

XI. 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, 2006 through June 30, 2007.

A. Assist with Lagoon Enhancement Plan Investigations

Description and Purpose

The 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.

The Lagoon Enhancement Plan correctly noted that state and local government funding is limited and “implementation needs to be opportunistic”. Budget concerns stymied progress until the floods of January and March 1995. Aspects of the Plan were then recognized as possible emergency means to prevent flooding in the Mission Fields neighborhood north of the river, as well as a way to restore riparian and wetland habitat on the south side. Working in conjunction with CDPR, the California Department of Transportation (Cal-Trans) developed a conceptual plan for mitigation of impacts associated with replacement of the Highway 1 Bridge that washed out in March 1995. Cal-Trans planned to incorporate certain features of the Lagoon Enhancement Plan to mitigate for disturbance to riparian habitat caused by construction crews. Cal-Trans envisioned a mitigation bank in the Odello West field by lowering the south bank levee and creating 37 acres of riparian habitat and five acres of freshwater wetland.

Implementation and Activities During 2006-2007

During this period, CDPR and the Conservancy continued their native riparian plant revegetation efforts within the 100-acre portion of the “Odello West” property that is now part of the Carmel River State Beach. The State Legislature appropriated \$4 million for the Conservancy to restore habitat in the lower Carmel River, and CDPR entered into an agreement with the Conservancy to implement and manage the project. The dredging and filling of the new south arm of the lagoon was completed in 2005, and monitoring of the extensive re-vegetation effort with native plants is ongoing. For a summary of the status of the lagoon restoration project in 2006, see CDPR’s *2006 Carmel River Lagoon Enhancement Report* dated January 2007 (CDPR 2007). A report

on the project's progress in 2007 will be released in early 2008. Annual trends in water quality and aquatic invertebrate fauna were reported in a detailed appendix to the 2006 report, prepared by California State University at Monterey Bay's Watershed Management Institute (Larson et al. 2006).

District staff provided hydrological data to the Carmel Area Wastewater District (CAWD) to aid them in evaluating and monitoring their efforts, funded by California American Water (CAW), to augment flow to the lagoon using recycled water. A proposal to use treated water from the CAWD plant to increase the amount of water available for steelhead habitat in the lagoon was continued for a third year in Fall 2006. CAW is attempting to have their releases of recycled water to the lagoon formally permitted for direct release by the Central Coast Regional Water Quality Control Board (CC-RWQCB) as part of their discharge permit renewal in 2007. The CAWD discharges currently meet agricultural water quality standards so these discharges can be released onto surrounding habitat to irrigate vegetation, but not directly into the lagoon. The Carmel River Lagoon Technical Advisory Committee (CRL-TAC) hosted discussions of what would be needed to successfully complete the process, and made recommendations to CAW and the CC-RWQCB. Efforts on this project will continue in 2007-2008.

District staff monitored receiving water quality, and provided expertise to representatives from numerous state, federal and local agencies, as well as members of the public, regarding the best ways to obtain additional water for the lagoon during the dry summer and fall months of the year. During 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 have, at times, led to fish mortalities.

During Fall 2006, CAWD released recycled water for the sole purpose of percolating it into the soil adjacent to the lagoon in an attempt to improve lagoon water quantity and quality. Specifically, CAWD released a total of 31.3 AF of tertiary treated wastewater from August through November 2006. In addition, the CDPR utilized its well to provide irrigation water primarily to irrigate its riparian restoration areas adjacent to the south arm of the lagoon, and secondarily for the organic demonstration farming operation on its land, which is part of the agricultural history aspect of the lagoon restoration program. There were plumbing and piping problems with the well's water distribution system late in the year, so some small and unknown fraction of the water intended for agricultural and riparian use actually leaked out to percolate directly into the lagoon's aquifer. Any water not consumed in evapotranspiration of the crops or riparian vegetation, also theoretically percolated into the aquifer underlying the lagoon. Specifically, CDPR applied a total of 175.10 AF of groundwater between July 2006 and June 2007 to irrigate the riparian restoration area, and to supply the organic demonstration farm. There has been no quantitative analysis of the effect of these releases on lagoon water quality.

District staff was also involved in ongoing discussions under the auspices of the CRL-TAC regarding Monterey County Public Works Department's (MCPWD) breaching of the sandbar that forms each year between the lagoon and the ocean. NMFS and CDFG have indicated that a water surface elevation of from four to ten feet, depending on the time of year, would be an optimal management target to benefit steelhead rearing.

