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SOQUEL CREEK LAGOON MONITORING REPORT, 2007

Prepared by

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aquatic biology

Prepared for

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ACKNOWLEDGMENTS

I would like to dedicate this 2007 report to the memory of Yehudit Sherman. She was a fine biologist and a pleasure to work with over the past 15 years. She created many of the graphs in previous monitoring reports. She contributed drawings to previous educational enhancement projects that were completed after the 1990 Lagoon Plan. Yehudit also edited the 2004 Lagoon Plan Update, making it more readable. When sampling the streams, she worked as long and as hard as necessary to accomplish the task at hand with unwavering determination. She has left us much too soon and will be deeply missed. Yet, we must continue on without her.

We appreciate the efforts of the Capitola Public Works Department with Matt Kotila, heavy equipment operator, in forming and maintaining the lagoon in 2007. We thank Lance Elliott in assisting in seining the fish to relocate them during sandbar construction. Mark has been a positive force in preparing the flume and lagoon for the summer. We appreciated Gary Quail's help and good humor in censusing the fish. We appreciate efforts of all Begonia Festival participants in avoiding wading in the lagoon during the parade. The Begonia Festival organizers, volunteers and students, under the supervision of Ed Garcia of the City Public Works staff, effectively dismantled the floats and removed flowers by boat after the Begonia Festival in September. We thank Nels and Susan Westman again for the loan of their boat for fish censusing in October. Watching their giraffe float approach the Stockton Bridge was exciting during the Begonia Festival. We appreciate Ed Morrison's daily attention to managing the flume inlet as streamflow lessens through the summer and his preparation for storm events. Ed Morrison, Matt Kotila and Ed Garcia were successful in maintaining the sandbar until mid-December 2007, during a fall with several small, early storms and big waves.

We are grateful to the volunteers who do the annual fish censusing at the lagoon. Some are Friends of Soquel Creek (Steve Leinau, Ned Spencer, David --- and Tom Mader) and include other local residents, students and innocent bystanders who happen along. Biologists from NOAA Fisheries also helped sample both weekends (David Swank and Mike), looking for tagged fish from their study. Carol Whitehill and Lois Robin were on hand this year to photo-document our sampling activities. Volunteers are very welcome to help on typically the first two Sunday mornings in October. Seining usually ends by 1:00 pm, in time for other afternoon activities.

REPORT SUMMARY

Sandbar Construction and Breaching. After a winter with little rain, sandbar construction began on 21 May, prior to Memorial Day weekend. Sandbar construction has been permitted by the California Department of Fish and Game (1600-2003-0357-3), the Army Corps of Engineers (25714-0S) and under the National Marine Sanctuary Permit MBNMS-2004-033-A1. The Creek flowed laterally across the beach at approximately 6 cubic feet per second and emptied into the Monterey Bay at the jetty. The flume had been mostly cleared of sand the previous week. The channel was blocked off to allow rescue of fish. Nine seine hauls were made in the lateral channel with a beach seine that was 30 ft x 4 feet with 1/8-inch mesh. There was considerable kelp in the upper lateral channel that made seining difficult and unproductive in that location. Lance Elliott of the Capitola Public Works Department assisted Don Alley in the fish relocation. The overflow from the lagoon ran through a narrow channel cut adjacent to but not immediately alongside the flume. Fish captured included approximately 75 staghorn sculpins (*Leptocottus armatus*), 7 young-of-the-year starry flounders (*Platichthys stellatus*) and 1 large threespine stickleback (*Gasterosteus aculeatus*). No steelhead (*Oncorhynchus mykiss*) or tidewater goby (*Eucyclogobius newberryi*) were detected. Rescued fish were relocated to the main lagoon/ estuary. The sandbar was closed for the summer on 23 May. The lagoon was allowed to fill overnight before the flume outlet was opened on 24 May.

From 2300 hr 17 December to 0200 hr 18 December (early Tuesday morning), Morrison and Kotilla from the City were at the beach during a storm event. According to Morrison, by 0130 hr they witnessed the lagoon level rise and the creek gently flow through the notch in the sandbar. By 0600 hr the creek was flowing gently across the beach to the bay, with the estuary level still a few inches over the top of the flume. It had been raining steadily but lightly through the night, with an increase in intensity about 0500hr. At 0615 hr in the morning, 18 December, the discharge estimate at the Soquel Village stream gage was 8.6 cfs. The lagoon level had reached approximately 8 inches above the top of the flume before receding, based on the observed bathtub ring around the lagoon. Between 0600 and 1000 hr, streamflow had reached 18.9 cfs at the gage and begun to drop. By 1130 hr the estuary level had dropped to more than 2 feet below the top of the flume with a stream inflow of 12 cfs. The channel across the beach varied between 20 and 25 feet wide. 1 board had been removed from the flume inlet prior to breaching. Water had entered the flume through the grating on top of the flume. More boards were not taken out because more rain was anticipated that day and again on Wednesday. Later in the day after steady rainfall, streamflow reached 44 cfs at the gage, which was more discharge than the flume could have passed successfully. So, the creek flowed though the sandbar notch prior to the point that the flume had reached full discharge capacity on Tuesday morning and prior to what would have been potential flooding conditions later in the day. The sandbar remained open for the winter season.

