II. MONITOR WATER RESOURCES

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). The District currently maintains precipitation, streamflow, storage, water level, and water quality monitoring programs. These programs and the activities to implement them from July 2005 through June 2006 are summarized below.

A. Precipitation Monitoring

Description and Purpose

During the period from July 1, 2005 through June 30, 2006, the District continued to access long-term precipitation records at Los Padres and San Clemente Dams obtained from California American Water (CAW) and maintained by the District. District staff also records precipitation at its Monterey office located at Ryan Ranch, and receives daily rainfall reports from the National Weather Service Climatological Station, Monterey (maintained by R.J. Renard). In addition, real-time and historical rainfall data for our 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 conditions.

Implementation and Activities During 2005-2006

Work during this period involved continuing maintenance of the existing precipitation monitoring network. A summary of daily precipitation at San Clemente Dam during Water Year (WY) 2006 (defined as October 1, 2005 through September 30, 2006) is shown in **Figure II-1**. In WY 2006, 28.03 inches of precipitation were recorded at San Clemente Dam. The average annual recorded precipitation at this site for the period from 1922 through 2006 is 21.51 inches, making rainfall in WY 2006 about 130 percent of average. **Figure II-2** shows a comparison of WY 2006 rainfall at San Clemente Dam and the average monthly rainfall at this site.

B. Streamflow Monitoring

Description and Purpose

Since its inception, the District has collected streamflow measurements at approximately 15 mainstem sites on the Carmel River and on 16 tributaries to the Carmel River. The District's principal streamflow measuring sites within the Carmel River Basin (CRB) are shown on **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. Over the next decade, 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
- Assessing and scheduling fish rescue activities
- Assessing effectiveness of riparian mitigations
- Evaluating surface and ground water 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 2005-2006

During the 2005-2006 period, the District operated and maintained 15 streamflow gaging stations within the Carmel River Basin/District Boundary. In addition, continuous water level data were collected at both Los Padres and San Clemente Reservoirs, and at the Carmel River Lagoon. The District continuous recording gaging stations are listed below:

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

Tributary/other
Cachagua Creek
Pine Creek
San Clemente Creek
Tularcitos Creek
Hitchcock Creek
Garzas Creek near Lower Garzas Canyon
Garzas Creek at Garzas Road
Potrero Creek

[1] The District utilizes both float gages and data recorders with pressure transducers to monitor stream stage.

Robinson Canyon Creek
San Jose Creek
Arroyo del Rey at Del Rey Oaks

Continuous Water Level
Los Padres Reservoir
San Clemente Reservoir
Carmel River Lagoon

Operation and maintenance of the streamflow gaging stations 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 to produce mean daily streamflow records for the sites. **Table II-1** summarizes the computed annual flows for the District sites (with at least four years of continuous data) for the WY 1992-2006 period. In addition, **Table II-1** includes annual flow values for the two USGS operated mainstem sites for the 1992-2005 period.

During the 2005-2006 period, District staff continued to maintain the existing streamflow monitoring network. Streamflow within the Carmel River Basin during WY 2006 was well above normal, particularly in the spring of 2006, as significant late season rainstorms continued through April 2006. Consequently, the majority of the streamflow work over this period involved numerous streamflow measurements by District staff using the current meter method. The measurements are necessary to define the high flow portion of existing stage-discharge relationships or rating curves for each of the District's gaging stations. Streamflow measurements obtained at San Jose Creek and Potrero Creek in early April 2006, of 235 cubic feet per second (cfs) and 88 cfs, respectively, were the highest ever made by wading the stream at those sites. In addition, eight mainstem measurements in the 1,000 – 3,000 cfs range were obtained off of Carmel River bridges utilizing a bridge crane/sounding weight assembly during stormflows, in order to improve existing station rating curves.

- **Summary of Streamflow Conditions --** Streamflow during WY 2006 within the Carmel River Basin was classified as wet. The heaviest storm flow event of the year occurred rather late in the season on April 5, 2006. Peak streamflow along the Carmel River on April 5, 2006 was measured as 3,350 cfs and 3,650 cfs at the Don Juan Bridge and Highway 1 Bridge sites, respectively. It should be noted that these peak flow figures are provisional and are subject to revision.

During WY 2006, 107,217 acre-feet (AF) of unimpaired runoff were estimated at San Clemente Dam. This total represents 154% of the average annual runoff (69,550 AF) expected at San Clemente Dam. This runoff provided streamflow to the ocean from December 27, 2005 through July 6, 2006, although periodic closures occurred during this period. **Figure II-4** shows a comparison of the actual and average cumulative unimpaired inflows at San Clemente Dam for WY 2006.

C. Storage Monitoring

Description and Purpose

Since December 1987, the District has calculated end-of-month (EOM) storage values in the major reservoirs and aquifers within the Monterey Peninsula Water Resources System (MPWRS). The storage values for Los Padres and San Clemente Reservoir are estimated based on EOM water level elevations and area-elevation-capacity curves provided for each reservoir by CAW. These reservoir storage values represent "usable" storage and are adjusted for dead storage and minimum pool requirements. The storage values for the Upper Carmel Valley (UCV) aquifer subunits, Lower Carmel Valley (LCV) aquifer subunits, and the coastal subareas of the Seaside Groundwater Basin are estimated based on groundwater levels observed in selected monitor wells measured by the District and CAW. The aquifer storage values also represent "usable" volumes and are adjusted for water inaccessible to existing wells (i.e., below casing perforations) or held in reserve as a safeguard against seawater intrusion or other adverse environmental impacts. The current total usable storage capacity for the water resources system is 37,550 AF. Of this total, an estimated 1,550 AF are in reservoir storage and 36,000 AF are in aquifer storage. For this report, all reservoir storage values are rounded to the nearest 10 AF and all aquifer storage values are rounded to the nearest 50 AF.

These storage estimates are compiled by the District to provide a quantitative basis for managing the area's water resources. These estimates are used to make decisions regarding water production and water rationing. These estimates are also used to calibrate the District's Carmel Valley Simulation Model (CVSIM).

Implementation and Activities During 2005-2006

At the end of September 2006, system storage totaled 29,200 AF or 78 percent of capacity. This total was approximately 103 percent of the 28,350 AF storage that is expected under normal conditions at this time of the year. **Figure II-5** shows a monthly comparison of usable system storage versus average system storage during the October 2005 – September 2006 period. Of the total storage at the end of September 2006, an estimated 800 AF were in Los Padres and San Clemente Reservoirs, 25,500 AF were in the Carmel Valley Alluvial Aquifer, and 2,900 AF were in the coastal subareas of the Seaside Groundwater Basin.

It should be noted that the remaining usable storage capacity in San Clemente Reservoir was constrained in June 2003 when CAW, at the direction of the California Department of Water Resources (DWR), was required to lower the water level in the reservoir from elevation 525 feet above mean sea level (msl) to elevation 514 feet msl. This “drawdown” project is required by DWR as an interim safety measure at San Clemente Dam and remained in effect in Water Year 2006. As constrained by DWR, usable storage capacity in San Clemente Reservoir during the high-flow season (February - May) is limited to approximately 70 AF and during the low-flow period (June - January) is limited to less than 10 AF.

D. Ground Water 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 storage monitoring, compilation of annual and long-term well hydrographs, water table contour mapping, Carmel River Management Program, Seaside Basin Watermaster Program, and other special projects. The monitor well measurements are stored in a database program 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 CAW from each of their production wells, and these measurements are also utilized in the District's program.

Implementation and Activities During 2005-2006

- **Carmel Valley Aquifer --** The District's monitor well network in the Carmel Valley aquifer consists of dedicated monitor wells and several private 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 EOM 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 II-6 is a typical hydrograph from the lower Carmel Valley, showing groundwater level fluctuations at the Rancho Cañada East monitor well (River Mile [RM] 3.13), compared with mean daily streamflow in the Carmel River at Highway 1 (RM 1.09). River miles are measured upstream from the mouth of the Carmel River. This monitor well is located nearby the most westerly CAW production well in Carmel Valley, the Cañada well. The monitor well is located approximately 375 feet from the river channel, and about 250 feet from the Cañada well. As shown on this figure, the groundwater elevation increased approximately 22 feet between the beginning of December 2005 and the middle of May 2006, due to the reduced groundwater production at this time of the year, combined with the resumption of Carmel River flows in this lower reach of the river. Groundwater levels remained relatively stable until surface flows receded and groundwater pumping increased beginning in July 2006.

The hydrograph of a monitor well closer to the coast is shown in **Figure II-7**. This monitor well, the CAWD-Rio North well, is located at RM 1.65, and approximately 850 feet from the river channel. At this location, the magnitude of seasonal water level fluctuation, approximately six feet, is significantly less than at the Rancho Cañada East monitor well, due to its location farther from the river and major production wells in the lower Carmel Valley. The seasonal rise in water level at the CAWD-Rio North well lagged relative to the Rancho Cañada East monitor well. This lag time illustrates the effect of distance from the river channel on the timing of groundwater recharge from river flow events.

During the October 2005-September 2006 period, the monitoring data indicated that groundwater storage in the Carmel Valley aquifer remained relatively full during the water year. In the river

reach between San Clemente Dam and the Narrows (i.e., aquifer subunits 1 and 2), the lowest storage capacity estimate was 91% of capacity at the end of September 2006. Similarly, in the river reach from the Narrows to the Carmel River Lagoon (i.e., aquifer subunits 3 and 4), the lowest storage capacity estimate was 88% of capacity at the end of October 2005. The aquifer remained relatively full during the year due to a number of factors, including:

- Availability of adequate base flows during spring and early summer months,
- Timing and magnitude of controlled river releases from the upstream reservoirs,
- Maximized dry-season production from CAW wells in the Seaside Basin,
- Water supply management practices implemented by the District in coordination with CAW, the California Department of Fish and Game and the National Marine Fisheries Service, as part of the Quarterly Water Supply Strategy and Budget process, and
- State Water Resources Control Board (SWRCB) Order No. WR 95-10 (and subsequent amendments) and the Seaside Basin adjudication decision, which constrain CAW production from the Carmel River and Seaside Groundwater Basins, respectively.

● **Seaside Groundwater Basin --** In the Seaside Basin, monthly water level measurements were collected from 16 monitor wells in the Seaside Coastal Subareas, and four were monitored in the Seaside Inland Subareas. An additional 18 wells in the Seaside Inland and Laguna Seca Subareas were monitored on a semi-annual schedule during the year. These additional wells are a combination of active or inactive production wells, and dedicated monitor wells. **Figure II-8** shows water level data available from representative wells in the coastal Seaside Basin monitor well network. These graphs show 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 CAW Paralta production well. The graphs illustrate the more dominant effect that production from the Paralta well has had on water levels in the Santa Margarita Sandstone, which is the aquifer zone from which the Paralta well obtains most of its production. The graphs also illustrate the effect of changed water supply practices resulting from SWRCB Order WR 95-10. Under this Order, CAW has been directed to maximize production from its Seaside Basin sources as a means to reduce production and associated impacts from the Carmel River system. Seasonal recoveries associated with short-term reduced wintertime production and District aquifer storage and recovery (ASR) injection testing have not been sufficient to reverse the observed downward water-level trend. Additional information on the ASR testing program is available at the District office. Discussion of the District's Phase 1 ASR Project is included in Section VI.

E. Ground Water Quality Monitoring

Description and Purpose

The District maintains an ongoing ground water quality monitoring program for the two principal groundwater sources within the District: the Carmel Valley alluvial aquifer, and the Seaside Basin Coastal subareas. 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 CAW. The District manages all well construction, maintenance, and field sampling activities associated with the program. Water samples are analyzed at the Monterey County Consolidated Chemistry Laboratory in Salinas. The Monterey County Health Department, CAW, 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 2005-2006

Currently, the sampling schedule for Carmel Valley is 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.