On June 16, 2006, C DPR, with assistance from volunteers and interagency staff and with informal approval of State and Federal regulatory agencies, sandbagged the outlet of the lagoon in an effort to raise the lagoon level to improve over-summer habitat for steelhead. This effort was successful in raising the lagoon water level from a record low of 1.6 feet to 7.8 feet (NGVD 1929) by June 21, 2006. As a result of this effort, lagoon levels remained above 6 feet almost continuously through July 2006. It is likely that, without these efforts, lagoon levels would not have risen as high as they did, as inflow to the lagoon declined to 24 cfs by the end of June and less than 1 cfs by the end of July 2006. Flow to the lagoon declined to less than 0.5 cfs on August 11 and ceased on September 7, 2006. Lagoon levels declined from 6 feet to 4 feet in August, but held roughly at that level through mid-October.

Lagoon levels slowly climbed back to around 6 feet from mid-October through mid-January 2007. Small amounts of surface flow were recorded at the MPWMD Highway 1 gage for nine days between November 13, 2006 and January 4, 2007. Flow once again reached the lagoon on January 11, 2007, and lagoon levels rose from just below 6 feet to over 8.5 feet, until the lagoon was breached by Monterey County Public Works Department (MCPWD) on February 11, 2007. MCPWD opened the river mouth by a breach in a south-southwest direction through the barrier beach, and over the bedrock ledge that extends from the southern bluffs under the beach sand. This breaching approach was supported by the members of the CRL-TAC, including the National Marine Fisheries Service (NMFS) and the California Department of Fish and Game (CDFG), in contrast to the historical straight westerly breach across the beach, as the most feasible and environmentally-friendly alternative, given the configuration of the beach at that time. The southerly breach was intended to maintain higher water levels in the lagoon and avoid the sudden drop in water levels associated with the normal westerly breach. While the southerly breach was not expected to maintain lagoon levels as well as the northerly breach that was made in 2005, it was expected that the southerly breach would avoid erosion of the northern beach berm and Scenic Road bluffs that had occurred in 2005. Subsequently, the lagoon elevation dropped approximately two and a half feet over the four days following the initial breach.

Flows increased to the mean daily high flow for the water year of 213 cubic feet per second (cfs) at the USGS Near Carmel stream flow gage on February 28, 2007, and then steadily declined to 27 cfs on March 21, 2007, when the lagoon closed naturally for the last time. As a result of low river flows and winter ocean-wave action that periodically built up the beach, the lagoon was closed five times in February and March 2007, totaling approximately 13 days or 34% of the time during those months. During several open periods prior to March 21, the lagoon drained to record low levels of less than 1.5 feet. After a natural closure on March 21, the lagoon surface reached an elevation of approximately 8.5 feet. On March 26, 2007, the C DPR sculpted an approximately 500 foot outlet channel to the south to manage inflow, while maintaining a lagoon elevation of approximately 8.4 feet. This effort was focused on maximizing lagoon volume and avoiding any further mechanical re-breaching of the lagoon for the rest of the year, while still allowing access to the ocean for spawned out steelhead kelts and emigrating for as long as possible through a high-level outlet channel. These actions were supported by the agencies participating in the CRL-TAC, and appeared to be successful in that they maintained lagoon volume, while still allowing an additional 15 days of egress for steelhead kelts and smolts. The lagoon was last connected to the ocean on a continuous basis through the C DPR-created outlet channel on April 9, 2007. After that point, there is insufficient data to determine how often the

outlet channel was open or closed, and the beach's sand berm gradually built up on its own, raising lagoon levels to the annual high point of approximately 9.5 feet on April 27, 2007. The CDPR made their last adjustments of the year to the outlet channel on April 26, 2007, to raise the sand berm and close the outlet channel. Lagoon levels then gradually declined to a little over 3.5 feet by June 31, 2007.

At CDPR's request, District staff began facilitating the CRL-TAC meetings in June 2006, with the District General Manager as chair and the District Water Resources Engineer and Senior Fisheries Biologist as staff support. The CRL-TAC meets as needed concerning the issue of management of the Carmel River lagoon and beach. The CRL-TAC met ten times between July 2006 and June 2007 [7/12/06, 9/8/06, 10/11/06, 11/16/06, 12/22/06, 1/17/07, 2/7/07, 3/30/07, 4/24/07, and 6/19/07]. These meetings included one public information session with community stakeholders to enable them to hear presentations from experts on beach sand dynamics on the morning of November 16, 2006.