Stream Inflow to the Lagoon. Habitat conditions in the 2007 lagoon followed a winter with few storms, with a baseflow at the time of sandbar closure of only approximately 5 cfs (**Table 13; Figure 18**). This was the lowest June baseflow since 1994, another dry year. However, the

baseflow did not decline as drastically as in other dry years, presumably because of good aquifer recharge the previous wet winter of 2005-2006. The early summer inflow as of 1 June 2007 (4.7 cfs) was much less than in 2006 (28 cfs), as estimated at the USGS gage in Soquel Village. By 1 September prior to any fall rainfall, streamflow had declined to 1.3 cfs in 2007 compared to 6.6 cfs in 2006 at the USGS gage. The September 2007 baseflow was the 4th lowest in the last 17 years.

Water Temperature. In 2007, the lagoon was consistently warmer near the bottom in morning and afternoon than in 2006 from late July through mid-September and in late October. Water temperatures were similar or cooler in 2007 compared to 2006 from mid-June to early July and from late 30 September through mid-October. In 2007, water temperatures near the lagoon bottom were rated "good" (<20°C at dawn) at all stations from 24 June to 5 August (except 22 July) and from 16 September onward (12 monitorings). However, mostly "poor" ratings (>21.5ºC) occurred on 22 July and immediately before and during the Begonia Festival (1-2 September). On 18 August temperatures were fair to good (**Table 3, Figures 3a-d; Appendix A**). The warmer temperatures in 2007 compared to 2006 occurred despite the higher lagoon levels in 2007 and deeper conditions in 2007 at all sites except at the flume. Warmer lagoon temperatures in July and September in 2007 were consistent with warmer inflow temperatures compared to 2006 (**Figure 3e**). The warmer July lagoon water temperatures occurred in 2007 despite similar average air temperatures recorded in Capitola compared to 2006 (**Table 4**). However, air temperatures in September 2007 were warmer than in 2006 in Capitola and Watsonville, consistent with warmer lagoon temperatures in the lagoon in 2007. In addition, there was undoubtedly less water circulation through the lagoon in 2007 with the lower stream inflow, reducing the cooling effect of the stream inflow at night (**Table 10**). Maintenance of a deep lagoon for most of the summer without tidal overwash usually helps to minimize water temperature near the bottom.

As in 2006, the 2007 water temperature at dawn within 0.25 m of the bottom of the lagoon became warmer as the monitoring stations progressed down the lagoon to the flume (**Figure 3f**). Water temperature of the stream inflow was cooler in the morning than the lagoon with 2-week fluctuations in lagoon inflow temperature mirrored in early-morning lagoon temperatures (**Figure 3f**). The correspondence between inflow fluctuations and lagoon temperature fluctuations indicated that the inflow temperature influenced the lagoon temperature in 2007 as in previous years. In the afternoon near the lagoon bottom, Station 1 at the flume was often the warmest, and Station 4 at the mouth of Noble Gulch was usually the coolest as in previous years (**Figure 3g**). However, in early August, Station 1 was the coolest in the afternoon near the bottom on a day that was overcast in the morning and sunny in the afternoon. Station 4 often showed the greatest temperature drop down through the water column in the afternoon, presumably due to cool inflow from Noble Gulch. The warmest water temperatures observed near the bottom at the 4 stations during 2-week intervals occurred on 22 July with readings of 22.1, 22.3, 22.1 and 21.6°C in the morning and 23.9, 23.3, 23.3 and 22.4ºC in the afternoon at Stations 1-4, respectively (**Figures 3f-g; Appendix A**). This day also had the warmest morning inflow temperature recorded during the 2-week monitoring at 18.6ºC.

Lagoon water temperatures (**Figures 4a- 4l**) closely mirrored temperatures in the stream inflow (**Figures 5a-b**) in 2007, as in past years. Daily temperature *minima* in the lagoon were consistently warmer near the bottom than the stream inflow in 1999-2007 (**Figures 4a-b, 5a-b; Alley 2005**). Daily temperature *maxima* near the bottom were warmer in the lagoon than the stream in 1999 and 2001-2004 and 2007, but were cooler in 2000 and 2005 (**Alley 2006**). In 2006, the daily temperature *maxima* in the stream were similar to that near the lagoon bottom. However, in 2007, the daily lagoon maximum was usually more than 2ºC warmer than the maximum inflow temperature (**Figures 4a and 5a**). The daily stream temperature fluctuated more than the daily lagoon temperature near the bottom.