- **Carmel Valley Aquifer --** Groundwater quality data were collected from a network of eight monitor wells in the Carmel Valley aquifer in November 2005, and three wells in the upper Carmel Valley area in May 2006. The results indicated that, in general, there were only minor changes in overall water quality compared to samples collected in the previous year. Staff is particularly interested in tracking indicators of potential sea-water intrusion in the coastal portion of Carmel Valley. To that end, three 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 in the coastal area 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 potential seawater intrusion into the aquifer. Currently, only the deeper wells at each of the three coastal locations are sampled.

Well number 16S/1W-14Jg is the deepest of an array of three wells located at the Carmel River State Beach parking lot, 0.07 miles (approximately 375 feet) from the shoreline. **Figure II-9a** shows specific conductance (a measure of the Total Dissolved Solids concentration) and chloride concentration for the historical period of record at this well beginning in February 1990. While both specific conductance and chloride concentration increased from 2004 to 2006 and therefore merit continued attention of the water quality results, these levels are not unprecedented. Due to the proximity to the ocean and the permeability of the alluvial sediments, there has been mixing of fresh and seawater at this site, most notably during the end of the 1987 – 1991 drought period. It should also be noted that the data from the District's monitor well network indicate that nitrate concentrations in the shallow zone of the aquifer are well below the State drinking water

standard of 45 milligrams per liter (mg/L). The highly permeable nature and flushing effect of the aquifer have prevented long-term build-up of contaminants as can occur in more poorly recharged aquifer systems.

- **Seaside Groundwater Basin --** Twelve monitor wells in the coastal subareas of the Seaside Basin were sampled in November 2005. This total includes two wells that were added to the monitor well network in 1997 and two that were added in 1999. 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. Part of the 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. **Figure II-9b** shows specific conductance and chloride concentrations in two coastal wells for the historical period of record beginning in April 1991. Results from the District's monitoring program indicate that the specific conductance averages approximately 350 and 825 micromhos/centimeter, for the Paso Robles and Santa Margarita aquifer zones, respectively.

F. 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 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 for recommending appropriate reservoir release schedules and for determining the 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: below Los Padres Reservoir at RM 25.4, below San Clemente Reservoir at the Sleepy Hollow Weir (RM 17.1), and at the Carmel River Lagoon (RM 0.1). Monitoring at these specific stations gives District staff information on the quality of water released from each reservoir and in the surface layer of the lagoon.

District staff also monitors river temperatures continuously at eight locations within the Carmel River Basin (**Figure II-10**). 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 2005-2006

District staff carried out a semi-monthly surface water quality sampling program. Data were collected for the following chemical and physical parameters: 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 eight locations on the Carmel River (**Figure II-10**), 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. SCL	San Clemente Fish Ladder	(RM 18.1)
5. SHW	Sleepy Hollow Weir	(RM 17.1)
6. GAR	Garland Park	(RM 10.8)
7. NAR	Below Narrows	(RM 8.5)
8. SAL	South Arm Lagoon	(RM 0.1)

The following paragraphs describe the results of the semi-monthly data collection and the continuous temperature recorders at specific sampling stations.

- **Carmel River Lagoon--** Water temperature for the Carmel River Lagoon was sampled in the south arm of the lagoon (SAL) on the Carmel Area Wastewater District (CAWD) sewer pipe. Water temperature for the South Arm Lagoon (SAL) station is shown in **Figure II-11**. Water temperature was collected in the south arm from July 1, 2005 to March 29, 2006 and May 11, 2006 to June 30, 2006. There was intermittent sampling due to the loss of the data recorder. The sensor was replaced on May 11, 2006. The maximum annual water temperature of 76.8 degrees Fahrenheit (°F) occurred on July 10, 2005. Average annual water temperature at this station during the sampling period was 60.7°F. Average daily water temperatures over 68°F occurred 67 times or 21% of the time. Constant temperatures over 68°F are considered stressful for steelhead (Brungs and Jones, 1977). Water quality data collected at this station is listed in **Table II-2**. The minimum dissolved oxygen measurement recorded was 6.2 mg/L. The pH measurements ranged from 7.5 to 9.0. Carbon dioxide measurements ranged from 5 to 15 mg/L. The conductivity measurements ranged from 271 to 19,820 uS/cm. The surface salinity ranged from 0.1 to 11.9 ppt. The conductivity and salinity are highly variable at the lagoon due to tidal influences and river inflows. The turbidity measurements ranged from 0.15 to 22.0 NTU. None of these parameters were detrimental to steelhead, though the high water temperatures and low dissolved oxygen were within the suboptimal range and considered stressful.

- **Below Narrows--** Water temperature for the Below Narrows (NAR) station is shown in **Figure II-12**. This station is a seasonal sampling location with the objective of documenting maximum thermal regime below the Narrows. Maximum thermal regime is generally sampled from June through August. The sampling period for the reporting year was July 7, 2005 to March 20, 2006. The maximum annual water temperature observed was 70.7°F and occurred on July 11, 2005. Maximum daily average water temperature at this station was 67.4°F occurring on July 11, 2005. Average water temperature during the reporting year was 57.3°F. While the instantaneous water temperatures exceeded the

optimal levels for steelhead on a few days, the average daily temperatures were always adequate.

- **Garland Park--** Water temperature for the Garland Park (GAR) station is shown in **Figure II-13**. The maximum annual water temperature was 68.7°F occurring on July 11, 2005. Average water temperature during the reporting year at this station was 54.8°F. Maximum daily average water temperature was 64.2°F occurring on July 11, 2005. Water temperatures were within the adequate range for steelhead during the entire reporting year.

- **Sleepy Hollow Weir--** Water temperature for the Sleepy Hollow Weir (SHW) station is shown in **Figure II-14**. The maximum annual water temperature was 72.5°F on August 1, 2005. Average water temperature during the reporting year at this station was 56.9°F. The maximum daily average water temperature was 69.4°F occurring on August 1, 2005. Water quality data collected at this station is listed in **Table II-3**. The minimum dissolved oxygen measurement recorded was 9.2 mg/L, which is within the suitable criteria recommended by the Environmental Protection Agency (EPA) for steelhead (Chapman, 1986). Carbon dioxide measurements ranged from 5-10 mg/L. The pH measurements ranged from 7.5 to 8.6. The conductivity measurements ranged from 200 to 366 uS/cm. The semi-monthly turbidity measurements recorded were between 0.1 to 5.4 NTU. None of the parameters measured were harmful to steelhead with the exception of high average water temperatures during the July, August, and June months. The high average water temperatures were in the suboptimal range during these months for steelhead.

- **Above San Clemente Reservoir--** Water temperature for the Above San Clemente (ASC) station is shown in **Figure II-15**. This station is a seasonal sampling location with the objective of documenting maximum thermal regime above the San Clemente Reservoir. Maximum thermal regime is generally sampled from June through August. The maximum annual water temperature was 72.8°F on July 17, 2005. Average water temperature during the reporting period at this station was 56.2°F. Maximum daily average water temperature at this station was 68.9°F occurring on July 17, 2005. The maximum daily average water temperatures during the month of July were within the suboptimal range. The rest of the reporting year water temperatures were within ranges for suitable rearing.

- **Below Los Padres Reservoir--** Water temperature for the Below Los Padres (BLP) station is shown in **Figure II-16**. The maximum annual water temperature was 70.0°F occurring on July 11, 2005. Average water temperature at this station was 57.2°F. The maximum average water temperature at this station was 67.6°F on July 10, 2005. Water quality data collected at this station is listed in **Table II-4**. Water quality at this station is highly influenced by reservoir water quality and release location. The minimum dissolved oxygen measurement recorded was 8.1 mg/L occurring on September 21, 2005, which is within the suitable criteria recommended by the EPA for steelhead. Carbon dioxide measurements ranged from 5 to 10 mg/L. The pH and conductivity measurements ranged between 7.0 to 8.0 and 178 to 359 uS/cm, respectively. Turbidity measured at this station ranged from 0.2 to 6.6 NTU. While the instantaneous water temperatures exceeded the

optimal levels for steelhead, the average daily temperatures were always adequate. Other water quality parameters measured were within the adequate range for steelhead.

- **Above Los Padres Reservoir--** Water temperature for the Above Los Padres (ALP) station is shown in **Figure II-17**. This station is a seasonal sampling location with the objective of documenting maximum thermal regime above the Los Padres Reservoir. Maximum thermal regime is generally sampled from June through August. The maximum annual water temperature was 68.6°F occurring on July 16, 2005 and July 31, 2005. Average water temperature during the reporting period was 54.0°F. Maximum daily average water temperature at this station was 66.4°F occurring on July 31, 2005. Water temperatures measured at this site were within the adequate range for steelhead.

G. Carmel River Lagoon Water Level Monitoring

Description and Purpose

Since 1987, the District has monitored the level of surface water in the Carmel River 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, Monterey County Water Resources Agency (MCWRA), and MPWMD. In addition, the water level data are available in real-time via the MCWRA's ALERT system to enhance flood warning for residents located along the northern margin of the Lagoon and wetland.

Implementation and Activities During 2005-2006

During the 2005-2006 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. Water level data collected at the Lagoon site are retrieved on a monthly basis via laptop computer, and monthly water level plots are created using graphics software.

The monthly plot for December 2005 shown in **Figure II-18** illustrates the first lagoon opening of the 2005-2006 rainy season, on December 27, 2005. Prior to this event, the lagoon mouth was closed, with an inflow to the lagoon of about 60 cfs. The fact that the lagoon level was rising rapidly, and a major rainstorm was in the forecast within the next several days, prompted the Monterey County Public Works Department (MCPWD) to open the lagoon mouth using bulldozers. The method of opening the lagoon mouth was different than in most years as an outflow channel angled toward the south was cut, allowing outflow to exit over an existing bedrock sill. This method was effective at preventing the lagoon volume from completely evacuating in a matter of hours, as it has done in a good number of years. Unfortunately, the storm runoff event on December 31, 2005, of approximately 3,000 cfs, forced the outlet channel straight out (as opposed to the former southerly cut) and completely reshaped the outflow channel configuration at the beach berm.

OBSERVED TRENDS, CONCLUSIONS AND/OR RECOMMENDATIONS:

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. The District's streamflow monitoring program continues to produce high quality data in a cost-effective manner. For example, the current annual cost of maintaining a single streamflow gaging station charged by the United States Geological Survey (USGS) is $19,600 per year. If the District's streamflow monitoring program was maintained by the USGS, the annual cost would be $353,000 (based on 18 gage sites). The District is able to maintain its streamflow monitoring network with approximately 75 percent of a full-time District staff position (Hydrography Programs Coordinator), and an annual equipment-operating budget of about $2,000.

There is limited storage of surface water by dams on the Carmel River. Los Padres Dam, completed in 1948, holds 1,478 AF of usable storage, based on an estimate by CAW in 1998. Usable storage in San Clemente Dam, completed in 1921, has been essentially eliminated by order of the Department of Water Resources (DWR) due to seismic safety concerns. As an interim safety measure through WY 2006, DWR has required CAW to lower the dam water level from 525 feet to 514 feet elevation, which is too low for water supply use. CAW has proposed a dam seismic strengthening program that is currently undergoing state and federal environmental review.

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 1987-91 drought period. The relatively stable storage in the Carmel Valley alluvial aquifer in recent years is attributable to a combination of more favorable hydrologic conditions and the adoption of improved water management practices that have tended to preserve high storage conditions in the aquifer.