In addition to facilitating the CRL-TAC meetings, the District Water Resources Engineer assumed responsibility for compiling and editing the *Final Study Plan for the Long-Term Adaptive Management of the Carmel River State Beach and Lagoon*, which was finalized and released on April 17, 2007. It is available on-line at:

http://www.mpwmd.dst.ca.us/Mbay_IRWM/IRWM_library/CarmelBay/LongTermStudyPlanFinal2007-04-17.pdf. The District General Manager worked with other local agency managers and community representatives to pursue State funding to implement this study plan, but despite a number of joint efforts and promising meetings with State legislators, no applicable source of funding was found during this reporting period.

CDPR and the Monterey County Water Resources Agency (MCWRA) continued to work together to develop a draft *Interim Adaptive Management Plan* by February 2007 for the management of the beach at the Carmel River Lagoon, which would serve as the basis for a CDFG Stream Bed Alteration Agreement Application for the annual breaching and re-closure of the lagoon. By June 2007, CDPR had also produced a working draft of an *Initial Study – Mitigated Negative Declaration for the Carmel River Lagoon Water Elevation Adaptive Management Project*. The CRL-TAC provided review, suggestions, and comments to these agencies on their ongoing efforts to develop a mutually agreeable plan and application. The two agencies intend to continue to pursue this approach next reporting year.

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. Saturation paste conductivity of soils in the vicinity of the vegetation monitoring stations was measured annually from 1995 through 2004. Wildlife surveys and bathymetric surveys continue to be conducted each year.

Implementation and Activities During 2006-2007

The District conducted two of three types of long-term monitoring during this period:

- Topographic Surveys and hydrology
- Wildlife Surveys
- **Vegetation Monitoring** – In 2006, the District did not conduct vegetation surveys in the wetlands for the first time since the monitoring stations were established in July 1995. A combination of factors went into the decision not to monitor the vegetation in 2006. First, the efforts to maintain adequate water volume in the lagoon for steelhead and other aquatic species that began with the placement of sand bags at the river mouth on June 16, 2006, maintained the water elevation at a level that was unprecedented through the summer in the previous years of the Mitigation Program. Surface water communication between the lagoon and Carmel Bay was effectively closed on July 6, 2006, and the elevation of the lagoon remained high enough to prohibit effective monitoring of transects and quadrats in the lowest portions of the wetlands. Second, the timing of sampling affects the outcome of vegetation monitoring, as different species are more abundant or scarce depending on temperature, light and hydrologic regime. It has always been a goal to complete the vegetation monitoring in the month of July, but twice it was necessary to postpone monitoring until August due to the hydrologic conditions. In 2006, however, the water elevation was still too high to effectively access some of the quadrats well into the last week of August. Lastly, the Mitigation Program only requires that this monitoring be conducted every two years.

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. 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 areas. 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 Odello artichoke field.

Significant changes in vegetation were not observed between the summers of 1995 and 2007. Fluctuations 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.

A more detailed discussion of the results of vegetation monitoring to date was presented in the 2005 Mitigation Report. Data gathered thus far suggest that factors favoring freshwater species over salt tolerant species may be occurring. Determining whether any changes are attributable to

water management practices upstream as opposed to the timing of beach breaching, changes in hydrologic regime or even global weather dynamics is a more complex question. Review of the available data has not identified significant changes from one year to the next. Nor have strong relationships between species composition or distribution and water management practices been identified. Nonetheless, staff anticipates continued monitoring of the wetlands in July 2007 to determine long-term trends, and will report on it in the next 2008 Mitigation Program Report.

- **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 (see Section XI-C of this report), continued to maintain a water level recorder and ALERT station at the south arm (see Section II-G), 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 runoff at various locations including Highway 1 (see Section II-B), and water production upstream of the lagoon (see Section III).

- **Wildlife Monitoring** – District staff contracted with the Ventana Wilderness Society and Big Sur Ornithology Lab (BSOL) to conduct avian studies in the riparian corridor of the Carmel River at sites from Carmel Valley Village to a point just upstream of the lagoon (Section X-C). One of the concluding recommendations of the November 1995, Habitat Restoration Group report was for the District to conduct more wildlife monitoring around the lagoon. The BSOL will continue the avian monitoring around the lagoon initiated in 1997 by Dr. David Mullen under contract to the District.