As in past years, no thermocline was detected by the data loggers or at any of the 4 monitoring stations during the summer in 2007, with complete mixing of the water column on a diurnal cycle. The lagoon was likely 7-8 feet deep at most and subject to daily inland breezes. Water temperature was somewhat cooler at depth compared to nearer the surface by afternoon, being cooler near the bottom in the afternoon in 2007. Each night, water temperature cooled to the bottom, with the surface often being slightly cooler than deeper layers by early morning (particularly in August), and as indicated on 6 of 11 occasions for comparisons at 10-day intervals, beginning in late June (**Table 5; Figures 4a-b, 4k-l**).

Aquatic Vegetation. In 2007, unlike most years, a thick layer of decomposing kelp remained on the lagoon bottom after sandbar closure, especially under the Stockton Bridge and upstream. This decaying matter provided greater than usual amounts of nutrients for plant production. The suspended phytoplankton bloom was thicker than other years after sandbar closure, lasted longer, and continued throughout July, reappearing in late September. Filamentous algae was first noted during monitoring on 24 June 2007, approximately 4 weeks after sandbar closure (**Table 10 and Appendix A**).

Pondweed was first observed on 9 July 2007, 6 weeks after sandbar closure, and was much more abundant than the previous year. By 1 September 2007, all algae in Reaches 1 (downstream of Stockton Bridge) and 3 (upstream of the trestle) was associated with and attached to pondweed. In most years, the pondweed becomes most abundant in September.

In 2007, surface algae was first observed in Reaches 2 and 3 on 24 June, one month after sandbar closure. Then it disappeared until mid-August 2007 when it was observed in all reaches (**Table 10**). Algae mat coverage of the lagoon bottom increased rapidly to 100% by 24 June in the reaches that could be observed (2 and 3), 4 weeks after sandbar closure. It remained at 100% until middle August when pondweed became prominent (**Table 10**). The average thickness of bottom algae in 2007 was thicker in all reaches and at Noble Gulch compared to 2005 and 2006 (**Tables 10-12**). The percent coverage of the bottom was somewhat less in 2007 than the 2 previous years because of the greater prominence of pondweed in 2007.

Oxygen Levels. Critical oxygen levels are lowest at dawn, or soon after, because oxygen has

been depleted by cell respiration over night before plant photosynthesis can begin producing oxygen with the light. This was the time that oxygen levels were most importantly measured and rated. In 2007, oxygen levels for steelhead were either "fair" (between 5 and 7 mg/l) or "good" (greater than 7 mg/l) *near the bottom at dawn* at all stations during monitorings except for "poor" (between 2 and 5 mg/l) ratings in early August at the railroad trestle and 3 of 4 monitoring stations in mid-October after a stormflow that caused tea-colored turbidity and prevented complete light penetration to the lagoon bottom (**Tables 2 and 3, Figure 6a and Appendix A**). The lagoon level was reduced quickly to allow light to penetrate the entire water column. This encouraged photosynthesis and oxygen production. Therefore, oxygen concentration at dawn stayed above 5 mg/l at most stations throughout the lagoon period within 0.25 m of the bottom.

Oxygen concentrations near the bottom at dawn were generally higher in 2007 than 2006 throughout the lagoon period except in mid-October 2007 after the stormflow-generated turbidity (**Figures 6a and 6f**). Thus, with the algae thickness greater in 2007 and the greater prominence of pondweed with algae attached, early morning oxygen levels were higher even though oxygen consumption at night from plant respiration was presumably higher. Apparently, greater oxygen production during the day at these algal densities more than compensated for the respiration loss of oxygen overnight. This phenomenon was also observed between 2006 and 2005 (**Alley 2006**).

On all monitoring days except 13 October (with turbidity caused by stormflow), the oxygen concentration was higher in the afternoon than in the morning at all stations, despite higher afternoon water temperature, and even on cloudy days (**Figures 6b-6e**). The highest oxygen concentration was measured on the afternoon of the Begonia Festival at the Stockton Bridge site (18.7 mg/l) without morning overcast (**Appendix A**). Once the algae and pondweed became established in the lagoon, oxygen concentrations generally increased down the water column in afternoon (9 July–16 September). After mid-September, plant life was on the decline and this pattern did not hold up.