In contrast, storage conditions in the coastal portion of the Seaside 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 CAW production in the Seaside Basin is derived. This downward trend in water levels reflects the changed production operations in the Seaside Basin stemming from SWRCB Order 95-10. The increased annual reliance on production from CAW's major production wells in Seaside, along with significant increases in non-CAW 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, CAW requested a court adjudication of water production and water storage rights in the Seaside Basin in 2003. Hearings were conducted in December 2005 and a final adjudication decision was entered in March 2006. The final decision established a new, lower natural safe yield for the basin, i.e., 3,000 AF per year, and an operating safe yield for the basin, i.e., 5,600 AF per year. Under the decision, pumpers in the basin were allocated a share of the operating safe yield and told that this share would be reduced every three years until the operating safe yield matched the natural safe yield of the basin.

In addition, one of the means to mitigate this observed 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). Continued testing of the District's full-scale test injection well was carried out during RY 2006 to further confirm the feasibility of this important means to help replenish the basin. Fortunately, 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, and there have been no identifiable trends indicative of seawater intrusion in the coastal areas of these two aquifer systems.

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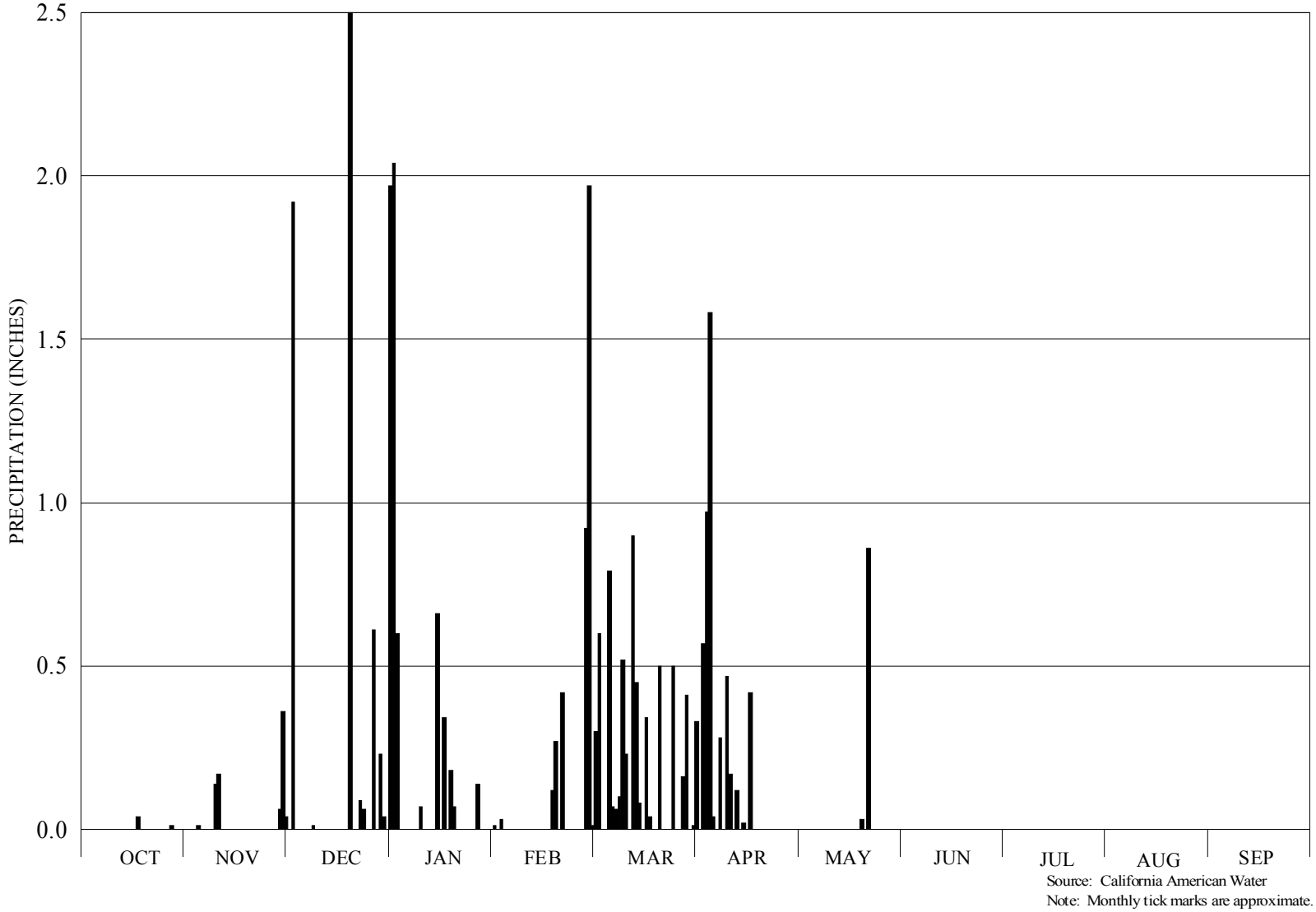
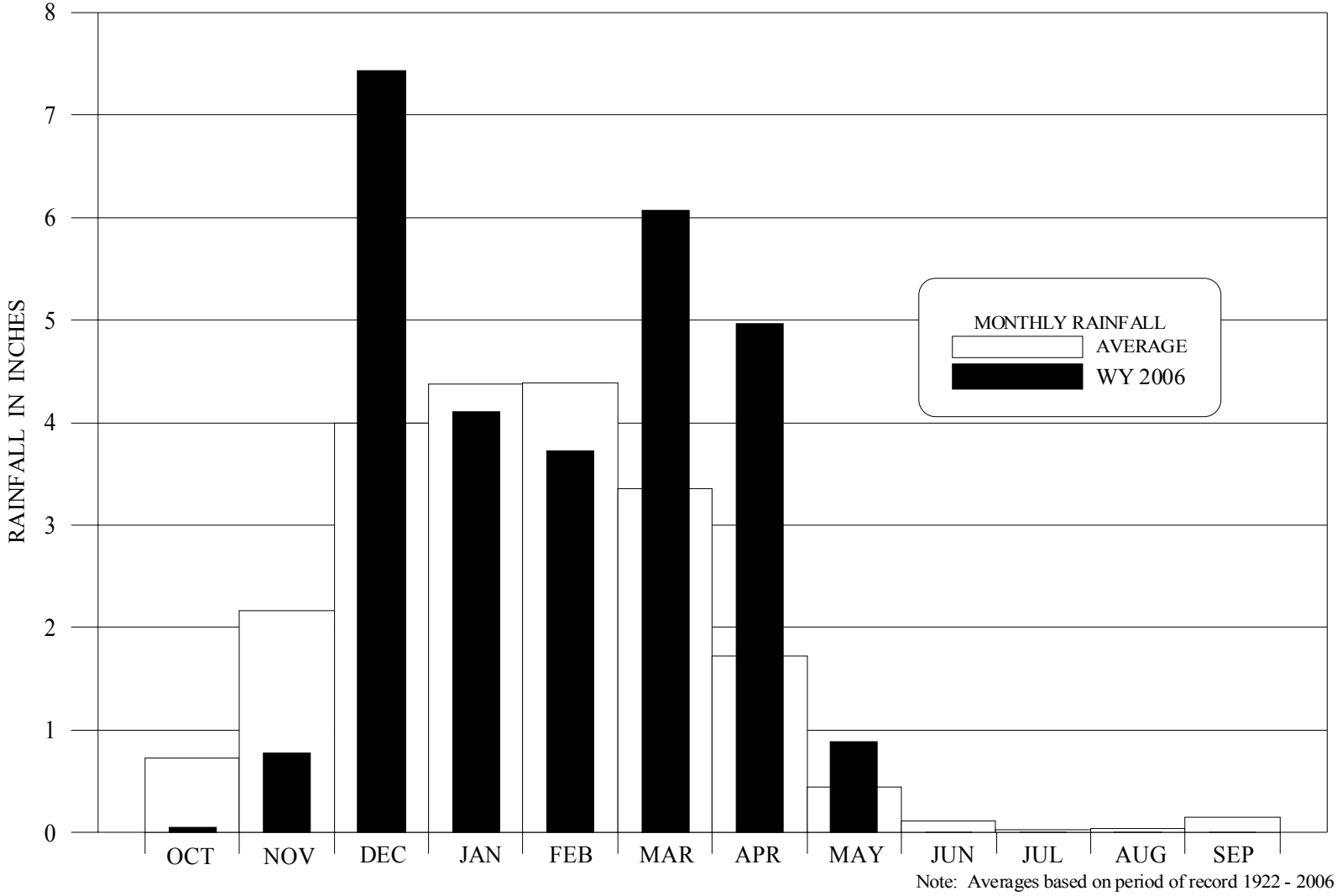
Figure II-1
San Clemente Reservoir Daily Rainfall: Water Year 2006



Source: California American Water
Note: Monthly tick marks are approximate.

Figure II-2
Monthly Distribution of Rainfall at San Clemente Reservoir: Water Year 2006 v. Average Conditions



