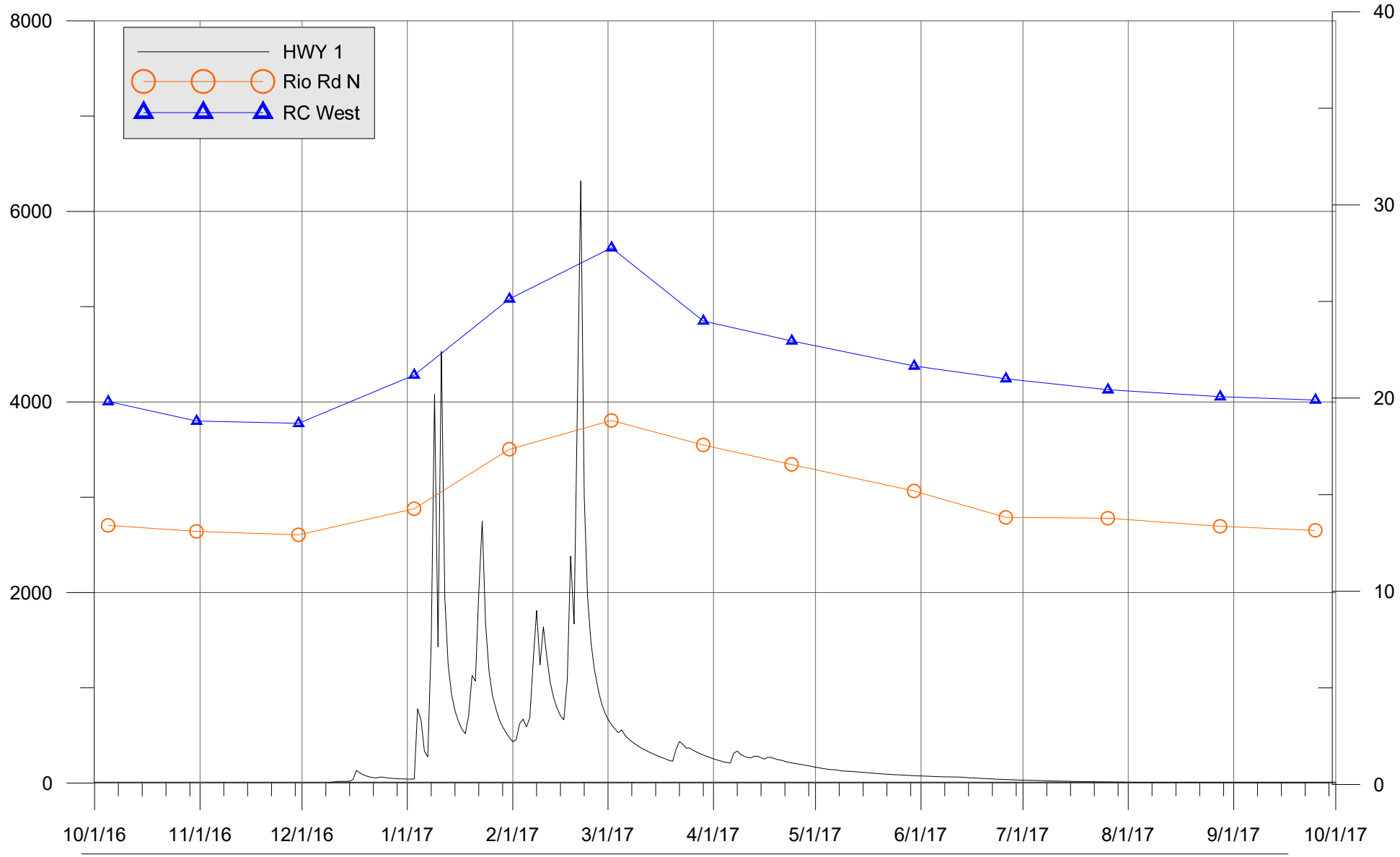
in overall water quality compared to samples collected in 2016. Staff is particularly interested in tracking indicators of potential seawater intrusion in the coastal portion of Carmel Valley. Accordingly, three clustered sets of wells were established west of Highway 1, with each set being made up of three wells completed at different depths. Review of historical data indicated that the shallower and intermediate wells at the two well clusters closest to the coast are subject to the mixing of fresh water and saline water as high tides and surf overtop the sand berm between the lagoon and the ocean. This contributes to episodic mixing within the shallower and intermediate zones of the aquifer, but is not necessarily representative of larger-scale seawater intrusion into the aquifer. As described above, the three wells in the cluster closest to the ocean were destroyed by river erosion in March 2011, and the wells in the next closest cluster to the ocean were inaccessible due to high water during the sampling period, so during this Mitigation Report period, only the deeper well at the farthest well cluster from the coast (Well 16S/1W-13Lc) was sampled.

Well 16S/1W-13Lc is the deepest in the array of three wells located on State Parks property near the Carmel Area Wastewater District treatment plant at River Mile (RM) 0.65, currently the most proximate well to the ocean in Carmel Valley that was available for sampling. Although Specific Electrical Conductance (SEC) and Chloride concentration fluctuate slightly from year to year (**Figure IV-5**), and both were slightly lower in this well in 2017 relative to 2016, overall increases in SEC and Chloride concentration are seen at this monitor well over the period of record. Additional background on historical water-quality at the coastal monitor well sites can be found in District Technical Memorandum 90-04, *Summary of Carmel Valley Groundwater-quality from Coastal Monitor Wells*, which is available at the District office. Staff will continue to track future results for trends that might indicate significant changes in concentrations of these or other constituents in the coastal area of the aquifer.

Water quality in well 16S/1E-23La, located 6.72 miles upstream from the river mouth, remained generally unchanged in 2017 relative to 2016, as shown on the graph of SEC and Chloride that is included to track long-term trends (**Figure IV-6**). Staff will continue to track changes in all of the monitor wells in the basin to determine if they are indicative of long-term trends, or anomalous short-term events.

- **Seaside Groundwater Basin** -- Eleven monitor wells in the coastal subareas of the Seaside Basin were sampled in August, October and December 2017. The locations of the Seaside monitor wells are shown in **Figure IV-7**. One function of the District's monitor-well network in the Seaside Basin is to serve as an early warning of potential sea-water intrusion into the two principal aquifer zones, the Paso Robles Formation and the Santa Margarita Sandstone. The water-quality results from the Seaside Basin indicate that very little water-quality changes have occurred over the period of record since monitoring began in 1990, and that there is no indication of sea-water intrusion in this area of the basin at this time. **Figure IV-8** shows SEC and Chloride concentrations in two coastal wells, one in the shallower Paso Robles Formation aquifer, and one in the deeper Santa Margarita Sandstone aquifer, for the historical period of record beginning in April 1991. Results from the District's monitoring program indicate that SEC averages

approximately 350 and 825 microSiemens/centimeter (μS/cm), for the Paso Robles and Santa Margarita aquifer zones, respectively.



MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

Figure IV-1 Hydrographs of Monitor Well Levels and Carmel River Streamflow

Well levels measured at Rancho Canada West and Rio Road North Monitor Wells.
Carmel River Streamflow measured at Highway 1 Bridge.

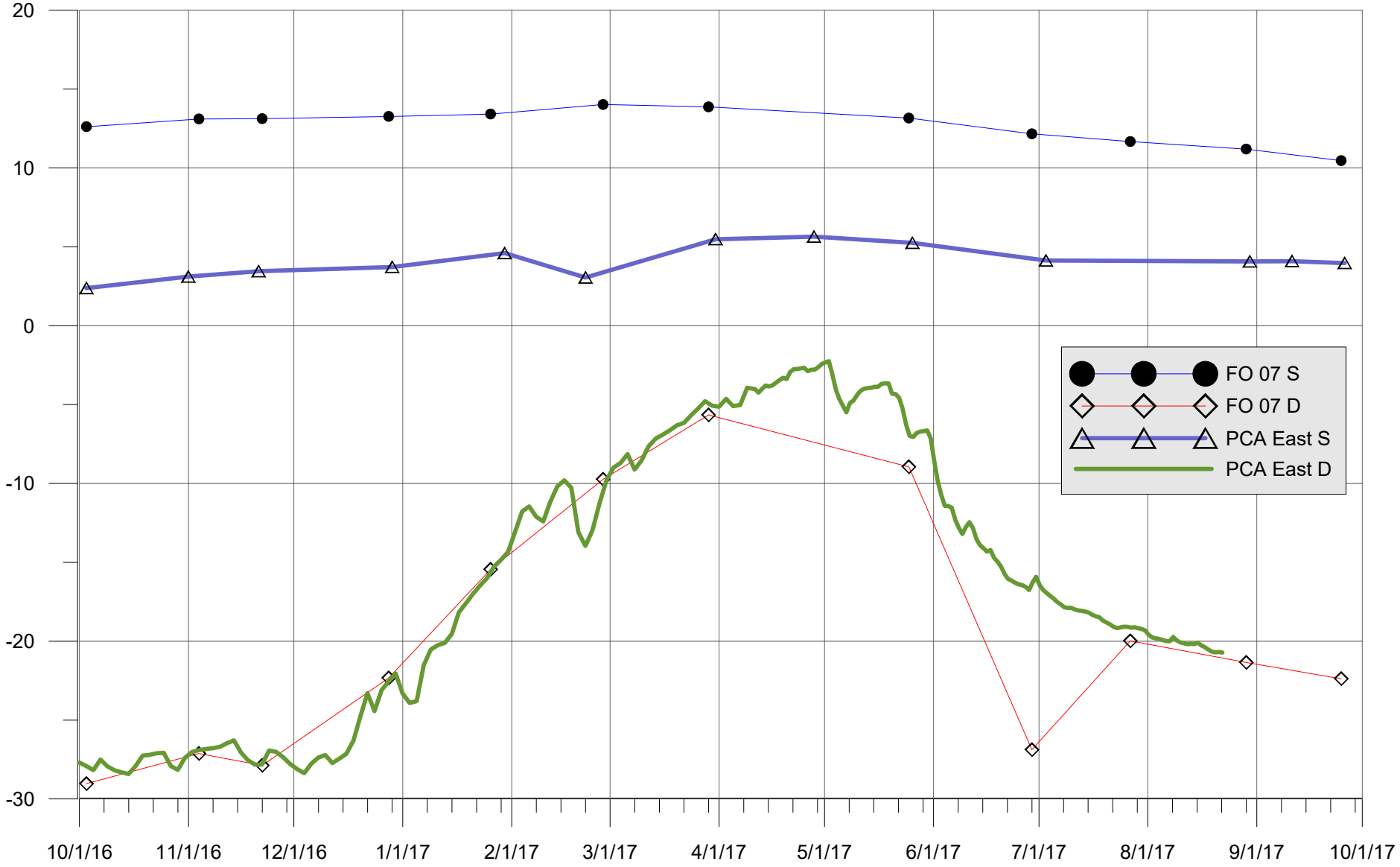
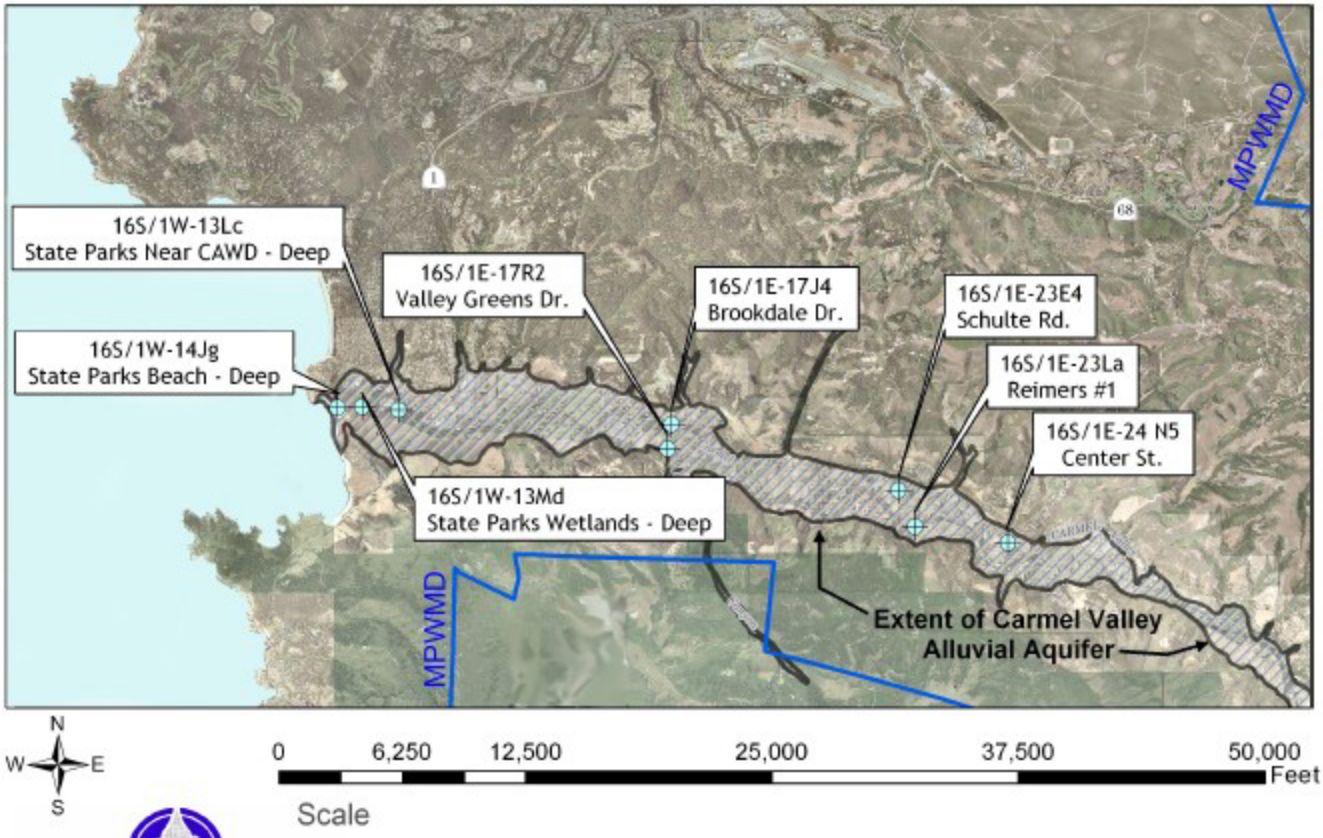


Figure IV-2 Hydrographs of PCA East and FO 07 for WY 2017

Figure IV-3

LOCATION OF MPWMD LOWER CARMEL VALLEY WATER QUALITY MONITORING WELLS (River Mile 0.0 to 9.0)



Monterey Peninsula Water Management District

u/tom/pdf12/wellmaps/lvwq.jpg

Figure IV-4

LOCATION OF MPWMD CARMEL VALLEY WATER QUALITY MONITORING WELLS
(River Mile 11.75 to 15.50)

N
W E
S

0 1,250 2,500 5,000 7,500 10,000 Feet

River Mile (RM)	Well Common Name	State Well Number
12.52	Boronda Rd.	T16S/R2E-33Q1
13.65	Little League #1	T17S/R2E-03La
14.28	De Los Helechos	T17S/R2E-10B1

Monterey Peninsula Water Management District

Figure IV - 5 WATER-QUALITY RESULTS
State Parks Near CAWD (deep) - 16S/1W-13Lc
River Mile 0.65

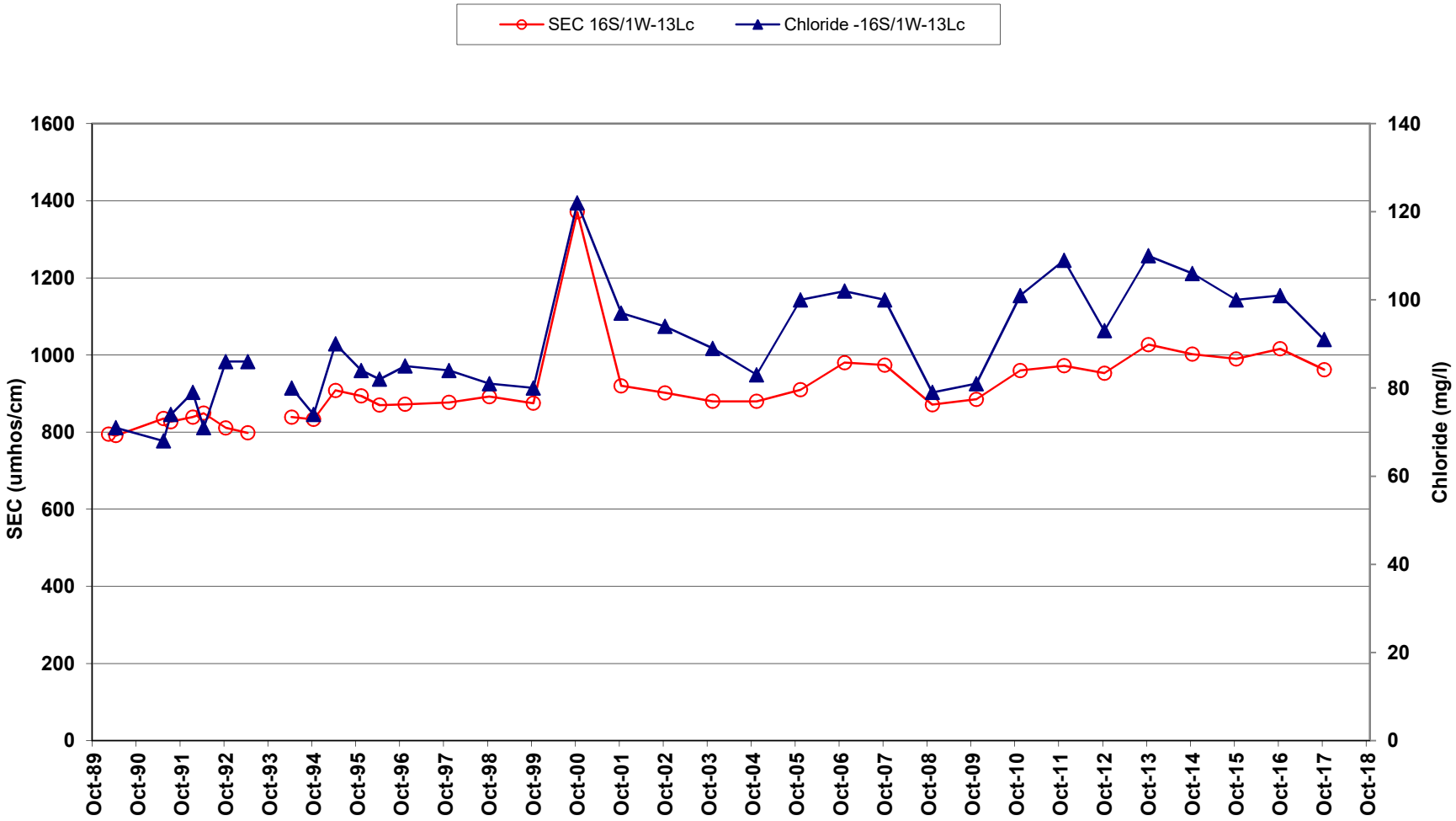


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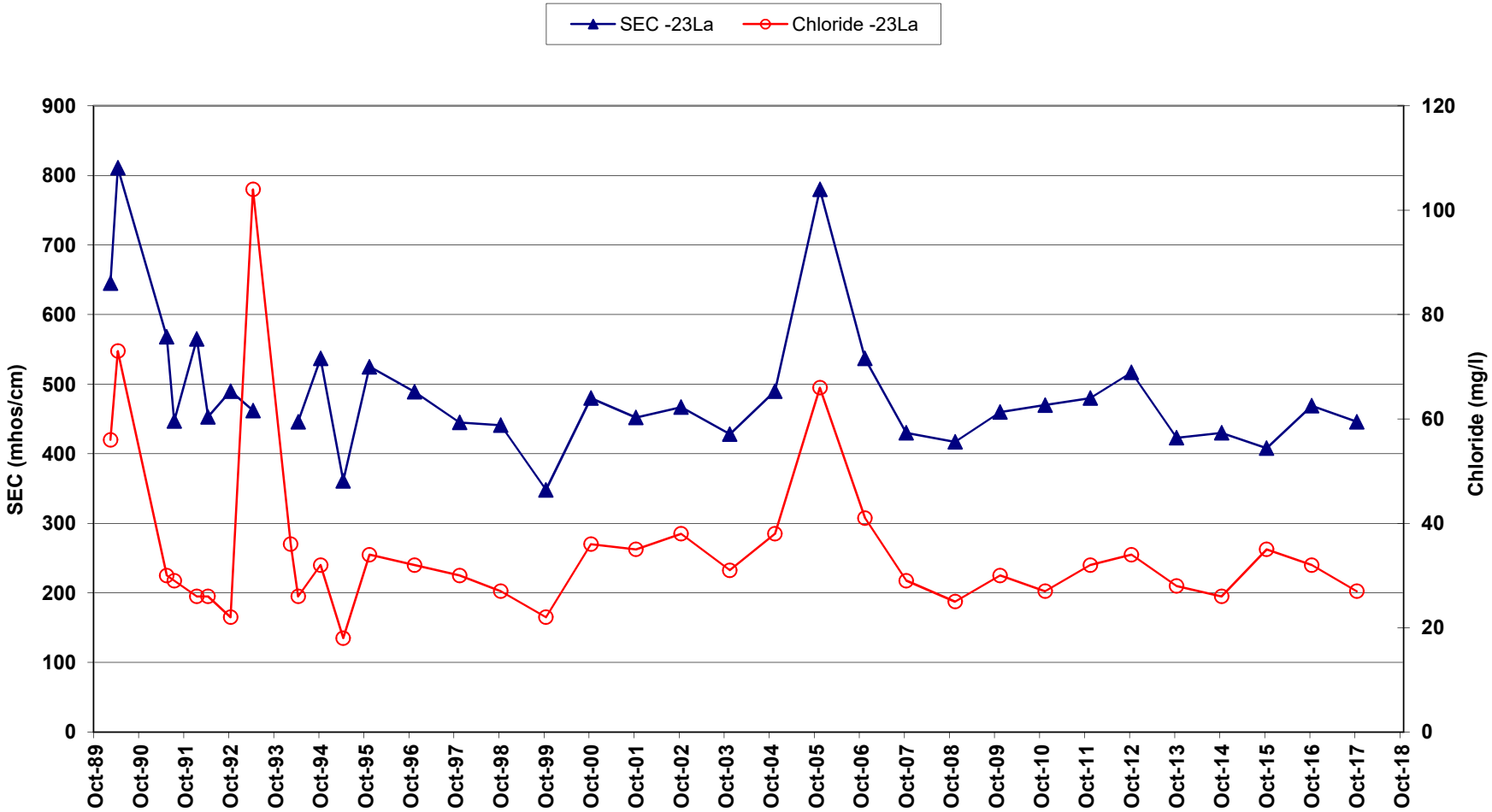
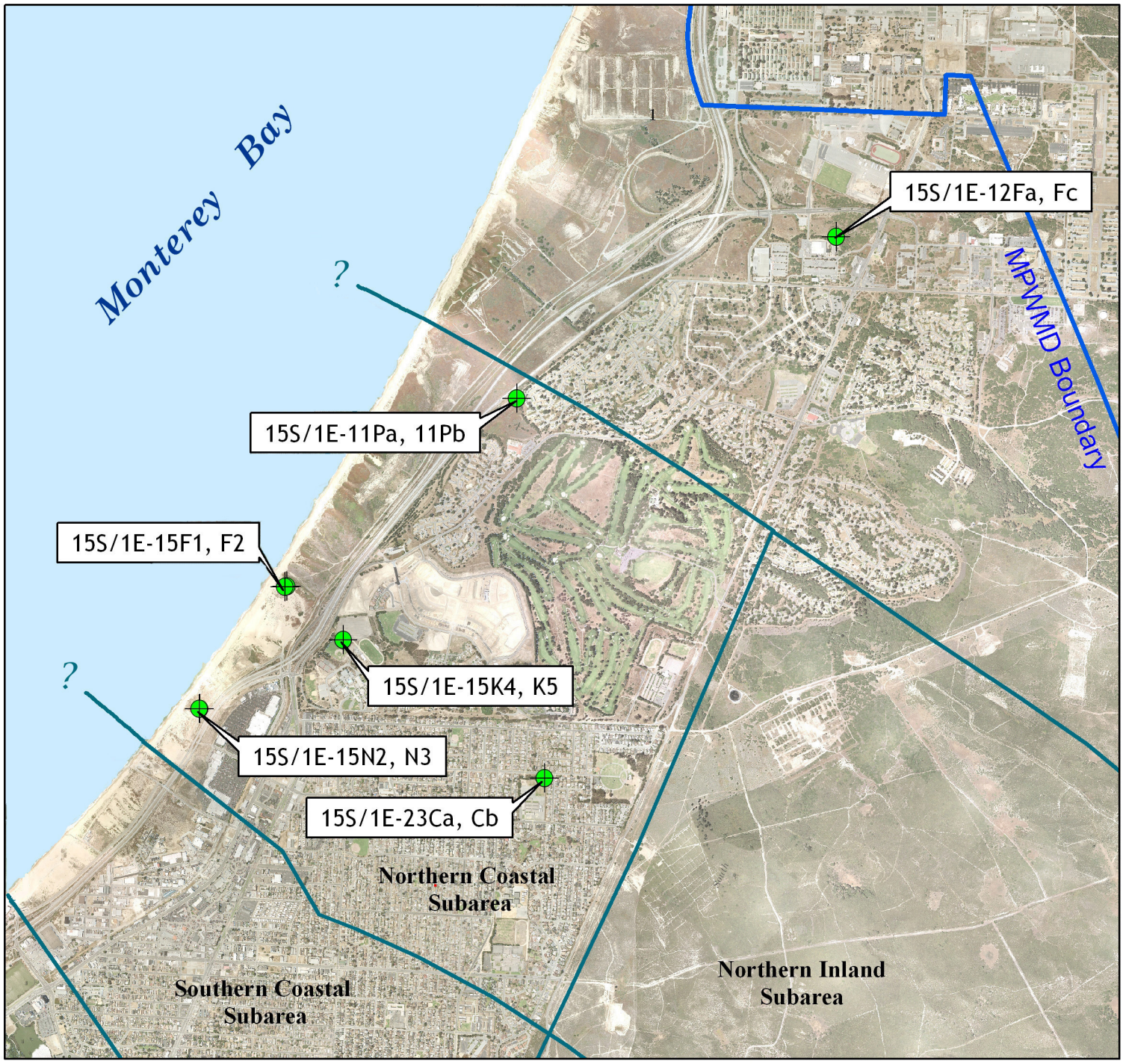
Figure IV - 6 WATER-QUALITY RESULTS
Reimers #1 - 16S/1E-23La
River Mile 6.72



/U:\mpwmd\Allocation\Annual Mit. Report RY 2017\RY 2017-Place your files here\IV Groundwater\Fig_IV-6_2017_graph23La.xls

Figure IV-7

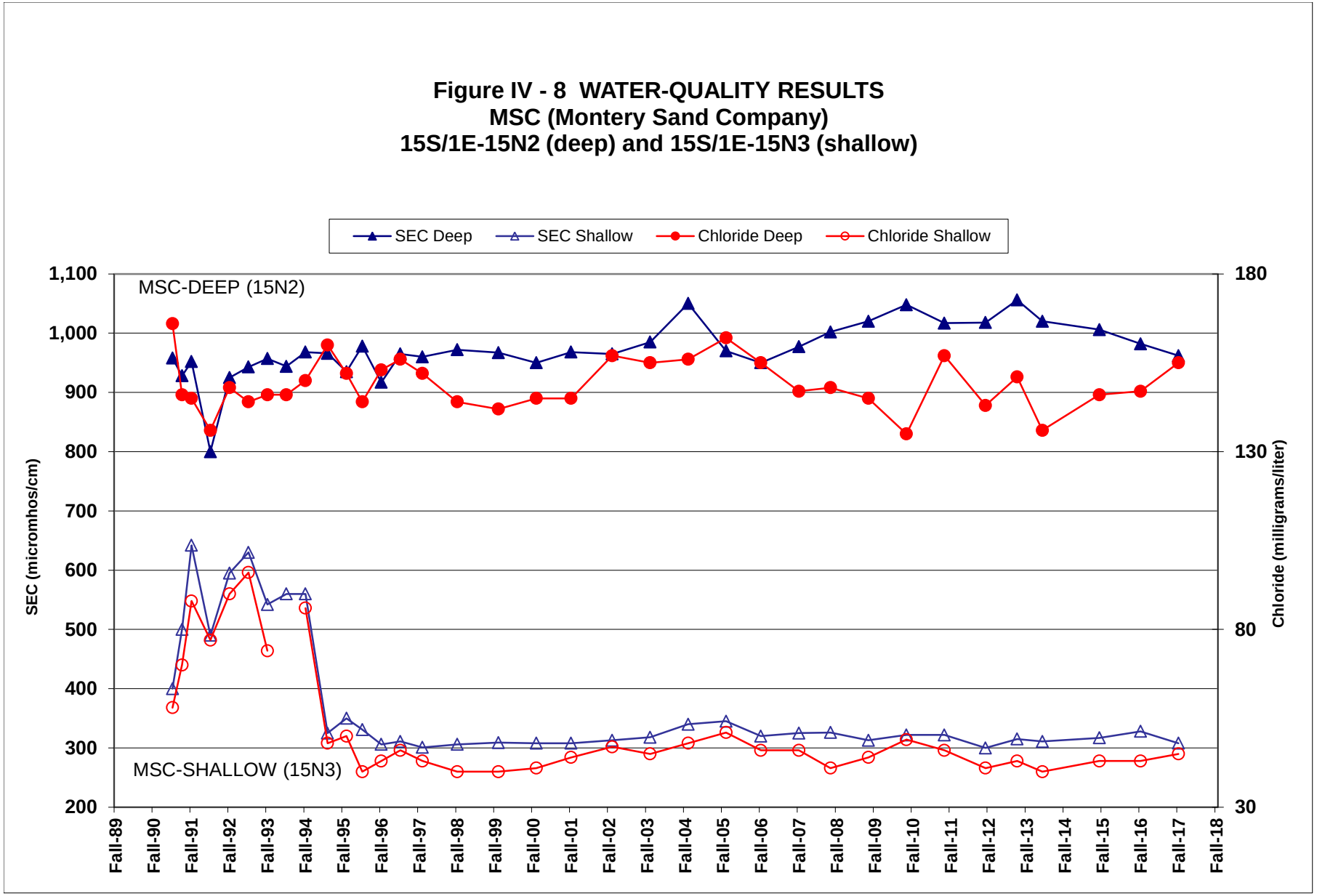
SEASIDE BASIN COASTAL GROUND WATER QUALITY MONITOR WELL LOCATIONS



Monterey Peninsula Water Management District

u/tom/pdf12/wqmaps/WQseaside

Figure IV-8



U:\mpwmd\Allocation\Annual Mit. Report RY 2017\RY 2016-Grab your files here\IV Groundwater Monitoring\Fig IV 8 2017SCB_charts.xls/MSCschart

V. ANNUAL LOW-FLOW MEMORANDUM OF AGREEMENT

Description and Purpose

The original Memorandum of Agreement (MOA) between the California Department of Fish and Game (now California Department of Fish and Wildlife, CDFW), Cal-Am, and the District was developed in July 1983 to balance CDFW's requirement to conserve and protect the fish and wildlife resources of the state and Cal-Am's responsibility to supply water to the citizens of the communities of the Monterey Peninsula. This MOA is modified each year to reflect specific storage conditions and inflow projections at Los Padres and San Clemente Reservoirs in the Upper Carmel River watershed. Specifically, the MOA addresses the release of water into the Carmel River from San Clemente Dam and was originally designed to maximize surface flow to the Narrows during the low-flow season. In addition to specifying minimum flow releases from San Clemente Dam, the past MOAs limited Cal-Am diversions from San Clemente Dam to the Carmel Valley Filter Plant (CVFP) and directed how Cal-Am was to produce water from the Lower Valley Wells. Normally, the MOA is formulated in May and remains in force until the end of December. The agreement may be modified or extended by mutual consent of all the parties.