In 1997, Dr. Mullen calculated the “Species Diversity Index” of the avifauna in the wetlands north of the lagoon, along transects established in 1996. The project was envisioned to track possible changes in the utilization of this area by birds. 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. The specific methods and results of the BSOL surveys are presented in annual reports to the District. The last one which covered sampling sites near the lagoon at the mouth of the Carmel River was for summer 2004. Sampling in the vicinity of the lagoon from there on was carried out by the CDFPR. Their results for summer 2006 are included in a separate annual report funded by the District and entitled *Avian Community Dynamics in the Lower Carmel River Watershed, 1992 – 2006*. This report was prepared by Thorngate, Scullen, and Olsen in July 2007.

Special Studies During 2006-2007

- **Steelhead Population Monitoring**

In response to a request from the interagency Carmel River Lagoon TAC, the District helped design and support a mark-recapture study to estimate the steelhead population in the lagoon at the end of the fall rearing season and before the lagoon might be breached for the year. This study was led by biologists from the District and the NMFS, and staffed with employees of the District, NMFS, CDFG, and CDFPR, as well as volunteers from CRSA and adjacent homeowners,

and students from California State University at Monterey Bay's Watershed Management Institute. The study was conducted on three consecutive days from December 13 through 15, 2006. A large seine was used to capture fish from nine different areas of the lagoon. A total of 284 juvenile fish were captured and marked with blue dye, then re-released back into the lagoon. Over the next two days, the same areas were seined again. The ratio of marked fish versus unmarked fish captured over the two days was used to calculate a Schnabel population estimate for the lagoon of 3,734 juvenile steelhead. The 95% confidence intervals of this estimate were from 2,128 to 15,221 fish, using the two-tailed Students-t value for a significance level of 0.05% and 160 degrees of freedom. The fish averaged approximately eight inches long and were in excellent condition. In the past few years, the lagoon's water surface elevation was quite low in the fall, and water quality was poor, resulting in low fish survival. Based on this year's population estimate, it appears the changes made this past summer in the lagoon's management were successful, resulting in a large cohort of smolt sized fish. The last time a similar effort was made to quantify the steelhead population in the lagoon was in October 1996, when consultant Don Alley estimated there were 5,643 fish in the lagoon using a single mark-recapture survey to develop a Petersen population estimate. These two estimates are not directly comparable because they were collected in different months, following different water year types.

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. Barring the development of a water supply project that can reliably provide more water to the Carmel River or offset water production from Carmel Valley, few feasible alternatives have been identified. In the summer of 2004, the addition of treated water from the Carmel Area Wastewater District was implemented on a seasonal basis, and some water from an old agricultural well was also added, although there were concerns about the effects of water quality and quantity on both juvenile steelhead and red-legged frogs. Determination of desirable lagoon volume is conducted in conjunction with the monitoring studies noted above and the findings of the Lagoon Enhancement Plan. Development of alternative means to provide adequate volume will consider the implementation of the selected alternative in the final Lagoon Enhancement Plan.

Implementation and Activities During 2006-2007

District staff continued the annual survey of four key lagoon cross sections (**Figure XI-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 received an increased load of sand from Tularcitos Creek and other drainages following the El Niño winter of 1998. Much of the sediment eventually washed into the main body of the lagoon, and subsequently some of the sediment 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 XI-2**, which shows the results of the annual surveys conducted since 1994.

In August 2007, staff completed the annual surveys of cross sections (XS) 1-4. The August 2007 XS surveys indicated very little change in lagoon substrate elevation at the four XS from the previous year's surveys (September 2006). The unchanged substrate conditions from 2006 to 2007 are consistent with the lack of high river flows during WY 2007, which was classified as "critically dry" based on low river runoff. In other words, river energy was insufficient to mobilize sands within the lagoon. Similar to surveyed conditions in September 2006, the August 2007 lagoon substrate elevations that were surveyed are among the lowest in the multi-year data set, indicating a relative increase in lagoon volume at the XS compared to past years.

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 restoration of the Odello West property and 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 have also attended meetings and had discussions with other agencies regarding the use of an old agricultural well and treated water from the Carmel Area Wastewater District to augment the lagoon during periods of low water.

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 be changing 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 this period, for example, there have been two extremely wet years (1995 and 1998), and two above normal years (1996 and 1997), in terms of runoff. 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 drawdown effects on wetland dynamics. It is recommended that the annual 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.