Note: Averages based on period of record 1922 - 2006

Figure II-3
Carmel River Basin Principal Streamflow Gaging Stations

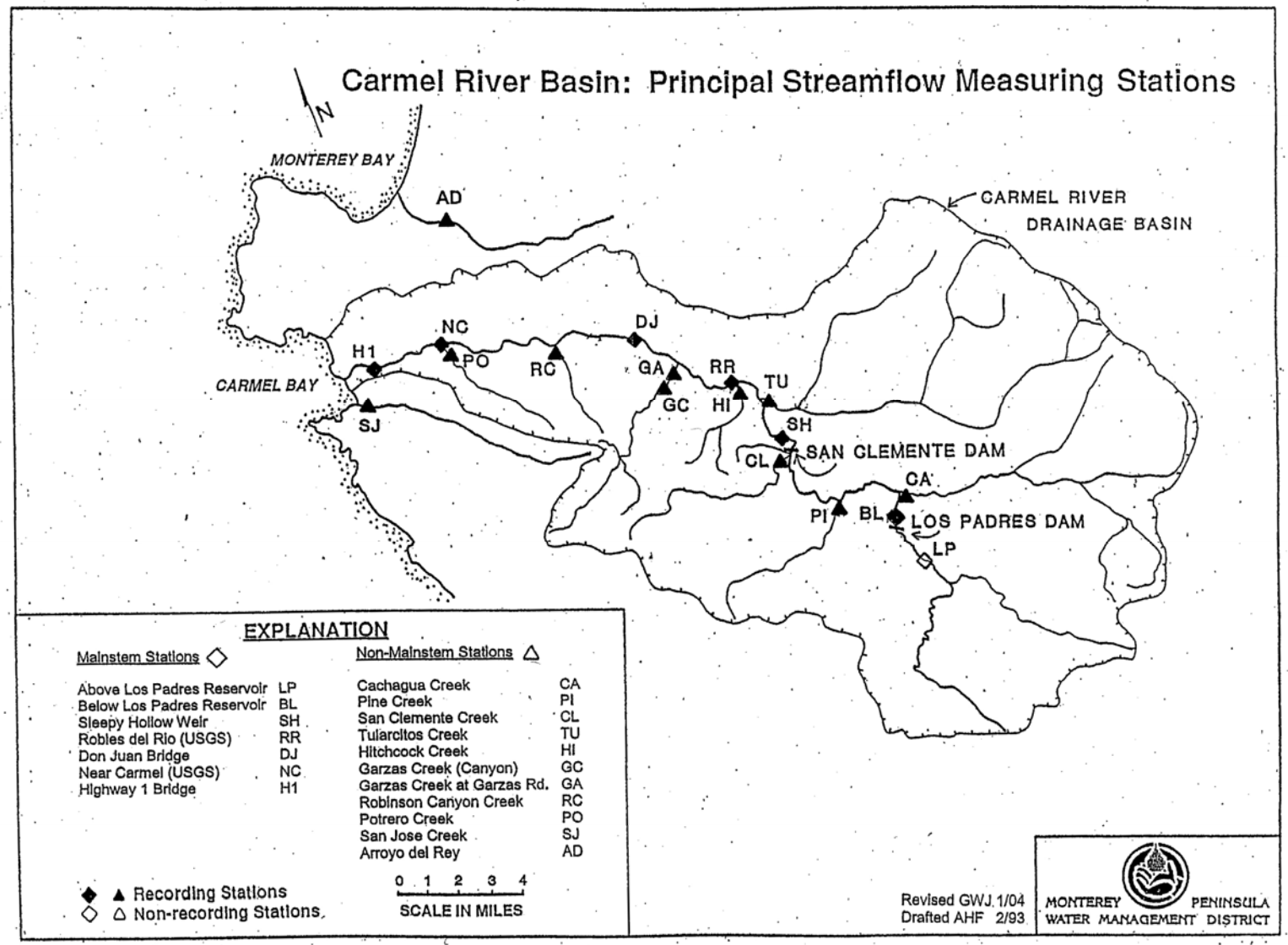


Figure II-4
Cumulative Unimpaired Runnoff: Carmel River at San Clemente Dam

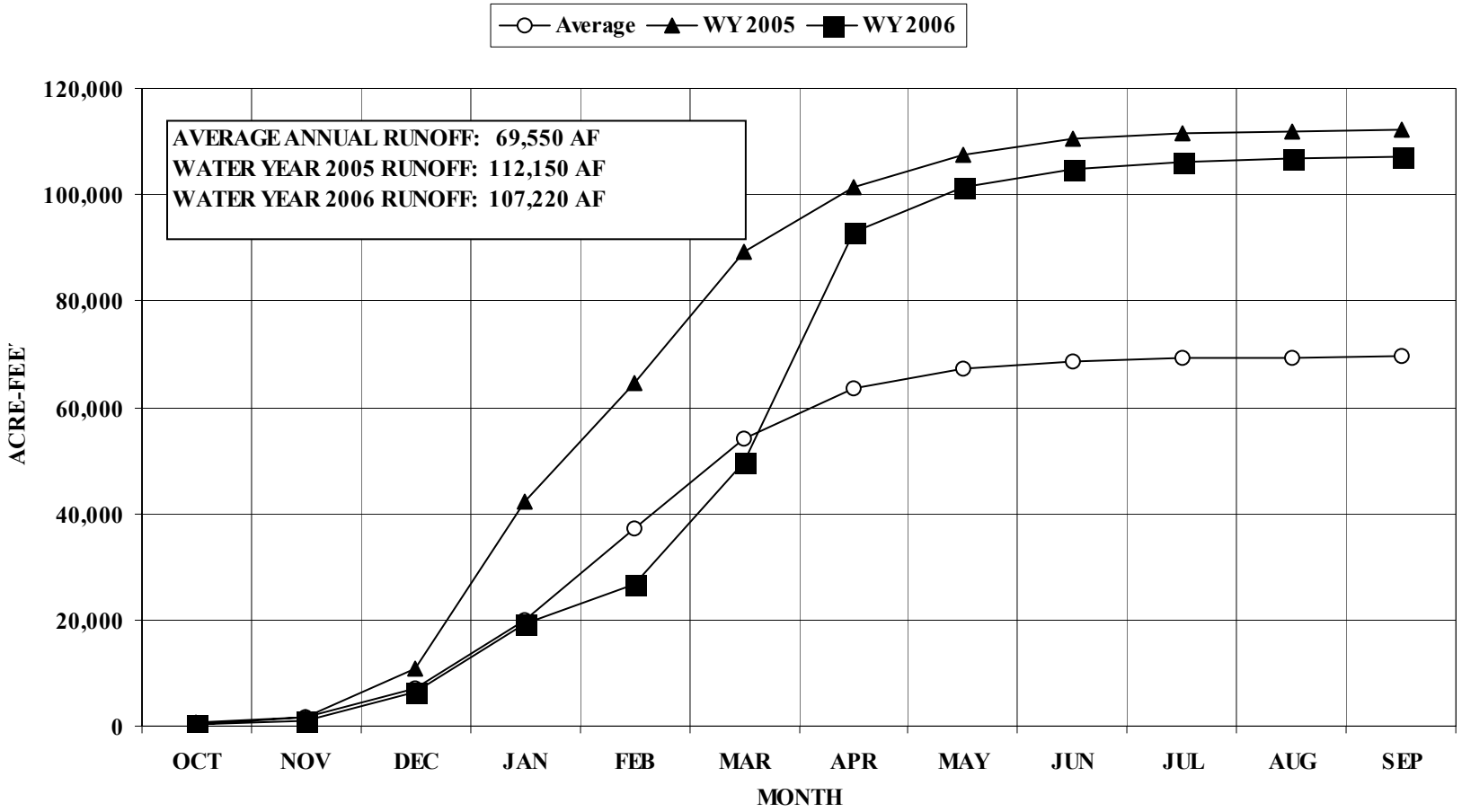


Figure II-5
End-of-Month Usable Storage for the Monterey Peninsula Water Resources System: Water Year 2006

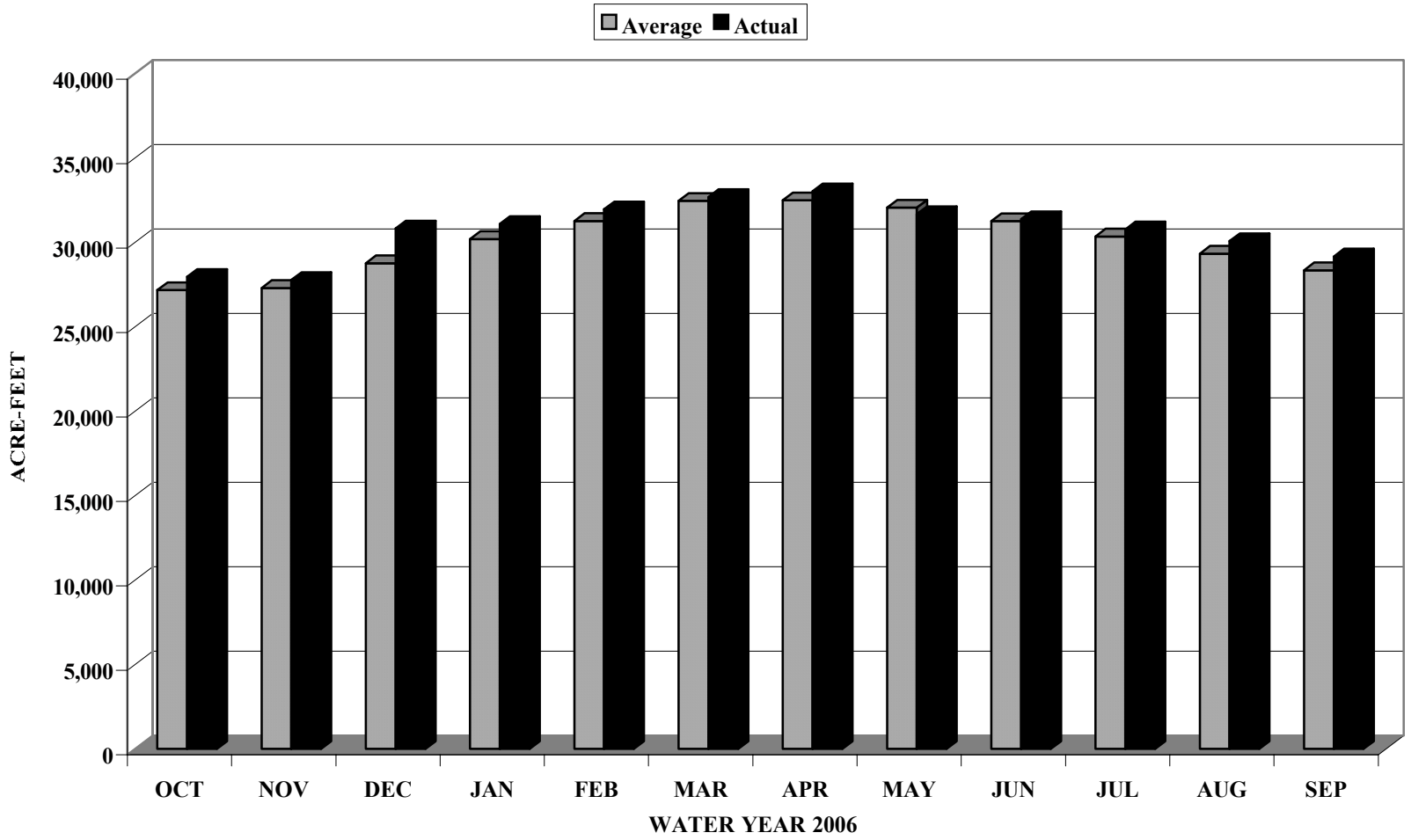


Figure II-6
Mean Daily Streamflow and Ground Water Elevation at the Rancho Canada East Well

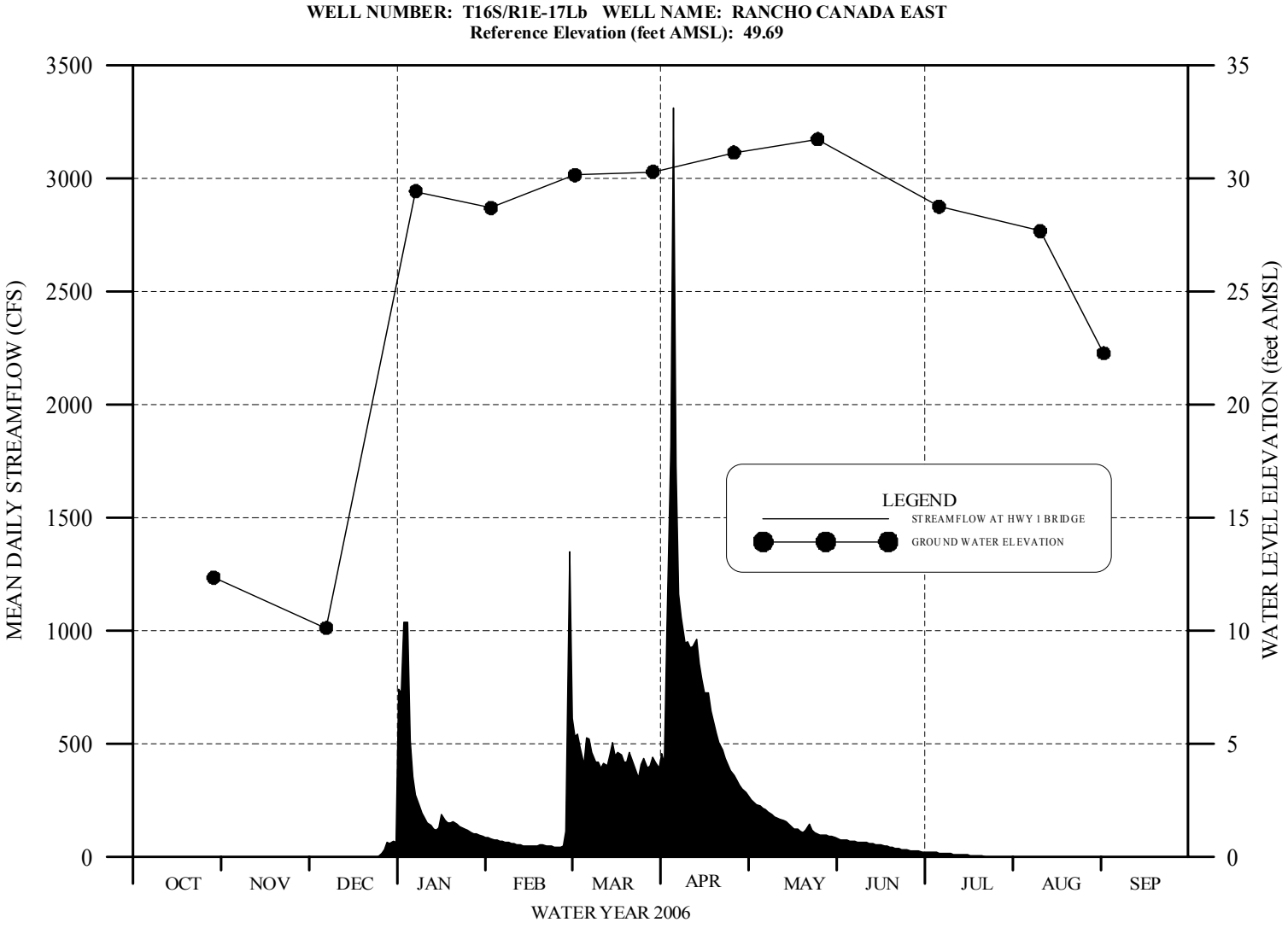


Figure II-7
Mean Daily Streamflow and Ground Water Elevation at the CAWD Rio North Well.