Implementation and Activities During 2016-2017

- **2017 MOA** – The 2016 MOA was developed on July 27, 2017 and approved by the District Board on August 21, 2017. The final document was signed by the District and forwarded to Cal-Am for their concurrence, but was not signed by CDFW due to the same unresolved language that was proposed in 2009 by CDFW. Based on storage conditions and expected reservoir inflows, it was agreed that Cal-Am would maintain minimum flows in the Carmel River below Los Padres at 14.7 to 16.2 cfs for August through November, then potentially returning to estimated natural river flows of as much as 25.2 cfs in December 2017. The 2017 MOA included terms to: (a) limit operation of Cal-Am wells in the Carmel Valley above Robinson Canyon Road Bridge during low-flow periods; and (b) require Cal-Am to make reasonable efforts to operate the lower Carmel Valley wells in sequence from the most downstream well, progressing upstream as wells are needed and available for production.

VI. QUARTERLY WATER SUPPLY STRATEGY AND BUDGET

Description and Purpose

Under Ordinance No. 19, which was adopted in December 1984, the District was required to develop an annual water-supply strategy. This strategy included estimates of projected demands and proposed production targets for the Cal-Am system. The strategy was designed to limit Cal-Am surface-water diversions from the Carmel River to no more than 35 percent of total Cal-Am production. Based on the District strategy, Cal-Am developed a water-supply budget specifying monthly production targets.

Under Ordinance No. 41, which was adopted in March 1989, development of the water-supply strategy and budget was changed from an annual to a quarterly process, and Cal-Am's annual surface-water diversions were reduced to a goal of no more than 29 percent of total production. Currently, the quarterly strategy and budget values are developed jointly by Cal-Am, the District, CDFW and NMFS, in conformance with the annual low-flow Memorandum of Agreement (MOA). The strategy is designed to maximize the long-term production potential and protect the environmental quality of the Carmel Valley and Seaside basins. The budget includes monthly production targets for each of Cal-Am's major production sources -- San Clemente Reservoir, Upper Carmel Valley (UCV) Aquifer, Lower Carmel Valley (LCV) Aquifer, and the Coastal Subareas of the Seaside Basin -- which reflect current and expected system conditions. The quarterly strategies and budgets are normally developed in December, March, June, and September of each year.

Starting in April 2002, the Quarterly Water Supply Strategy and Budgets were fundamentally changed by the State Water Resources Control Board (SWRCB), which adopted Order WRO 2002-0002 on March 21, 2002, and by NMFS and Cal-Am, who signed a Conservation Agreement on September 18, 2001. This order and agreement changed the way that Cal-Am operates its diversions and wells upstream of Robinson Canyon Road Bridge. Specifically, Cal-Am was ordered to:

1. Immediately upon issuance of SWRCB Order WRO 2002-0002, cease withdrawal of water from the San Clemente Dam during low-flow periods except during an emergency. For the purpose of the Order, "low-flow periods" are defined as times when stream flow in the Carmel River at the Don Juan Bridge gage (RM 10.8) is less than 20 cfs for five consecutive days.

2. Reduce diversions during low-flow periods from the Scarlett No. 8 Well, Los Laureles Wells Nos. 5 and 6, Panetta Wells, Garzas Wells Nos. 3 and 4, and the Robles Well. Current diversions are 1-7 days per month at each well. Diversions at these wells shall be reduced to a maximum of two eight-hour days per month, except that those wells that currently operate only one eight-hour day per month shall continue to operate at not more than one eight-hour day per month. To the maximum degree practicable, Cal-Am shall operate these wells at night. In consultation with NMFS, USFWS, CDFW and the District, Cal-Am can operate the Scarlett 8 well incrementally to meet maximum daily demand after using all other available downstream sources at

maximum capacity.

3. Install, not later than March 31, 2002, a pump that delivers water from the Begonia Zone to the Carmel Valley Village Zone. The "Begonia Zone" is defined to include water well production facilities in AQ3, AQ4 and the Seaside Groundwater Basin. The "Carmel Valley Village Zone" is defined to include all Cal-Am users upstream from the Del Monte Regulating Station.

4. The Russell Wells shall be limited to a combined total instantaneous diversion rate of not more than 0.5 cfs during low-flow periods.

5. During the low-flow periods, except for 0.5 cfs, all water diverted to Carmel Valley Village Zone shall be water that originates from the Begonia Zone (as defined in Paragraph 3 above).

In addition, the production goals for the quarterly budget process have changed over time. Beginning in 1998, the quarterly budgets were formulated with an annual production goal of 11,285 AF during each Water Year from the Carmel River Basin, in conformance with goals and requirements established by SWRCB Orders WR 95-10, WR 98-04, and subsequently in conformance with WRO 2002-0002, CDO 2009-0060, and WRO 2016-0016. Releases from San Clemente Reservoir were maximized throughout the year and groundwater production in the UCV was limited to periods when sufficient streamflow was available to recharge the aquifer.

Starting in March 2006, the annual limit for Cal-Am's production from its wells in the Coastal Subareas of the Seaside Groundwater Basin for customers in its main system used in the quarterly budgets was reduced from 4,000 AF per year to 3,504 AF per year based on the final judgment in the basin adjudication. Accordingly, the total annual limit for Cal-Am from the Carmel River and Seaside Groundwater Basins for its main system was set at 14,789 AF. It should be noted that the March 2006 Seaside Basin adjudication decision was amended in February 2007. The decision was amended in part to allow Cal-Am to combine its production allocation from the Coastal Subareas with its production allocation from the Laguna Seca Subarea.

On January 15, 2008, the SWRCB issued a draft Cease and Desist Order (CDO) against Cal-Am. The Draft CDO refers to the 1995 SWRCB Order 95-10, and notes that compliance with Order 95-10 had not been achieved after 12 years. The CDO institutes a series of cutbacks to Cal-Am production from the Carmel River and prohibits new or intensified connections in the Cal-Am main system. MPWMD and several other parties participated in formal hearings before the SWRCB in the summer of 2008. After several draft versions, the final SWRCB determination on the CDO was issued on October 20, 2009. The District subsequently filed a suit to challenge this ruling, and the Monterey County Superior Court issued a stay on November 3, 2009. In response to a challenge by SWRCB, the court ruled on November 23, 2009 that the stay will remain in effect until the hearing that was held in Santa Clara in April 22, 2010. At that hearing, the Court lifted the stay and the CDO was reinstated. The CDO reduced the Cal-Am annual upper limit of diversion from the Carmel River previously set by Order 95-10 at 11,285 AF to 10,429 AF in WY 2010.

In WY 2015, the CDO (Order 2009-0060) set Cal-Am Carmel River production to 9,945 AF. In WY 2016, the CDO (Order 2016-0016) set the Cal-Am River production to 8,310 AF. The Seaside adjudication decision limited Cal-Am production in the Coastal and Laguna Seca Subareas of the Seaside Basin to 2,251 AF and 48 AF, respectively. This brought the WY 2017 total production limit from all sources to 10,609 AF (not including any adjustments for supplemental supplies or carryover storage).

Implementation and Activities During 2016-2017

During 2016 and 2017, the quarterly strategies and budgets were structured to optimize production from the Coastal Subareas of the Seaside Basin and minimize impacts from production in the Upper Carmel Valley (UCV). Activities in Water Year 2017 are described below.

- **Cal-Am Main System Production in Water Year 2017**[1] – During WY 2017, Cal-Am produced 9,641 acre-feet (AF) of water for customer service from all sources in its Carmel River, Seaside Coastal and Laguna Seca Subarea systems. This production consisted of 5,306 AF from Carmel River source wells, 2,024 AF of native water from Seaside Coastal wells, 300 AF from Laguna Seca Subarea wells, 241 AF from the Sand City desalination plant, 491 AF from Table 13, 1,487 AF from ASR Recovery, and 93 AF produced from the MalPaso well and delivered to the Cal-Am system. Of the system total, no water was diverted at San Clemente Dam because it was removed in the summer of 2015.

[1] Beginning with the 2002-2003 Mitigation Report, Cal-Am production is reported on a Water Year basis, from October 1 of one Calendar Year through September 30 of the following Calendar Year. This is a change from previous annual reports in which the reporting period was July of one year through June of the following year. This change makes the mitigation report consistent with reporting requirements under SWRCB Order No. WR 95-10.

VII. WELL REGISTRATION AND REPORTING PROGRAM

Description and Purpose

All owners of wells within the District are required to register and report their annual water production. The purpose of the program is to provide annual aggregate estimates of water production from both Cal-Am and non-Cal-Am wells in the various groundwater production zones in the District. The information provided is used to make decisions regarding management of the limited water resources of the Monterey Peninsula area.

The District began its Well Registration and Reporting Program in 1980. From 1981 through 1990, well owners were allowed to report water production by one of three methods: Water Meter, Land Use, or Power Consumption Correlation. In March 1990, the District adopted Ordinance No. 48 requiring installation of water meters on all large production wells (i.e., those producing 20 or more AFY). In November 1991, District rules were further amended with the adoption of Ordinance No. 56, which extended the metering requirement to all existing medium production wells, defined as those producing between 5 and 20 AFY, and all new wells within the District. Ordinance No. 56 also eliminated the Power Consumption Correlation reporting method.

Implementation and Activities During 2016-2017

Figure VII-1 shows summaries of reported production from Cal-Am and non-Cal-Am wells in WY 2017, and **Figure VII-2** shows the WY 2016 data for comparison.

With respect to the District's Water Allocation Program limits, Cal-Am production from the MPWRS in WY 2017 was 10,231 AF, or 7,410 AF (42.0%) less than the Cal-Am production limit of 17,641 AF that was established with the adoption of Ordinance No. 87 in 1997. Non Cal-Am production within the MPWRS in WY 2017 was 2,746 AF, or 300 AF (9.8%) less than the non Cal-Am production limit of 3,046 AF established by Ordinance No. 87. Combined production from Cal-Am and non Cal-Am sources within the MPWRS was 12,977 AF in WY 2017, which is 7,710 acre-feet (37.3%) less than the 20,687 acre-feet production limit set for the MPWRS as part of the District's Water Allocation Program. Therefore, no action is necessary at this time, although staff will continue to monitor production trends within the MPWRS and District-wide. A comparison of reported water production from the MPWRS in Reporting Year 1997, WY 2007, and WY 2017 relative to the District's Water Allocation limits is presented in **Figure VII-3**. 1997 was the last time the production limits were adjusted. Prior to 2008, the LSS was not included in the MPWRS, but was added with the adoption of Ordinance 135 on September 22, 2008. However, the production limits in the District's Allocation Program did not change. Production from the MPWRS in RY 1997 and WY 2007 presented in **Figure VII-3** has been adjusted to include production from the LSS. Production from non-Cal-Am sources has not fluctuated a great deal, and since production from LSS is included, non-Cal-Am production has been over the production limit several years. Historical Cal-Am production presented in **Figure VII-3** was also adjusted to include production from the LSS. Cal-Am production from the MPWRS has greatly decreased, and since Cal-Am represents such a large portion of total production, combined production from Cal-Am and non-Cal-Am sources has also decreased over the last several years.

During WY 2017, District staff inspected 17 new water meter installations and six replacement

meters to ensure compliance with the District's water meter installation standards and guidelines. In addition, staff reviewed copies of three applications for permits for construction of new wells within the District from the Monterey County Health Department. Staff also advised recipients of County well construction permits that MPWMD Water Distribution System permits or written exemptions were also required.

Lastly, it should be noted that 99% of the groundwater production within the District was reported by the water meter method in WY 2017. In addition, 99% of registered well owners in the District reported annual production for their wells in WY 2017.

Figure VII-1

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
DRAFT WATER PRODUCTION SUMMARY FOR WATER YEAR 2017

SOURCE AREAS [1,2]	NON CAW (NON CAL-AM) WELLS						CAW (CAL-AM) WELLS		AQUIFER SUBUNIT TOTALS	
	WATER METER		LAND USE		SUB-TOTAL		WATER METER			
	NO. OF WELLS	PRODUCTION (AF) [3]	NO. OF WELLS	PRODUCTION (AF)	NO. OF WELLS	PRODUCTION (AF)	NO. OF WELLS	PRODUCTION (AF)	NO. OF WELLS	PRODUCTION (AF)
AS1	9	78.5	1	0.1	10	78.6	0	0.0	10	78.6
AS2	57	139.4	31	30.9	88	170.3	4	475.2	92	645.5
AS3	136	991.0	42	32.2	178	1,023.2	8	[5]6,811.8	186	7,835.1
AS4	32	148.5	4	3.1	36	151.6	2	914.2	38	1,065.8
SCS	12	923.8	2	1.8	14	925.7	6	1,730.4	20	2,656.1
LSS	9	372.8	2	2.9	11	375.8	4	299.1	15	674.9
CAC	8	28.9	5	10.5	13	39.4	0	0.0	13	39.4
CVU	305	547.5	40	35.7	345	583.2	0	0.0	345	583.2
MIS	137	313.4	8	5.5	145	318.9	0	0.0	145	318.9
ACTIVE	705	3,543.9	135	122.8	840	3,666.7	24	10,230.7	864	13,897.4
INACTIVE	349		35		384		10		394	
NOT REPORTING	4		12		16		0		16	
SAND CITY DESAL							0	249.0		adjusted for SC desal
METHOD TOTALS:	1,058	3,543.9	182	122.8	1,240	3,666.7	34	10,479.7	1,274	14,146.4

NOTES:
1. Shaded areas indicate production within the Monterey Peninsula Water Resources System. The LSS was added to the Monterey Peninsula Water Resources System in Septembter 2008.
2. CAW - California American Water
3. Source areas are as follows:
   AS1 - UPPER CARMEL VALLEY - San Clemente Dam to Esquiline Bridge
   AS2 - MID CARMEL VALLEY - Esquiline Bridge to Narrows
   AS3 - LOWER CARMEL VALLEY - Narrows to Via Mallorca Bridge
   AS4 - LOWER CARMEL VALLEY - Via Mallorca Bridge to Lagoon
   SCS - SEASIDE COASTAL SUBAREAS
   LSS - LAGUNA SECA SUBAREA (Ryan Ranch Area is within LSS)
   CAC - CACHAGUA CREEK and UPPER WATERSHED AREAS
   CVU - CARMEL VALLEY UPLAND - Hillsides and Tularcitos Creek Area
   MIS - PENINSULA, CARMEL HIGHLANDS AND SAN JOSE CREEK AREAS
4. Any minor numerical discrepancies in addition are due to rounding.
5. 2,345.19 AF is included in CAW production from AS3 to account for water delivered to ASR in WY 2017.
6. This total includes water produced in both SCS and LSS, and does not 1,501.33 AF of ASR water that was recovered for Customer Service in WY 2017.
7. Production includes 1.80 AF to Ryan Ranch from CAW Main System in WY 2017. No water was delivered to Seaside Municipal System in WY 2017.

DISTRICT-WIDE PRODUCTION		
SURFACE WATER DIVERSIONS:		
	CAW Diversions (San Clemente Dam):	0.0
	Non Cal-Am Diversions Within MPWRS:	21.0
CAW WELLS:		
	[6]SEASIDE:	2,029.5
	CARMEL VALLEY:	8,201.2
	Within the Water Resources System:	10,230.7
	Outside the Water Resources System:	0.0
	Sand City Desal	249.0
	[7] *CAW TOTAL, Wells and Diversion:*	10,479.7
NON CAW WELLS:		
	Within the Water Resources System:	2,725.2
	Outside the Water Resources System:	941.5
	Non Cal-Am Diversions Outside the MPWRS:	27.8
	NON CAW TOTAL, Wells and Diversion:	3,715.5
	GRAND TOTAL:	14,195.2

Figure VII-2

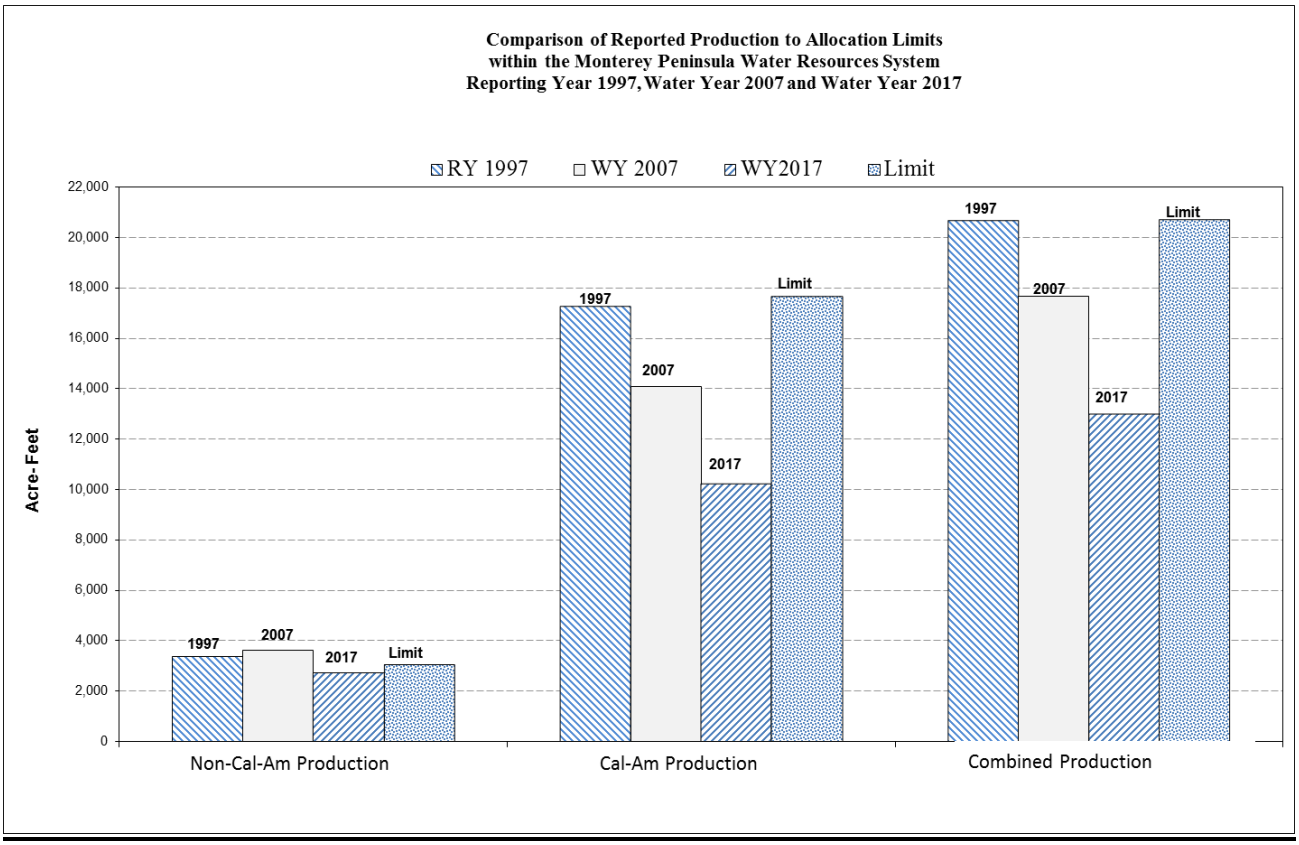
MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
DRAFT WATER PRODUCTION SUMMARY FOR WATER YEAR 2016

SOURCE AREAS [1, 2]	NON CAW (NON CAL-AM) WELLS						CAW (CAL-AM) WELLS		AQUIFER SUBUNIT TOTALS	
	WATER METER		LAND USE		SUB-TOTAL		WATER METER			
	NO. OF WELLS	PRODUCTION [3] (AF)	NO. OF WELLS	PRODUCTION (AF)	NO. OF WELLS	PRODUCTION (AF)	NO. OF WELLS	PRODUCTION (AF)	NO. OF WELLS	PRODUCTION (AF)
AS1	9	96.0	1	0.1	10	96.1	0	0.0	10	96.1
AS2	56	138.0	32	31.7	88	169.6	3	153.7	91	323.3
AS3	133	1,113.7	46	34.7	179	1,148.4	6	[5]6,206.9	185	7,355.3
AS4	29	352.3	6	3.1	35	355.4	2	1,344.3	37	1,699.7
SCS	8	936.4	2	1.8	10	938.2	6	1,559.3	16	2,497.5
LSS	7	351.7	2	2.7	9	354.4	4	316.7	13	671.1
CAC	8	20.7	8	12.1	16	32.8	0	0.0	16	32.8
CVU	299	534.6	44	39.0	343	573.6	0	0.0	343	573.6
MIS	130	313.3	10	5.5	140	318.8	0	0.0	140	318.8
ACTIVE	679	3,856.7	151	130.7	830	3,987.4	21	9,580.9	851	13,568.3
INACTIVE	348		30		378		11		389	
NOT REPORTING	9		13		22		0		22	
SAND CITY DESAL							0	160.9		adjusted for SC desal
METHOD TOTALS:	1,036	3,856.7	194	130.7	1,230	3,987.4	32	9,741.9	1,262	13,729.2

NOTES:
1. Shaded areas indicate production within the Monterey Peninsula Water Resources System. The LSS was added to the Monterey Peninsula Water Resources System in Septembter 2008.
2. CAW - California American Water
3. Source areas are as follows:
   AS1 - UPPER CARMEL VALLEY - San Clemente Dam to Esquiline Bridge
   AS2 - MID CARMEL VALLEY - Esquiline Bridge to Narrows
   AS3 - LOWER CARMEL VALLEY - Narrows to Via Mallorca Bridge
   AS4 - LOWER CARMEL VALLEY - Via Mallorca Bridge to Lagoon
   SCS - SEASIDE COASTAL SUBAREAS
   LSS - LAGUNA SECA SUBAREA (Ryan Ranch Area is within LSS)
   CAC - CACHAGUA CREEK and UPPER WATERSHED AREAS
   CVU - CARMEL VALLEY UPLAND - Hillsides and Tularcitos Creek Area
   MIS - PENINSULA, CARMEL HIGHLANDS AND SAN JOSE CREEK AREAS
4. Any minor numerical discrepancies in addition are due to rounding.
5. 699.18 AF is included in CAW production from AS3 to account for water delivered to ASR in WY 2016.
6. This total does not includes 609.45 AF of ASR water that was recovered for Customer Service in WY 2016.
7. Production includes 1.31 AF to Ryan Ranch from CAW Main System in WY 2016. No water was delivered to Seaside Municipal System in WY 2016.

DISTRICT-WIDE PRODUCTION	
SURFACE WATER DIVERSIONS:	
CAW Diversions (San Clemente Dam):	0.0
Non Cal-Am Diversions Within MPWRS:	13.3
CAW WELLS:	
[6] SEASIDE:	1,876.0
CARMEL VALLEY:	7,704.9
Within the Water Resources System:	9,580.9
Outside the Water Resources System:	0.0
Sand City Desal	160.9
[7]CAW TOTAL, Wells and Diversion:	9,741.9
NON CAW WELLS:	
Within the Water Resources System:	3,062.2
Outside the Water Resources System:	925.2
Non Cal-Am Diversions Outside the MPWRS:	50.7
NON CAW TOTAL, Wells and Diversion:	4,051.4
GRAND TOTAL:	13,793.3

Figure VII-3


Comparison of Reported Production to Allocation Limits
within the Monterey Peninsula Water Resources System
Reporting Year 1997, Water Year 2007 and Water Year 2017
RY 1997
WY 2007
WY2017
Limit
Acre-Feet
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1997
2007
2017
Limit
Non-Cal-Am Production
Cal-Am Production
Combined Production

VIII. WATER EFFICIENCY AND CONSERVATION

Description and Purpose

As a legislated function of the Monterey Peninsula Water Management District (MPWMD or District), a comprehensive water Conservation Program was implemented in October 1979. The Conservation Program expanded in 1983 when the District facilitated development of *The Water Conservation Plan for Monterey County*. The Conservation Plan, adopted by the MPWMD Board in 1986, included a goal to reduce demand by 15 percent of the then-estimated year 2020 demand through implementation of a number of water saving measures including retrofits, use of recycled water, education and other means. At the time the plan was adopted, 2020 demand was expected to be 24,000 AFY for the Peninsula, making the conservation goal 3,600 AF.

Ordinance No. 30, adopted in 1987, was the cornerstone conservation ordinance for the Monterey Peninsula. This ordinance required retrofit to Ultra-Low Flush 1.6 gallons per flush toilets upon resale and in new construction, remodels/additions and changes in use. The ordinance was adopted in July 1987 and codified as MPWMD Regulation XIV, Water Conservation. Regulation XIV also implemented other mandatory water saving measures and a verification process. MPWMD's Regulation XIV has been regarded as a model for other agencies.

In 2009, MPWMD undertook an extensive overhaul of Regulation XIV. Revisions incorporated new technology and best management practices and made the regulation easier to understand. Substantial amendments to the program included significantly expanded indoor and outdoor water efficiency requirements for new construction, visitor-serving commercial uses and Non-Residential customers. For example, all Non-Residential Users that did not have 1.6 gallons-per-flush (gpf) toilets by January 1, 2010 were required to install High Efficiency Toilets (HET) by December 31, 2013. Another example is a requirement for Rain Sensors to be installed on all automatic Irrigation Systems upon Change of Ownership or Use and Expansion of Use (i.e., remodels).

Another legislated function of the MPWMD is the authority to implement and enforce water rationing. A water rationing plan developed by the Monterey Peninsula Water Management Agency (the predecessor to the MPWMD) was available when the MPWMD was established. Amendments to the plan were made in 1981 (Ordinance No. 7) and in 1988 (Ordinance Nos. 35 and 37) during drought-related rationing administered by MPWMD that continued through 1991. Water-use reductions of approximately 30 percent were achieved during the 1988-91 rationing.

In 1997, in response to SWRCB Order 95-10[1], the MPWMD Board of Directors tasked its staff with preparing a plan to address compliance with the Order (i.e., regulatory supply shortage) as well as with physical water shortages. MPWMD worked with a variety of community interests including California American Water (CAW), to conceive and develop the Expanded Water Conservation and Standby Rationing Plan (Plan), which was adopted as Ordinance No. 92 in 1998 (codified as Regulation XV). The Plan consists of seven stages. The first four stages

1 SWRCB Order No. WR 95-10 concluded that CAW does not have a legal right for about 10,730 AFA (about 69% of the water supplied to CAW customers) which was being diverted from the Carmel River and that diversions were having an adverse effect on the public trust resources of the river.

provide CAW and the District with conservation "tools" to keep community water use within regulatory limits. Stages 5-7 of the Plan contain more stringent actions including per-capita rationing that would be triggered by a drought-induced water supply shortage and/or non-compliance with regulatory restrictions.

In February 2017, the MPWMD Board of Directors adopted Ordinance No. 169 which repealed the existing Regulation XV, The Expanded Water Conservation and Standby Rationing Plan of the Monterey Peninsula Water Management District and replaced it with a streamlined conservation and rationing plan known as "The 2016 Monterey Peninsula Water Conservation and Rationing Plan."

A key element of the Conservation Program was also added in 1997 when the District began issuing rebates for voluntary toilet replacements with Ultra-Low Flush (ULFT) 1.6 gallons-per-flush toilets. Initially, the District shared funding with CAW. Today, the rebate funds for CAW's customers are supported by the ratepayers through a conservation surcharge on the CAW bill, with the District administering the program.

The Rebate Program has been expanded over the years. At the end of WY 2017, the following items qualified for a rebate[2]:

Residential Indoor

- High Efficiency Toilet
- Ultra High Efficiency Toilet
- High Efficiency Residential Dishwasher
- High Efficiency Residential Clothes Washer
- Instant-Access Hot Water System
- On-demand pump or point-of source water heater as part of an Instant-Access Hot Water System

Non-Residential Indoor

- High Efficiency Toilet
- Ultra High Efficiency Toilet
- Pint Urinal
- Zero Water Consumption Urinal
- Water Broom
- Cooling Tower Conductivity Controller
- CEE Tier II Water Efficient Ice Machine
- X-ray film processor recirculation system
- Cooling Tower pH/Conductivity Controller
- Dry Vacuum Pumps
- High Efficiency Connectionless Steamer
- Water Efficient Commercial Dishwashers
- Medical equipment steam sterilizer retrofit with a water tempering device

2 Rebates are issued when funding is available.

- Water Efficient Commercial Steam or "Combi' Oven
- Commercial Ozone Laundry System
- Commercial Waterless Wok Stove

Outdoor Water Efficiency Rebates

- Smart (Weather-Based) Irrigation System Controller
- Soil Moisture Sensor
- Rainwater Harvesting (water storage capacity)
- Lawn removal and replacement with low water use plants or permeable surfaces
- Rotating Sprinkler Nozzles (minimum purchase and installation of ten)
- Graywater Irrigation System supplied by one Clothes Washer for irrigation and/or one or more Bathrooms that have a Bathtub/Shower connected to a Graywater Irrigation System
- Non-Residential Graywater Irrigation Systems considered on a case-by-case basis

Implementation and Activities During 2016-2017

● **Conservation Inspections** -- District staff continued an intensive inspection program to ensure compliance with the Conservation and Permit Regulations. Change of Ownership inspections make up the bulk of the District's inspection program. Most of the **1492** properties that changed ownership in FY 2016-2017 were inspected prior to the close of escrow. **Sixty-eight** percent (**68%**) of the inspected properties were found to be in compliance during the first inspection. An additional 1 percent (**1%**) passed during the second inspection, typically after replacing older toilets identified during the initial inspection. Subsequent enforcement is through non-compliance notice on the title of the property.

District staff inspected **905** properties for compliance with Water Permit conditions during FY 2016-2017.

A total of about **2,509** inspections were conducted in FY 2016-2017. An estimated **3.99** acre-feet (AF) of water were saved by new retrofits verified this year in these two categories.

● **Other Conservation Incentives** -- The District continued to offer incentives for property owners who agree to install water efficient appliances to offset new water fixtures as a condition of a Water Permit. Credit, in the form of water fixture units, remained available to offset new water fixtures in Remodels and Additions when an older model appliance is replaced with a High Efficiency Dishwasher (HEDW), High Efficiency Clothes Washer (HECW), High Efficiency Toilet (HET), and/or Instant-Access Hot Water (IAHW) System. This incentive program is one way to allow limited Remodeling and Additions without increasing water use.

○ **Rebate Program** -- The Water Conservation Rebate Program is available on a first-come, first-served basis. District staff continues to meet with local community organizations to advertise the program.

From July 1, 2016, through June 30, 2017, a total of 1,768 applications for rebates were received, **1,347** applications were approved with the use of the rebate refund. **Table VIII-1** summarizes the Rebate Program for FY 2016-2017.