Begonia Festival Observations and Water Quality Findings. The City's fishery biologist was present during and after the Begonia Festival. The day of the Festival, 2 September, was initially sunny and remained so through the day. The lagoon depth was maintained at an excellent gage height of 2.53–2.55 ft. There were 8 floats in the nautical parade. In conformance with the permit requirements from the California Department of Fish and Game, no floats were propelled by waders. Means of propulsion included electric motor, kayaks, canoes, a rowboat, surfboards and poles. The float using poles had to be hitched to a rowboat to make headway against the typical head-breeze that develops in the afternoon. Thus, the lagoon bottom was not disturbed and increased turbidity was negligible. The secchi depth was to the bottom after the parade. Conductivity near the bottom increased very slightly at the Stockton Avenue Bridge from 681 before to 697 umhos after the parade, as was the pattern at 2 other measured sites (**Appendix A**). This was little change and not stressful to steelhead. There was no odor of hydrogen sulfide, and no fish mortality was observed.

Oxygen concentrations in the afternoon following the nautical parade were higher than the previous day and the highest recorded for the season. This was likely because there was no

overcast that day, unlike the previous day, and water temperature was warm to speed up photosynthetic rates of the aquatic plants.

Steelhead Sampling. Our steelhead population estimate based on mark and recapture for fall 2007 was 6,064 +/-1,671 compared to 992 juveniles +/- 125 in 2006 and 1,454 juveniles +/- 347 in 2005 (**Table 14, Figure 16**) (methods in **Ricker 1971**). This was the largest estimate thus far and well above our 15-year average of 1,488 juveniles. The other species captured in Fall 2007 were threespine sticklebacks, staghorn sculpins, juvenile Sacramento suckers and starry flounders. No PIT-tagged juveniles from 2007 NOAA Fisheries tagging less than a mile upstream were captured on either sampling day in 2007. We would expect more juveniles to use the lagoon in 2007 than 2006 because there were lower adult passage flows late in the spawning season in 2007, encouraging more spawning in the lower creek to seed the lagoon with more young-of-the-year steelhead.

We concluded from the size distributions of captured juveniles that steelhead grew slower in 2007 than 2006 in the summer lagoon, consistent with more competition from a much larger juvenile population in 2007. The median size of juvenile steelhead captured the first day was 125-129 mm SL (**Figure 7**) (155-159 mm SL in 2006 (**Figure 8**)). The median size captured steelhead on 14 October was 125-129 mm SL (145-149 mm SL (unclipped only) in 2006). Comparison of size distributions and the median size in each of the last 9 years, young-of-the-year growth rate was similarly lower in 2002-2005, with intermediate growth rates in 1998-1999 and 2001 and 2007, with faster growth rates in 2000 and 2006.

Pollution Sources. The lagoon near the beach was closed to human contact due to bacterial levels above the maximum acceptable level. The gulls are a primary source of pollution, both for bio-stimulating nutrients and bacteria. They forage through the human refuge left on the beach. They bathe and defecate in the lagoon. They roost and defecate on the buildings surrounding the lagoon. Reducing the gull population at Soquel Creek Lagoon would be a major step in reducing pollution. The use of gull sweeps has been observed to be successful in other locales to prevent gull roosting. The wires strung across the roof of the Paradise Grill have been effective in discouraging roosting on that restaurant. All of the refuse cans on the beach were equipped with gull-proof lids in 2006 (**Ed Morrison, pers. comm.**). Refuse containers with gull-proof lids may reduce gull numbers. The City has received funding to deter gull use on restaurant roofs, to redirect restaurant gutter systems away from the lagoon and to provide waste cans with gull-proof lids. Parallel wires were strung over the Paradise Grill Restaurant in 2006, which deterred gull roosting. Rock doves (pigeons) are another source of bird pollution as they circulate between the wharf and the railroad trestle over Soquel Creek Lagoon. As stated in the original Management Plan, the trestle could be screened to eliminate roosting areas.

Regarding pollution from urban runoff, installation and maintenance of silt and grease traps on storm drains is critical to reducing pollution by petro-chemicals. All new drainage systems from new development and parking lots should be installed with effective traps and percolation basins

to encourage winter percolation of storm runoff. The City has obtained grant money to install silt and grease traps on 4 storm drains that empty into the lagoon.

Ideally, all storm drains leading to the lagoon ideally should be re-directed away from the lagoon in summer. Included in these is the culvert draining Noble Gulch. Significant quantities of gray water and oily slicks have consistently emptied into the lagoon from Noble Gulch until 2001, and gain in 2005 and 2006 (**Alley 1995; 1996b; 1997-2000; 2005**). There was improvement noted in 2007 with only one instance (30 September) of an observed gray water plume issuing from Noble Gulch out of 14, 2-week monitorings. By comparison, these plumes were observed on 8 of 12, 2-week monitorings in 2006. This improvement may have resulted from replacement of sewage pipes along Riverview Road in the vicinity of Noble Gulch in fall of 2006.

There has been a pollution problem and high flashiness in streamflow in the past after the first small storms of the fall. At times, the lagoon required breaching prematurely because the flume could not accept all of the stormflow, and flooding was imminent. Retrofitting of storm drainage systems with holding tanks or percolation basins could reduce the sudden increase in street runoff and pollution during early storms. Drains leading from Wharf Road (across the Rispin property), the Auto Plaza and 41st Avenue businesses north of Highway 1 are some of the sources of this problem.