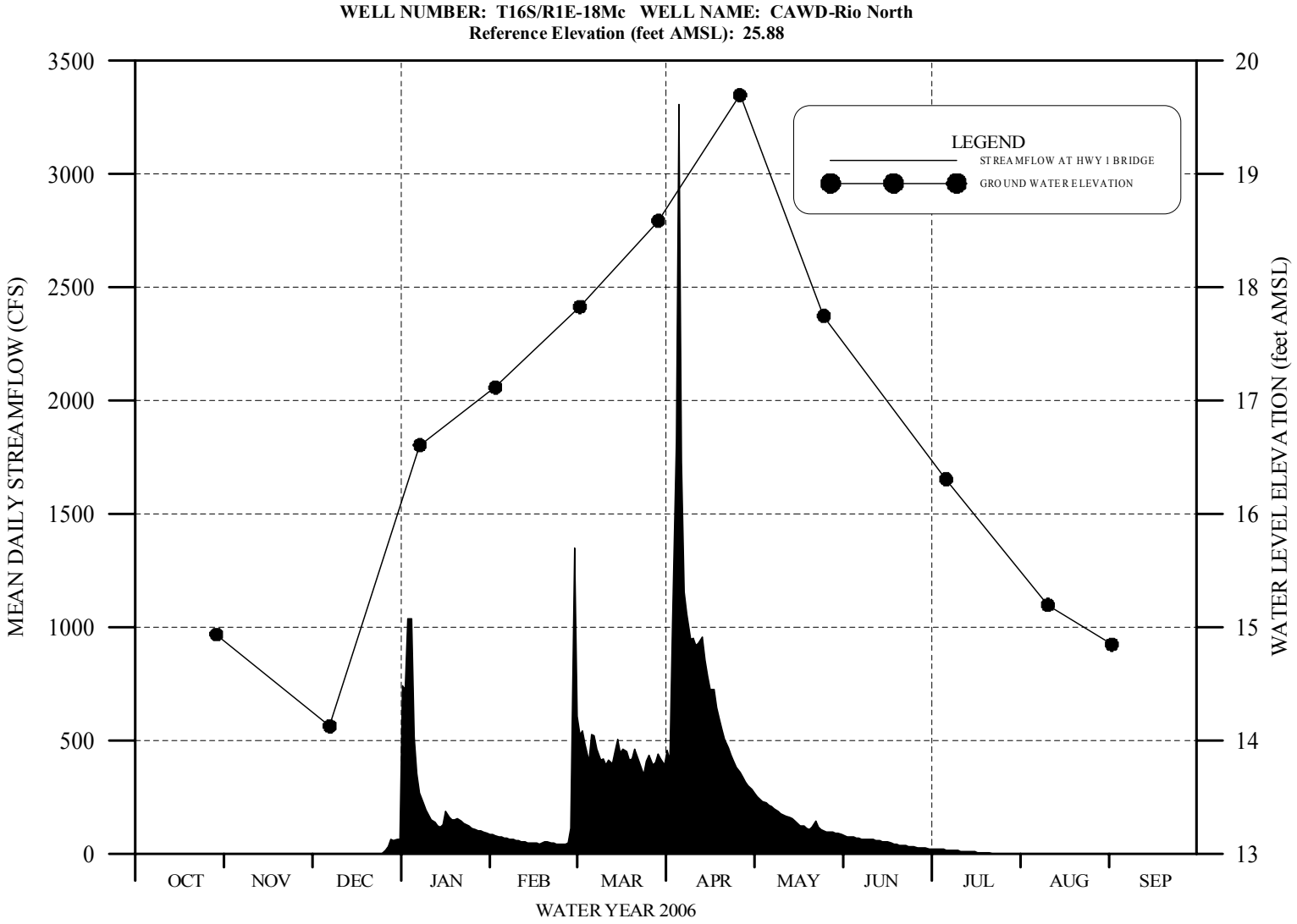
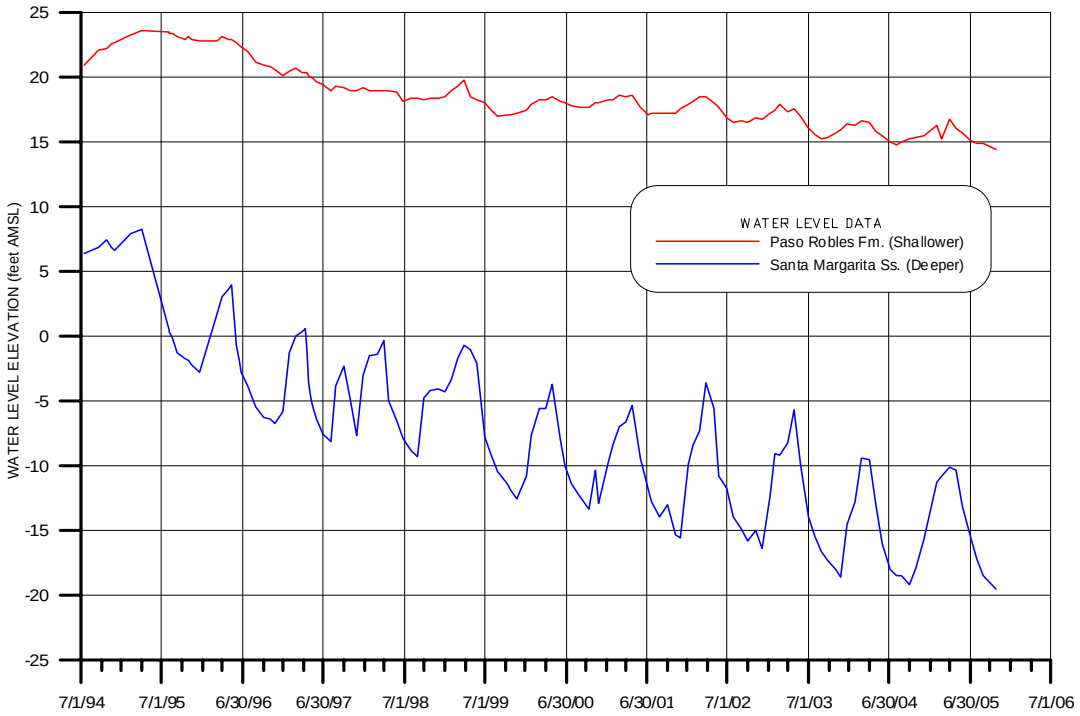