● **Conservation Education** -- District activities remained focused on public education and encouraging Peninsula residents and businesses to implement new water conservation and efficiency practices and to maintain existing equipment and behaviors. Individualized Water Waste education took place as necessary to remind water users not to wash sidewalks, leave hoses running or ignore leaks. Efforts again successfully kept community water use below regulatory limits. A comprehensive report on the conservation program is prepared annually and is available on the District's website.

- The District continued supporting water conservation education through the Water Awareness Committee of Monterey County (WAC). WAC is a nonprofit water-education organization serving Monterey County. The District, as a founding member, holds a seat on the WAC Board of Directors and contributes annual financial and staff support to its efforts. WAC provides books on water-efficient landscaping, Drip Irrigation, and other water related subjects to libraries in Monterey County, sponsors a school water education program and provides outreach opportunities for the public to learn about local water issues.

- District staff participated in several events during FY 2016-2017. Outreach events included: Pebble Beach Community Services District Open House, Monterey Peninsula College Earth Day, City of Monterey's Cutting Day, City of Pacific Grove's Good Old Days, and Water Awareness Day at the Monterey County Fair. The events provided the public with an opportunity to learn about the District's extensive activities and programs.

- Entered a drought tolerant landscape display in the Monterey County Fair and was awarded first place in the Water-Wise Landscape category.

- The District participated in educating the Hospitality Industry at the Monterey County Hospitality Association Nick Lombardo Golf Tournament.

- The District hosted Convert Thirsty lawn to a Drought Tolerant Garden class.

- Water Demand staff attended the leading-edge WaterSmart Innovations Conference and Exposition. The conference offered four sessions with choices of eight different water efficiency tracks per session.

- Hosted a hands-on sheet-mulching workshop at Martin Luther King Elementary School.

- Water Demand staff gave a presentation to the Multi-Family Dwelling properties owners and property management companies to discuss water efficiency requirements.

- In 2012, a third CIMIS station (#193) was installed in ET zone 2 at the Pacific Grove Municipal Golf Course. A second CIMIS station is located at Laguna Seca Golf Ranch.

This CIMIS Station (#229) was activated on January 1, 2011, and is located in ET zone 3. The first CIMIS Station (#210) is located on the border of zones 3 and 6 and was activated on July 22, 2008.

- The District planted an organic garden at the main office, irrigation supplied by the Rainwater cistern on Site.
- Offered two Specialized Landscaping classes focusing on drought tolerant landscape and native plants selections.
- Hosted several rainwater harvesting, and water efficient irrigation workshops.
- Several ordinances were approved in recent years that affect water savings.

    - Ordinance No. 144, adopted August 16, 2010, added Rebates for Cooling Tower Conductivity/pH Controllers, Dry Vacuum Pumps, High Efficiency Connectionless Food Steamers, High Efficiency Commercial Dishwashers, Graywater Irrigation Systems, retrofits of medical steam sterilizers that utilize a continuous water flow with a water tempering device, and WaterSense labeled Ultra-High Efficiency Toilets.

      The ordinance also amended the Rebate amounts for Pint Urinals (from $250 to $300), Rotating Sprinkler Nozzles (from $0.50 to $4.00 with a minimum purchase of ten), Water Efficient Ice Machines (from $450 to $500), and X-ray film processor recirculation systems (from $2,000 to $3,500), Cistern storage capacity was increased from 3,000 to 25,000 gallons with an added eligibility condition that the Site must have sufficient roof area to provide the runoff to fill the Cisterns during a normal Water Year. The ordinance also increases the maximum Lawn Rebate increases from 2,000 to 5,000 square-feet.

    - Ordinance No. 145, adopted September 20, 2010, clarified and amended rules found in the permits, conservation, and enforcement regulations of the District.

    - Ordinance No. 148, adopted April 18, 2011, amended Rule 141, Water Conservation Rebates, to implement new and additional policies related to Lawn removal Rebates adopted by the District's Board in Resolution 2011-04. The ordinance also amended portions of the Rebate Program to strengthen conditions of approval, clarified that Sites must comply with applicable District rules before Rebates are issued, and disqualified from the Rebate Program Qualifying Devices mandated by local, State or Federal water conservation programs.

- Ordinance No. 149, adopted September 19, 2011, amended Rule 141, Water Conservation Rebates, to delete the Rebate for Rain Sensor in keeping with discussions between California American Water and the California Public Utilities Commission's Division of Ratepayer Advocates.

  The ordinance also amended the Rebate amounts for Residential High Efficiency Clothes Washers from $250 to $500, Commercial High Efficiency Clothes Washers from $450 to $1,000, Lawn removal from $1.25 per square-foot to $1.00 per square-foot and reduces the maximum area of Lawn removal that qualifies for a Rebate from 5,000 square-feet to $2,500 square-feet. The ordinance also eliminated the Rebate for Synthetic Turf.

- Ordinance No. 153, adopted June 19, 2012, increases the Cistern Rebate incentive by adding a higher rebate tier for the first 500 gallons of storage capacity. The Rebate increases to $50 per 100 gallons for the first 500 gallons.

- Ordinance No. 156, adopted November 18, 2013, adds a Rebate for Ultra-Low Flush Toilet, High Efficiency Toilet and Ultra High Efficiency Toilet flappers. The ordinance adds a $50 Rebate for replacement of Ultra-Low Flush Toilets with High Efficiency Toilets. The lower Rebate is justified due to implementation of amendments to the Health and Safety Code §17921.3 that mandates the sale and installation of High Efficiency Toilets in California after January 1, 2015. The ordinance amends language related to mandatory inspection of Lawn removal and Cistern Rebate applications.

- Ordinance No. 159, adopted April 21, 2014, amends the Rebate Program to allow a limited time for Non-Residential Users to receive a Rebate for purchase and installation of High Efficiency Clothes Washers, allows Public and non-profit entities to receive a Rebate for installation of more than 20 High Efficiency Toilets, and gives the Board discretion to approve Rebates in excess of $2,500 for Lawn removal at Public Sites.

- Ordinance No. 167, adopted December 15, 2015, amends the Rebate Program to allow a Rebate for High Efficiency Urinals purchased before January 1, 2016.

- Ordinance No. 169, adopted February 17, 2016, repealed the existing Regulation XV and replaced it with a streamlined conservation and rational plan.

- Ordinance No. 170, adopted May 16, 2016, amends Rules on process and issue Water Permits and Water Distribution System Permits, and clarified permitting and conservation requirements.

- Ordinance No. 172, adopted August 15, 2016, amends Regional Water Efficient

Landscape Requirements.

- Ordinance No. 175, adopted on November 14, 2016, amends rules of the System Capacity of Water Distribution Systems in the Carmel Valley Alluvial Aquifer.

- Ordinance No. 176, adopted January 25, 2017, clarified and amended rules found in the permits, conservation, and enforcement regulations of the District.

Table VIII-1
Summary of Rebate Program

Type of Devices Rebated	Number of devices	Rebate Paid	Estimated AF	Gallons Saved
High Efficiency Toilet (HET)	210	20,777.66	8.767080	2,856,762
Ultra-Low Flush to HET	471	46,512.56	4.710000	1,534,758
Ultra HET	61	8,850.59	0.610000	198,769
Toilet Flapper	5	54.54	0.000000	0
High Efficiency Dishwasher	175	21,875.00	0.525000	171,072
High Efficiency Clothes Washer	542	271,846.69	9.128272	2,974,457
Instant-Access Hot Water System	13	2,589.00	0.000000	0
On Demand Systems	5	500.00	0.000000	0
Zero Use Urinals	0	0	0.000000	0
High Efficiency Urinals	0	0	0.000000	0
Pint Urinals	0	0	0.000000	0
Cisterns	38	41,278.75	0.000000	0
Smart Controllers	9	1,153.12	0.000000	0
Rotating Sprinkler Nozzles	198	792	0.000000	0
Moisture Sensors	0	0	0.000000	0
Lawn Removal & Replacement	10	68,240.00	5.832168	1,900,418
Graywater	1	20000	0.000000	0
Ice Machines	0	0	0.000000	0
Totals: Month; AF; Gallons; YTD	1738	504,469.91	29.572520	9,636,235

IX. ALLOCATION OF NEW WATER SUPPLY

The MPWMD Water Allocation Program requires that each new water Connection or Expansion of Use be accounted for so that System Limits are not exceeded. Ordinance No. 70, adopted by the District Board on June 21, 1993, ended the moratorium on the issuance of new water Connections that was imposed in January 1991 as a result of the Water Allocation Program EIR. The ordinance established a consumption Allocation of water that could be used by each Jurisdiction from a total of 358 Acre-Feet Annually (AFA). This amount was calculated from a formula based on the production capacity of the Paralta well, an interim water supply project development by the District in cooperation with California American Water (CAW) (see also **Section X**).

Of the 358 AFA available from the Paralta well, a 50 AFA District Reserve Allocation was established in 1993 for community benefit projects. In February 1995, Ordinance No. 73 rescinded the District Reserve and allocated the remaining water equally among the eight Jurisdictions. Of the original 50 AFA, 34.720 AFA remained and was distributed equally (4.34 AFA each) among the Jurisdictions.

As described in Section XI of this report, specific water "Entitlements" associated with funding of the Pebble Beach Reclamation Project are available for areas within the Del Monte Forest pursuant to Ordinance No. 109. These Entitlements are not water "Allocations", and are therefore tracked separately. In addition, there are several other Entitlements of water available to specific areas of the CAW service area.

Implementation and Activities During 2016-2017

Between August 1993 and July 2017, a total of 252.401 AFA of the 342.720 AFA Paralta Well Allocation had been permitted for use by Jurisdictions, leaving **90.319** AFA remaining, or **26.4** percent of the Jurisdictions' Paralta well Allocations. Credits from expired or canceled Water Permits ("Pre-Paralta Credits") are tracked by Jurisdiction and may be used for Expansions of Use and New Connections similar to the Paralta Allocation. Finally, credits that were received for public retrofit projects from March 1995 to July 1998 (pursuant to Ordinance Nos. 75 and 91) and Water Use Credits that were transferred to a Jurisdiction are tracked as "Public Credits". **Table IX-1** provides the status of water Allocations for each Jurisdiction as of June 30, 2017.

Table IX-2 summarizes the Entitlements of water available to specific areas of the CAW service area.

In April 2005, the first Water Use Permits were issued to property owners in the Del Monte Forest who purchased water from the Pebble Beach Company (PBC). Property owners taking advantage of this program pay PBC for the Entitlement and receive documentation of their

purchase. The District processes and records a Water Use Permit on the title of the property that provides notice of the amount of Water Entitlement available. Regular Water Permits are required when the property owner desires to use the water available from a Water Use Permit. As of June 30, 2017, Water Use Permits and Water Permits had been issued for a total of **47.470 AFA** new and expanded uses.

Ordinance No. 132. In January 2008, the Board adopted Ordinance No. 132 (adding Rule 23.6) to allow the expansion and extension of the CAW System to provide Connections to, and Potable water service for the use on and benefit of property located within Sand City. This rule enables the issuance of Sand City Water Use Permits for new and expanded water uses on Sand City Sites, in a cumulative amount of no more than 206 AFA. As of June 30, 2017, **21** Water Use Permits and Water Permits had been issued for a total of **4.232 AFA**.

Ordinance No. 165. In August 2015, the Board adopted Ordinance No. 165 (adding Rule 23.8) to allow the expansion and extension of the CAW System to provide Connections to, and Potable water service for the use on and benefit of property located within the Carmel River watershed and the City of Carmel-by-the-Sea. This rule enables the issuance of Malpaso Water Use Permits for new and expanded water uses on Carmel River watershed and the City of Carmel-by-the-Sea Sites, in a cumulative amount of no more than 80 AFA. As of June 30, 2017, **89** Water Use Permits and Water Permits had been issued for a total of **3.089 AFA**.

Table IX-1

ALLOCATION REPORT
Reported in Acre-Feet
Water Year 2016-2017

Jurisdiction	Paralta	Pre-Paralta Credits	Public	Total Water Available
Airport District	8.100	0.000	0.000	5.197
Carmel-by-the-Sea	19.410	1.081	0.910	2.660
Del Rey Oaks	8.100	0.440	0.000	0.000
Monterey	76.320	50.659	38.121	2.558
Monterey County	87.710	13.080	7.827	12.960
Pacific Grove	25.770	1.410	15.874	0.155
Sand City	51.860	0.838	24.717	23.373
Seaside	65.450	34.438	2.693	43.416
TOTALS	**342.720**	**101.946**	**90.142**	**90.319**

Allocation Holder	Water Available	Total Demand from Water Permits Issued	Remaining Water Available
Quail Meadows	33.000	32.320	0.680
Water West	12.760	9.207	3.553

* Does not include 15.280 AFA from the District Reserve prior to adoption of Ordinance No. 73.

Table IX-2

ENTITLEMENT REPORT
Reported in Acre-Feet
Water Year 2016-2017

Entitlement Holder	Entitlement	Total Demand from Water Permits Issued	Remaining Entitlement/and Water Use Permits Available
Pebble Beach Co. [1]	233.83	26.029	207.801
Del Monte Forest Benefited Properties [2] **(Pursuant to Ord No. 109)**	131.170	47.470	83.700
Macomber Estates	10.000	9.595	0.405
Griffin Trust	5.000	4.829	0.171
CAWD/PBCSD Project Totals	**380.000**	**87.923**	**292.077**

Entitlement Holder	Entitlement	Total Demand from Water Permits Issued	Remaining Entitlement/and Water Use Permits Available
City of Sand City	165.000	4.232	160.768
Malpaso Water Company	80.000	3.089	76.911

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Increases in the Del Monte Forest Benefited Properties Entitlement will result in reductions in the Pebble Beach Co. Entitlement.

X. WATER-USE TRENDS

Description and Purpose

Based on data provided by California American Water (Cal-Am), Monterey Peninsula Water Management District staff tracks water use (Cal-Am metered consumption) over time to assess community water-use trends. These data are used in water-supply planning (augmentation) as well as development of conservation programs (e.g., assess the degree of conservation savings needed and the effectiveness of conservation programs).

Implementation and Activities During 2016-2017

Water-use trends may be tracked by using production data at the well head, as described above, or by considering Cal-Am metered consumption information, as described below. **Figure X-1** provides water-use trends from 1980 through 2017, as represented by consumption in acre-feet per Cal-Am connection (AF/connection) for customers[1] in the Cal-Am's Monterey Co. District (i.e., the "Main System"). This is based on Cal-Am annual "Customers & Consumption by Political Jurisdiction & Classification" reports that provide water-use information for each political jurisdiction and Cal-Am system subunits, as well as several user classifications. For WY 2017, the use per connection is based on Cal-Am's total metered consumption[2] (8,577 AF) divided by Cal-Am's total customers (38,573) and equaled 0.222 AF/connection.

Water consumption per connection in WY 2017 was the lowest rate on record during the 1980-2017 period, likely due in part to increased awareness of the need for conservation and higher water charges. Review of **Figure X-1** indicates that water use per connection for the last 29 years (1989-2017) is significantly less than in the preceding 9 years (1980-1988). The sharp decline in WYs 1989, 1990, and 1991 is attributable to mandatory water rationing in response to the 1987-1991 drought period. From 1992-2004, annual water consumption remained relatively stable, with a range from approximately 0.33 to 0.40 AF/connection, and average of 0.359 AF/connection, compared to the average of 0.500 AF/connection for the 1980-1988 period. Since WY 2004, a general annual declining trend has occurred. Notably, water consumption in WY 2017 (0.222 AF/connection) was 44% of the pre-drought consumption in RY 1987 (0.503 AF/connection).

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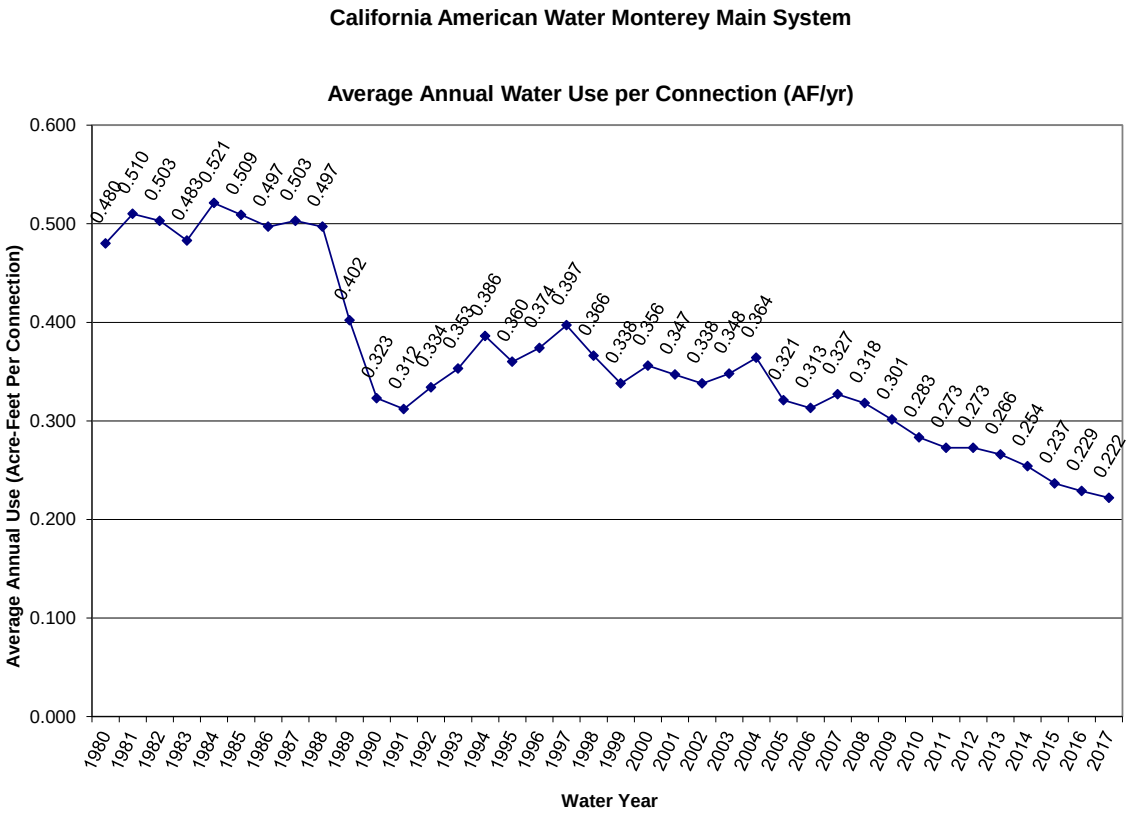
[1] Includes residential, multi-residential, commercial, industrial, golf course, public authority, other and non-revenue metered connections.

[2] Excludes Cal-Am satellite systems with separate well sources (i.e., Ryan Ranch, Hidden Hills, Bishop, Ralph Lane, Chualar and Ambler). Also excludes water supplied to MPWMD by Cal-Am wells to irrigate Carmel River riparian vegetation as part of the Allocation EIR Mitigation Program.

Figure X-1
California American Water Use Per Connection for Main System: 1980 – 2017



XI. WATER DISTRIBUTION SYSTEM MANAGEMENT (WATER PERMITS)

Description and Purpose

The Monterey Peninsula Water Management District (MPWMD or District) balances water supply and demand by carefully tracking the amount of allotted water used by the eight Jurisdictions within the MPWMD boundaries. The Monthly Water Allocation Program Report, found in the District's regular meeting Board packet, summarizes the amount of water available to each Jurisdiction. The current Allocation system, implemented after adoption of the Water Allocation Program EIR, replaced a system based on each Jurisdiction receiving a percentage of the total available production. The current process makes only newly developed water supplies available for new and expanding uses through an Allocation by Jurisdiction system, which is tracked every time a Water Permit is issued. In mid-1993, water from the Paralta Well project resulted in an Allocation of water to the Jurisictions, ending a moratorium that was established in 1989.

In addition to Allocations for each of the Jurisdictions, there are several separate Water Entitlements: Water West, a water company purchased by California American Water (CAW) in the early 1990's, has an independent Entitlement of water for properties within the boundaries of the former system. Properties located in the Quail Meadows subdivision, Pebble Beach Company (PBC) properties, Hester Hyde, Griffin Trust, and J. Lohr properties also have an independent Entitlement of water. Water from the PBC's Entitlement can be assigned to other properties located within the Del Monte Forest (Pebble Beach).

Implementation and Activities During 2016-2017

- **Permit Activity** -- From July 1, 2016, through June 30, 2017, a total of **831** Water Permits were issued. As shown in **Table XI-1**, **0** new residences and **557** residential Remodels/additions were permitted in the CAW system. There were **123** Non-Residential Water Permits issued for Remodels/Additions and Changes of Use in the CAW system. As of June 30, 2017, a total of **90.319 AF** of water remained available in the areas served by CAW, as shown in **Section IX**. This includes water from pre- and post-Paralta Allocations and water added to a Jurisdiction's Allocation from Water Use Credit transfers and public retrofits.

- **Reclamation** – The Carmel Area Wastewater District/Pebble Beach Community Services District (CAWD/PBSCD) Recycled Water Project began operation in 1994, producing Reclaimed Water to replace Potable water previously used to irrigate golf courses and recreational open space in the Del Monte Forest (Pebble Beach area). At the start of operation, the District released Water Entitlements to the project sponsors for their fiscal participation. The PBC received 365 AF, Macomber Estates received 10 AF, and the Griffin Trust received 5 AF. The District retains 420 AF of the project's estimated savings of 800 AFA; none of the District share has been allocated.

Ordinance No. 109. In May 2004, the Board adopted Ordinance No. 109 (amending Rule 23.5) to enable financing of upgrades to the CAWD/ PBCSD Recycled Water Project. This ordinance

enabled Water Entitlements held by the PBC to be made available to properties throughout the Del Monte Forest in order to finance the Project Expansion. Ordinance No. 109 also provided a framework for several ancillary agreements for financing, construction and operation, and sale of Recycled Water.

In April 2005, the first Water Use Permits were issued to property owners in the Del Monte Forest who purchased water from the PBC. Property owners taking advantage of this program pay PBC for the Entitlement and receive documentation of their purchase. The District processes and records a Water Use Permit on the title of the property that provides notice of the amount of Water Entitlement available. Regular Water Permits are required when the property owner desires to use the water available from a Water Use Permit. As of June 30, 2017, **47.470 AF** of Water Use Permit water had been used to permit new and expanded uses (see **Section IX**).

Ordinance No. 132. In January 2008, the Board adopted Ordinance No. 132 (adding Rule 23.6) to allow the expansion and extension of the CAW System to provide Connections to, and Potable water service for the use on and benefit of property located within Sand City. This rule enables the issuance of Sand City Water Use Permits for new and expanded water uses on Sand City sites, in a cumulative amount of no more than 206 AFA. As of June 30, 2017, **21** Water Use Permits and Water Permits had been issued for a total of **4.232** AF.

Ordinance No. 165. In August 2016, the Board adopted Ordinance No. 165 (adding Rule 23.8) to allow the expansion and extension of the CAW System to provide Connections to, and Potable water service for the use on and benefit of property located within the Carmel River watershed and the City of Carmel-by-the-Sea. This rule enables the issuance of Malpaso Water Use Permits for new and expanded water uses on Carmel River watershed and the City of Carmel-by-the-Sea Sites, in a cumulative amount of no more than 80 AFA. As of June 30, 2017, **89** Water Use Permits and Water Permits had been issued for a total of **3.089 AFA**.

- **Interagency Coordination** -- District staff continues extensive coordination with community development personnel from the local Jurisdictions to facilitate communication regarding the Water Permit process. Presentations on the local water-supply situation are given regularly, and meetings are held to discuss permit procedures and to answer questions about Allocation management. Through these meetings, rapport has been developed with the local agencies, making the management of water supplies more productive and accurate.

Table XI-1
Summary of Water Permits Issued

CALIFORNIA AMERICAN WATER **Main System** **(July 2016-June 2017)**			
Type of Water Permit	**No. of Permits**	**Capacity (Acre-Feet)**	**Average Use Per Permit (Acre-Feet)**
New Residential	0	0.000	0.000
• *Pebble Beach Entitlements**	17	3.250	0.191
• *Sand City Entitlement**	17	1.303	0.077
• *Malpaso Water Entitlement**	5	0.593	0.119
Residential Remodels/Additions	557	0.251	0.001
• *Pebble Beach Entitlements**	33	1.094	0.033
• *Sand City Entitlement**	0	0.000	0.000
• *Malpaso Water Entitlement**	19	1.095	0.058
New Non-Residential	1	0.111	0.111
• *Pebble Beach Entitlements**	0	0.000	0.000
• *Sand City Entitlement**	0	0.000	0.000
• *Malpaso Water Entitlement**	0	0.000	0.000
Non-Residential Remodels/Additions	123	0.915	0.007
• *Pebble Beach Entitlements**	1	0.035	0.035
• *Sand City Entitlement**	0	0.000	0.000
• *Malpaso Water Entitlement**	2	1.281	0.641

**Pebble Beach and Sand City Entitlements are tracked separately from Main California American Water System permits.*

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XII. MONITOR PRODUCTION AND COMPLIANCE WITH SWRCB ORDER WR 2009-0060 AND WR 2016-0016

Implementation and Activities During 2016-2017

Regarding compliance with State Water Resources Control Board (SWRCB) Order WR 2016-0016 (i.e, the "Cease and Desist Order" or CDO), California American Water (Cal-Am) target production from the Carmel River Basin in Water Year (WY) 2016 for the SWRCB tally was based on the initial regulatory limit of 8,310 acre-feet (AF). This number was then reduced by Sand City Desalination Project production of 241 AF and ASR Recovery of 887 AF over the 600 AF cap on ASR diversion counted in river pumping, resulting in an adjusted base amount of 7,182 AF. Actual Cal-Am Carmel River Basin diversions (after adjustments) for WY 2017 were 5,906 AF. Thus, Cal-Am reported diversions were below the adjusted diversion limit from the Carmel River Basin imposed by the SWRCB. WY 2017 was the 20th straight year in which compliance with Order WR 95-10 was achieved, the 8th year for compliance with Order WR 2009-0060, and the first year of compliance with SWRCB 2016-0016. A major purpose of the District's *Expanded Conservation Plan and Standby Rationing Program* is to ensure continued compliance with the SWRCB Orders. The community was in Stage 1 of the conservation program throughout the 2016-2017 reporting period.

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XIII. MONITOR PRODUCTION AND COMPLIANCE WITH MPWMD ALLOCATION LIMITS

Description and Purpose

The adoption of Ordinance No. 70 in June 1993 revised the Monterey Peninsula Water Resource System (MPWRS) supply limit from an annual production limit of 19,881 acre-feet per year (AFY) to 20,673 AFY. The California American Water (Cal-Am) annual production limit of 16,744 AFY (Option V from Finding No. 403 of the Final Water Allocation Program EIR; Ordinance No. 53) was revised to 17,619 AFY, and the non-Cal-Am production limit of 3,137 AFY was revised to 3,054 AFY. This new water supply limit reflected the 385 AFY of new water production allocation from the Paralta Well project and minor adjustments to reflect the integration of the Water West system into the Cal-Am system, the annexation of Quail Meadows Subdivision into Cal-Am, and the refinement of the non-Cal-Am production estimate.

Ordinance No. 83, adopted in April 1996, set Cal-Am's annual production limit at 17,621 AFY and the non-Cal-Am annual production limit at 3,046 AFY, based on permanent reductions in water use by non-Cal-Am water users in exchange for water service from Cal-Am. As part of the agreement, 15% of the historical non-Cal-Am production was set aside to meet the Monterey Peninsula Water Management District (District) long-term water conservation goal. Based on these changes, a new limit for the MPWRS as a whole was set at 20,667 AFY.

The Cal-Am production limit was again amended in February 1997, when Ordinance No. 87 was adopted as an urgency ordinance to provide a special community benefit reserve allocation of 19.6 AFY of production to the Community Hospital of the Monterey Peninsula. Ordinance No. 87 increased the total annual Cal-Am production limit to 17,641 AFY, but did not change the non-Cal-Am limit. Thus, the new limit for the MPWRS as a whole is 20,687 AFY.

In addition to District-imposed production limits as part of its Water Allocation Program, Cal-Am must also comply with limits set by the State Water Resources Control Board (SWRCB) in 1995 as part of Order WR 95-10. The Order includes a provision that Cal-Am water diversions (surface and groundwater production) from the Carmel River basin should not exceed 11,990 AF in Water Year (WY) 1996, and not exceed 11,285 AF in WY 1997 and subsequent years. In 2009, the SWRCB issued Order 2009-0060 (i.e., the "Cease and Desist Order" or CDO), which further modified the Cal-Am production limits and imposed a production ramp-down schedule by water year (see **Section XII**). The water year begins on October 1 and ends on September 30 of the following year. The District program to monitor water use includes tracking Cal-Am compliance with the SWRCB goals.

Implementation and Activities During 2016-2017

District staff continued to manage the overall supply budget, sending periodic reports to the cities and/or county and providing updates and general information as needed. The monitoring programs initiated by Ordinance Nos. 52 and 53 continue to be implemented. Beginning with the 2001-2002 Annual Report, the District changed the reporting period for the Well Registration and Reporting Program from a Reporting Year (July 1-June 30) to a Water Year (October 1-

September 30) to be consistent with the SWRCB Order reporting requirements, and other hydrological reporting programs. The 2000-2001 Annual Mitigation Report was the last report in which groundwater production within the District was presented in a Reporting Year format. Water production tables for the current year in this report use WY 2017 data (October 1, 2016 through September 30, 2017). Compliance with production limits imposed by MPWMD as part of the Water Allocation Program are shown in **Table XIII-1**.

Table XIII-1
MPWMD ALLOCATION LIMIT COMPARED TO WATER PRODUCTION[1] IN THE MONTEREY PENINSULA WATER RESOURCE SYSTEM
Data from Water Years 2016 and 2017

WATER USER	ALLOCATION LIMIT	WY 2016 PRODUCTION	% LIMIT	WY 2017 PRODUCTION	% LIMIT
Cal-Am	17,641 AF	9,581 AF	54%	10,231	58%
Non-Cal-Am	3,046 AF	3,160 AF	104%	2,725	89%
TOTAL	**20,687 AF**	**12,741 AF**	**62%**	**12,956**	**63%**

Notes:
1. MPWRS includes production from the Carmel River and underlying Carmel Valley alluvial aquifer, Coastal Subareas and Laguna Seca Subarea of the Seaside Groundwater Basin. Does not include Sand City desal plant production.
2. The Water Year (WY) runs from October 1 to September 30.
3. The non Cal-Am Production figures include non Cal-Am surface-water diversions.

Source: MPWMD production reports

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[1] Production values (table above) are based on amounts of water diverted and pumped and are, therefore, higher than the metered sales figures for water delivered to customers.

XIV. DETERMINE DROUGHT RESERVE

Description and Purpose

In conceptual terms, drought reserve can be defined as the balance between water supply and water demand that is necessary to insure a specified level of drought protection. The question that remains is how much protection is "adequate". There is no universally accepted standard for quantifying "adequate" levels of drought protection for municipal water supply systems. Moreover, drought protection can be measured in a number of ways including safe or firm yield, annual shortfalls, frequency or severity of water rationing, carryover storage, or some indicator of environmental stress.

For the Monterey Peninsula Water Management District (MPWMD), the level of desired drought protection has been specified by the Board of Directors in terms of water rationing. Adequate drought protection exists as long as the frequency of mandatory water rationing is less than predetermined standards. The determination of whether or not mandatory water rationing would be imposed during a reoccurrence of particular drought periods is based on simulated system operations for the 1958-2002 period of record.