Continuing and New Recommendations and Those Not Yet Fully Implemented

1. Renew efforts to use wedges on the flume inlet boards to prevent their dislodgment from vandals and back-flushing from the tide, especially in the fall when the beach becomes eroded.

2. If sufficient turbidity occurs after the first small storms of the season to prevent light from penetrating to the bottom of the intact lagoon for more than one day, continue to reduce lagoon depth temporarily to insure that light reaches the bottom. This will prevent death of aquatic vegetation and increased biological oxygen demand, with the associated loss of oxygen production that would have occurred from photosynthesis. Thus, anoxic conditions will be prevented. When the lagoon clears up, re-establish the maximum lagoon depth.

3. Take special care to pack sand under the flume, between the pilings, during final sandbar closure in order to prevent seepage under the flume after closure.

4. Complete the hookup with PG&E to finish automation of the switch on the pump in the Esplanade storm drain to better transfer water to the sewer during the dry season.

5. Continue to disallow wading to propel floats during the Begonia Festival's nautical parade.

6. If the sandbar is in place after November 15, maintain an opening in the flume inlet to allow early spawning adults to pass through the flume from the bay during early storms.

7. Continue to use gull-proof lids on refuse cans on the beach and around the lagoon. Use enough refuse containers to satisfy the demand for refuse disposal.

8. Look into installing gull sweeps on restaurant roofs. The stringing of wire above roofs as observed over the Paradise Grill Restaurant should continue and be expanded to other restaurants to successfully prevent gull roosting there.

9. Look into screening the railroad trestle to discourage roosting and nesting by rock doves.

10. Repair the cracked flume. Its integrity is jeopardized, and the beach sinkholes created by flume underflow are a safety hazard.

11. As stated in previous reports, if the streamflow in Soquel Creek in the vicinity of Soquel Village approaches the point of losing surface flow, notify Tiedemann Nursery and the Fish and Game Department so that direct water pumping from the stream may be reduced or discontinued until flow returns. Loss of surface flow should be prevented.

12. Continue to retain large woody material in the lagoon for fish cover.

13. During daily artificial breaching during sandbar construction, continue to maintain water depth in the estuary such that no isolated pools and backwaters form at the margins to strand fish. Blocking of the sandbar may be required to maintain sufficient depth. Check the estuary margins to prevent stranding of fish.

14. In anticipation of a sandbar breach in the fall, the notch in the sandbar should be cut slightly lower than the piling bolt. *Continue to make the notch a 20-30 foot wide swath across the beach to maximize the possibility of maintaining an estuary with some depth after the breach.* Continue to place secondary berms near the flume exit and entrance to prevent tidal overwash through this swath. The City may have to periodically re-establish the notch if it does not rain or high tides obliterate it. If a storm is predicted, the sandbar needs a notch as preparation.

15. Continue to notify the California Department of Fish and Game 12 hours before the possibility of a sandbar breach and immediately after the breach occurs.

16. The City should encourage and influence planners, architects and property owners through the permit process to maximize water percolation and to filter out and collect surface runoff pollutants from new and existing development in the City and upstream.

17. The City should request from the responsible flood control district that sediment and grease traps be installed on drains leading into lower Soquel Creek and that they be

annually inspected and cleaned.

18. The City should continue to fund activities to permanently remove Arundo from lagoon-side residences and other non-native plants in the riparian corridor between Highway 1 and the lagoon.

19. Continue to census the juvenile steelhead in the fall to monitor the use of the lagoon as an important nursery area under varying management scenarios and restoration efforts.

LAGOON AND ESTUARY FORMATION

Results of Fish Seining Prior to Construction Activities

21 May 2007. The Creek flowed laterally across the beach at approximately 6 cubic feet per second and emptied into the Monterey Bay at the jetty. The flume had been mostly cleared of sand the previous week. The channel was blocked off to allow rescue of fish. Nine seine hauls were made in the lateral channel with a beach seine that was 30 ft x 4 feet with 1/8-inch mesh. There was considerable kelp in the upper lateral channel that made seining difficult and unproductive in that location. Lance Elliott of the Capitola Public Works Department assisted Don Alley in the fish relocation. The overflow from the lagoon ran through a narrow channel cut adjacent to but not immediately alongside the flume. Fish captured included approximately 75 staghorn sculpins (*Leptocottus armatus*), 7 young-of-the-year starry flounders (*Platichthys stellatus*) and 1 large threespine stickleback (*Gasterosteus aculeatus*). No steelhead (*Oncorhynchus mykiss*) or tidewater goby (*Eucyclogobius newberryi*) were detected. Rescued fish were relocated to the main lagoon/ estuary. The fish rescue was completed by 1000 hr.