Figure II-8
Seaside Basin Ground Water Monitoring Wells

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

WATER LEVEL ELEVATION
FO-07 MONITOR WELL



WATER LEVEL ELEVATION
PCA-EAST MONITOR WELL

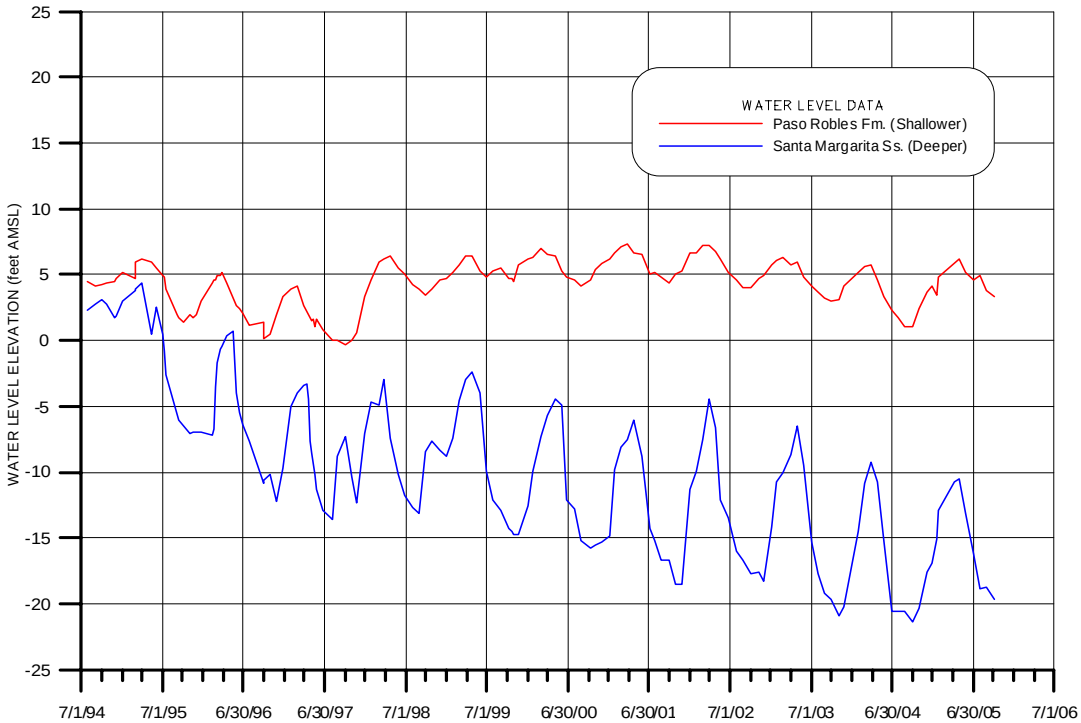


Figure II-9a
Water Quality in a Coastal Well in Carmel Valley

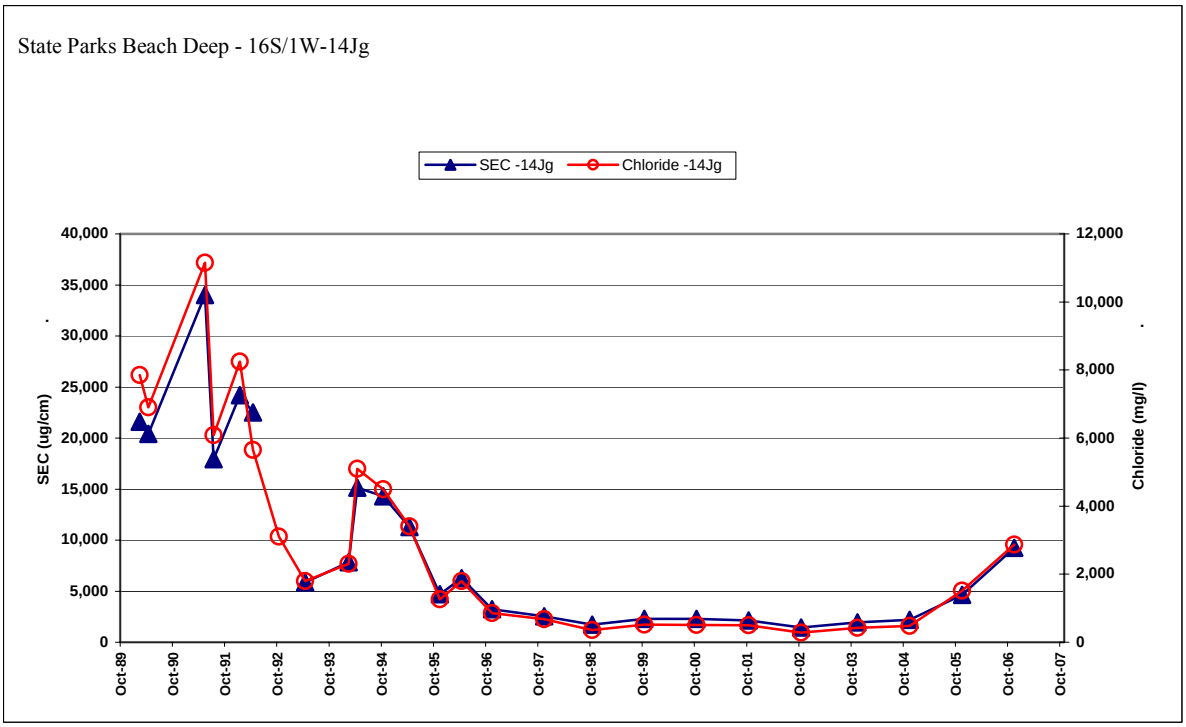


Figure II-9b
Water Quality in Two Coastal Wells in Seaside

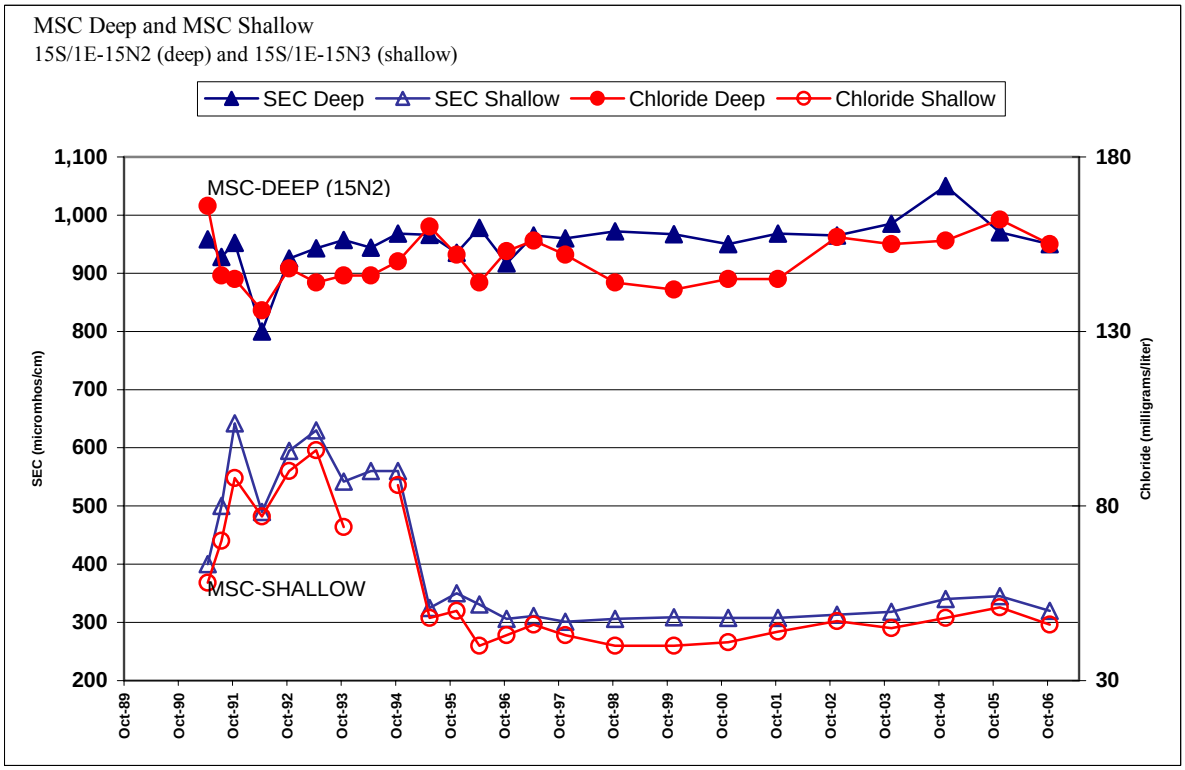


Figure II-10
Temperature and Semi-monthly Water Quality Monitoring Locations
Within the Carmel River Basin During RY 2006

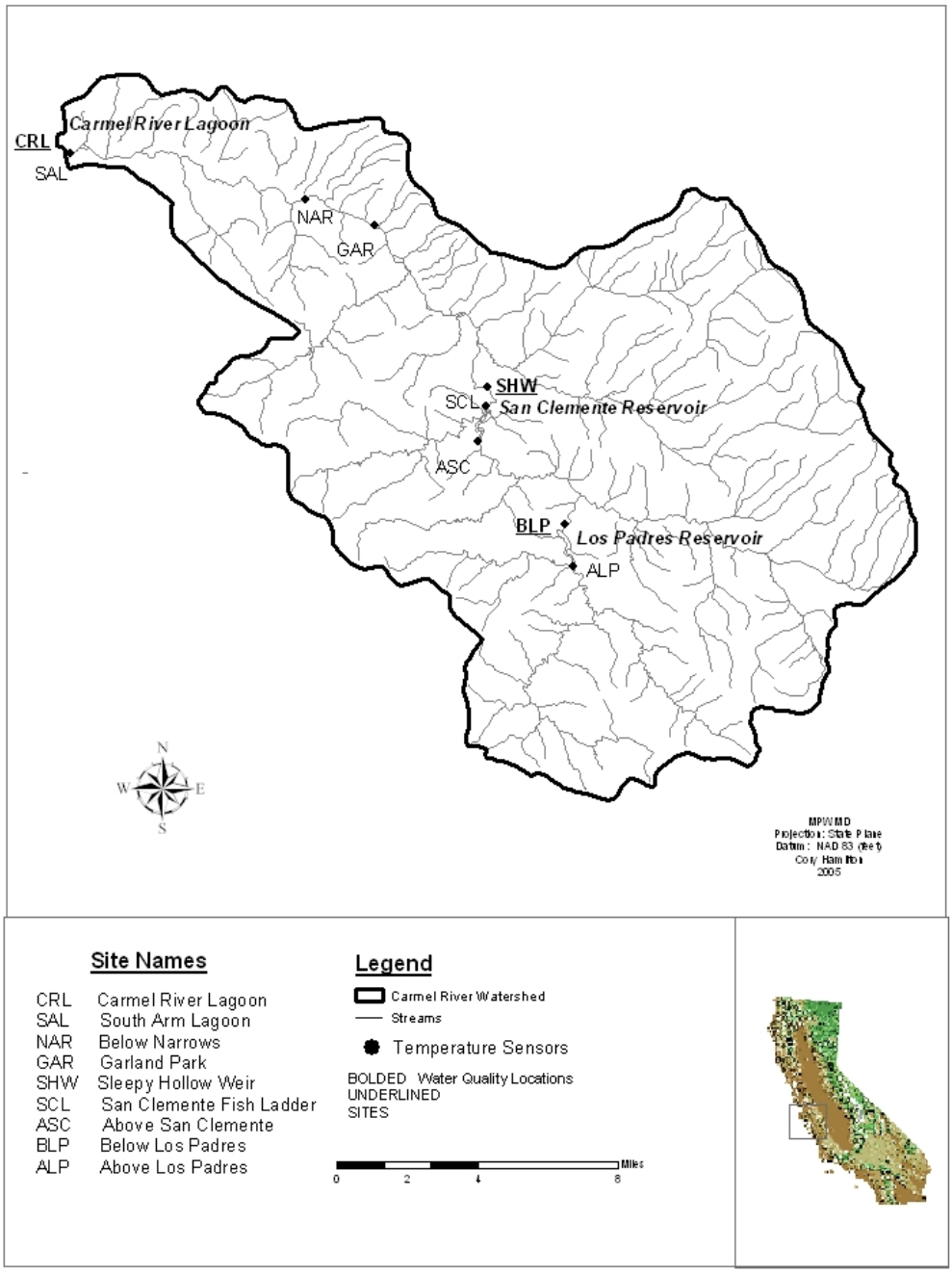


Figure II-11
Daily Temperatures Recorded from a Continuous Temperature Data Logger
At the South Arm Lagoon (SAL) Station During RY 2006

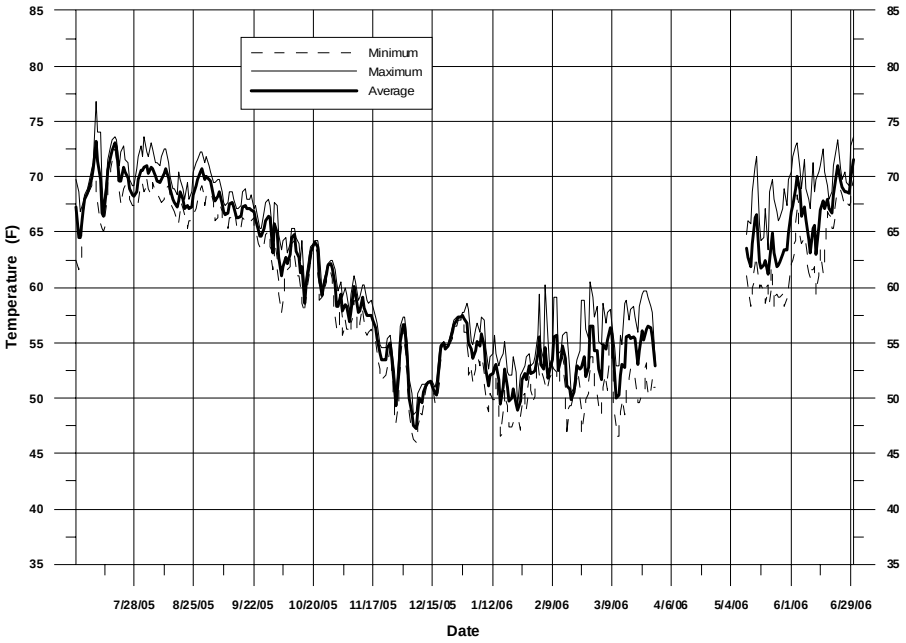


Figure II-12
Daily Temperatures Recorded from a Continuous Temperature Data Logger
At the Below Narrows (NAR) Station During RY 2006