In more specific terms, drought reserve can be expressed as the total usable storage in the Monterey Peninsula Water Resources System that is required on May 1 to limit mandatory water rationing to the predetermined frequency. The total storage that is required includes carryover storage for use during the following water year and the storage necessary to satisfy the demand that is expected to occur during the remainder of the current water year. In August 1993, the Board adopted a drought protection goal that allows no more than 20 percent mandatory water rationing two percent of the time, or two out of 100 years, on average.

Implementation and Activities During 2016-2017

In 2017, District staff determined that approximately **20,755 acre-feet (AF)** of usable storage were required on May 1, 2017 to avoid requesting a District-wide voluntary 15 percent reduction in water demand. Given that actual, usable storage on May 1 was estimated at **32,290 AF**, no demand reductions beyond existing Stage 1 restrictions were necessary for 2017 based on physical water availability. The 2017 trigger values are based on the maximum California American Water (CAW) production limit set by the State Water Resources Control Board in Order No. WR 2009-0060 (8,310 AF) for CAW's diversions from the Carmel River, the maximum production limit for CAW's diversions from the Coastal Subareas of the Seaside Groundwater Basin set by the Court as a result of the Seaside Groundwater Basin adjudication (2,251 AF), and the non CAW water production limit that was specified in the District's Water Allocation Program (3,046 AF).

XV. AUGMENT WATER SUPPLY

The Findings for Adoption of the Water Allocation Program EIR identified a set of general mitigation measures that relate to increasing the water supply. Finding No. 403-A states that the Monterey Peninsula Water Management District (MPWMD or District) shall pursue construction of a major, long-term water supply project to provide water for restoration of the environment and for public water supply. Finding No. 403-B states that the District should pursue a series of smaller "near-term" water supply projects to provide additional water for drought protection and some new growth until the long-term project is completed.

In 1996, District efforts related to both long-term and near-term projects were consolidated into the MPWMD Water Augmentation Plan (WAP). Specific goals and objectives were adopted in January 1997, and revised in January 1998, April 2000, and March 2001. Since 2001, the MPWMD Board has held Strategic Planning Workshops to set strategic planning initiatives, set goals and objectives to guide District activities, receive progress reports and provide policy guidance. Augmenting the water supply remains a major focus. Activities for the July 2016 through June 2017 reporting period were primarily guided by goals and objectives in the Strategic Plan adopted by the Board on April 20, 2015.

To maintain consistency with the Water Allocation Program EIR, the following sections describe MPWMD efforts for long-term and near-term projects separately. In practice, District water augmentation efforts are integrated. For aquifer storage and recovery (ASR), the long-term MPWMD ASR Phase 1 and Phase 2 Projects and associated water rights will be described under **Section XV-A**; the annual ASR operation activities will be discussed under **Section XV-B**.

A. Long-Term Water Supply Project

Description and Purpose

The mission of the District is to provide a long-term sustainable water supply to meet community needs while protecting the environmental quality of the Monterey Peninsula Water Resource System (Sand City desalination, Carmel River, and Seaside Basins) for the benefit of the community and the environment. The following paragraphs provide background information followed by a review of actions in the July 2016 through June 2017 period. Additional information is provided by the General Manager at most monthly regular board meetings, available on the District website at: www.mpwmd.net.

Background: In the early 1990s, the electorate did not approve public funding for two major water supply projects – a small 3,000 acre-foot per year desalination project in 1993 and the proposed 24,000 acre-foot (AF) New Los Padres Dam and Reservoir (NLP) Project in 1995. Since then, the District has focused its efforts on non-dam alternatives, including a proposal for a large desalination project. The District participated extensively in the 1999-2002 California Public Utilities Commission (CPUC) "Plan B" process to identify a non-dam alternative to the NLP. Since 2012, the District has worked with Cal Am on the Monterey Peninsula Water Supply Project (MPWSP), a portfolio comprised of (i) a 6,200 AFA desalination plant owned by Cal-Am, (ii) an Advance Water Purification Facility known as "Pure Water Monterey", a joint

project of Monterey One Water (M1W) and the District, and (iii) additional ASR by the District and Cal-Am.

The State Water Resources Control Board (SWRCB) decisions on Carmel River issues in July 1995 and subsequent orders continue to influence water augmentation efforts to the present. The SWRCB Order WR 95-10 identified an estimated 10,730 acre-feet per year (AFY) of historical unauthorized Cal-Am diversions from the Carmel River that must be replaced by another water project or projects. With few exceptions, SWRCB orders have a "one-for-one replacement" requirement, whereby any new water supply that is developed for Cal-Am use must offset the 10,730 AFY of unauthorized diversions from the Carmel River before new water supply can be used for new construction or remodels that intensify water use in the Cal-Am system. Thus, water for existing legal lots of record and other future needs will be available only when Order 95-10 and its subsequent requirements have been fully satisfied.

Because of a lack of progress toward completion of a replacement water supply and despite strong objections from the Monterey Peninsula, the SWRCB issued a Final Cease and Desist Order on October 20, 2009 (CDO 2009-0060). This Order set mandatory reductions in Carmel River diversions that that were to culminate in reducing Cal-Am Carmel River diversions to an authorized amount of 3,376 AFY by December 31, 2016.

Cal-Am, in conjunction with the District, Monterey Peninsula Regional Water Authority, the City of Pacific Grove and the Pebble Beach Company, submitted an application to amend the CDO on April 28, 2016. On July 19, 2016, the SWRCB adopted Order 2016-0016 extending the CDO period to December 31, 2021. The effective diversion limit (EDL) for the Carmel River was lowered to no more than 8,310 AFY and additional mitigation measures to offset impacts to public trust resources were ordered by the SWRCB[1].

Seaside Basin Setting: Management of the Seaside Basin also has important ramifications for long-term community water supply. SWRCB Order 95-10 directs Cal-Am to maximize pumping in the Seaside Basin to the extent practicable in order to reduce diversions from the Carmel River. Thus, since 1995, the Seaside Basin has become an increasingly important source of water supply. Unfortunately, it has also exhibited signs of stress from over-pumping due to Order 95-10 as well as significant increases in non-Cal-Am use.

The Superior Court rendered a Final Decision on adjudication of basin water rights on March 27, 2006 (as amended). The Decision determined that the Seaside Basin is in overdraft; quantified water rights for parties with overlying water rights ("Alternative Producers"); and set a reduced "natural safe yield" and a near-term "operating yield" allowed to be produced by certain parties with appropriative rights ("Standard Producers") as they work toward a "physical solution" to eliminate the overdraft. The Decisions set a timetable that included triennial reductions in basin production. Thus, by 2021, Cal-Am's legal share of water rights in the basin will be reduced to 1,474 AFY – down from production of nearly 4,000 AFY prior to adjudication. A nine-member Watermaster Board was created to implement the Decision with continued oversight by the

1 Additional detailed background information can be found in previous years Mitigation Program Annual reports and in SWRCB Orders 95-10 and 2009-0060.

Court. The MPWMD holds one seat on the Watermaster Board with two out of 13 votes; a MPWMD Board member serves as the MPWMD representative. The Watermaster has generally held monthly meetings since its formal commencement on April 5, 2006. The Watermaster website is at:
http://www.seasidebasinwatermaster.org/.

District staff sits on the Watermaster Technical Advisory Committee and contributes data and analysis for several technical reports required by the Court. MPWMD staff and consultants, along with other partners, have been retained by the Watermaster to provide contract technical services, including project management, data collection, and preparation of documents required by the Court as part of the Seaside Basin Monitoring and Management Program.

Water Supply Needs: Community water-augmentation efforts have focused on compliance with SWRCB Orders and the Seaside Basin Adjudication. In addition, the MPWSP includes water supply for existing lots of record. As presently envisioned, 9,752 AF of new supply will be added as a result of the MPWSP. Because of continuing water conservation outreach and incentives, the SWRCB CDO, and the enactment of a steeply-tiered rate structure, water use on the Monterey Peninsula has trended down and is currently hovering at levels not seen since 1960.

Other Regional Water Supply Projects:
In addition to the Cal-Am MPWSP project, two other regional desalination projects have been proposed:

1. "Deep Water Desal" -- A desalination project to be located in Moss Landing proposed by private investors that features a deep water intake to avoid harm to shallow marine organisms, and location near the power plant to serve a large computer "server farm" in association with the City of Salinas (www.deepwaterdesal.com); and

2. "The People's Moss Landing Water Desalination Project ("PMLWDP") is a proposed desalination plant in Moss Landing that will produce 13,404 acre feet per year of potable water. This desalination project would also be located in Moss Landing and is proposed by private investors that would partner with a public agency to deliver water to the Salinas Valley and Monterey Peninsula (http://www.thepeopleswater.com/).

It is uncertain whether either of these projects will complete environmental review and be constructed.

Monterey Peninsula Regional Water Authority (MPRWA or Water Authority): In early 2012, the mayors of six Peninsula cities -- Carmel-by-the-Sea, Del Rey Oaks, Monterey, Pacific Grove, Sand City and Seaside -- created a Joint Powers Authority (JPA) called the Monterey Peninsula Regional Water Authority. According to its website, the Water Authority's goal is to find a solution to the pending Peninsula water shortage due to the SWRCB's Cease and Desist Order and the Seaside Basin Adjudication. The Water Authority is concerned that the community has been unable to reach a consensus on a water supply solution, and if a project is not in place by the CDO deadlines, the community will face severe rationing and an economic crisis. The Water Authority believes in a portfolio approach to achieve an adequate and cost-

effective water supply for the Peninsula while addressing public concerns about the transparency of the project development process, and about the projected increased cost of water. The Water Authority website is: www.mprwa.org.

In February 2012, the Water Authority invited the MPWMD General Manager to serve on its Technical Advisory Committee (TAC).

Monterey Peninsula Water Supply Project Governance Committee (Governance Committee): In order to enhance coordination between the public and private sector, provide oversight on behalf of the public, and help reduce the cost of future regional water supply projects, the Governance Committee was formed under an Agreement dated November 5, 2013 (revised April 30, 2014). The Governance Committee is comprised of the Water Authority, MPWMD, County of Monterey and Cal-Am.

Through mid-2017, the Governance Committee continued to monitor progress on the desalination component, Pure Water Monterey, and construction of the Monterey pipeline. MPWMD facilitates meetings of the Governance Committee. Additional information including agenda packages and meeting minutes are at:
http://www.mpwmd.net/GovernanceCommittee/GovernanceCmte.htm

MPWMD Water Supply Project Priorities: On April 20, 2015, the District Board adopted its Strategic Plan, which included One-Year and Three-Year goals and objectives related to water supply projects, as follows[2]:

> **Desalination**: Further develop the "Ratepayer Relief Bonds" proposal for a public contribution for the Cal-Am regional desalination project. (Note: Though not enumerated as a specific goal, the Board also supported evaluation of an alternative non-Cal-Am desalination project as a "back-up" measure, given the delays and uncertainties associated with the Cal-Am desalination project).
>
> **Groundwater Replenishment (GWR)**: Enter into a cost-sharing agreement for GWR and advance CEQA and feasibility work. This project is also known as "Pure Water Monterey" with the MRWPCA as the lead.
>
> **Aquifer Storage and Recovery**: Complete Water Project 1 (ASR Phase 1), including an enhanced back-flush pond; redefine easement and enter into agreements with City of Seaside and Fort Ord Reuse Authority (FORA); complete construction.
>
> **Local Projects**: Work with jurisdictions to advance planning and development of local supplies. Possible examples include: Pacific Grove golf course irrigation with recycled water, well development for Del Monte Golf Course irrigation, and other projects. The District has provided seed-level matching funding to advance local planning.

2 The staff note and proposed Strategic Plan are at Item 24 in the following link:
http://www.mpwmd.net/asd/board/boardpacket/2015/PDF/April%2020%20Pkt.pdf

Odello Property: Regulate and provide oversight to owners' proposal to de-link their water rights and transfer those rights to Cal-Am for community use, and transfer the agricultural property into open space public land. This is also referred to as the "Malpaso Water Company water entitlement."

The Three-Year Strategic Goals included:

Develop Comprehensive Strategy for SWRCB Permit 20808-B: The District has successfully reassigned portions of the original New Los Padres Reservoir water rights Permit #20808 to Phases 1 and 2 of ASR (20808-A and 20808-C.) However, permit conditions for each are not consistent. The remainder Permit 20808-B could be revoked by the SWRCB if water is not put to an authorized use by the year 2020, unless an extension is approved. A strategy for the remainder will include:

- Identify two to three potential new injection and recovery sites, both in the Seaside Basin and the Carmel Valley;
- Evaluate possible source well rehabilitation and/or expansion in Carmel Valley, which could entail potential treatment capacity expansion.
- Develop strategy for direct diversion component of water right.
- Amend existing permits and consider conforming all permits to same standards; Attempt to create greater operating flexibility such that any injection well can inject any water and wells can be used for both recovery and production.
- Consider completing a water availability analysis and an IFIM study to develop new permit conditions.

Prepare for Allocation of "New Water": The District will need to develop fair and equitable mechanisms to allocate water from new water projects to the jurisdictions. Policies need to be considered for:

- Allocation of nearly 1,200 AF for legal lots of record;
- Local projects that may free-up potable supplies within jurisdictions;
- Additional water supplies that could be created by future ASR, Table 13 water rights, Odello East (Malpaso) water rights, and changes in water right permit conditions;
- Use of any "excess" supplies in the early years of the MPWSP, before allocation to full build-out of Pebble Beach or legal lots of record;
- Update and evaluation of the jurisdictions' general plan needs.

Establish a Long-Term Strategy for Los Padres Dam: In 2011, the District proposed increasing water supply capacity at Los Padres Dam through either a rubber dam on the existing spillway, or dredging. Cal-Am has expressed little or no interest in these projects in the past, due in part to the high cost and logistical challenges associated with replacing or enhancing fish transport through the dam, dredging the reservoir, and because the National Marine Fisheries Service (NMFS) has indicated that permanent removal of Los Padres Dam is a priority for restoration of the Central Coast Steelhead. However, many fisheries experts believe that a regulated river with the dam intact would

be a better long-term solution for the steelhead as well as property owners along the river. The District will address:

- Dam ownership;
- Dam removal and steelhead recovery;
- Property owners and rights;
- Additional water supply;
- Fish passage over Los Padres Dam and through the reservoir;
- Extending District river work permit jurisdiction upriver to extend regulatory authority.

The One-Year Goals focused on continued progress on the projects identified above for the 2013 Strategic Plan, with the following refinements:

- Add a goal to pursue Proposition 1 and federal funding opportunities.
- For Local Projects, add Monterey Regional Airport, Monterey County Fairgrounds, and Pebble Beach Company Del Monte Golf Course as possible projects.
- Develop ordinance and allocation frameworks for locally developed water supplies. This includes regulation and oversight for water right transfers in the Carmel River Basin (e.g., Odello) and Seaside Groundwater Basin (e.g., Cypress, DBO) as well as reallocation of potable water saved by conversion to non-potable irrigation sources (Pacific Grove).

The Three-Year Goal to create long-term strategy for Los Padres Dam (described above) was changed to be a One-Year Goal to establish a short-term action plan as well as a long-term strategy for the dam.

The Three-Year Goal to develop a comprehensive strategy for SWRCB Permit 20808-B (described above) remained the same. Similarly, the Three-Year Goal to prepare for allocation of "new water" was also continued, with the addition of the need to "clean up District rules regarding Water Credit transfers, sales and categories."

In 2014, the State Legislature signed sweeping legislation (Sustainable Groundwater Management Act [SGMA]), which could potentially have a substantive effect on water supply planning and development of water projects. The District Board accomplished the following with respect to SGMA:

- Adopted a resolution designating the District as the Groundwater Sustainability Agency for the Carmel Valley Alluvial Aquifer..
- Worked with SWRCB and the Department of Water Resources to resolve issues regarding the categorization of the Carmel Valley Alluvial Aquifer, and succeeded in obtaining an exemption from the requirements of SGMA.
- Worked with the Watermaster to ensure reporting requirements for the adjudicated Seaside Groundwater Basin are met.
- Coordinated with Marina Coast Water District and MCWRA to address interaction between the Salinas Valley and Seaside Groundwater Basins.

The 2015 Adopted Strategic Goals document is also available on the District website at: http://www.mpwmd.net/who-we-are/mission-vision-goals/bod-goals/

Implementation and Activities During 2016-2017

The following paragraphs describe action on the water augmentation goals identified above in the July 1, 2016 through June 30, 2017 period, unless only data for a Water Year (October 2016 through September 2017) are available. A brief summary of accomplishments is provided. Please refer to the 2015-2016 Annual Report for more detailed background information.

Monterey Peninsula Water Supply Project – The District worked jointly with Cal-Am, the Water Authority, and other parties to further the MPWSP. The District continued to actively participate in CPUC hearings and settlement agreements regarding Cal-Am's Application A.12-04-019 for the MPWSP.

Groundwater Replenishment/Pure Water Monterey Project – The District provided the majority of funding and provided services for work on this innovative water recycling plant, working in partnership with the Monterey One Water which will own and operate the system.

This past year, the project partners successfully obtained water rights for the project, secured State Revolving Fund loan monies from the State Water Resources Control Board (SWRCB) to build the project, and certified an Addendum to the Environmental Impact Report to add the Monterey Pipeline and Hilby Pump Station. Construction on the Monterey Pipeline began in late 2016 with the District acting as Project Manager for environmental compliance assurance. When completed, the pipeline will allow Pure Water Monterey water to be supplied to Pebble Beach, Carmel and Carmel Valley and also allow excess Carmel River water to be delivered to the ASR wells in the winter. Construction on all components of Pure Water Monterey began in 2017 with completion expected in mid-2018.

Aquifer Storage and Recovery (ASR) - The District continued to refine facilities at the Santa Margarita site, and continued to work with FORA and the City of Seaside on securing property needed to install permanent pipelines connecting the Phase 1 and 2 sites and an expanded back-flush pit. The District completed all facilities at the Phase 2 Seaside Middle School site.

Local Water Projects– For a third year, the District approved grants to local public entities to help them pursue small water projects, including: (1) the City of Monterey for evaluating capture and reuse of urban stormwater, (2) The Pebble Beach Company for a non-potable supply well for irrigation of its Del Monte Golf Course, and (3) the City of Seaside for drilling a new well. Previously funded local projects are making progress: Pacific Grove was slated to begin operations of its "Water Factory" in January 2018. The City of Monterey is partnering with M1W to develop a stormwater resource plan for

the Monterey Peninsula and Carmel Valley with additional grant funds from Prop. 1. The City of Seaside has not yet moved forward with a new well.

Odello Property/Water Rights Transfer –The District passed Ordinance No. 165 to establish a Water Entitlement to Malpaso LLC, based on its existing license from the SWRCB for the old Odello property south of the Carmel River and east of Highway One. This became the model for similar ordinances for other water right transfers. Several home remodels and business expansions have been accomplished with water from the Malpaso entitlement.

Water Rights/SWRCB Permit 20808-B – The District continued work on an integrated ground water – surface water GSFLOW/MODFLOW model to update instream flow needs for steelhead in the Carmel River, with a focus on model calibration, data review and input. The model was operable in late-2017, and will allow the District to model different water supply scenarios and their impacts on the Carmel River. The model will be an important tool to assess water availability under a wide range of scenarios for water use under Permit 20808-B.

Proposition 1 Integrated Regional Water Management Program – The District took the lead for the Monterey Peninsula region in negotiating an agreement for sharing Proposition 1 Disadvantaged Community funds in the Central Coast funding area. The Monterey Peninsula region would receive $435,000 for planning and implementation of projects. In related action, the District completed a Memorandum of Agreement to receive grant funding from the federal Bureau of Reclamation to facilitate integrated management in light of future climate change.

Los Padres Dam Improvements – The District continued to facilitate study of improvements to upstream passage at the dam and held technical workshop meetings with technical staff from Cal-Am, MPWMD and regulatory agencies. The District also entered into an agreement with AECOM to assess dam alternatives and sediment management. Future areas of study will include: sediment management, mitigating for downstream habitat impacts, and an evaluation of alternatives ranging from complete dam removal to increasing storage at the reservoir.

Sustainable Groundwater Management Act (SGMA) – The District continued to work with the Department of Water Resources in defining requirements under the SGMA for the Carmel Valley Alluvial Aquifer. MPWMD also coordinated with stakeholders in the Seaside Groundwater Basin regarding DWR recognition of the adjudicated Seaside Basin boundary for the latest version of DWR Bulletin 118, as well as general management issues in the vicinity of the Seaside and Salinas Basin boundaries.

B. Near-Term Water Supply Projects

Description and Purpose

Section XV-A above describes long-term water supply alternatives, including the MPWMD ASR Phase 1 and Phase 2 Projects. This section focuses on annual ASR operations. Since 1996, the District has evaluated the feasibility of ASR at greater levels of detail. As of June 2015, the District had constructed five ASR wells in the Seaside Basin: (1) a shallower ASR pilot test well into the Paso Robles Formation (located at Mission Memorial Park in Seaside) in 1998; (2) a 720-foot deep, full-scale test well into the Santa Margarita Formation in 2002 (now ASR-1); (3) another full-scale ASR well at the Santa Margarita site (ASR-2) in 2007; a full-scale ASR well at the Seaside Middle School site (ASR-3) in 2012; and a second full-scale well at the Middle School site (ASR-4) in 2014. To comply with the SWRCB water rights permit conditions, MPWMD submits detailed annual reports to the SWRCB after each operational season, which also confirms that diversions for the ASR projects have complied with regulatory requirements. A similar report is provided to the Central Coast Regional Water Quality Control Board as part of its ongoing oversight of the ASR program in the Seaside Basin.

Implementation and Activities During 2016-2017

The District operated the ASR facilities in coordination with Cal-Am while diverting 2,345 acre-feet (AF) of Carmel River Basin water for injection and storage in the Seaside Basin during the 2017 water year (WY). Since inception of the ASR program, a total of 8,031 AF has been diverted from the Carmel River for storage and subsequent recovery through the end of WY 2017. In Water Year 2017, 1,501 AF of ASR-stored water was extracted (recovered), for delivery to Cal-Am system customers.

XVI. STEELHEAD FISHERY MITIGATION MEASURES

The Findings for Certification of the Water Allocation Program Final EIR (Findings Nos. 388-A through D) identified mitigation measures to reduce impacts to the Carmel River steelhead population, including: (a) expansion of the program to capture and transport smolts during spring, (b) prevent stranding of early fall and winter migrants, (c) rescue juveniles downstream of Robles del Rio during summer, and (d) implement an experimental smolt transport program at Los Padres Dam (LPD). Monitoring of adult returns and juvenile populations provides an indication of the overall success of the steelhead mitigation measures. The following sections briefly describe the purpose of each mitigation measure and activities during the current reporting period.

A. Capture and Transport Emigrating Smolts during Spring

Description and Purpose

The goal of this program is to reduce disruption of the steelhead life cycle due to streamflow diversions. During spring months, when steelhead smolts are actively emigrating from freshwater to the ocean, the diversion of surface and groundwater from the river and alluvial aquifer sometimes interferes, and in some cases, blocks migration into the ocean. This threatens individual fish, reduces the number of smolts that successfully reach the ocean, and indirectly affects the number of adults that eventually return to freshwater. When streamflow is too low for natural emigration, or when smolts are at risk of being stranded, the Monterey Peninsula Water Management District (MPWMD or District) monitors streamflow, captures emigrating smolts, and transports them to the lagoon or ocean.

Implementation and Activities During 2017

During the primary three-month smolt migration period, March-May 2017, flows in the lower river at the Highway 1 Gage were excellent for smolt migration with flows ranging from 669 to 76 cubic feet per second (cfs) **(Figure XVI-1)** and no smolt trapping was needed **(Figure XVI-2).**

B. Prevent Stranding of Fall/Winter Juvenile Migrants

Description and Purpose

As in other central California streams, juvenile steelhead in the Carmel River move downstream into lower reaches of the river well ahead of the peak emigration of smolts. Depending on river conditions and diversions during the previous dry season, there is some risk that pre-smolts and other juvenile steelhead will be stranded following early fall and winter storms, which increase flows and stimulate the fish to move downstream into habitats that are subsequently dewatered after the storm peak passes. This risk occurs primarily from October through February, although during severe droughts, the risk period may extend into March. The District mitigates this problem by capturing and transporting juveniles when necessary during the high-risk period. Currently, juveniles trapped during fall/winter months are transported upstream to viable habitats above the Narrows or held at the District's Sleepy Hollow Steelhead Rearing Facility (SHSRF).

Implementation and Activities During 2016-2017

District staff monitored river conditions during the fall and winter months of 2016-2017. Flow at the District's Highway 1 Gage dropped to zero cfs in July 2016 and the lower river remained dry through early December 2016 **(Figure XVI-1)**. Due to the dry conditions, there was a moderate risk of fish stranding and conditions were carefully monitored throughout the fall and winter but no additional rescues were needed. In Fall 2017, the lower river remained wet so there was no risk of stranding.

C. Rescue Juveniles Downstream of Robles Del Rio during Summer

Description and Purpose

About 1.5 miles of habitat between Boronda Road and Robles del Rio Road, and up to nine miles of habitat below the Narrows, are seasonally subject to dewatering depending on the magnitude of streamflow releases at LPD, seasonal air temperatures, and water demand. Beginning as early as April or May of each dry season, the District rescues juvenile steelhead from the habitat in these reaches. The goal of this program is to help maintain a viable steelhead population by transplanting juveniles to permanent river habitat above the Narrows (if it is available), and/or rearing juvenile steelhead at the SHSRF if existing habitat is not available or is already fully saturated with juvenile steelhead.

Implementation and Activities during 2016 and 2017 Rescue and Rearing Seasons

- **MPWMD Fish Rescue Totals-** Since 1989, District staff has rescued 432,570 steelhead from drying reaches in the Carmel River watershed. Compared to previous rescue seasons, rescue totals in the 2016 and 2017 dry seasons were only 6% and 37% of the 1989-2017 average of 14,916 **(Figure XVI-3)**. Rescue and transport mortality for the 2016 and 2017 dry seasons were 0.87% and 0.51%. Average rescue transport mortality for the 1991-2017 period is 0.57% **(Figure XVI-4).** All fish >65mm were scanned for PIT tags, none were found.

2016 MPWMD Annual Mainstem Rescue Totals – The surface flow dropped below 10 cfs at the Highway 1 Bridge June 3, 2016. In response to this decline, District staff began monitoring daily river conditions. Rescues began on June 13th and were conducted until September 2, 2016. Rescue operations occurred between Highway 1 Bridge (RM 1.0) and Cal-Am's Begonia iron treatment plant reach (RM 7.7), plus one day at the Los Padres smolt bypass outlet. During this period staff conducted 32 rescue operations over 6.7 miles, yielding a total of 670 steelhead, including: 425 young-of-the-year (YOY), 239 yearlings (1+), and 6 mortalities (0.89%) **(Table XVI-1a)**. Fish were transported and released at the District's Sleepy Hollow Steelhead Rearing Facility (411), lower circle area (14) and at the below Los Padres area (239) **(Table XVI-1b)**.

2016 MPWMD Tributary Rescue Totals – A total of five rescue days were conducted on Robinson Canyon, Garzas, and Hitchcock creeks. Rescue operations occurred in late May and June, yielding a total of 247 steelhead, including: 226 young-of-the-year (YOY), 19 yearlings (1+), and 2 mortalities (0.81%) **(Table XVI-1a)**. Fish rescued out of the tributaries were released

at their confluence with the Carmel River, Hitchcock (175) and Garzas (70). No fish were rescued out of Robinson Canyon Creek **(Table XVI-1b).**

2017 MPWMD Annual Mainstem Rescue Totals - The surface flow of the Carmel River dropped below 10 cfs at the Highway 1 Bridge July 30, 2017. In response to this decline, District staff began monitoring daily river conditions. River conditions did not warrant any rescues in the lower river. One rescue was conducted at the Los Padres Spillway on October 24, 2017 when reservoir levels decreased below the bedrock sill and created isolated pools. Three yearling (1+) fish were rescued. Fish rescued at the Los Padres Spillway were released at the Los Padres gaging pool (3) **(Table XVI-1b)**.

2017 MPWMD Tributary Rescue Totals – Staff conducted 21 rescues operations in the tributaries, including 2 in Potrero Creek, 3 in Robinson Canyon Creek, 4 in Garzas Creek, 9 Hitchcock Creek, and 3 in Cachagua Creek. Total number of steelhead rescued was 5,496 including: 5,436 young-of-the-year (YOY), 32 yearlings (1+), and 28 mortalities (0.51%) **(Table XVI-1a)**. Fish rescued out of the tributaries were released near or at their confluence with the Carmel River, Potrero (126), Robinson Canyon (434), Garzas (1,360), Hitchcock (2,618) and Cachagua (930) **(Table XVI-1b)**.

- **Sleepy Hollow Steelhead Rearing Facility (SHSRF)** - The District's Water Allocation Mitigation Program includes construction and operation of a facility for rearing juvenile steelhead through the dry season. In early 1997, the District completed construction of the SHSRF, which included: (1) a diversion and pump station, (2) two large circular tanks, (3) an 800-foot long rearing channel, (4) electrical, water, pressurized air and drainage systems, (5) an office/shop/lab building and (6) miscellaneous equipment.

As conditions changed, significant additional Facility upgrades and modifications were made between 2000 and 2003 including a cooling tower, large emergency generator, upgraded impellers on the existing pumps, purchases of an additional backup pump and a mobile emergency pump, and installation of a centrifugal separator to reduce the buildup of coarse sediment in the cooling tower and rearing channel. In 2005 and 2006, new wooden weir boards were installed and waterproofed in the rearing channel to prevent fish movement between bays and to serve as an additional water retention backup mechanism. In 2007, eight, 250-gallon, insulated rearing troughs replaced a defunct 22-foot diameter tank. These tanks are used to rear small rescued fish, for additional quarantine treatments, or for growth and survival experiments. In 2008, Tank 3, the remaining 22-foot diameter holding tank, was outfitted with a large re-circulating pump, filtration, and UV sterilization system to hold fish when the river's water quality is inadequate for fish survival or if the Facility's river pumps should fail.

Facility Modifications in Reporting Year 2017 – The District is in the process of completing a major intake system upgrade that will improve the reliability and ease of maintenance of the intake pumps during both high and low flow conditions. This project is funded by funds from the California American Water (Cal-Am) Settlement agreement with the National Marine Fisheries Service (NMFS) and California Department of Fish and Wildlife (CDFW), administered through the State Coastal Conservancy (SCC), and is expected to be completed by 2019. During this reporting year, District staff secured the funding and support of the SCC while the consultants

continued to finalize the design and permitting.

Summary of 2016 SHSRF Fish Stocking and Releases – In 2016, all rescued Mainstem steelhead were held at the Facility. Overall, 407 fish were brought to the Facility, with 387 of those PIT tagged and stocked in the rearing channel. During the six-month holding period (June 13 – December 2), 86.2% of the fish survived (93.6% in the rearing channel) and 351 fish were released below the Narrows in excellent condition **(Table XVI-2)**.

No fish were held at the Facility in 2017 since no mainstem rescues were needed.

D. Monitoring of Steelhead Population

Description and Purpose

The District uses three primary techniques to monitor the health of the steelhead population: (1) counts of adult steelhead passing LPD and DIDSON (Dual-frequency IDentification SONar) results in the lower river, (2) surveys of winter steelhead redds, and (3) surveys of the juvenile steelhead population at the end of the dry season in October.