As required in the permit, a fisheries biologist was present during all activities that could affect the fish habitat in the lagoon/estuary during sandbar construction. This was our seventeenth year of monitoring and assisting in activities associated with sandbar construction at Soquel Creek Lagoon. Annual monitoring reports for the first 16 years are available at the City (**Alley 1991-2006**). As stated in the Soquel Lagoon Management and Enhancement Plan (**1990**) and 2004 Soquel Creek Lagoon Management and Enhancement Plan Update (**2004**), all instream removal of kelp, sea grass and other organic debris was to be accomplished without the use of heavy equipment in the stream channel except within 25 feet of the flume. The bulldozer/tractor could traverse the area adjacent to the flume.

Monitoring of Flume Maintenance and Sandbar Construction

Sandbar construction was done prior to Memorial Day weekend, as is preferred by the City. The winter storms had been very minimal, and streamflow was only an estimated 6 cfs at the stream gage in Soquel Village. The lagoon had not experienced any flushing flows over the winter, leaving decomposing kelp and seagrass in the estuary the entire winter. A thick black ooze of decomposing material existed in the vicinity of the Stockton Avenue Bridge, 6-8 inches thick. The water was a milky green color up and downstream of the bridge, making it unadvisable to rake in those areas in fear of creating toxic conditions for fish. Therefore, raking was focused on the lower lagoon within approximately 25 meters of the flume inlet. In this area, relatively recent kelp and seagrass had accumulated. Deposits of seagrass were observed as far upstream as Noble Gulch. Considerable decomposing kelp existed near the eastern abutment of the railroad trestle. Unlike other years, the thalweg of the lower lagoon below Stockton Bridge was on the west side (Venetian Court side) and not near the restaurants.

21 May 2007. The sandbar construction began this day. Soquel Creek was flowing out to the Monterey Bay in a channel that went laterally across the beach to the jetty. As in most years past, the stream channel flowed laterally along the sea wall east to the jetty. The flume had been mostly cleared of sand the previous week by Public Works staff with adequate screening of the intake hose for water pumped into the flume. A narrow channel was cut through the beach adjacent to the flume, but not immediately alongside, to bypass flow after the lateral channel was blocked off for fish rescue. The sand from the auxiliary channel was used to block off the lateral channel. By 0620 hr, the lateral channel was nearly blocked off, with a small notch still allowing water to flow into the lateral channel. The lateral channel was blocked off from the estuary at 0730 hr, and the fish were rescued from it before the channel was covered over with sand. Fish were relocated to the main estuary/lagoon. Flume boards on the eastern restaurant side of the flume inlet had been previously removed. The western side was left boarded up. Before sandbar closure of the auxiliary channel at 1350 hr, 3 boards were added to the east side of the flume inlet. The lagoon began to slowly fill after sandbar closure. Public Works was concerned that if he opened the flume outlet, the lagoon would not fill overnight and/or the flume would fill with sand overnight because of the low streamflow. If the flume filled with sand, sandbar construction would be delayed while the sand was cleared out of the flume, with possibly several more days being needed to ultimately close the sandbar for the summer season. Therefore, the flume outlet was left closed overnight. Matt Kotila, the tractor operator, began to cover over the lateral channel with sand after sandbar closure. Considerable kelp was buried near the restaurants where the lateral channel had been. By the end of the day, the lateral channel was covered over with sand down to the jetty. All tractor work was performed above the tidal action and water contact was avoided.

22 May 2007. The lagoon had partially filled overnight, but had not spilled over the 3 boards in the flume inlet. The flume was approximately 1/3 full of water, indicating that water had seeped in through cracks between the boards. The flume outlet was partially buried in sand, and no water was leaving the flume. No steelhead were observed in the lower lagoon prior to sandbar opening this day. The sandbar was opened at 0800 hr adjacent to the flume. Four Public Works staff and the biologist raked kelp and seagrass out of the lagoon within 25 meters of the flume inlet. Young-of-the-year starry flounders and staghorn sculpins were observed during raking. At 1100 hr, the biologist walked up the creek, looking for stranded fish. No steelhead were observed. Only a school of approximately 30 very small, unidentified fish [possibly Sacramento suckers (*Catostomus occidentalis*)] was observed in a large side pool that remained watered. No predatory birds were observed. The estuary was stream-like with considerable cobble 3-5 inches in diameter on the hard streambed. The stream ran along the eastern bulkhead down to the Stockton Avenue Bridge and widened. Then it flowed to the west around a wide sand deposit located adjacent to the restaurants. The thalweg was on the western, Venetian Court side of the lower lagoon. The mid-channel bar still existed between the Stockton Avenue Bridge and the railroad trestle. The downed cottonwood remained across from Noble Gulch. Two large redwood stumps were still situated in the lagoon, downstream of Noble Gulch. The estuary bottom downstream of the Stockton Avenue Bridge consisted of very soft sand and black ooze in places.