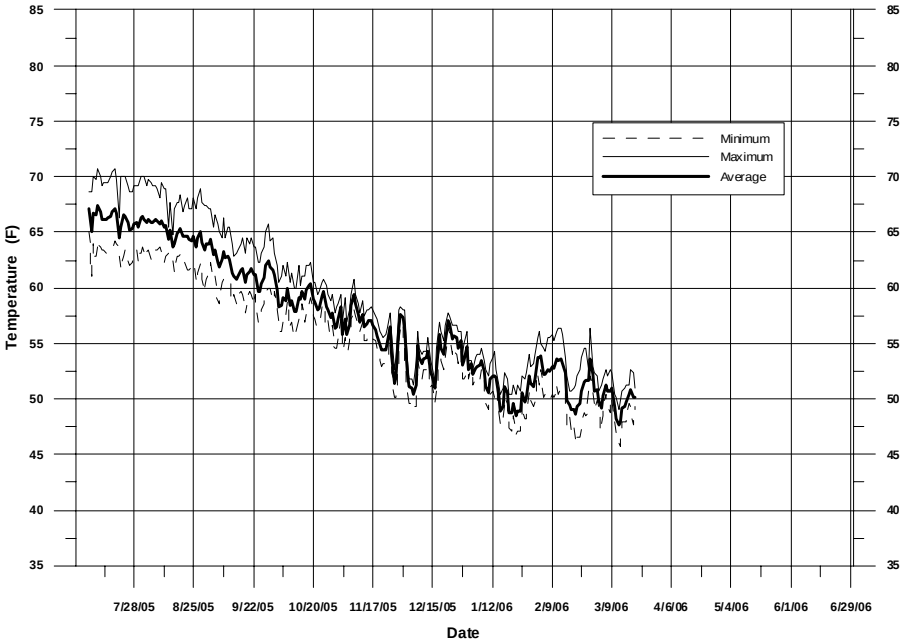


Figure II-13
Daily Temperatures Recorded from a Continuous Temperature Data Logger
At the Garland Park (GAR) Station During RY 2006

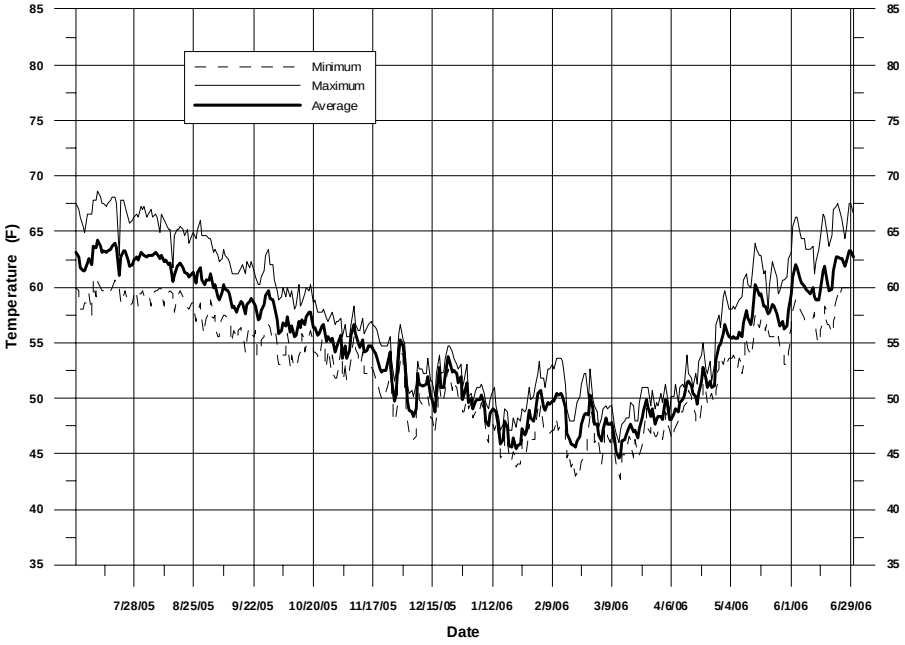


Figure II-14
Daily Temperatures Recorded from a Continuous Temperature Data Logger
At the Sleepy Hollow Weir (SHW) Station During RY 2006

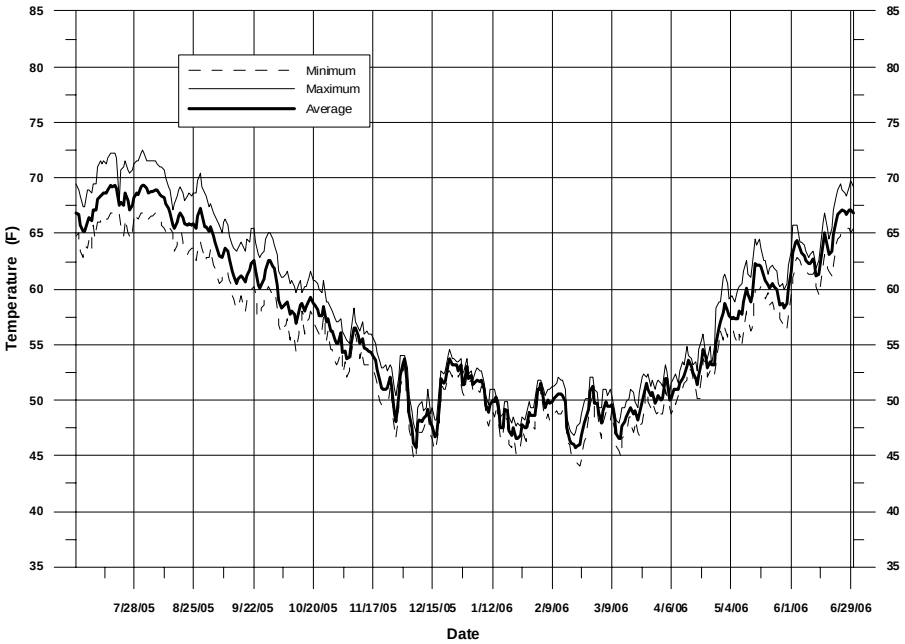


Figure II-15
Daily Temperatures Recorded from a Continuous Temperature Data Logger
At the Above San Clemente (ASC) Station During RY 2006

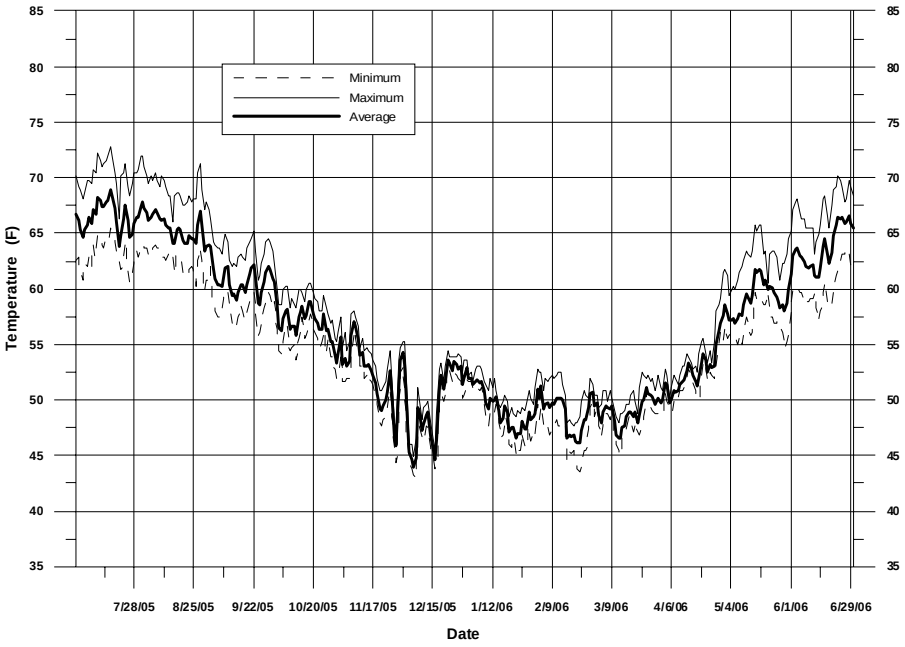


Figure II-16
Daily Temperatures Recorded from a Continuous Temperature Data Logger
At the Below Los Padres (BLP) Station During RY 2006

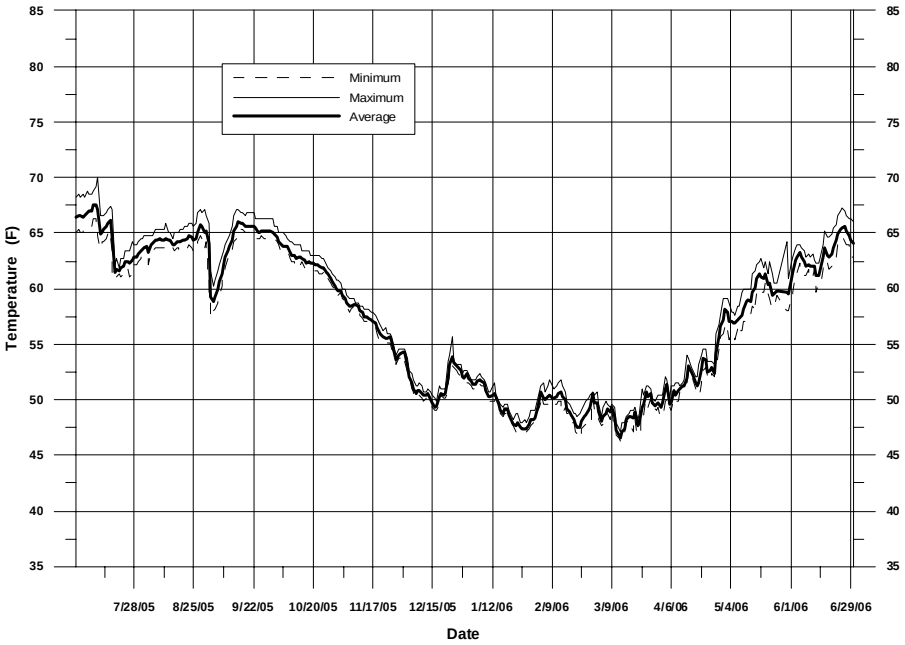


Figure II-17
Daily Temperatures Recorded from a Continuous Temperature Data Logger
At the Above Los Padres (ALP) Station During RY 2006