Implementation and Activities during 2017

- **Winter Steelhead Adult Counts** - The LPD Fish Trap is operated and monitored by Cal-Am. The trap was monitored from December 16, 2016 to June 28, 2017. The number of trapped adult sea-run steelhead reported during the 2017 migration season (Jan. - April) was seven – a small number but the first adults at LPD since 2013 **(Figure XVI-5)**. The average run size for the 1991-2017 period is 98 fish. Additionally, there were 54 resident trout counted in the trap this season.

- **Winter Redd Surveys –** Since 1994, the District has conducted winter steelhead redd (nest) surveys downstream of LPD. The primary purpose of the surveys is to conduct a thorough assessment of steelhead redds and adult fish (including spawning pairs, singles, kelts, and carcasses) in the Carmel River, then use those results to help evaluate the health and abundance of each steelhead life stage.

In addition, the general condition of the spawning habitat as well as the numbers of steelhead smolts, juveniles, and fry are noted in each reach. Also, noted are any areas where low flows might be creating migration barriers to upstream or downstream fish passage.

Thirdly, the surveys are used to track gravel movement and monitor spawning activity in conjunction with the District's Spawning Gravel Enhancement Project below LPD, where in 2014, 1,500 tons of 1.5 - 4" gravel was placed with the goal of increasing the available spawning habitat by 50% above Cachagua Creek.

2016 Redd Survey Summary:
The 2016 results were discussed in the MPWMD 2016 Mitigation Report.

2017 Redd Survey Summary:
Once flows finally dropped enough to allow safe access, one nearly complete redd survey pass from lower Rancho Cañada (RM 2.0) to Los Padres Dam (RM 24.8) was conducted between May 8 and June 7, 2017 by MPWMD fisheries staff. River flows ranged from 150 to 60 cfs at the survey locations. Additionally, several adults and redds were observed in the Los Padres Dam plunge pool in March, and the lower portions of several tributaries were surveyed during other fisheries activities (rescues).

Overall, 36 steelhead redds were observed between Via Mallorca Br. (RM 3.24) and the LPD plunge pool in the newly placed spawning gravel (RM 24.8). Four steelhead adults and a number of otoliths (indicating deceased kelts) were also seen, as well as more than 50 large smolts/older juveniles. Despite the relatively low numbers of redds counted due to the high river flows and late season survey, the many hundreds of fry seen throughout the entire river indicate a successful spawning season.

The lower portions of all seven major tributaries were surveyed as part of other District activities (rescues, flow monitoring). Only one adult and one redd were counted, but every tributary had 100's of fry. During rescues, ~4,200 fry were saved from the lower, drying portions of the creeks. This supports the hypothesis that adult steelhead may use the tributaries more for spawning than the mainstem during high flow/high turbidity years.

Pacific Lamprey – Lamprey numbers appear to be rising in the Carmel River the past few years, and with the removal of SCD they are able to spawn in the upper watershed for the first time since the 1920's. In 2017, staff counted 53 lamprey redds, half of which were seen in or above the CRRDR reach.

Striped Bass – Striped bass (SB) have been present in the Carmel River lagoon for approximately 10 years, but they were first observed up in the lower river in 2015. In 2016 they extended their range an additional 4.3 miles upstream. In 2017 many SB were observed in groups throughout the lower river and two individuals were seen in the CRRDR reach, 18.5 miles upstream of the lagoon. To date, no juvenile bass have been found in the river.

- **Juvenile Population Surveys** - Since Fall 1990, the District has surveyed the juvenile steelhead population in the Carmel River below LPD. This information is crucial to assess the success of adult reproduction and to determine whether or not freshwater habitats are adequately seeded with juveniles.

In 2016, nine survey sites were sampled throughout the 15-mile reach between Scarlett Well Bridge and LPD. The effects of the long drought are evident, as the average juvenile steelhead population density remained quite low for the third year at 0.22 fish-per-lineal-foot (fpf) of stream **(Table XVI-3),** well below the prior long-term (1990-2016) average density of 0.73 fpf **(Figure XVI-6)**. During the surveys, 384 fish >65mm were PIT tagged.

In 2017, 11 survey sites were sampled throughout the ~24-mile reach between Highway 1 and LPD, including the Valley Greens Br. site that can only be sampled during very wet years. Also, District staff assisted NMFS on a number of additional surveys throughout the watershed. Fish density below the Narrows was very low, between 0.01- 0.07 fpf **(Table XVI-3)**, likely due the

lack of adults spawning in the lowest section of the river, and from much of the habitat being covered with a layer of sand, causing the overall average to be quite low again this year at 0.32 fpf, but still the highest since 2013, before the drought. The juvenile population in the upper river, above the Carmel River Re-route and Dam Removal project (CRRDR) had a significant increase over recent years. During the surveys, 607 fish >65mm were PIT tagged.

- **Constraints to Cal-Am Diversions from the Lower Aquifer** - During the 1992 SWRCB hearings on complaints against Cal-Am's diversions from the Carmel River, testimony was presented that outlined the potential benefits of a modified way of managing the sequence of pumping from Cal-Am well fields in the Carmel Valley Alluvial Aquifer. Pursuant to Condition No. 5 of SWRCB Order WR 95-10, Cal-Am is required to operate its Carmel Valley production wells beginning with the most downstream well, and moving upstream to other wells as needed to meet demand. The goal of this order is to maximize the length of viable stream and aquatic habitats in the lower Carmel Valley.

During the 2016 dry season, it was estimated that this mode of operation and flow releases from Los Padres Reservoir resulted in 1.3 miles of additional viable aquatic habitat. Rescues were needed through the River Meadows reach (RM ~7.7) including the Red Rock survey site. Juvenile population estimates were completed at the Scarlett Well (Narrows) site (see **Table IX-3**), but fish numbers were low at only 0.07 fish-per-foot (fpf), so the additional habitat supported approximately 480 juveniles.

In 2017, due to the wet winter, the entire river channel remained wet with flows to the lagoon all summer and fall. Based on the estimated population density at the Red Rock and Lower River sites (see **Table XV1-3**), this habitat produced about 1,300 additional juveniles.

E. Other Activities Related to the Steelhead Resource

The District continues to carry out several activities that were not specifically identified as part of the original Allocation EIR Mitigation Program, but will improve habitat conditions, help restore the steelhead resource, or provide additional key data on the steelhead resource. These include: (a) rescue and transportation of kelts, (b) spawning habitat restoration and monitoring, (c) assessment of steelhead migration barriers, (d) operation of the DIDSON fish counter, (e) assessment of the benthic macro-invertebrate (BMI) communities, and (f) Carmel River habitat mapping.

Implementation and Activities in 2016-2017

- **Rescue and Transportation of Kelts** – "Kelts" are adult steelhead that have already spawned, typically from January through April, and begin to migrate back to the ocean in late spring and early summer. Under existing conditions, these fish are threatened by receding flows in many years, especially when the upstream migration of adults is delayed due to lack of early-season storms. District staff rescue and transport these fish to more stable waters, when needed.

In both 2016 and 2017, the lower river remained wet until June so no trapping was necessary and no kelts were captured during summer rescues.

- **DIDSON Fish Counts** – DIDSON (Dual-frequency Identification Sonar) produces high definition video images in all conditions, including low light and high turbidity. It is also a passive technique that does not require fish handling and does not impede migration. The DIDSON site is currently being evaluated for its applicability as a future long-term monitoring site for the estimation of adult escapement.

The 2017 migration season was characterized as a "Extremely Wet" Water Year Type (WYT). The Carmel River Lagoon first breached to the Pacific Ocean on December 19, 2016, marking the start of the steelhead migration period. The DIDSON was put in on December 28, 2016 and operated until February 25, 2017, when extreme high flows scoured out the framing for the camera and caused failure, ceasing data collection. During the 60 days of operation, 27 (45%) days are readable, 27 (45%) are too turbid to read and 6 (10%) had data malfunctions. During the 27 days that are readable, there were 53 upstream counts and 23 downstream counts of fish observed to be 40 cm or greater.

- **Bioassessment Program** – Using the California State Water Resources Control Board's Reach Wide Benthic (RWB) protocol's Surface Water Ambient Monitoring Program (SWAMP) procedures, sampling was completed at four sites between Cachagua (CRCA) (below LPD) and Red Rock (CRRR) (at mid-valley) in November 2016. The control site above Los Padres Reservoir (CRLP) was not sampled in 2016 due to the large Soberanes Fire that burned much of the Carmel River's upper watershed and restricted access to the site. Sites are given an Index of Biotic Integrity (IBI) score between 0 (poor) and 100 (excellent) (**Figure XVI-7)**.

In 2016, Site CRRR had IBI score of 33, the lowest ever measured at the site, while the Sleepy Hollow site (CRSH) had an IBI score of 56 which was the highest score measured compared to historic data (King, T., 2016 and 2017). These disparate scores likely reflect the negative consequence of the long drought (CRRR) and the positive result of removing a large dam (CRSH).

Another noteworthy component of the 2016 BMI data was the presence of the introduced New Zealand mud-snail (*Potamopyrgus antipodarum*) (NZMS) at the farthest downstream site CRRR. This was the first year that NZMS were identified within the Carmel River watershed. They were not found in the other (upstream sites) but comprised 18 percent of the BMIs at site CRRR, which may have contributed to the site's relatively low IBI score in 2016.

In fall 2017, samples were collected from seven sites, including the CRLP control site and two additional downstream sites that had remained wet all year – Valley Greens (CRVG) and Cross Roads (CRCR). In all, 4,072 BMIs were processed, comprising 75 taxa.

Site CRLP, located above Los Padres Reservoir, receives an unregulated flow regime and has had a wide range of IBI scores with the lowest score (40) documented in 2014 during the drought and the highest score to date (93) in 2017 during the "Extremely Wet" water-year.

Site CRCA is located approximately one mile downstream of Los Padres Reservoir and had more consistent IBI scores when compared to the reference site CRLP; and the IBI scores approximated the historic average IBI score of 34 (King et al. 2010). Site CRCA receives a regulated flow regime that likely contributed to its suppressed yet relatively consistent range of IBI scores. Also noteworthy for site CRCA was the low abundance of BMIs in 2017: 311

BMI/m^2 were recovered from the entire sample. This is less than the standard subsample size of 600 organisms and is substantially less than the typical range of abundance in samples collected with the RWB procedure.

Other factors potentially affecting BMI abundance and community structure at site CRCA could be low dissolved oxygen (DO) and seasonally heavy algae blooms, which have developed in late summer and fall over the last several years and particularly in 2017 after the basin-wide fires. It is possible that planktonic and decomposing algae are released downstream of the dam, which could change the food resources available to BMI and fish, and depending on the species of algae, may be a poor food resource or even deleterious to aquatic life. Heavy and potentially harmful algae blooms have been documented for many lower elevation reservoirs in California over the last several years due to recent drought, high summer temperature, and the introduction of nutrients into surface waters (http://www.mywaterquality.ca.gov/habs/what/index.html).

The removal of SCD and the newly constructed Carmel River channel likely contributed to improved BMI community structure as evidenced by the highest CRSH IBI score documented in 2017. Site CRSH is the most proximal site downstream of the newly constructed channel, which became operational in late fall/winter of 2015/2016. The relatively high IBI score (56) in 2016 indicates that activities associated with channel construction and dam removal had no meaningful deleterious effects on BMI assemblage. During the 2016/2017 water-year there was substantial alteration of the new channel causing mobilization of sand and gravel downstream of the project area. Despite the increases in course sediments, the BMI community appeared to respond favorably as the historically high IBI score indicated at site CRSH in 2017.

The three lowermost sites in the watershed (CRRR, CRVG, and CRCR) sampled in 2017 had high populations of the NZMS comprised over 60% of the BMIs in the samples, an over three-fold increase in one year. The currently known upstream extent of NZMS in the Carmel River is within the lower section of Garland Park according to Dr. John Olsen, Assistant Professor of Ecology with California State University, Monterey Bay.

High abundances of NZMS are known to adversely affect fish populations by being a poor food resource, and through their displacement of indigenous BMI populations that are the preferred food resource for many fish species (http://www.usu.edu/buglab/Content/Files/2007NZMS.pdf; http://ucanr.edu/sites/uccenzms/; https://www.wildlife.ca.gov/Conservation/Invasives/Species/NZmudsnail).

OBSERVED TRENDS, CONCLUSIONS AND/OR RECOMMENDATIONS:

- **Adult Steelhead**

Two major factors continue to effect adult steelhead this reporting year: the five-year California drought that ended in late 2016 and the removal of ninety-year-old San Clemente Dam. The removal of the dam allows unrestricted access to many additional miles of mainstem and tributary habitat. Additional work completed in summer of 2016 removed two other major barriers in the reach (Old Carmel Dam and Sleepy Hollow Ford) allowing fish unobstructed

passage below LPD both upstream and downstream for the first time since the 1890's. Large quantities of sand released from the San Clemente reach filled in many pools and runs during the winter of 2017. It remains to be seen what effect this will have on adult spawning and juvenile rearing in the lower river.

One drawback to SCD's removal was the loss of the fish ladder with its associated fish counter, and the long-term data base on the number of returning adults. Without this counter we will have to rely on adult counts from LPD, the DIDSON camera, and redd surveys. Looking forward, important migration and life history data will be collected from the PIT tagging program currently being implemented by the District and NMFS on the Carmel River.

Previous redd surveys below SCD confirm that the spawning habitat in the lower river has improved considerably over the last 20 years and many adults now spawn there instead of the upper watershed. In addition, juvenile steelhead rescued by the District from the lower river that survive to adulthood may be more likely to return to the lower river to spawn rather than migrate upstream.

Variability of adult steelhead counts are likely the result of a combination of controlling and limiting factors including:

- the continued effects of the severe five-year drought on all steelhead life stages including adult steelhead, as migration is limited or blocked and spawning reaches dry early;

- adverse ocean conditions with increased water temperatures off the coast of California, and degraded ocean water quality likely affecting the abundance of food resources and possibly even the survival of returning steelhead;

- variable lagoon conditions, caused by artificial manipulation of the sandbar and/or naturally occurring periods of low winter flows; and

- low densities of juvenile fish affecting subsequent adult populations.

- **Juvenile Steelhead**

Long-term monitoring of the juvenile steelhead population at eleven sites along the mainstem Carmel River below LPD shows that fish density continues to be quite variable both year to year and site to site from less than 0.10 fish-per-foot (fpf) of stream to levels frequently ranging above 1.00 fpf, values that are typical of well-stocked steelhead streams. In this 2016-2017 reporting period, the average population density was much less than the long-term average of 0.71 fpf for the Carmel River, likely due to the recent drought, poor habitat conditions in the lower river, and low numbers of returning adults.

The variability of the juvenile steelhead population in the Carmel River Basin is directly related to the following factors:

<u>Positive Factors</u>:

- General improvements in streamflow patterns, due to favorable natural fluctuations, exemplified by relatively high base-flow conditions between 1995 and 2012 and the very wet conditions in 2017;

- District and SWRCB rules to actively manage the rate and distribution of groundwater extractions and direct surface diversions within the basin, coupled with changes to Cal-Am's operations at LPD, the increased availability of ASR water in the summer, and extensive conservation measures, all help provide increased streamflow below SCD;

- restoration and stabilization of the lower Carmel River's stream banks, providing improved riparian habitat (tree cover/shade along the stream, an increase in woody debris and the associated invertebrate food supply) while preventing erosion of silt/sand from filling gravel beds and pools;

- extensive juvenile steelhead rescues by the District over the last 28 years, now totaling 432,570 fish through 2017;

- rearing and releases of rescued fish from the SHSRF of 97,600 juveniles and smolts back into the river and lagoon over the past 21 years (16 years of operation), at sizes generally larger than the river-reared fish, which in theory should enhance their ocean survival.

Negative Factors:

- variable lagoon conditions, including highly variable water surface elevation changes caused by mechanical breaching, chronic poor water quality (especially in the fall), and predation by birds and striped bass;

- barriers or seasonal impediments to juvenile and smolt emigration, such as intermittent periods of low flow below the Narrows during the normal spring emigration season;

- spring flow variability such as low-flow conditions that could dewater redds prematurely or high flows that could either deposit sediment over redds or completely wash them out;

- occasionally elevated fall temperature and hydrogen sulfide levels below LPD, and the increase in sediment from the SCD removal project;

- the potential for enhanced predation on smolts and YOY migrating through the sediment field above LPD; and

- invasive species: striped bass have recently (2015) started migrating up the river from the lagoon (up to the San Clemente reach in 2017) and are likely preying on juvenile steelhead. New Zealand Mud Snails (NZMS) were first discovered during BMI surveys at Red Rock (mid-valley) in 2016 and now comprise up to 62% of the BMI in the lower river. NZMS out compete native invertebrates and are a poor food item themselves for steelhead.

District staff continues to provide technical expertise and scientific data to CAW engineers and environmental consultants, DWR/DSOD, CDFW, NMFS, U.S. Fish and Wildlife Service, and

others involved in addressing the resource management issues associated with both LPD and the area influenced by the SCD Removal and Carmel River Reroute Project. District staff also continues to provide technical expertise and scientific data to California Department Parks and Recreation, Monterey County Water Resources Agency, Monterey County Public Works Department, California Coastal Commission, U. S. Army Corps of Engineers, Carmel Area Wastewater District, and other regulatory agencies and stakeholders involved in the management of the Carmel River, the Carmel River Lagoon and the barrier beach.

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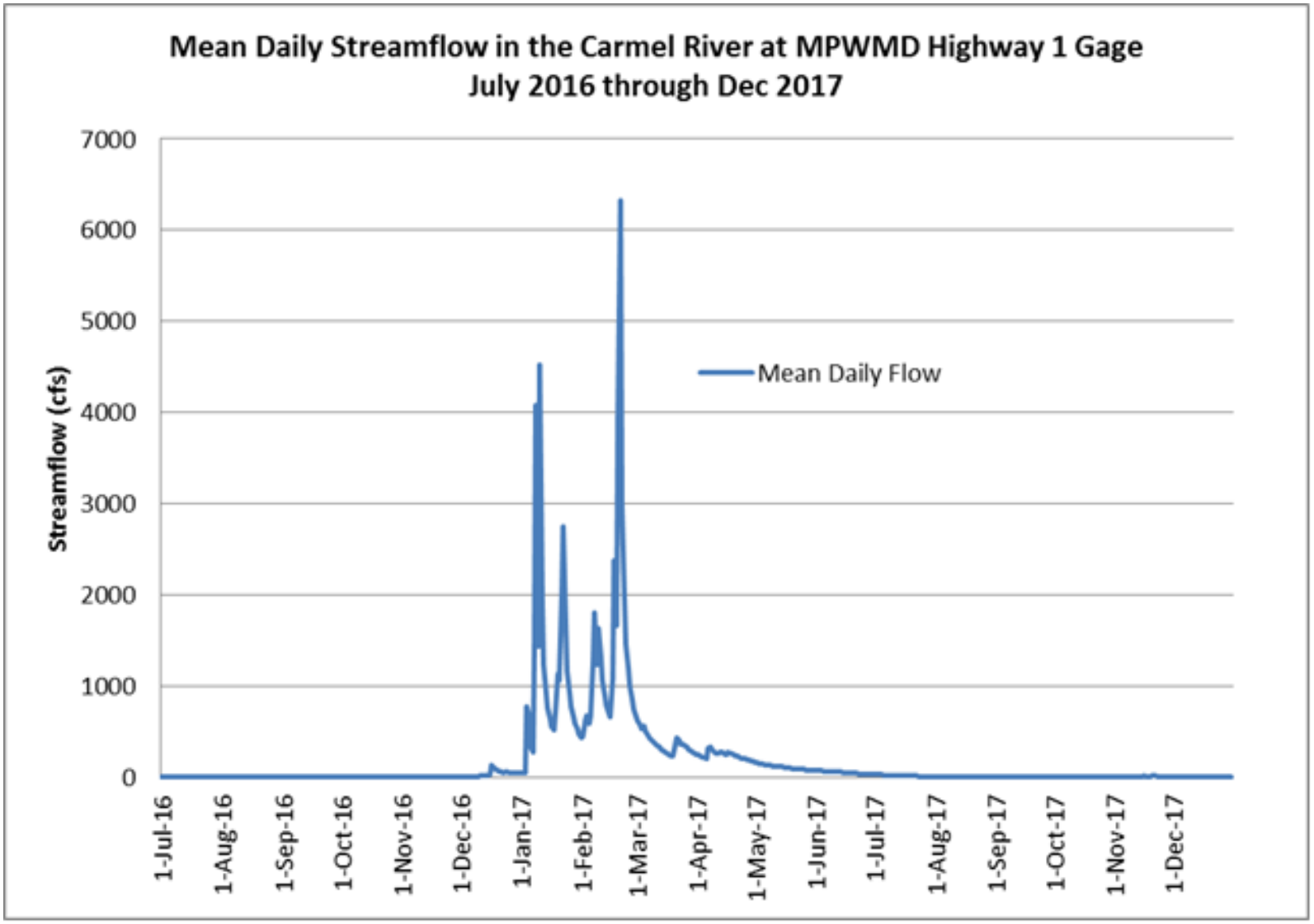
Figure XVI-1


Mean Daily Streamflow in the Carmel River at MPWMD Highway 1 Gage
July 2016 through Dec 2017
Streamflow (cfs)
7000
6000
5000
4000
3000
2000
1000
0
Mean Daily Flow
1-Jul-16
1-Aug-16
1-Sep-16
1-Oct-16
1-Nov-16
1-Dec-16
1-Jan-17
1-Feb-17
1-Mar-17
1-Apr-17
1-May-17
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1-Oct-17
1-Nov-17
1-Dec-17

Figure XVI-2

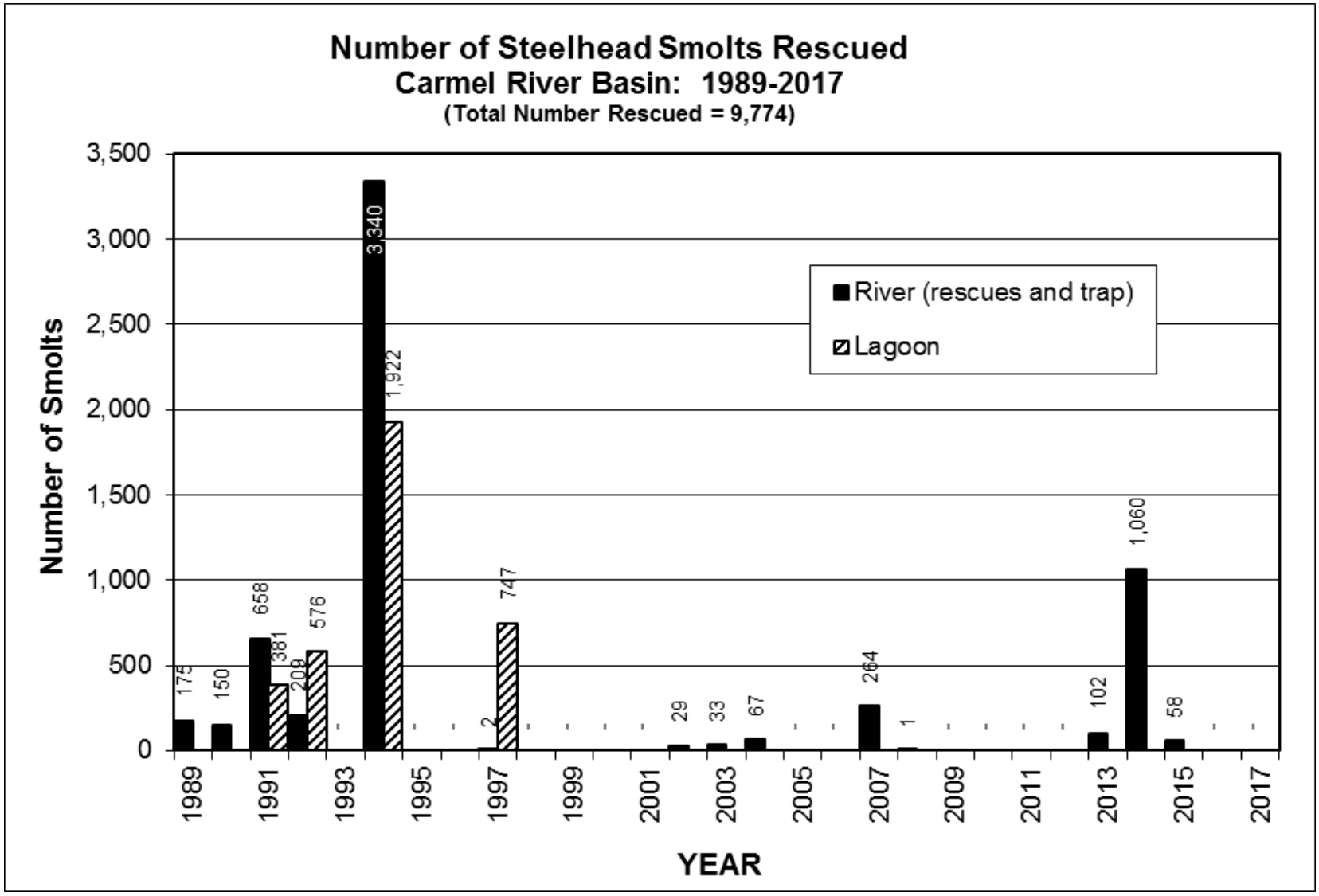

Number of Steelhead Smolts Rescued
Carmel River Basin: 1989-2017
(Total Number Rescued = 9,774)
Number of Smolts
YEAR
River (rescues and trap)
Lagoon
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
175
150
658
381
209
576
3,340
1,922
2
747
29
33
67
264
1
102
1,060
58

Figure XVI-3

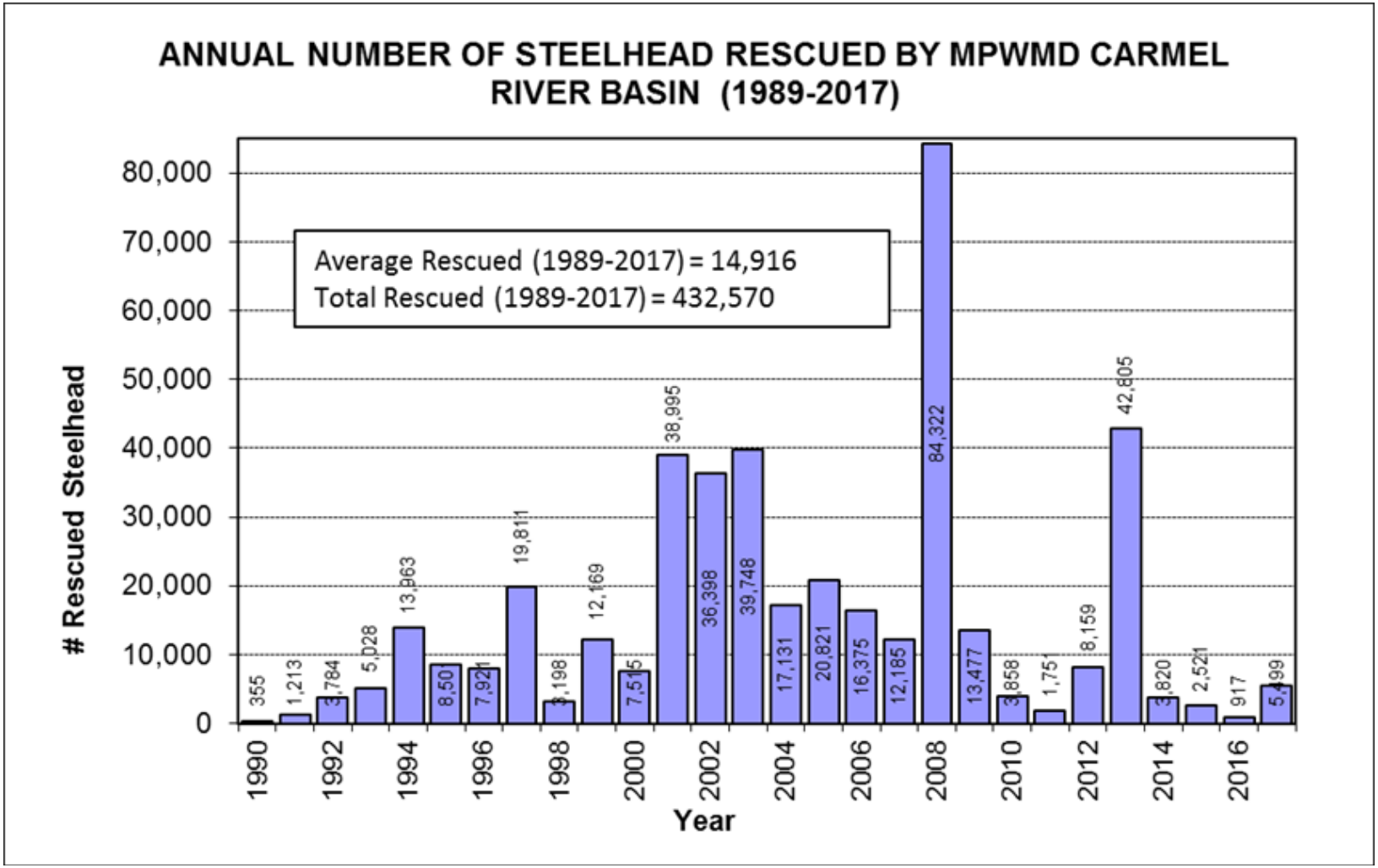

ANNUAL NUMBER OF STEELHEAD RESCUED BY MPWMD CARMEL RIVER BASIN (1989-2017)
Average Rescued (1989-2017) = 14,916
Total Rescued (1989-2017) = 432,570
Rescued Steelhead
Year
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
355
1,213
3,784
5,028
13,963
8,501
7,921
19,811
3,198
12,169
7,515
38,995
36,398
39,748
17,131
20,821
16,375
12,185
84,322
13,477
3,858
1,751
8,159
42,805
3,820
2,521
917
5,499