The sandbar was closed by Matt Kotila at 1235 hr to prevent saltwater incursion and to allow the

lagoon to refill. The flume's overhead grate was exposed. Public Works opted to leave the flume outlet closed due to concern that the lagoon would not fill and/or sand would plug up the flume if this were done. One board was removed from the flume inlet, leaving 2 boards in place overnight. The lateral channel alongside the jetty was filled by the end of the day.

23 May 2007. The lagoon had filled slightly less overnight than the previous night. The water had not overtopped the boards in the flume inlet, and the flume was approximately 1/3 full of water. The flume outlet was fully exposed at the beginning of the day with no water exiting. The sandbar was re-opened at 0900 hr. Again, 5 Public Works staff and the biologist raked kelp and seagrass out of the lagoon. One young-of-the-year steelhead was observed near the flume inlet during raking. The biologist walked up the creek channel at 1050 hr, looking for stranded fish. None were observed in side channels. One young-of-the-year steelhead was observed in the main channel near the railroad trestle. The cofferdam had been removed from the construction site, exposing a freshly poured concrete wall to the lagoon. No construction workers were present. No predatory birds were observed on the walk upstream. The sand around the flume inlet was compacted with the tractor in order to prevent leakage under the flume. Filter fabric was placed around the flume inlet, followed by a layer of black visquine. Sandbags were placed around the periphery of the visquine to hold it in place. This year the visquine was covered with sand by hand instead of by tractor. The sand was tamped down by foot around the flume inlet. The concern was that the tractor displaced the visquine and promoted leakage around the flume inlet. The weir inside the flume was still in place. Because of concern that the lagoon would not fill if an underwater portal was placed lower down on the flume inlet boards, a larger notch was cut in the upper boards (instead of an underwater portal further down) to allow adult steelhead kelts and juvenile smolts to exit through the flume. All of the flume inlet boards were placed in the flume inlet. A notch 8 inches deep and 7 inches wide was cut in the upper two boards for fish passage. The sandbar was closed for the summer at 1245 hr. The biologist and Public Works agreed that the flume outlet should remain closed to allow the lagoon to fill up to the cut notch. The purpose was to maximize the lagoon volume in order to minimize lagoon water temperature and predation for the steelhead, while providing smolt passage once the lagoon water level was brought up. Approximately 20-30% of the kelp and seagrass that had deposited in the lower lagoon had been raked out, downstream of Stockton Bridge.

24 May 2007. From this day onward until project completion, the beach preparation was monitored by Ed Morrison, the city staff person in charge of field operations. Grading work was done along the Venetian Court area to maintain the sand level below the drains in the wall along the walkway. The area long the east side of the lagoon was shored up with another layer of sand. Low-lying areas along the beach were filled to prepare the beach for weekend visitors. The biologist observed the lagoon in mid-afternoon. Water quality measurements were taken through the water column in the thalweg near the western bridge abutment of Stockton Avenue Bridge. The water column was slightly saline at 0.9 ppt down to the bottom, which was 1.3 ppt. Water temperature at 1500 hr was warm for this early season, with it 19.6 C at the surface and declining to 18.7 C at 1.25 meters below the surface and increasing to 19.5 C on the bottom at 1.35 meters. Oxygen was good at above 8 mg/l until it dropped suddenly to 1.5 mg/l at 1.25 meters below the surface. Oddly, it increased to 6.75 mg/l on the bottom. The probe was moved over to the bridge

piling to detect salinity. The salinity on the bottom there was only 1.4 ppt. With the low salinity readings, the biologist recommended that the City not install the shrouds on the flume inlet at this point. The lagoon level had only reached 1.06 feet on the height gage on the bulkhead. The water level was 4 boards below the top of the flume inlet at 1520 hr.

25 May 2007. Ed Morrison called at 0930 hr. He stated that water was flowing through the notch in the 2 upper boards of the flume inlet with about 2 inches depth in the notch. He had opened the flume outlet and water was flowing out of the flume for the first time since sandbar construction began. Ed suggested that they would put a plywood board over the boards to reduce seepage. At 1500 hr, Ed reported that the lagoon level was about the same as earlier and that the plywood had not yet been installed.

26 May 2007. At 1030 hr, Ed Morrison reported that the lagoon had increased approximately 1 inch from the previous afternoon. The flume outlet remained open overnight with boards left in the lower outlet to maintain depth within the flume. The plywood was installed. By 1730 hr, the water level had risen to within 2 inches of the top of the flume, as reported by Ed Morrison.

29 May 2007. Water temperature probes were placed in the lagoon and the stream above the lagoon. Gage height was 2.46 ft.