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. As indicated in the survey plots, the sandy bed

of the lagoon can vary significantly from year to year. Significant scour of sand at the four lagoon cross sections (XS) was documented during the September 2006 surveys. One year later in August 2007, substrate elevations at the XS were essentially unchanged due to the “critically dry” river flow conditions in WY 2007. The August 2007 lagoon substrate elevations that were surveyed are among the lowest in the multi-year data set, indicating a relative increase in lagoon volume at the XS compared to past years. In general, no major trends indicating sand accumulation or depletion at the lagoon cross sections have been identified based on available data. These data are necessary to answer to questions concerning whether or not the lagoon is filling up with sand, thus losing valuable habitat.

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Figure XI-1
Map of Monitoring Transects and Stations at Carmel River Lagoon Area

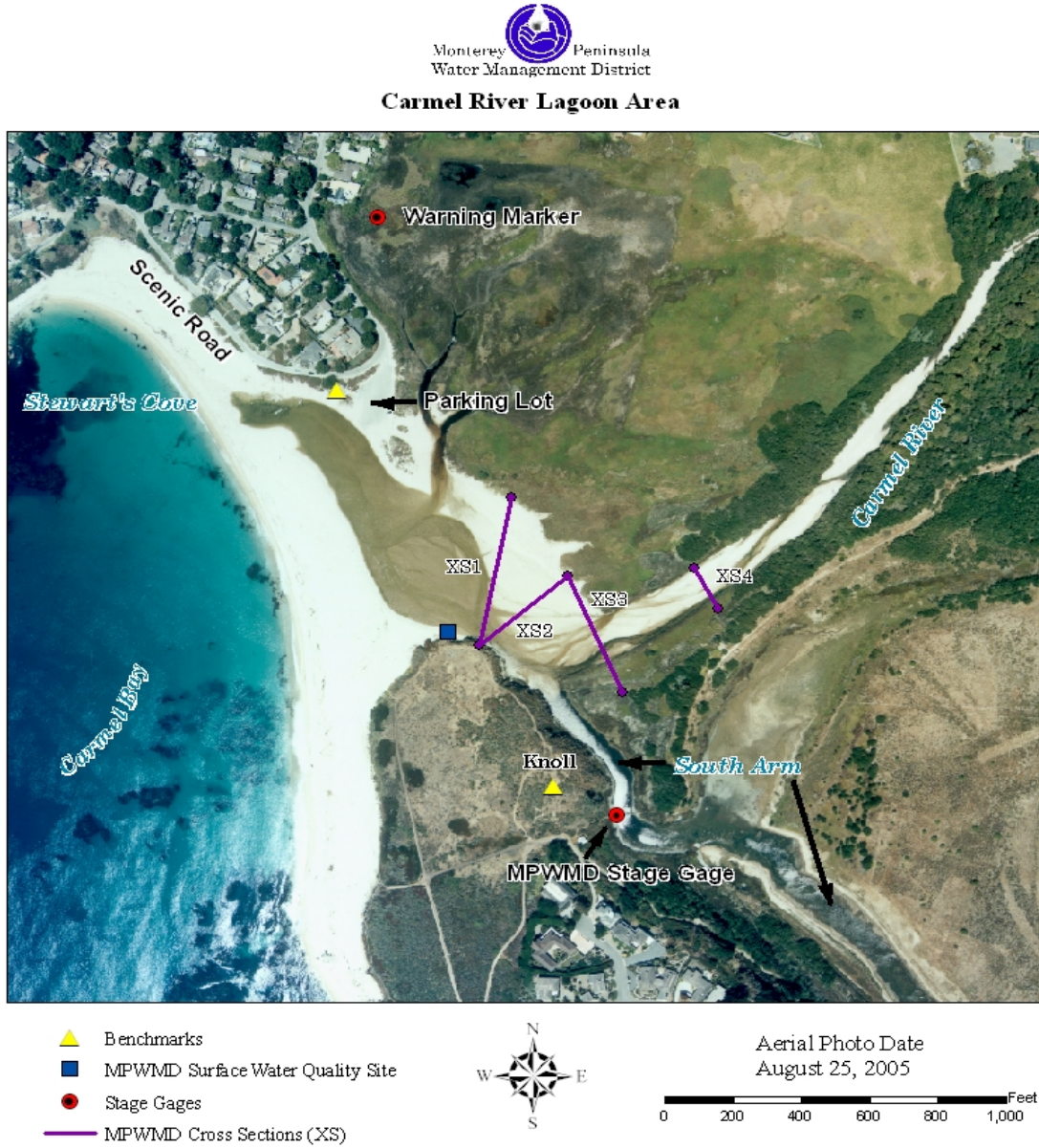


Figure XI-2