Figure XVI-4

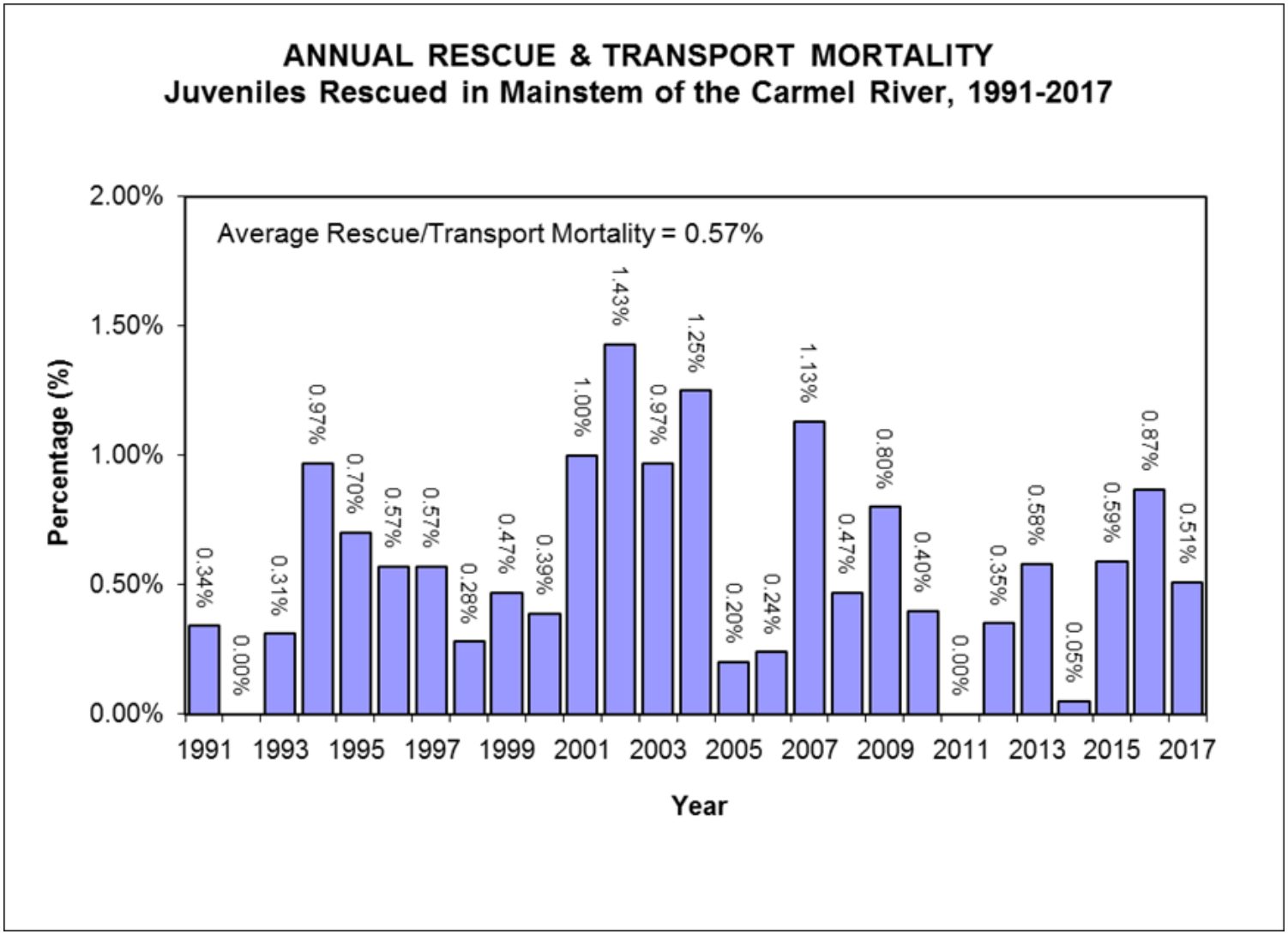

ANNUAL RESCUE & TRANSPORT MORTALITY
Juveniles Rescued in Mainstem of the Carmel River, 1991-2017
Average Rescue/Transport Mortality = 0.57%
Percentage (%)
2.00%
1.50%
1.00%
0.50%
0.00%
0.34%
0.00%
0.31%
0.97%
0.70%
0.57%
0.57%
0.28%
0.47%
0.39%
1.00%
1.43%
0.97%
1.25%
0.20%
0.24%
1.13%
0.47%
0.80%
0.40%
0.00%
0.35%
0.58%
0.05%
0.59%
0.87%
0.51%
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
Year

Figure XVI-5

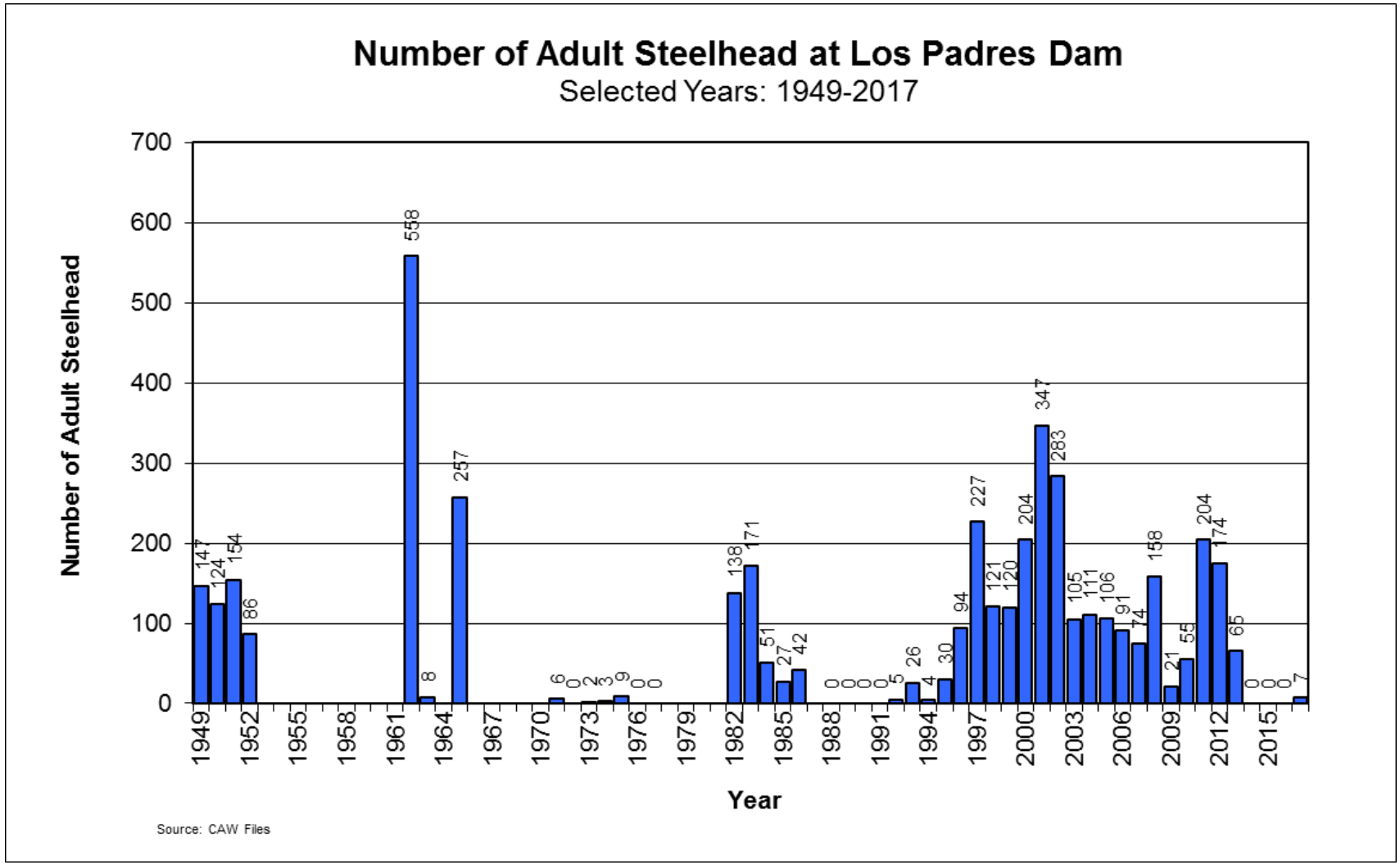

Number of Adult Steelhead at Los Padres Dam
Selected Years: 1949-2017
Number of Adult Steelhead
Year
Source: CAW Files
0
100
200
300
400
500
600
700
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
2012
2015
147
124
154
86
558
8
257
6
0
2
3
9
0
0
138
171
51
27
42
0
0
0
5
26
4
30
94
227
121
120
204
347
283
105
111
106
91
74
158
21
55
204
174
65
0
0
7

Figure XVI-6

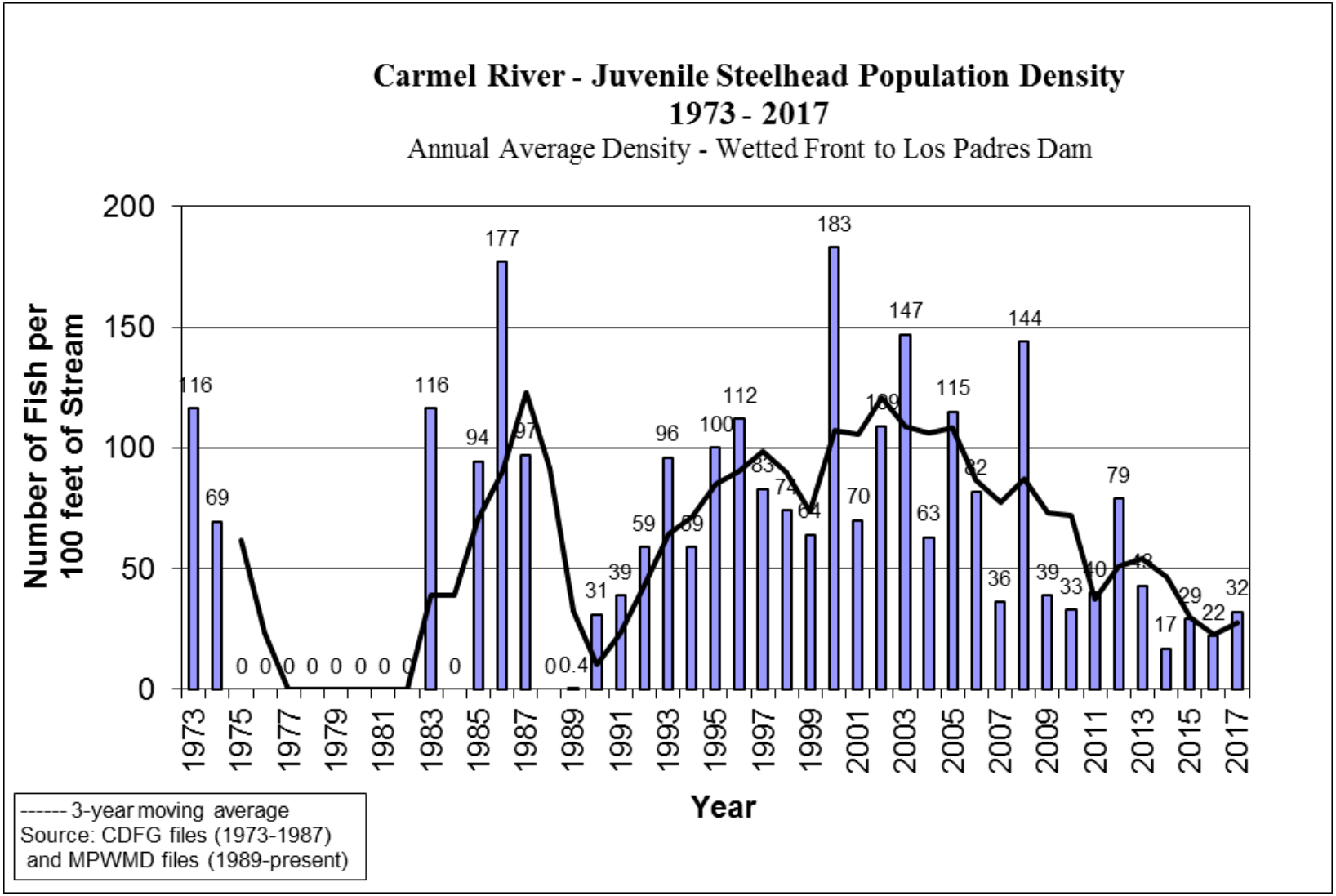
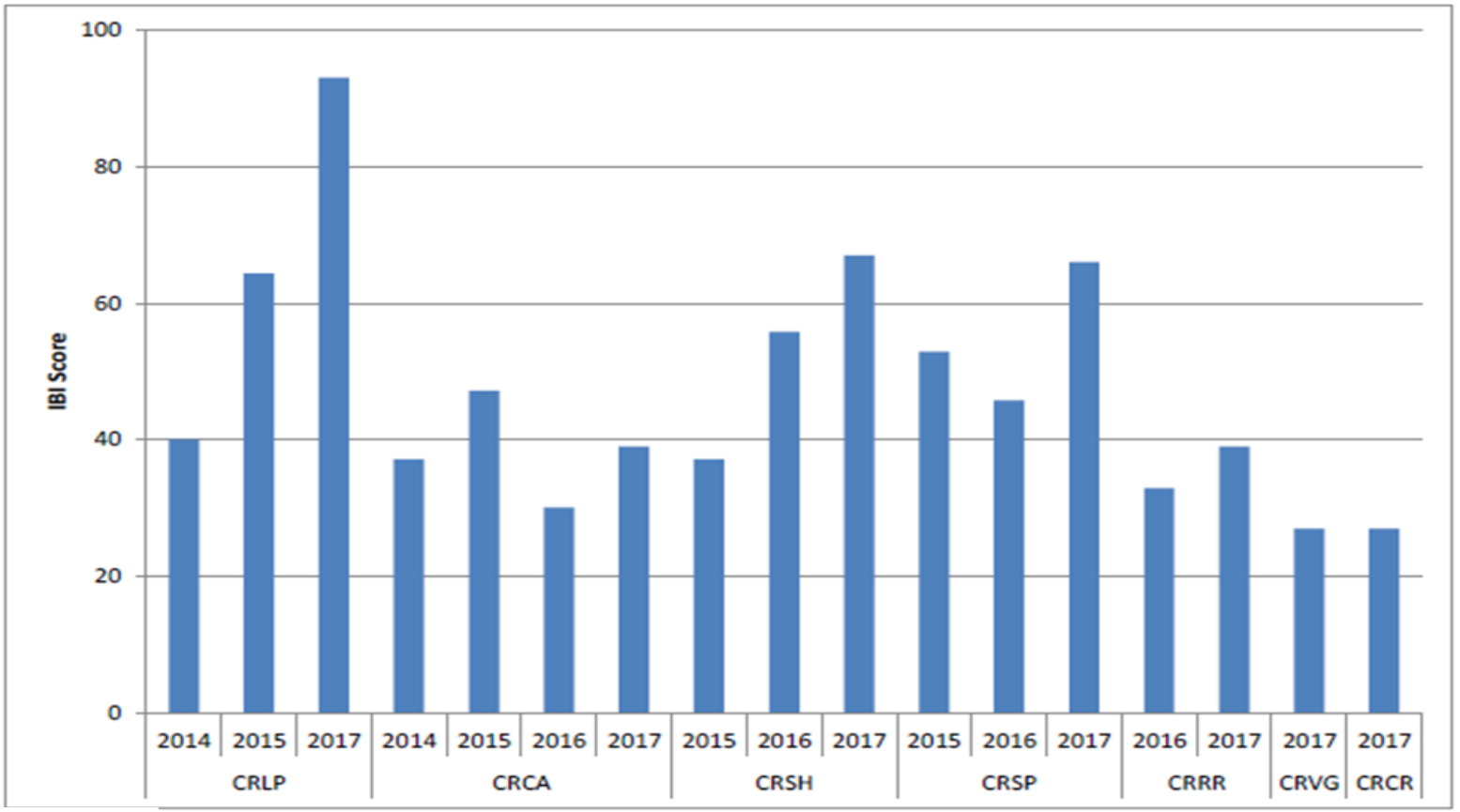

Carmel River - Juvenile Steelhead Population Density
1973 - 2017
Annual Average Density - Wetted Front to Los Padres Dam
Number of Fish per 100 feet of Stream
Year
200
150
100
50
0
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
116
69
0 0 0 0 0 0 0 0 0
116
0
94
177
97
0 0.4
31
39
59
96
69
100
112
83
74
64
183
70
109
147
63
115
82
36
144
39
33
40
79
48
17
29
22
32
------ 3-year moving average
Source: CDFG files (1973-1987)
and MPWMD files (1989-present)

Figure XVI-7



Index of Biotic Integrity scores for Carmel River in 2014 through 2017 at sites where samples were collected using the reach-wide benthic procedure. Scores range from 0 (poor) to 100 (very good).

CRLP – Above LPR; CRCA – Cachagua (below LPD); CRSH – Sleepy Hollow; CRSP –Stonepine, CRRR – Red Rock; CRVG – Valley Greens, CRCR – Cross Roads.

Table XVI-1a

Number of Steelhead Rescued in the Carmel River Watershed by Age Group and General Location, Rescue Years 2016-17.

Age Group	MPWMD 2016 Mainstem	MPWMD 2016 Tributaries	MPWMD 2017 Mainstem	MPWMD 2017 Tributaries
YOY	425	226	0	5,436
1+	239	19	3	32
Smolts	0	0	0	0
Kelt	0	0	0	0
Mortality	6	2	0	28
Totals	**670**	**247**	**3**	**5,496**

Table XVI-1b

Transplant Locations of (non-smolt) Steelhead Rescued in the Carmel River Watershed, Rescue Years 2016-17.

Season	Rescue Location	Release Location	River Mile	Number Released
2016	Mainstem	Sleepy Hollow Steelhead Rearing Facility	17.1	411
2016	Mainstem	Lower Circle Area	15.0	14
2016	Mainstem	Below Los Padres Area	24.8	239
2016	Tributary	Confluence of Hitchcock Creek	14.6	175
2016	Tributary	Confluence of Garzas Creek	12.5	70
2017	Mainstem	Below Los Padres Area	24.8	3
2017	Tributary	Confluence of Potrero Creek	3.9	126
2017	Tributary	Confluence of Robinson Canyon Creek	8.1	434
2017	Tributary	Confluence of Garzas Creek	12.5	1,360
2017	Tributary	Confluence of Hitchcock Creek	14.6	2,618
2017	Tributary	Cachagua Ball Field	23.0	930

NOTE: River miles are approximate.

Table XVI-2

Sleepy Hollow Steelhead Rearing Facility

Fish Rearing Summary: June 13 to Dec 2, 2016

Holding Location	Size/Age	# Stocked	# Morts (see notes)	#Unaccounted for Morts	Total # Released	% Survival	Mortality Notes	Release Location
RC 1	Lg (1+)	45	4	0	41	91.1	jumped out during high turb. event	Below Narrows
RC 2	X-Lg (2+)	18	0	0	18	100		Below Narrows
RC 3	Lg (1+)	49	2	0	47	95.9	trapped in seine net at release	Below Narrows
RC 8/9 combo	Med (Lg YOY)	264	19	0	245	92.8	mostly post tagging morts	Below Narrows
Rearing Channel Overall		**376**	**25**	**0**	**351**	**93.6**		
Quarantine Tanks *		407	6	25				
Facility Overall Survival**		**407**	**31**	**25**	**351**	**86.2%**		
			8%	**6%**				

* All fish were held in QT tanks for up to 2 months during the Garrapata Fire and were PIT tagged before being stocked in RC.

** Includes Quarantine Tank moratilities - 31 morts (25 unaccounted for, 6 deaths)

RC = Rearing Channel bay

Table XVI-3

Carmel River Juvenile Steelhead Annual Population Survey [1]

Lineal Population Density at Survey Stations (numbers per foot of stream) [2, 3]

YEAR	Valley Greens Br. RM 4.8	Red Rock (Mid Valley) RM 7.7	Scarlett Narrows RM 8.7	Garland Park RM 10.8	Boronda RM 12.7	DeDamp Park RM 13.7	Stonepine Resort RM 15.8	Sleepy Hollow RM 17.5	SCR Lower Delta RM 19.0	SCR Upper Delta RM 19.6	Los Compadres RM 20.7	Cachagua RM 24.7	**Overall Annual Average (nos./ft)**	**(nos./mi)**
1990					ND		0.50	0.27			0.26	0.22	**0.31**	**1,650**
1991					0.12		0.74	0.39			0.09	0.62	**0.39**	**2,070**
1992				0.67	0.36		0.96	0.30			0.40	0.83	**0.59**	**3,098**
1993			0.62	0.91	0.92	0.82	0.84	0.52			1.22	1.84	**0.96**	**5,075**
1994		ND	0.44	0.23	0.43	ND	0.50	0.29			1.51	0.71	**0.59**	**3,100**
1995		0.49	0.65	1.01	1.61	ND	1.42	0.69			0.50	1.63	**1.00**	**5,281**
1996		0.24	1.52	0.82	1.05	**2.03**	1.22	0.29			0.95	1.92	**1.12**	**5,890**
1997		0.02	0.22	1.02	1.74	1.15	0.50	0.22			1.15	1.41	**0.83**	**4,359**
1998		0.19	0.30	0.67	0.34	1.50	0.27	0.60			0.54	**2.24**	**0.74**	**3,901**
1999		0.17	0.26	0.50	0.32	0.62	1.67	0.45			0.46	1.35	**0.64**	**3,403**
2000		0.91	1.03	0.64	1.38	**5.66**	1.71	1.46			1.41	**2.30**	**1.83**	**9,680**
2001		ND	0.48	0.35	0.63	0.68	1.08	0.32			0.47	1.62	**0.70**	**3,716**
2002		ND	0.68	0.85	1.67	0.83	1.07	0.50	0.33	0.68	1.52	**2.73**	**1.09**	**5,734**
2003		1.53	0.82	**2.16**	1.86	1.45	1.55	1.23	0.58	1.09	1.69	**2.16**	**1.47**	**7,738**
2004		0.25	0.46	0.78	1.21	0.43	1.24	0.55	0.21	0.41	0.45	0.89	**0.63**	**3,302**
2005		1.23	0.60	1.34	1.16	0.91	1.62	1.63	0.21	0.85	0.98	**2.10**	**1.15**	**6,062**
2006		1.13	0.64	0.86	0.87	0.47	0.37	0.95	1.65	0.28	0.82	1.00	**0.82**	**4,339**
2007		ND	0.15	0.50	0.77	0.06	0.33	0.16	0.36	0.25	0.49	0.50	**0.36**	**1,885**
2008		ND	0.90	**2.61**	**3.64**	1.11	1.19	1.38	0.17	0.71	1.13	1.56	**1.44**	**7,603**
2009		0.24	ND	0.25	ND	0.27	ND	0.48	ND	ND	ND	0.72	**0.39**	**2,070**
2010	0.19	0.06	ND	0.30	0.38	0.17	0.31	0.32	0.26	0.11	0.60	0.78	**0.33**	**1,737**
2011	0.11	0.17	ND	0.36	ND	ND	ND	1.07	ND	ND	ND	0.27	**0.40**	**2,091**
2012	ND	0.67	0.47	1.01	1.58	0.35	0.59	0.37	**1.31**	0.74	0.82	0.83	**0.79**	**4,195**
2013	ND	ND	0.41	ND	ND	ND	ND	ND	ND	ND	0.40	0.48	**0.43**	**2,270**
2014	ND	ND	0.07	0.14	ND	ND	0.18	0.12	ND	0.24	0.30	0.17	**0.17**	**920**
2015	ND	ND	ND	0.10	ND	ND	0.19	0.30	ND	0.30	0.38	0.46	**0.29**	**1,522**
2016	ND	ND	0.07	0.15	0.14	0.19	0.13	0.24	site removed	0.34	0.40	0.31	**0.22**	**1,156**
2017	0.01	0.07	0.41	0.17	0.36	0.20	0.35	0.25		0.24	0.71	0.74	**0.32**	**1,690**
Station Ave (#/ft)	**0.10**	**0.49**	**0.53**	**0.74**	**1.02**	**0.99**	**0.82**	**0.57**	**0.56**	**0.48**	**0.76**	**1.16**	**0.71**	**3,769**
Station Ave (#/mile)	**546**	**2,594**	**2,817**	**3,886**	**5,410**	**5,252**	**4,336**	**3,002**	**2,980**	**2,534**	**3,990**	**6,108**		
Overall Station Averages:													**0.69**	**3,621**

[1] Surveys completed in October and results based on repetitive 3-pass removal method using an electrofisher.

[2] RM; indicates miles from rivermouth

[3] ND indicates stream was dry at sampling station or that site was not sampled that year. Blanks = site not added yet. 2009 - huge storm mid-Oct and river got too high to sample. 2013 - much of river dry. SCR under construction.

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XVII. RIPARIAN HABITAT MITIGATION MEASURES

The Findings of Adoption of the 1990 Water Allocation Program Final EIR identified four mitigation measures to reduce impacts to the Carmel River riparian corridor, which includes wildlife that is dependent on streamside habitat (Finding Nos. 389-A through D, and 391). The measures are: (a) conservation and water-distribution management to retain water in the river; (b) prepare and oversee a Riparian Corridor Management Plan; (c) implement the Riparian Corridor Management Program; and (d) expand the existing monitoring program for soil moisture and vegetative stress.

Since 2007, the Monterey Peninsula Water Management District (MPWMD or District) has been the lead agency in developing and implementing the Integrated Regional Water Management Plan (IRWM Plan) for the Monterey Peninsula region. In 2017, the District reached out for assistance with this effort to the Regional Water Management Group. The Big Sur Land Trust agreed to take the lead in updating the IRWM Plan to 2016 standards and will also facilitate a project solicitation. MPWMD continued to maintain the IRWM web site and also facilitated a grant agreement with the Department of Water Resources for Prop 1 funds for Disadvantaged Communities

The IRWM region consists of coastal watershed areas in Carmel Bay and south Monterey Bay between Pt. Lobos on the south and the Fort Ord Dunes State Park on the north – a 38.3-mile stretch of the Pacific coast. The area encompasses the six Monterey Peninsula cities of Carmel-by-the Sea, Del Rey Oaks, Monterey, Pacific Grove, Sand City, Seaside, and extends into portions of the unincorporated area of Monterey County in the Carmel Highlands, Pebble Beach and the inland areas of Carmel Valley and the Laguna Seca area.

A funds sharing agreement for the Central Coast funding area consisting of coastal watersheds from Santa Cruz County to Santa Barbara County was executed in 2016 that will allow the Monterey Peninsula region to plan for receiving $4.6 million in IRWM grant funding over the next several years. Additional information is contained at the end of this chapter.

A. Conservation and Water Distribution Management to Retain Water in the Carmel River

The purpose of this measure is to reduce pumping impacts on riparian vegetation, particularly in the region of Aquifer Subunit 2 (Scarlett Narrows to Carmel Valley Village). Activities to further this goal during 2016-2017 are summarized above in **Section II** (Hydrologic Monitoring), **Section V** (Annual Low Flow MOA), **Section VI** (Quarterly Budget), and **Section VIII** (Water Efficiency and Conservation).

B. Oversee Riparian Corridor Management Program

Riparian habitat mitigation measures proposed in the Water Allocation Program Final EIR have formed the basis for riparian corridor management activities undertaken since the Board of Directors certified the EIR in November 1990. The Riparian Corridor Management Program (RCMP) integrates the District's many riparian mitigation and management activities into one

program. Components of the RCMP include the Carmel River Erosion Protection and Restoration Program; continued irrigation around Cal-Am production wells in the lower Carmel Valley and around existing District restoration projects; in-channel vegetation management; public education; enforcement of District rules and regulations; and monitoring of wildlife, vegetation and soil.

C. Implement Riparian Corridor Management Program

The goal of the Riparian Corridor Management Program is the rehabilitation, restoration, enhancement and preservation of the streamside corridor along the Carmel River. As described below, several major sub-programs are carried out to achieve this goal.

Implementation and Activities During 2016-2017

During FY 2016-2017, MPWMD accomplished the following:

- continued revegetation efforts at exposed banks with little or no vegetation located in Aquifer Subunits 2 and 3 (Via Mallorca Rd. to Esquiline Rd.);
- operated under a Routine Maintenance Agreement with California Department of Fish and Wildlife and a Regional General Permit with the U.S. Army Corps of Engineers for maintenance activities associated with vegetation encroachment and restoration projects;
- made public presentations showing MPWMD-sponsored restoration work since 1984 and presented recent documentation of Carmel River State Beach, lagoon, and Scenic Road concerns;
- diversified restoration projects and experimented with planting techniques that allow trees to mature more quickly and depend less on irrigation;
- continued long-term monitoring of physical and biological processes along the river in order to evaluate the District's river management activities;
- continued the annual inspections of the Carmel River from the upstream end of the lagoon at River Mile (RM) 0.5 to Camp Steffani at RM 15.5 (staff members responsible for vegetation management and erosion prevention annually walk the entire river to observe and record erosion damage, conditions that could cause erosion [e.g., in-channel vegetation or debris], riparian ordinance infractions, presence of deleterious material, and the overall condition of the riparian corridor);
- carried out vegetation management activities at thirteen sites (Highway One Bridge, Via Mallorca Bridge, Rancho San Carlos Bridge, Valley Greens Bridge, Schulte Bridge, Robinson Canyon Bridge, Randazzo's Bridge, Garland Park, West Garzas, Boronda Bridge, Chalk Rock, Esquiline Bridge, and Ward Bridge);

The following sections describe MPWMD's work in more detail.

● Carmel River Erosion Protection and Restoration

Lower San Carlos Restoration Project: The two-mile reach between the lower end of the Rancho Cañada golf course and Rancho San Carlos Road Bridge has historically been unstable and has eroded at various locations during high flows in 1969, 1978-1983, 1995, 1998, 2006, 2007, 2011,

and 2017. Floodplain development and frequent seasonal Carmel River dewatering are the primary causes of this periodic instability, with continued channel degradation also a factor.

During the spring of 2011, additional erosion of the north streambank occurred immediately downstream of the Rancho San Carlos Road Bridge. MPWMD have subsequently inspected the site annually. High flows in January and February 2017 removed up 50 feet of the left streambank and resulted in the loss of several large cottonwoods and a portion of Santa Barbara sedge, which is used by Native Americans for making basketry. The District retained Balance Hydrologics, Inc. to develop a restoration plan. Construction work in the river is tentatively scheduled for the summer of 2018.

Riparian Ordinance Enforcement Action: MPWMD continues to work with private property owners on how to protect the riparian corridor. Typical actions included helping property owners plant native streamside vegetation on their property to prevent erosion.

Monitoring San Clemente Dam Removal and Carmel River Reroute: MPWMD engaged in efforts with state, local, and federal scientists interested in pre- and post-construction monitoring of the Carmel River. This included providing funding to the School of Natural Sciences at California State University Monterey Bay to carry out topographic, sediment, and large wood survey work.

- **Vegetation Restoration --** Various techniques for vegetation installation were employed at District restoration projects in FY 2016-2017. Planting techniques involved either rooted seedlings or cuttings sustained by irrigation, or deeper plantings set to tap summer groundwater without supplemental water applications. The District continued to diversify streambanks by planting with willows, black cottonwoods, and sycamores.

The primary objectives of the District's restoration planting effort are to stabilize eroded stream banks with native vegetation and to enhance habitat values near the stream, on adjacent floodplains, and terrace areas. One of the goals of the habitat enhancement program is to diversify restoration plantings by identifying microhabitat areas and revegetating them with species typical of those riparian habitat sites. District staff provided riparian plants to several private property owners. Rooted seedlings are obtained from cuttings and seeds collected from along the Carmel River and propagated by a local nursery.

- **Irrigation Program --** Established riparian vegetation has proven to be an effective deterrent to stream erosion; the mat-like roots of most riparian species bind together loose channel banks and foliage tends to slow the velocity of high river flows. The District selectively irrigates mature streamside vegetation and newly established restoration plantings in order to maintain a healthy, vigorous riparian corridor both for erosion protection and habitat enhancement.

Table XVII-1 and **Figure XVII-1** shows water use at various restoration and riparian mitigation sites for calendar year 2017. A total of 8.21 acre-feet (AF) of water were applied in 2017. In calendar year 2016, 7.01 AF were used to irrigate riparian vegetation. The irrigation season typically begins in April and continues through the end of November.

● **Vegetation Management** -- Since Fall 1990, the District has carried out annual vegetation management projects along portions of the Carmel River to reduce potential obstructions to river flow and to reduce the potential for bank erosion. In the past, the District has removed downed trees and vegetation that could deflect high water onto adjacent stream banks, thereby inducing erosion and degrading streamside habitat.