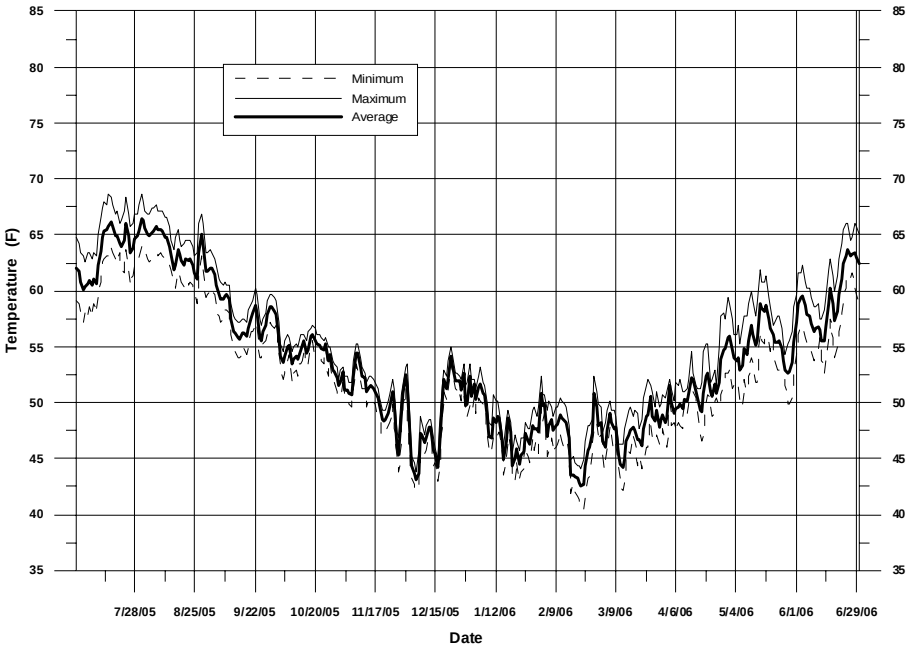


Figure II-18
Carmel River Lagoon Water Level: December 2005

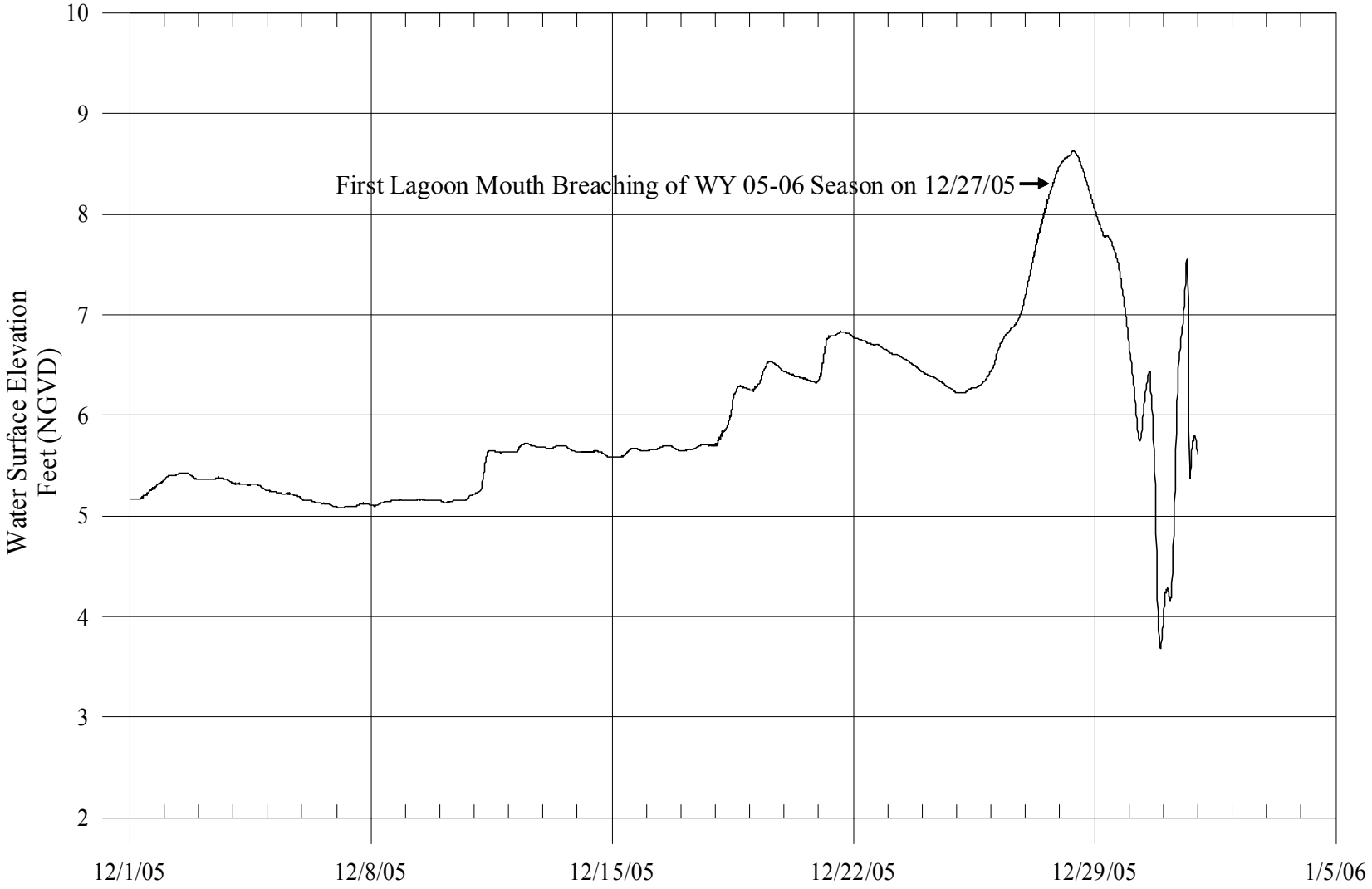


Table II-1
Carmel River Basin Total Annual Streamflow: Water Years 1992 – 2006

TRIBUTARY SITES	Drainage Area (Sq. Miles)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
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
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	2,410	9,300	8,020
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
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
HITCHCOCK CREEK	4.6	*	*	52	1,820	451	716	2,970	169	482	214	18	274	234	863	691
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	1,700	8,590	7,420
ROBINSON CANYON CREEK	5.4	619	2,360	89	2,230	619	1,430	6,890	545	823	433	82	448	354	1,710	1,010
POTRERO CREEK	5.2	*	*	30	1,790	506	1,210	5,970	855	1,020	310	43	210	163	1,470	1,050
SAN JOSE CREEK (outside CRB)	14.2	*	*	*	*	*	*	*	6,400	6,260	2,890	1,100	1,880	1,480	7,640	6,870
MAINSTEM SITES																
CARMEL RIVER 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
CARMEL RIVER 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	38,350	121,900	118,700
CARMEL RIVER 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
CARMEL RIVER 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	116,600	111,700

Notes: 1. Carmel River 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 is outside the Carmel River Basin, but is shown for comparison.
5. Water Years 2004 - 2006 figures are provisional and subject to change.
6. N/A - Streamflow record computations have not been completed.

Table II-2
Water Quality Data Collected by MPWMD during RY 2006 at Carmel River Lagoon (CRL) Site[1]

Date	Time 24 Hr	Temperature (F)	Dissolved Oxygen (mg/L)	Carbon Dioxide (mg/L)	pH	Conductivity (uS/cm)	Nacl (ppt)	Turbidity (NTU)	WSE (ft)
08-Jul-05	1355	70.3	9.2	10.0	8.1	733	0	0.15	6.69
22-Jul-05	1500	72.7	9.9	10.0	8.4	1240	1	0.85	5.85
12-Aug-05	1345	74.8	10.6	5.0	8.0	2637	1	0.3	3.74
21-Sep-05	1355	71.2	N/A	N/A	9.0	2372	1	0.65	3.61
14-Oct-05	1050	60.8	8.2	10.0	8.0	10290	6	0.55	4.88
10-Nov-05	1305	60.6	9.5	15.0	8.0	9020	5	1.2	5.10
30-Nov-05	0855	54.5	8.4	15.0	8.0	7010	3.9	1.2	5.17
12-Dec-05	1345	52.2	9.8	15.0	8.0	8920	5	2.5	5.72
22-Dec-05	1350	58.3	6.2	15.0	8.0	19820	11.9	2.7	6.68
9-Feb-06	1456	55.2	10.6	5.0	8.0	1878	1	0.7	9
24-Feb-06	1315	56.1	9.4	10.0	7.5	5760	3.1	5.4	2.11
15-Mar-06	1200	50.2	11.8	10.0	8.0	491	0.2	22	5.05
29-Mar-06	1330	52.2	11.5	10.0	8.0	367	0.2	4.2	4.65
19-Apr-06	1210	53.9	11.6	10.0	8.0	271	0.1	4.1	3.04
12-May-06	1250	63.7	10.6	10.0	8.0	365	0.2	0.9	3.66
25-May-06	1355	64.0	9.7	10.0	8.0	2609	1.3	1.95	8.03
9-Jun-06	1305	63.9	10.1	10.0	8.0	615	0.3	0.4	3.75
23-Jun-06	1415	70.1	8.5	10.0	7.5	465	0.2	1.9	6.54
Minimum		50.2	6.2	5.0	7.5	271	0.1	0.15	
Maximum		74.8	11.8	15.0	9.0	19820	11.9	22.0	
Average		61.4	9.7	10.6	8.0				

[1] The CRL station is located on the southwest end of the main body of the Lagoon, along the rock outcrop at River Mile (RM) 0.1.

Table II-3
Water Quality Data Collected by MPWMD During RY 2006
At Sleepy Hollow Weir (SHW) Site[1]

Date	Time 24 hr	Temperature (F)	Dissolved Oxygen (mg/L)	Carbon Dioxide (mg/L)	pH	Conductivity (uS/cm)	Turbidity (NTU)
8-Jul-05	1140	66.4	9.9	5.0	8.5	280	0.15
22-Jul-05	1330	70.7	9.8	10.0	8.6	279	0.15
12-Aug-05	1135	67.3	9.5	10.0	8.0	295	1.8
21-Sep-05	1055	61.5	9.8	10.0	8.0	343	2.8
14-Oct-05	0930	57.0	9.9	10.0	8.0	346	5.4
10-Nov-05	1025	55.8	10.3	10.0	8.0	366	5.2
30-Nov-05	1400	52.9	11.0	10.0	8.0	360	3.9
12-Dec-05	1155	49.5	12.2	10.0	8.0	360	4.3
22-Dec-05	1100	53.4	11.5	10.0	8.0	275	1.3
10-Feb-06	1055	50.0	12.5	5.0	8.0	245	0.1
24-Feb-06	1035	47.8	12.9	5.0	8.0	259	0.1
15-Mar-06	1030	48.0	12.9	10.0	8.0	214	2.2
29-Mar-06	1145	50.4	12.2	5.0	7.5	203	1.8
19-Apr-06	1020	51.1	12.6	5.0	8.0	200	1
12-May-06	1100	58.8	10.8	10.0	8.0	250	0.35
25-May-06	0920	58.3	10.8	10.0	8.0	245	0.22
9-Jun-06	1115	62.8	10.2	10.0	8.0	267	0.35
23-Jun-06	1313	70.3	9.2	10.0	8.0	274	0.68
Minimum		47.8	9.2	5.0	7.5	200	0.1
Maximum		70.7	12.9	10.0	8.6	366	5.4
Average		57.3	11.0	8.6	8.0	281	

[1] The SHW station is located 15 feet downstream of the Sleepy Hollow Weir site at RM 17.1

Table II-4
Water Quality Data Collected by MPWMD During RY 2006
At Below Los Padres (BLP) site[1]

Date	Time 24 hr	Temperature (F)	Dissolved Oxygen (mg/L)	Carbon Dioxide (mg/L)	pH	Conductivity (uS/cm)	Turbidity (NTU)
8-Jul-05	1045	67.1	8.6	5.0	8.0	266	0.6
22-Jul-05	1100	62.2	8.8	10.0	7.4	250	0.4
12-Aug-05	1030	64.2	8.5	5.0	7.5	262	1.3
21-Sep-05	1010	65.3	8.1	10.0	7.5	317	3.1
14-Oct-05	0845	62.2	8.3	10.0	7.5	265	3.6
10-Nov-05	0930	58.3	8.4	10.0	7.0	187	6.6
30-Nov-05	1025	54.5	9.4	10.0	7.5	359	6
12-Dec-05	0955	51.1	10.0	10.0	7.5	339	3.3
22-Dec-05	0950	52.7	10.0	10.0	7.5	267	4.6
10-Feb-06	1430	50.5	11.6	10.0	7.0	229	0.2
24-Feb-06	0950	48.2	12.4	5.0	8.0	222	0.35
15-Mar-06	0940	47.5	13.2	5.0	8.0	198	0.75
29-Mar-06	1105	49.6	12.4	5.0	8.0	187	2.2
19-Apr-06	0935	51.4	12.2	5.0	8.0	178	0.8
12-May-06	1010	59.0	10.7	10.0	8.0	225	0.25
25-May-06	1120	59.9	10.4	10.0	7.5	234	0.32
9-Jun-06	1025	62.6	9.7	5.0	8.0	252	0.45
23-Jun-06	1121	66.7	8.1	10.0	7.5	230	0.95
Minimum		47.5	8.1	5.0	7.0	178	0.2
Maximum		67.1	13.2	10.0	8.0	359	6.6
Average		57.4	10.0	8.1	7.6	248	

[1] The BLP station is located 200 feet downstream of the Los Padres Dam spillway at RM 25.4.