Carmel River Inspection - Annually, staff assesses the lower 15.5 miles from the lagoon to Camp Stephani in order to determine if and where clearing should occur. At sites where debris and/or live vegetation is judged to be a potential hazard, staff balances the goals of conserving aquatic and streamside habitat with reducing the potential for erosion of private and public property and infrastructure. Only woody plant material representing a bank erosion threat is treated by notching or partially cutting through the trunk and large limbs.

During the fall of 2016, thirteen areas with vegetation encroachment, debris piles, and downed trees in the channel bottom were selected for vegetation management:

1. Highway One Bridge Area (encroaching vegetation area approximately 500 ft^2): at River Mile (RM) 1 upstream and downstream of Highway One Bridge willows encroaching into the active channel were trimmed back.

2. Via Mallorca Bridge Area (encroaching vegetation area approximately 200 ft^2): at RM 3.2 upstream and downstream of Via Mallorca Bridge willows encroaching into the active channel were trimmed back.

3. Rancho San Carlos Bridge Area (encroaching vegetation area approximately 100 ft^2): at RM 3.9 upstream and downstream of Rancho San Carlos Bridge willows encroaching into the active channel were trimmed back.

4. Valley Greens Bridge Area (encroaching vegetation area approximately 100 ft^2): at RM 4.8 upstream and downstream of Valley Greens Bridge willows encroaching into the active channel were trimmed back.

5. Schulte Bridge Area (downed trees, debris piles, and encroaching vegetation area approximately 100 ft^2): at RM 6.7 upstream and downstream of Schulte Bridge debris piles have been forced up against vegetation. These debris piles were broken up with hand tools and removed from live vegetation. Some trees were trimmed to allow debris to pass through the constriction. In addition, downed trees in the area had their crown branches removed with the trunks being notched in several places and left in place for large wood habitat.

6. Robinson Canyon Bridge Area (encroaching vegetation area approximately 100 ft^2): at RM 8.5 downstream of Robinson Canyon Bridge willows encroaching into the active channel were trimmed back.

7. **Randazzo's Bridge Area (encroaching vegetation area approximately 100 ft^2):** beginning

at a private bridge known as Randazzo's Bridge at RM 10.1 tree branches encroaching into the active channel were trimmed back.

8. Garland Park Area (debris pile and encroaching vegetation area approximately 100 ft^2): at RM 11.0 encroaching vegetation constricting the channel was trimmed back and a debris pile was be broken up.

9. West Garzas Road Area (encroaching vegetation area approximately 200 ft^2): at RM 12.1 willows encroaching into the active channel were trimmed back and a downed tree was notched.

10. Boronda Bridge Area (downed tree and encroaching vegetation area approximately 200 ft^2): at RM 12.6 downstream of Boronda Road Bridge encroaching willows were trimmed back. In addition, a downed black cottonwood had its crown branches removed with the trunk being notched in serval places.

11. Chalk Rock Area (downed tree and encroaching vegetation area approximately 100 ft^2): at RM 13.5 willows encroaching into the active channel were trimmed back and some debris piles were broken apart. In addition, a large downed western sycamore had its trunk notched in serval places and left in place.

12. Esquiline Bridge Area (downed tree and encroaching vegetation area approximately 200 ft^2): upstream and downstream of Esquiline Bridge at RM 14.5 trees growing on mid-channel gravel bars were trimmed. In addition, a downed black cottonwood had its crown branches removed with the trunk being notched in several places and left in place.

13. Ward Bridge Area (downed trees): upstream of Ward's private bridge at RM 15.0; several large trees have fallen in a section with a split channel. These trunks were cut in several places to allow debris to pass. The large sections of tree trunks were left in place to provide large wood habitat.

In general, a width of up to 30 feet of open channel is desired. A total of approximately 2,000 square feet of stream cover encompassing approximately 0.05 acres in the channel bottom may have been affected by the vegetation removal. In addition, a total of approximately four debris piles were reduced in size by the management actions.

In addition to erosion hazard reduction, vegetation management objectives include removing trash and inorganic debris from the river channel. During FY 2016-2017, trash such as plastic, paper, cans, bottles and car parts were removed from the channel and disposed by the District.

In general, the health of the riparian corridor along the lower 15.5 miles of the river appeared to be good with continued development of naturally recruited species, such as black cottonwoods, willows, and sycamores, on some of the engineered floodplains as well as natural gravel bars. While most of the stream channel remained clear of major obstructions, District staff documented increases in vegetation encroachment into the channel bottom that will likely require continued monitoring and may require vegetation management activities in the future. District staff believes that continued selective removal of encroaching vegetation will be necessary

during the summer of 2018. Without such a program, it is possible that unauthorized vegetation removal by property owners along the river may increase and lead to a decline in the health and stability of the riparian corridor.

- **Public Information and Partnerships**

MPWMD continued its outreach program with presentations to senior environmental science classes from Robert Louis Stevenson, Carmel High School, Carmel Valley Association, and graduate students at California State University Monterey Bay. Topics included information on the Monterey Peninsula Water Resource System, proposed water supply projects within the region, MPWMD's Environmental Protection Program, the Carmel River steelhead life cycle, specific issues related to the Carmel River watershed.

D. Expand Monitoring Programs for Soil Moisture and Vegetative Stress

This mitigation measure involves implementing a groundwater and vegetation monitoring program to better assess plant water stress and related irrigation needs in the riparian zone. Data from soil-moisture and plant water-stress tests facilitate the identification and location of impacts resulting from the prolonged depression or rapid drawdown of the water table. Soil and plant monitoring also documents the beneficial results of riparian mitigations, and provides a statistical foundation for determining trends in conditions over time.

In calendar year 2017, staff collected bi-monthly canopy ratings of individual trees at four study sites in mid and lower Carmel Valley (Rancho Cañada, San Carlos, Schulte Restoration Project, and the Valley Hills Restoration Project). Canopy ratings are used to determine the amount of defoliation that is occurring in riparian trees due to moisture stress associated with a falling water table. **Figure XVII-2** shows average canopy ratings for both willows and cottonwoods. Results showed that willows and cottonwoods were healthy and vigorous during the summer months because the Carmel River flowed all year long because of high rainfall during the winter months. It should be noted that many trees are irrigated in the vicinity of large production wells to offset impacts associated with water extraction. Monitoring results help District staff determine irrigation requirements for portions of the riparian corridor that are under the influence of groundwater extraction. Photo documentation and measurements of foliage volume occurs in other areas as well, depending on river flow conditions and depth to groundwater.

In addition to vegetation and groundwater monitoring, avian (bird) species diversity monitoring has been carried out annually from 1992 to the summer of 2010 and then on a periodic basis starting in 2015. Data collected by Dr. David Mullen and the BSOL since 1992 compares habitat values at permanent monitoring stations and provides an indication of changing patterns of avian use in District restoration projects. The information collected on avian species diversity has helped document the response of populations to habitat enhancements implemented by the District. Since 1992, the avian monitoring work has shown healthy avian species diversity along river reaches where the District has implemented restoration projects, while diversity-index readings in control sites with established riparian vegetation seem to fluctuate depending on the presence of flow in the river channel, the quality of the habitat, and off site conditions during migration. The avian monitoring program is carried out on a periodic basis because of budget

constraints.

OBSERVED TRENDS, CONCLUSIONS AND/OR RECOMMENDATIONS:

With the exception of the Rancho Cañada to Rancho San Carlos Road Bridge reach, the Carmel River streamside corridor has stabilized in nearly all reaches that were affected by a combination of increased groundwater extraction, extreme drought and flood events that occurred during the 1970s, 1980s and 1990s. Prior to the 2016-17 winter high flows, a complex channel had developed in the lower 16 miles of the river with improved steelhead spawning substrate, diverse habitat, and a richer riparian community. Areas with perennial or near perennial flow (upstream of Schulte Bridge) or a high groundwater table, such as downstream of Highway 1, experienced vigorous natural recruitment in the channel bottom, which has helped to stabilize streambanks and diversify aquatic habitat. Areas that continue to be dewatered annually have less significant growth.

In areas with perennial flow, natural recruitment has led to vegetation encroachment that, in some areas, may constrict high flows and threaten bank stability. MPWMD continues to monitor these areas closely and to develop a management strategy to balance protection of native habitat with the need to reduce erosion potential. Environmental review of proposed projects and the process of securing permits is quite complex and requires an exhaustive review of potential impacts.

The Soberanes fire in the summer of 2016 combined with the removal of San Clemente Dam and high flows in the winter of 2016-17 proved to be a combination of events that significantly changed the river downstream of the former dam site. Quantities of silt, sand, and debris that had not been seen in the alluvial reach since high flows in 1998 were carried down from the fire-scarred upper watershed into the active channel. Past similar events during 1978-1983 and 1993-1998 contributed to substantial destabilization of streambanks in the lower 15.5 miles of the river; however, the 2016-17 event comes after significant reductions in annual diversions have been made and after long reaches of the river have been actively restored or passively recovered. Thus streambank instability was limited to the area downstream of Rancho San Carlos Road.

The recovery of streamside areas subjected to annual dewatering requires monitoring. Plant stress in the late summer and fall is evident in portions of the river that go dry. In these areas, streambanks can exhibit unstable characteristics during high flows, such as sudden bank collapse, because of the lack of healthy vegetation that would ordinarily provide stability. The drought that began with Water Year 2013 (beginning October 2012) and ended in Water Year 2016 is an ongoing concern because of the past history of channel erosion and bank instability after severe droughts in 1976-77 and 1987-1991. Impacts to streamside vegetation can manifest themselves for several years even after the end of a drought.

Based on annual cross-section work by CSUMB, several areas have experienced a filling in of pools with sand. Absent high flows like those that occurred in 2017, it is likely that he sand will be winnowed out and sent downstream over the next several years. When river flows drop in late spring or early summer of 2018, District staff will investigate the overall scour and

deposition of the streambed and report on this in next year's mitigation report.

Restoration project areas sponsored by MPWMD since 1984 continue to mature and exhibit more features of relatively undisturbed reaches, such as plant diversity and vigor, complex floodplain topography, and a variety of in-channel features such as large wood, extensive vegetative cover, pools, riffles, and cut banks.

As cited in previous reports, the most significant trends continue to include the following:

- increased encroachment of vegetation into the active channel bottom that can induce debris blockage, bank erosion and increased risks during floods,
- effects to areas with groundwater extraction downstream of Schulte Road,
- channel changes and erosion due to new supply of sediment from upstream associated with high flows, San Clemente Dam removal, and the Soberanes Fire in Water Year 2017,
- healthy avian species diversity, and
- maturing of previous restoration projects.

Carmel River Erosion Protection and Restoration

With the exception of the channel area between the Via Mallorca Road bridge and the Rancho San Carlos Road bridge, streambanks in the main stem appear to be relatively stable during average water years with "frequent flow" storm events (flows with a return magnitude of less than five years). The program begun by MPWMD in 1984 (and later subsumed into the Mitigation Program) to stabilize streambanks appears to be achieving the goals that were initially set out, i.e., to reduce bank erosion during high flow events up to a 10-year return flow, restore vegetation along the streamside, and improve fisheries habitat.

Consistent with previous reports, it is likely that the following trends will continue:

- Local, State and Federal agencies consider the Carmel River watershed to be a high priority area for restoration, as evidenced by the interest in addressing water supply issues, the removal of San Clemente Dam, proposed projects in the lower Carmel River, and continued oversight with the management of threatened species. Stringent avoidance and mitigation requirements will continue to be placed on activities that could have negative impacts on sensitive aquatic species or their habitats.
- Activities that interrupt or curtail natural stream functions, such as lining streambanks with riprap, have come under increasing scrutiny and now require significant mitigation offsets. Approximately 35% to 40% of the streambanks downstream of Carmel Valley Village have been altered or hardened since the late 1950s. Activities that increase the amount of habitat or restore natural stream functions are more likely to be approved or funded through State and Federal grant programs.
- Additional work to add instream features (such as large logs for steelhead refuge or backwater channel areas for frogs) can restore and diversify aquatic habitat.
- Major restoration projects completed between 1987 and 1999 have had extensive and successful work to diversify plantings. However, maintenance of irrigation systems is

ongoing and requires extensive work in water years classified as below normal, dry and critically dry.

- The channel will change due to a new supply of sediment coming from upstream of the old San Clemente Dam and additional sources of sediment associated with the Soberanes Fire of 2016.

In the spring of 2011, the river migrated into the north streambank downstream of the Rancho San Carlos Road Bridge (see **Figure XVII-3**). In the winter of 2017, during a series of high flows, erosion started taking place on the south side of the river. This reach has become unstable and the District is proposing a restoration project that would stabilize the streambanks in the summer of 2018. If no work to stabilize the streambank is carried out, it is likely that the river will continue to erode property along the southern and northern streambanks and there will be additional loss of mature riparian forest.

Eventually, without corrective measures to balance the sediment load with the flow of water or to mitigate for the effect of the downcutting, streambanks will begin to collapse and the integrity of bridges and other infrastructure in the active channel of the river may be threatened.

Vegetation Restoration and Irrigation

To the maximum extent possible, MPWMD-sponsored river restoration projects incorporate a functional floodplain that is intended to be inundated in relatively frequent storm events (those expected every 1-2 years). For example, low benches at the Red Rock and All Saints Projects have served as natural recruitment areas and are currently being colonized by black cottonwoods, sycamores and willows. In addition, willow and cottonwood pole plantings in these areas were installed with a backhoe, which allows them to tap into the water table. These techniques have been successful and have reduced the need for supplemental irrigation.

Channel Vegetation Management

Another notable trend relating to the District's vegetation management program was the widening of the channel after floods in 1995 and 1998. With relatively normal years following these floods, the channel has narrowed as vegetation recruits on the channel bottom and gravel bars. Current Federal regulations such as the Endangered Species Act (ESA) "Section 4(d)" rules promulgated by NOAA Fisheries to protect steelhead significantly restrict vegetation management activities. Because of these restrictions, the District can carry out activities only on the most critical channel restrictions and erosion hazards in the lower 15 miles of the river. In the absence of high winter flows capable of scouring vegetation out of the channel bottom, encroaching vegetation may significantly restrict the channel. As vegetation in the river channel matures in the channel bottom, more conflicts are likely to arise between preserving habitat and reducing the potential for property damage during high flows. MPWMD will continue to balance the need to treat erosion hazards in the river yet maintain features that contribute to aquatic habitat quality.

Permits for Channel Restoration and Vegetation Management

In 2012, MPWMD renewed its long-term permits with the U.S. Army Corps of Engineers and the California Regional Water Quality Control Board for routine maintenance and restoration work. In 2014, the District also renewed a long-term Routine Maintenance Agreement (RMA) with the California Department of Fish and Wildlife to conduct regular maintenance and restoration activities in the Carmel River.

Monitoring Program

Vegetative moisture stress fluctuates depending on the rainfall, proximate stream flow, depth to groundwater, and average daily temperatures, and tends to be much lower in above-normal rainfall years. Typical trends for a single season start with little to no vegetative moisture stress in the spring, when the soil is moist and the river is flowing. As the river begins to dry up in lower Carmel Valley (normally around June) and temperatures begin to increase, an overall increase in vegetative moisture stress occurs. For much of the riparian corridor in the lower seven miles of the Carmel River, this stress has been mitigated by supplemental irrigation, thereby preventing the die off of large areas of riparian habitat. However, many recruiting trees experience high levels of stress or mortality in areas difficult to irrigate. Riparian vegetation exposed to rapid or substantial lowering of groundwater levels (i.e., below the root zones of the plants) will continue to require monitoring and irrigation during the dry season.

With respect to riparian songbird diversity, populations dropped after major floods in 1995 and 1998 because of the loss of streamside habitat. Since 1998, species diversity recovered and now fluctuates depending on habitat conditions. Values indicate that the District mitigation program is preserving and improving riparian habitat.

Strategies for the future

A comprehensive long-term solution to overall environmental degradation requires a significant increase in dry-season water flows in the lower river, a reversal of the incision process, and reestablishment of a natural meander pattern. Of these, MPWMD has made progress on increasing summer low flows and groundwater levels by aggressively pursuing a water conservation program, implementing the first and second phases of the Seaside Groundwater Basin Aquifer Storage and Recovery Project, and recommending an increase in summer releases from Los Padres Reservoir.

Reversal, or at least a slowing, of channel incision may be possible if the supply of sediment is brought into better balance with the sediment transport forces. Additional sediment from the tributary watersheds between San Clemente Dam and Los Padres Dam will pass into the lower river in the foreseeable future now that San Clemente Dam has been removed. District staff are already seeing signs of additional sediment in the Carmel River below Esquiline Road Bridge associated with high flows in Water Year 2017.

Over the long term, an increase in sediment supply could help reduce streambank instability and erosion threats to public and private infrastructure. However, reestablishing a natural supply of

sediment and restoring the natural river meander pattern through the lower 15.5 miles of the Carmel Valley presents significant political, environmental, and fiscal challenges, and is not currently being considered as part of the Mitigation Program.

Integrated Regional Water Management (IRWM) Grant Program

The IRWM program promoted by the California DWR encourages planning and management of water resources on a regional scale and promotes projects that incorporate multiple objectives and strategies. In addition, the IRWM process brings stakeholders together and encourages cooperation among agencies in developing mutually beneficial solutions to resource problems.

MPWMD adopted the 2014 Update to the IRWM Plan for a region encompassing Monterey Peninsula areas within the District boundary, the area in the Carmel River watershed outside of the MPWMD boundary, Carmel Bay and the Southern Monterey Bay. The IRWM Plan combines strategies to improve and manage potable water supply, water conservation, stormwater runoff, floodwaters, wastewater, water recycling, habitat for wildlife, and public recreation.

Funding from the IRWM grant program and other programs requiring an adopted IRWM Plan could provide the incentive to undertake a set of projects that would continue to improve the Carmel River environment and engage a larger number of organizations in helping to develop and implement a comprehensive solution to water resource problems in the planning region. The Monterey Peninsula region is expecting to take advantage of about $4.3 million from Prop 1 IRWM funds over the next several years.

More information about the IRWM Plan and the group of stakeholders in the planning region can be found at the following web site:

http://www.mpirwm.org

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Table XVII-1

Monthly Irrigation Water Use During 2017
(Values in Acre-Feet)

Project Site	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Total
DeDampierre					0.008	0.059	0.086	0.069	0.040	0.031	0.006		**0.299**
Trail and Saddle					0.328	0.471	0.464	0.517	0.397	0.528	0.301	0.429	**3.435**
Begonia					0.030	0.034	0.047	0.033	0.024	0.025	0.015		**0.208**
Reimers					0.158	0.274	0.278	2.905	0.191	0.142	0.074		**4.022**
Schulte Bridge					0.002	0.001	0.001	0.003	0.005	0.009			**0.021**
San Carlos (Dow)					0.024	0.071	0.030	0.063	0.032				**0.220**
TOTAL WATER USE IN ACRE-FEET FOR DISTRICT RESTORATION PROJECTS IN 2017 =													**8.205**

Figure XVII-1

Riparian Irrigation Totals

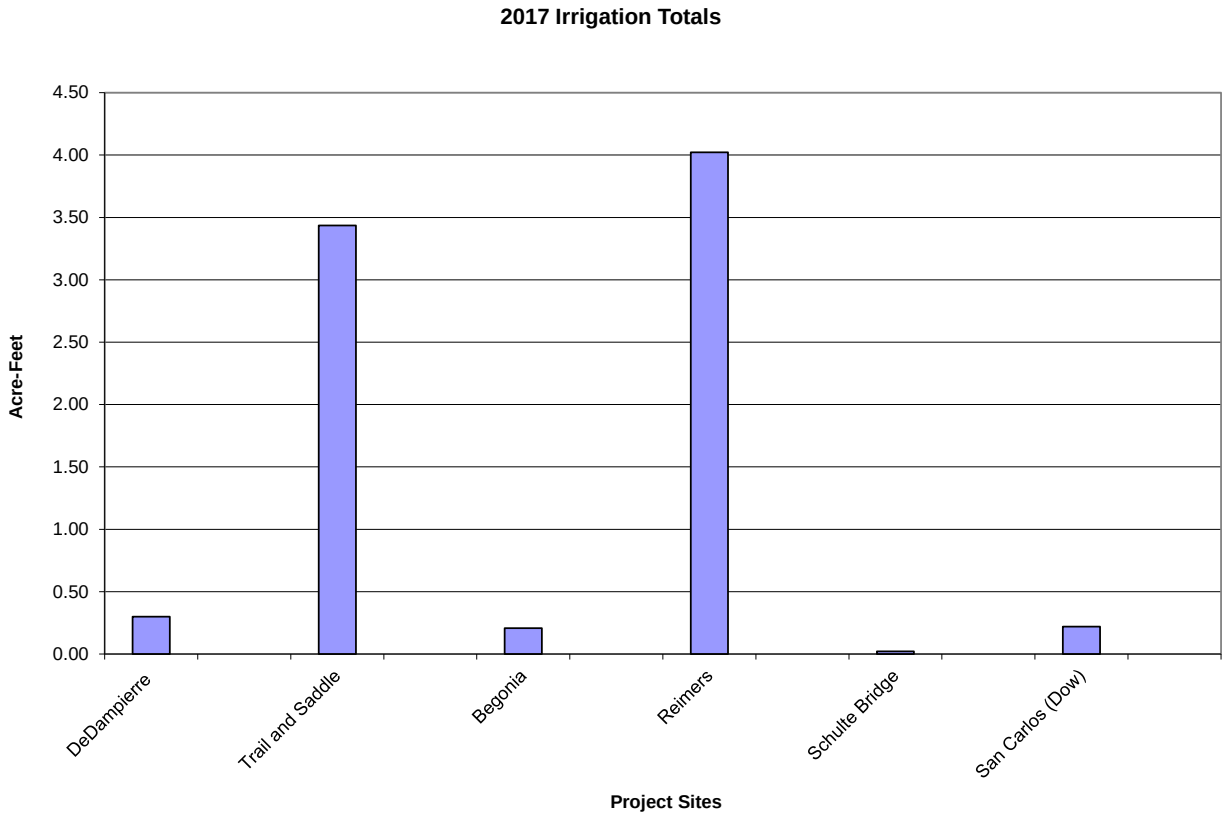
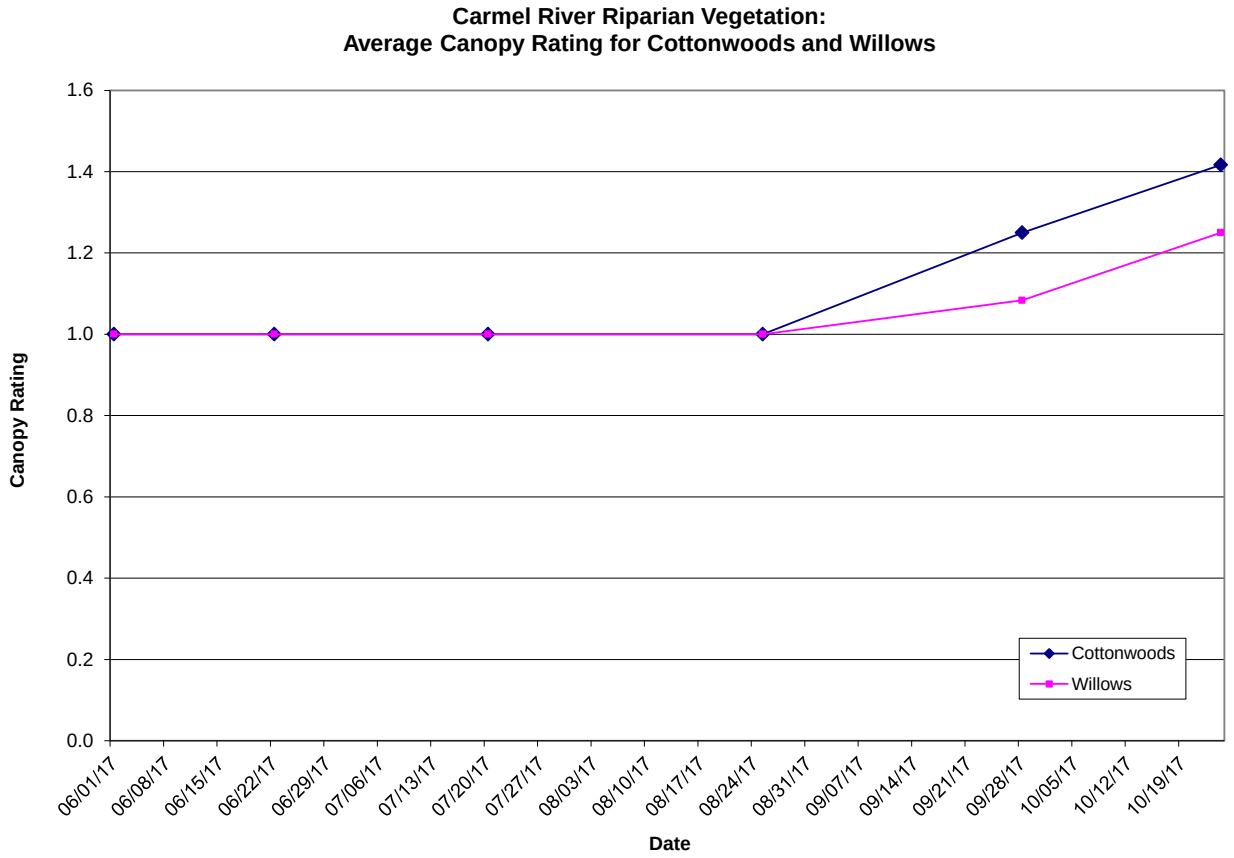


Figure XVII-2

2017 Average Canopy Rating for Cottonwoods and Willows



Canopy Rating Scale		Stress Level
1=	Green, obviously vigorous	none, no irrigation required
2=	Some visible yellowing	low, occasional irrigation required
3=	Leaves mostly yellowing	moderate, regular irrigation required
4=	< 10% Defoliated	moderate, regular irrigation required
5=	Defoliated 10% to 30%	moderate, regular irrigation required
6=	Defoliated 30% to 50%	moderate to high, additional measures required
7=	Defoliated 50% to 70%	high stress, risk of mortality or canopy dieback
8=	Defoliated 70% to 90%	high stress, risk of mortality or canopy dieback
9=	> 90% Defoliated	high stress, risk of mortality or canopy dieback
10=	Dead	consider replanting

Figure XVII-3

Streambank Erosion at Rancho San Carlos Road Bridge, Carmel River
March 30, 2018

Right Bank Looking Downstream

Left Bank Looking Downstream

XVIII. LAGOON HABITAT MITIGATION MEASURES

The Findings for Adoption of the Water Allocation Program Final EIR identified three mitigation measures to reduce impacts to the Carmel River Lagoon, including wildlife that is dependent on it (Finding Nos. 390-A through C, and 392). They include: (a) assist with lagoon enhancement plan investigations, (b) expand long-term monitoring program, and (c) identify feasible alternatives to maintain adequate lagoon volume. This section briefly describes the purpose of these three programs and summarizes the mitigation activities from July 1, 2016 through June 30, 2017.

A. Assist with Lagoon Enhancement Plan Investigations

Description and Purpose

The Monterey Peninsula Water Management District (MPWMD or District), Monterey County Water Resources Agency (MCWRA), California Department of Parks and Recreation (CDPR), and the California Coastal Conservancy (Conservancy) co-funded the Carmel River Lagoon Enhancement Plan, which was prepared by Philip Williams & Associates. A key aspect of the Lagoon Enhancement Plan was to identify alternative means to restore and enhance the lagoon environment. District staff participated on a plan review committee, which met on an as-needed basis, and contributed staff expertise for enhancement plan investigations. District staff reviewed and provided comments on the Draft Lagoon Enhancement Plan document. These comments, as well as comments from other reviewing agencies, were incorporated into the Final Plan dated December 1992.

Implementation and Activities during 2016-2017

During this period, the CDPR continued their native riparian plant re-vegetation efforts at a reduced level within the 100-acre portion of the "Odello West" property that is now part of the Carmel River State Beach. The re-vegetation work is ongoing, though the formal monitoring program and its reporting ended after five years in 2009.

District staff monitored receiving water quality and continued to provide expertise to representatives from numerous state, federal and local agencies, as well as members of the public. The lagoon water-quality data for both surface and subsurface profiles are presented in Section III. During many months in the summer and fall, there is usually no natural surface flow to the lagoon, and the lagoon has historically experienced poor water quality and low water levels that could contribute to poor growth or fish mortality.

For the second year in a row, no water was pumped from either the CDPR "Cal-Trans" well or the CDPR "Highway 1" well. No water was applied to CDPR riparian restoration areas adjacent to the south arm of the lagoon during this period or the previous RY. No water was added into the South arm of the Lagoon during the last two RYs.

During April of RY 2014-2015, the District began to report and graph lagoon levels in both NGVD 1929 and the newer sea level topographic datum, NAVD 1988, that was adopted by the

USGS in 1991. Most government agencies are shifting to the use of this newer datum. Lagoon elevation summaries starting this RY will be given in NAVD 1988. The difference between these older and newer sea level datums at this location along the California coast is +2.74 feet.

District staff did not provide any ongoing support to the Carmel River Lagoon Technical Advisory Committee (CRL-TAC) in this RY, regarding Monterey County Resource Management Agency (MC-RMA), Public Works (RMA-PW) management of the sandbar that forms each year between the lagoon and the ocean. The CRL-TAC remains operational in concept, but no further meetings were held during the last six RYs. Lagoon water levels can fall to less than five feet elevation (NAVD 1988, measured in the south arm) when the beach breaches in the middle. NMFS and CDFW have indicated that an elevation from four to ten feet at NGVD 1929 (equivalent to approximately seven to thirteen feet at NAVD 1988), depending on the time of year and life cycle needs of steelhead, would be an optimal management target to benefit steelhead rearing.

The lagoon was last connected to the ocean on a continuous basis last RY on June 13-14, 2016, when RMA-PW closed it mechanically. Lagoon elevations remained above the minimum target of 6.74 feet only through July 15, 2016. Lagoon levels never got lower than approximately 5.75 feet throughout the summer and fall of 2016. Wave over-wash events raised lagoon levels multiple times between September 19, 2016, and November 26, 2016, usually by less than one foot each time, except for an approximately 2.5 foot increase between October 10-16, 2016. Lagoon elevation peaked multiple tines throughout November to nearly 8.75 feet. The onset of winter flow that reconnected the lagoon to the river began to raise lagoon elevations to 14 feet between December 10-19, 2016. RMA-PW did not take any action to manage the lagoon in winter 2016. They sandbagged neighborhood homes, and utilized temporary portable pumps to disperse accumulating rainwater over the berms and into the lagoon. Lagoon levels rose naturally and water entered the remnant outlet channel from the prior season to initiate an unassited breach on December 19, 2016. During the remainder of RY 2016-2017 until final unaided closure of the lagoon during the following RY on July 14, 2017, the lagoon's water volume varied from approximately 3.7 to occasionally as high as 10.5 to approximately 12.9 feet. The lagoon was open to the sea over 96% of the time on 188 days of the 195-day period, between December 19, 2016 through the end of the RY on June 31, 2017. Note that the lagoon remained open at the end of this RY.

The lagoon was closed on less than 4% of the days in this RY, due to the very wet winter and spring that resulted in an Extremely Wet Water Year Type. Flow past the Highway 1 Gage to the lagoon ceased on July 13, 2016. The first rains of the year finally pushed flow back to Highway 1 Gage on December 9, and the lagoon opened on December 19, 2016. The first large winter storms of the RY occurred in January and February reaching a peak mean daily flow of 6,320 cfs on February 21, 2017. Flows declined through the next significant storm on March 21, 2017, and flows were boosted again by a two-day storm on the April 7-8, 2017. River flows steadily declined from there to 31 cfs at the end of the RY on June 30, 2017. Thus flows during this current RY occurred for a total of 219 consecutive days (60% of the time) past Highway 1 and into the lagoon.

The District continues to seek another participating agency to take over leadership of the CRL-

TAC and chair the meetings, but the District will continue to provide the same level of staff support. The CRL-TAC meets as needed concerning management of the Carmel River lagoon and beach. As described above, the CRL-TAC did not meet during the last five RYs. The District is no longer actively pursuing funding to implement *Final Study Plan for the Long-Term Adaptive Management of the Carmel River State Beach and Lagoon* (April 17, 2007), as no applicable source of funding was secured during the prior three RYs. The District is instead supporting analysis, permitting, and development of the Ecosystem Protective Barrier Project being advocated by the Carmel River Watershed Conservancy (CRWC) and pursued with grant funding acquired by the CRWC and provided to MC-RMA.

During the 2008-2009 RY, CDPR finalized its *Mitigated Negative Declaration for the Carmel River Lagoon Water Elevation Adaptive Management*, and acquired separate State and Federal permits for the closure of the lagoon in the spring to maximize habitat volume. However, due to State budgetary constraints, CDPR is no longer able to implement the permitted actions, and has not for the last seven RYs. CDPR continues to recommend that another agency with appropriate jurisdiction and funding take over the lagoon closure process, and the MC-RMA/RMA-PW have in effect informally done so in some years since 2011.

The MC-RMA is the parent county agency for RMA-PW. MC-RMA is now pursuing separate long-term State and Federal permit applications for lagoon breaching by RMA-PW. This is the sixth RY where MC-RMA and RMA-PW had most of the permits necessary for all their actions.

B. Expand Long-Term Monitoring Program

Description and Purpose

Long-term monitoring of the lagoon and its associated plant communities provides data that can be used to evaluate the wetlands' response to groundwater pumping. The purpose of the monitoring is to: (1) determine if changes in hydrology or plant species distribution and coverage are occurring due to the removal of groundwater upstream, and (2) implement additional mitigations if pumping-induced changes to hydrologic characteristics or vegetation are identified. The Mitigation Program calls for extensive studies such as vegetation mapping and soil surveys to occur every five years. In practice, lagoon vegetation has been monitored annually from 1995 through 2005, and nearly every other year thereafter, except 2011 when lagoon water levels were too high in summer to do so. This monitoring resumed in 2012. Saturation-paste conductivity of soils in the vicinity of the vegetation-monitoring stations was measured annually from 1995 through 2004. Wildlife surveys have not been conducted since 2010. Bathymetric surveys continue to be conducted each year.

Implementation and Activities during 2016-2017

The District has historically conducted three types of long-term lagoon monitoring activities, only two of which were completed this RY:

- Vegetation Surveys
- Topographic Surveys and hydrology

- Wildlife Surveys [last completed in 2015]

● **Vegetation Monitoring –** The same monitoring stations that were established in 1995 were sampled annually between 1995 and 2005, and then every other year until 2009, as the Allocation EIR only called for this monitoring to occur every two years. In July and August of 2011 the water level in the lagoon were too high to monitor the stations, except for very brief intermittent periods early in July. Therefore, vegetation monitoring did not occur in 2010 or 2011, but resumed in July 2012 and August 2014. In July and August of 2016, water levels were again too high to monitor the stations early in July, and the air quality was so bad the days that the monitoring was scheduled to occur due to the Sobranes wildfire in the Santa Lucia Mountains that staff made a decision to postpone the event till 2017. Vegetation and soil monitoring resumed in July 2017.

The report, *Biologic Assessment of the Carmel River Lagoon Wetlands*, prepared for the District by the Habitat Restoration Group in 1995, provides a detailed description of the methodology employed. Ten pairs of quadrats were intentionally located along transects at lower elevations of the wetlands because it is anticipated that changes in the vegetative community would first become apparent in these habitat types. The north side was emphasized because of disturbances on the south side associated with the creation of the Cal-Trans Carmel River Mitigation Bank and subsequent restoration of the former Odello artichoke field.

No dramatic changes in vegetation were observed between the summers of 1995 and 2009, although the drier conditions experienced from Water Year 2012 through 2016 have produced a different gestalt in portions of the wetlands. Water Year 2017 was characterized as Extremely Wet, and some changes were observed during the July 2017 sampling, as one would expect, such as a reduction in overall species diversity. Subtle differences in vegetative cover between years may be explained by slightly different sampling dates each year, made necessary by variations in the hydrologic regime from one year to the next, rendering some low-lying quadrats inaccessible until later in the season. The timing, magnitude and direction of wave action, runoff, and breaching of the sand bar at the mouth of the lagoon affect the duration of standing water in some of the lower-lying monitoring sites. The diversity and abundance of forbs in some lower lying quadrats and transects noticeably dropped from 2009 to 2014, while more salt-tolerant species such as salt-grass appear to becoming more dominant. However, there are exceptions, and it is too early to draw conclusions based on the limited data available. For example, some Obligate Wetland plants have declined along some transects, while increasing along other transects. Emergent species, such as pickleweed and silverweed take a while to appear following extended periods of inundation. They were missing from Transect #1 in 2012, which was monitored less a week after inundation, but showed up again during vegetation monitoring in 2014 at a time when the transects had not been inundated for nearly three months. Pale spikerush, an obligate wetland species categorized as a freshwater marsh plant, dropped out of four quadrats in 2014, but reappeared in one other quadrat where it was missing in 2012. Salt grass, a facultative wetland species characteristic of salt marshes, noticeably spread in three quadrats, decreased in abundance in two others, and completely dropped out of two other quadrats from 2012 to 2014.

A more detailed discussion of the results of past vegetation monitoring is presented in the 2005

Mitigation Program Report. Data gathered thus far suggest that factors favoring freshwater species over salt tolerant species may be occurring. Determining whether changes are attributable to water management practices upstream as opposed to the timing of monitoring, beach breaching, variation in hydrologic regimes or global weather dynamics are more complex questions. Review of the available data has not identified significant changes from one monitoring event to the next. Nor have strong relationships between species composition or distribution and water management practices been identified. Staff anticipates continued monitoring of the wetlands every other year in the future to provide evaluation of long-term trends.

- **Topographic Surveys and Hydrologic Monitoring --** During the period covered in this report, District staff surveyed four cross sections to track the movement of sediment in the lagoon, continued to maintain a water-level recorder and support an Automated Local Evaluation in Real Time (ALERT) station at the south arm, and measured groundwater elevations in three wetland piezometers that were installed in May 1996. There is a good correlation between surface-water elevation and water elevation in the piezometers. Staff also continues to track surface discharge into the lagoon at the Highway 1 gaging station, and water production upstream of the lagoon.

- **Wildlife Monitoring –** Birds are often used as indicators of the suitability of an area for wildlife because they tend to be easier to identify and count than other creatures. By tracking the species diversity index at a specific location over time, scientists are able to infer if changes have occurred that may affect the area's dependent wildlife. In the past, District staff contracted with the Ventana Wilderness Society and Big Sur Ornithology Lab (BSOL) to conduct avian point count surveys in the riparian corridor of the Carmel River at sites from Carmel Valley Village to a point just upstream of the lagoon. The District carried out this program from 1992 through 2010 on a regular basis. However, due to budget constraints, the avian point counts are carried out less frequently, with the last one occurring in 2015.

Avian monitoring specific to the lagoon was last carried out by the District at sites near the lagoon at the mouth of the Carmel River in the summer of 2004. Sampling in the vicinity of the lagoon was subsequently carried out by the CDPR from 2005-2008, when monitoring ceased due to ongoing budget constraints.

<u>Special Studies During 2016-2017</u>

- **Steelhead Population Monitoring**

MPWMD applied for and acquired ESA Section 7 coverage starting in 2009 to conduct a mark-recapture study as part of its semi-annual renewal of staff Scientific Collecting Permits from CDFW. These have been replaced by the agency's triennial "entity" permit good through 2020. No winter or spring/summer 2016-2017 population censuses were conducted this RY due to high lagoon levels prior to breaching that continued through the end of the RY, making it ineffective to seine the lagoon.

C. Identify Feasible Alternatives to Maintain Adequate Lagoon Volume

Description and Purpose

The purpose of this mitigation measure is to determine the volume required to keep the lagoon in a stable condition that can adequately support plants and wildlife. It is envisioned that alternative means to achieve and maintain the desired volume will be compared, and the most cost-effective means selected. One alternative that may achieve these goals is the development of a water supply project that can reliably provide more water to the Monterey Peninsula and result in reduced diversions from the Carmel River; however, few other feasible alternatives have materialized in spite of extensive evaluation. MPWMD staff previously estimated that approximately 8 cfs, or about 16 acre feet per day (AFD), can percolate through the barrier beach when the outlet is closed and lagoon water levels are stable at relatively high elevations (8 – 9 feet). This seepage rate was determined utilizing continuous streamflow data from the Carmel River at Highway 1 Bridge gaging station and the 1997 lagoon stage volume relationship over the 1991-2005 period. However, in May and June 2009, following the manual lagoon mouth closure on May 18, 2009, streamflow and lagoon storage data showed that 12 cfs or 24 AFD percolated through the beach berm and into the surrounding wetlands (based on an updated 2007 lagoon storage table). It is postulated that increased infiltration capacity of the lagoon may be due to a combination of the excavation of an outlet channel to the south, the two South Arm excavations in 2004 and 2007, and that the manual lagoon mouth closure results in a higher water surface elevation than was typical of the 1991-2005 period. A higher water surface elevation likely results in flow through the outlet channel that then percolates into the beach. This volume of water passing through the beach is significant, and is equivalent to about two-thirds of the daily Carmel River diversions historically needed to meet a portion of the municipal demand of the Monterey Peninsula during the summer. No treated water from the CAWD was added to the lagoon in this RY. There were concerns about the effects the recycled CAWD water might have on water quality in the lagoon that might affect both juvenile steelhead and red-legged frog habitat values so the action has ceased until impact evaluations could be completed. Those studies have been suspended indefinitely (see **Section XVIII-A** above). No water from an existing agricultural well was added to the lagoon in this RY. Determination of desirable lagoon volume will be conducted in conjunction with the monitoring studies noted above and the findings of the Lagoon Enhancement Plan. Development of feasible alternative means to provide adequate volume to sustain healthy lagoon habitat throughout the dry season continues to be sought by the District.

Implementation and Activities During 2016-2017

District staff continued the annual survey of four key lagoon cross sections (**Figure XVIII-1**) to track changes in the volume of sand in the active portion of the lagoon over time. An initial survey of the four cross sections was conducted in January 1988. Subsequent annual surveys have been conducted beginning in September 1994 through the present. Sedimentation in the lagoon is a concern because the Carmel River as a whole has taken on an increased load of sand from Tularcitos Creek and other drainages following the El Niño winter of 1998. However, it appears at this time, the majority of the sediment deposited along the Carmel River in 1998 has washed through the Carmel River system and lagoon, and has subsequently reached the ocean.

These four key cross sections provide a quantitative means to evaluate whether or not lagoon volume is changing significantly over time. The dynamic nature of the lagoon substrate is evident in **Figure XVIII-2**, which shows the results of the annual surveys conducted since 1994.

In September 2017, staff completed the annual surveys of cross sections (XS) 1-4. In Water Year 2017, approximately 201,300 acre-feet (AF) of streamflow passed through the lagoon as measured at the District's CR at Highway 1 Bridge (HWY 1) gage, and classified as an "Extremely Wet" year. The highest peak streamflow of WY 2017 was 8,760 cfs on February 21, 2017, recorded at the District's HWY 1 gage. It should be noted that two additional, significant peak flow events of 5,980 cfs and 7,390 cfs occurred on January 9 and January 11, 2017, respectively. Sustained, high streamflow conditions throughout Winter 2017 resulted in significant scour (sand loss) at all four cross sections compared to substrate conditions documented in August 2016 (**Figure XVIII-3**).

Review of the entire cross sectional data set (**Figure XVIII-2**) shows that the September 2017 lagoon substrate elevations for all four cross sections reached an historic low elevation along the south bank of the CR/lagoon. However, north bank substrate elevations have remained relatively stable since 1994. The overall sand loss at the cross sections since 1994, particularly XS 4, is consistent with the steady loss of streambed material in the vicinity of Highway 1 Bridge gaging station (and along reaches for several miles upstream) that has been occurring since 2006, suggesting a limited sand supply in the Lower Carmel River at this time. In addition, it should be noted that at elevation 10-feet (NGVD 1929 datum) the lagoon backwater zone now extends approximately one quarter mile upstream of the Highway 1 Bridge to the eastern margin of the Crossroads Shopping Center as a result of continued down-cutting of the stream channel.

OBSERVED TRENDS, CONCLUSIONS AND/OR RECOMMENDATIONS:

The District continues to support and encourage the ongoing habitat restoration efforts in the wetlands and riparian areas surrounding the Carmel River Lagoon. These efforts are consistent with goals that were identified in the Carmel River Lagoon Enhancement Plan, which was partially funded by the District. The District continues to work with various agencies and landowners to implement ongoing restoration of the Odello West property and future restoration of the Odello East property across the highway. Because of the restoration activities on the south side of the lagoon, the District has concentrated its monitoring efforts on the relatively undisturbed north side. Staff also continue to meet and discuss with other agencies the ongoing use of an existing CDPR agricultural well.

The District expanded its long-term monitoring around the lagoon in 1995 in an attempt to determine if the reduction in freshwater flows due to groundwater pumping upstream might change the size or ecological character of the wetlands. Demonstrable changes have not been identified. Because of the complexity of the estuarine system, a variety of parameters are monitored, including vegetative cover in transects and quadrats, water conductivity, and hydrology. It is notable that due to the number of factors affecting this system, it would be premature to attribute any observed changes solely to groundwater pumping. During the 23-year period to date, for example, there have been three ***Extremely Wet*** (1995, 1998, and 2017), two ***Wet*** (2005, 2006), five ***Above Normal*** (1996, 1997, 2000, 2010, and 2011), five ***Normal*** (1999, 2001, 2003, 2008 and 2009), two ***Below Normal*** (2004 and 2016), four ***Dry*** (2002, 2012, 2013,

and 2015), and two ***Critically Dry*** (2007 and 2014) Water Year types in terms of total annual runoff. Thus, the hydrology of the watershed has been wetter than average 43% of the time, and at least normal or better 65% of the time during that 23 year period. However, monitoring in 2014 occurred during a Critically Dry Water Year that followed two consecutive Dry Water Years, and 2015 was the first time a fourth year of drought was ever monitored. Other natural factors that affect the wetlands include introduction of salt water into the system as waves overtop the sandbar in autumn and winter, tidal fluctuations, and long-term global climatic change. When the District initiated the long-term lagoon monitoring component of the Mitigation Program, it was with the understanding that it would be necessary to gather data for an extended period in order to draw conclusions about well production drawdown effects on wetland dynamics. It is recommended that the current vegetation, conductivity, topographical and wildlife monitoring be continued in order to provide a robust data set for continued analysis of potential changes around the lagoon. During this RY the District budgeted to reactivate the CDPR lagoon water-quality profiler that has been out of service for four years, under an interagency MOU. However, repetitive failures of the vertical profiling controller, rendered the otherwise fully functioning water quality probe effectively useless. The District has budgeted for the replacement of the existing custom built profiler to be replaced with a stock one from Xylem/YSI. We intend to restore continuous data collection at the CAWD pipe site sometime during the next RY, pending acquisition and installation of the new profiling device.

Lagoon bathymetric cross sectional surveys, initially conducted in 1988, have been completed annually during the dry season since 1994. These data are useful in assessing changes in the sand supply within the main body of the lagoon and are necessary to answer to questions concerning whether or not the lagoon is filling up with sand, thus losing valuable habitat. As indicated in the survey plots, the sandy bed of the lagoon can vary significantly from year to year. Significant scour of sand occurred at the cross sections during WY 2017 compared to August 2016 conditions. Since 1994, an apparent trend of overall loss in sand volume appears to be emerging, as south bank substrate elevations are now at an historic low. The sand loss or down-cutting observed at the cross sections is consistent with the pervasive down-cutting that has occurred along the thalweg of the Lower Carmel River (LCR) upstream of the Highway 1 Bridge (HWY 1) for several miles, a trend believed to have begun in WY 2006 based on rating curve analysis at the HWY 1 site as well as physical field observation. In the recent "Critically Dry" years of WY 2007 and 2014 and "Dry" years of WY 2012 and 2013, no significant changes were documented compared to the respective prior years, thus it is concluded that substrate elevations at the cross sections generally do not change in these low-flow years, despite the regular occurrence of major lagoon mouth breaches in all of these years, except WY 2014. The "Extremely Wet" WY 2017 caused dramatic changes (scour) at the cross sections indicating that quantity of streamflow (peak flow and total volume) is likely the primary factor that controls significant substrate changes at the key cross sections.

Figure XVIII-1
Map of Monitoring Transects and Stations at Carmel River Lagoon.

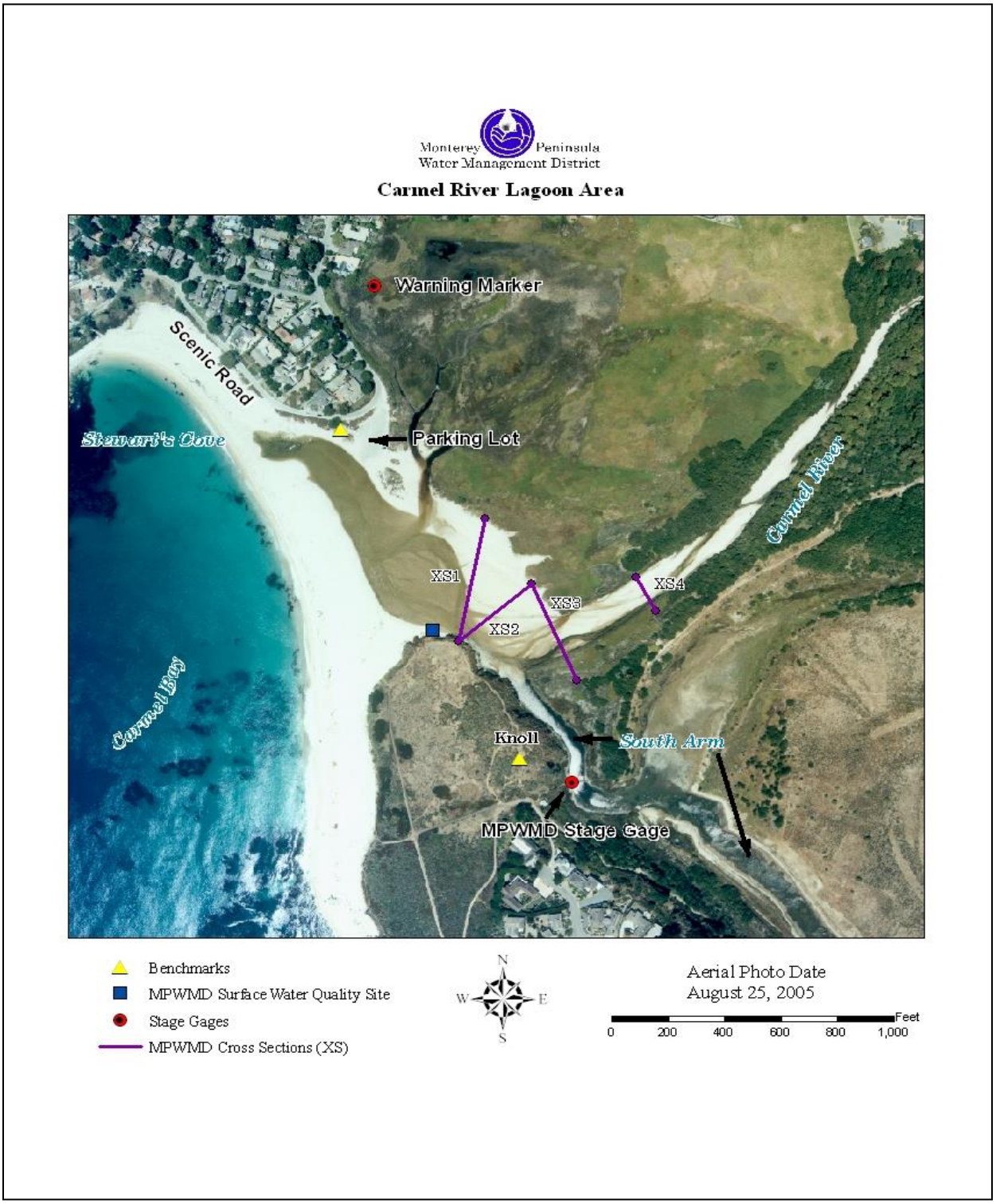


Figure XVIII-2
Carmel River Lagoon Cross Sections 1 through 4, based on Annual Surveys 1994-2017

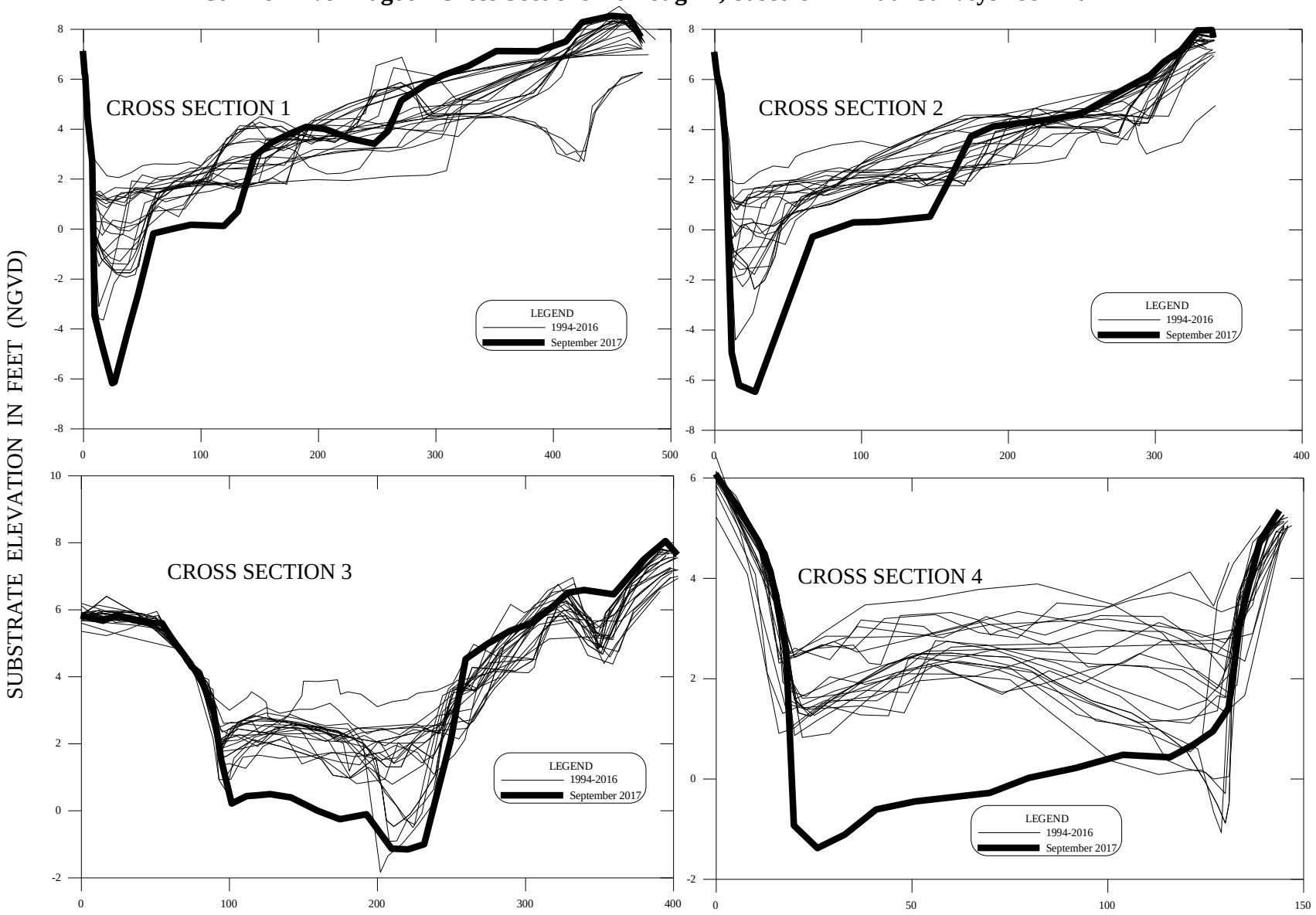
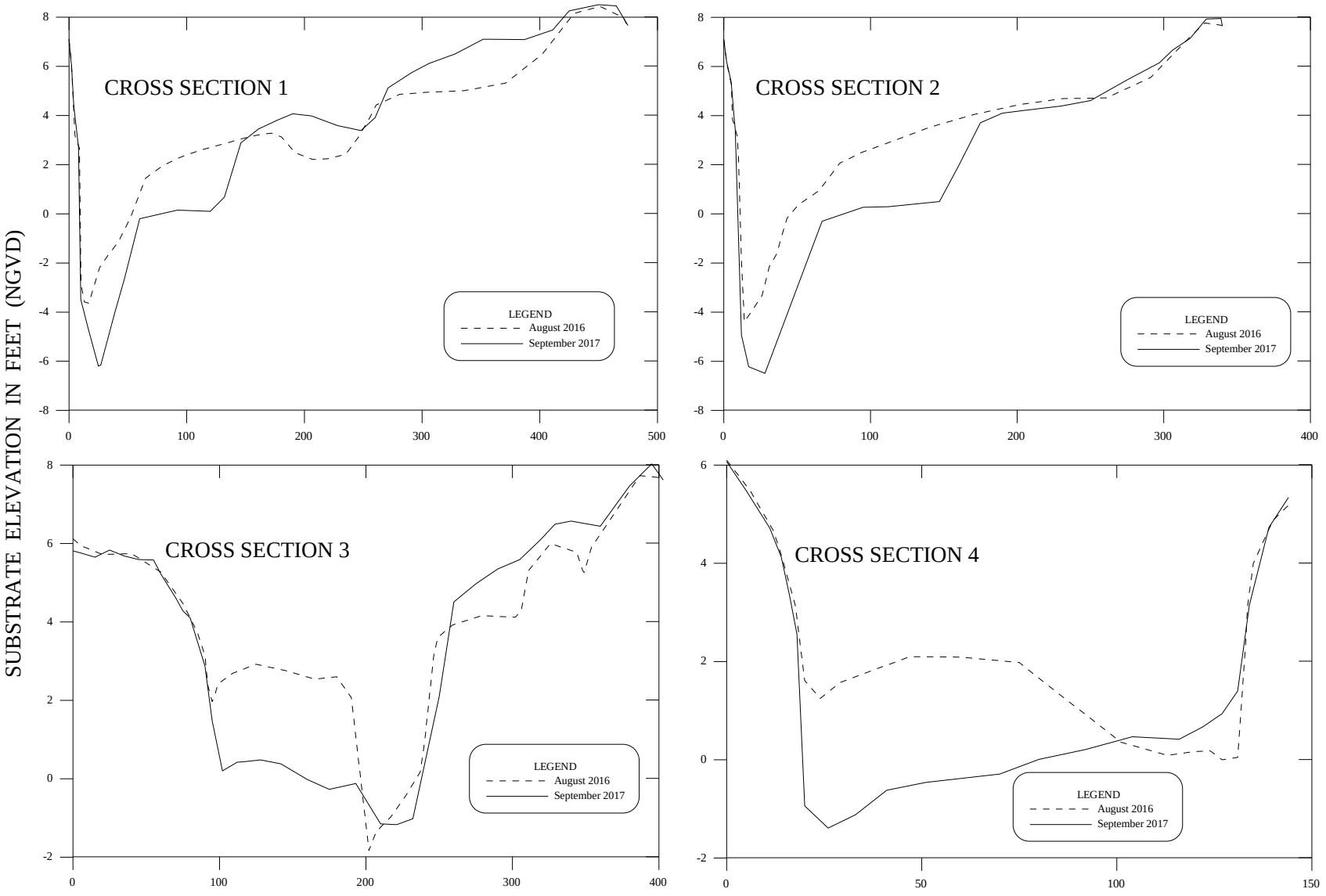


Figure XVIII-3
Carmel River Lagoon Cross Sections 1 through 4, Comparison of 2016 and 2017 Surveys



XIX. AESTHETIC MITIGATION MEASURES

The Findings for Adoption of the Water Allocation Program Final EIR identified one mitigation measure to reduce aesthetic impacts along the Carmel River associated with riparian vegetation – that is, to implement the riparian habitat mitigation measures described above in Finding No. 393. Accordingly, please refer to **Section XVII** for information on riparian mitigation activities during the period from July 2016 through June 2017.

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XX. SUMMARY OF COSTS FOR MITIGATION PROGRAM, JULY 1, 2016 THROUGH JUNE 30, 2017

Mitigation Program costs for FY 2016-2017 totaled approximately $2.17 million including direct personnel expenses, operating costs, project expenditures, capital equipment, and fixed asset purchases (**Table XX-1**). The annual cost of mitigation efforts varies because several mitigation measures are weather dependent. Expenditures in FY 2016-2017 were $0.10 million less than the prior fiscal year due to decreases in Mitigation Program costs. However, the overall costs have remained constant (average of $2.3 million per year) for last five years. In the past, expenditures had trended upward due to expenditures for the Aquifer Storage Recovery (ASR) Project. ASR Project costs are no longer captured under Mitigation Program Costs. FY 2014-2015 expenditures were $2.30 million; and FY 2015-2016 expenditures were $2.27 million.

During FY 2016-2017, revenues totaled $3.15 million including mitigation program revenues, user fees, grant receipts, investment income and miscellaneous revenues. The Mitigation Program Fund Balance as of June 30, 2017 was $2,045,194.

Table XX-1

Mitigation Program Cost Breakdown for the Period July 2016 through June 2017

EXPENDITURES	Data Collection	Riparian	Fish	Lagoon	Water Supply	IRGWMP	Admin	Total
Personnel Costs	$180,052	$213,126	$390,472	$75,649	$216,215	$22,390	$310,146	$1,408,050
Operating Expenses	54,677	64,721	118,577	22,973	65,659	6,799	94,184	427,590
Project Expenses	54,121	45,284	210,598	0	0	3,689	0	313,692
Fixed Asset Acquisitions	1,763	10,629	3,824	741	2,117	219	3,037	22,330
TOTAL EXPENDITURES	**$290,613**	**$333,760**	**$723,470**	**$99,362**	**$283,991**	**$33,098**	**$407,367**	**$2,171,662**

REVENUES	
Permit Fees	$22,957
Mitigation Revenue	2,039,913
User Fees	989,150
Grant Receipts	89,276
Investment Income	5,279
Miscellaneous	4,313
TOTAL REVENUE	**$3,150,888**
REVENUE OVER EXPENDITURES	**$979,226**

XXI. REFERENCES

The following selected references provide additional information about the subjects described in this Annual Report. References are organized by section.

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Section XX. Summary of Costs

(Annual Audit Reports on file at District office)

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