30 May 2007. Lagoon water quality was checked at the Stockton Bridge at 1130 hr, indicating favorable conditions for steelhead. Saltwater had dissipated with readings of 0.4 ppt throughout the water column and near the bridge abutment at the bottom. Water temperature was between 15.7 and 16 C through the water column (water depth of 1.65 meters). Oxygen levels were good at between 8.77 and 8.94 mg/l through the water column except 4.95 mg/l at the bottom. The water level was ½ inch below the top of the flume, and the flume outlet was open with a water depth of 1.0 ft at the exit. Sand had been added along the lagoon margin on the Venetian Court side to prevent tidal overwash. The reference gage height was excellent at above 2.60 ft. Sink holes had developed in the beach above the flume near the outlet, indicating water leakage from the flume through cracks in the flume. No leakage of water from the lagoon under the flume was evident.

In conclusion, during the entire sandbar construction and beach preparation, the City's tractor operator paid special attention to avoid working in the waters of the Monterey Bay by grading below the high tide line only after the tide had receded well below the work area.

Effect of Sandbar Construction on Tidewater Gobies in 2007

It was likely that if tidewater gobies were present, they used habitat upstream of the construction area, where there was less tidal fluctuation and salinity. No mortality of tidewater goby was observed during the construction activities. However, artificial water level fluctuations were created during sandbar construction activities. Only 2 sandbar breaches were required during sandbar preparation in 2007, with 3 breaches allowed by the permit without regulatory consultation. In 2007, there was much more decomposing kelp and sea grass in the estuary

because of the low winter runoff. The 2 breaches closely mimicked normal tidal fluctuations of an estuary. With each lowering of the water in the estuary, tidewater gobies would need to retreat to deeper water as water surface receded in the upper estuary. There were likely few, if any tidewater gobies left in Soquel Creek after the past torrential stormflows of the 1997-98 winter and high runoff in winter of 2005-2006. No tidewater gobies were detected during the previous fall 2006 lagoon sampling. The channel lacked sheltered backwaters for fish to escape high water velocity during high stormflows. However, tidewater gobies have been detected recently in Moran Lake and Aptos Lagoon after years of no detection, and they may repopulate Soquel Lagoon in the future from adjacent populations.

Effect of Sandbar Construction on Steelhead in 2007

No negative impacts to the steelhead population were detected in 2007. Access through the flume was not maintained for 3 days during the sandbar construction period. The flume outlet was left closed due to concerns about sand plugging the flume and lack of lagoon filling with the low streamflow (approximately 6 cfs). It was decided that keeping the flume clear of sand and establishing as deep a lagoon as possible with a maximum head prior to flume opening during the days of sandbar construction should take priority over maintaining continuous steelhead access to the bay. If the flume exit had been kept open during sandbar construction and the flume partially filled with sand overnight, the construction period may have been increased and the staffing requirements would have been increased. No steelhead smolts were observed during sandbar construction, indicating that most smolt emigration had already occurred. However, some smolt emigration may have been delayed slightly during the 3-day period of sandbar construction for late smolts. This delay was probably insignificant in 2007 when steelhead smolts and predatory birds were not observed in the lagoon at the time of sandbar construction.

The changing of the underwater adult portal to a larger notch at the top of the flashboards of the flume inlet appeared to provide adequate adult access to the flume without sacrificing lagoon depth. This is only necessary in drier years.

The seasonal effect of removing organic material and constructing the sandbar is to create good summer rearing habitat for steelhead and tidewater goby. Compared to allowing natural lagoon formation, a lagoon is created with cooler, freshwater conditions, with reduced potential for eutrophication and associated increased biological oxygen demand from plant decomposition and night-time respiration by live algae. Kelp and sea grass removal and sandbar closure create better fish habitat for tidewater goby and steelhead than if the sandbar was allowed to close naturally. Natural closure would allow considerable kelp and sea grass to become trapped in the lagoon to decompose. Under natural sandbar formation, much more saltwater would also be trapped to create an unmixed, anoxic lagoon bottom, which would collect heat and raise lagoon water temperature. The naturally formed sandbar would be lower in stature, allowing more tidal overwash of saltwater during especially high tides. Increased tidal overwash would further elevate water temperature, making the lagoon less hospitable for steelhead.

Recommendations for Lagoon Preparation and Sandbar Construction

1. Closing the sandbar in late May is better than mid-June or later because streamflow is sufficient to rapidly fill the lagoon in most years, and the juvenile steelhead most likely to be present in the lagoon are out-migrating smolts. Late May is prior to down-migration of most YOY steelhead from spawning sites above the lagoon. Small steelhead fry remain in the vicinity of spawning sites before moving down into the lagoon. Down-migrant trapping on the nearby San Lorenzo River in 1987 and 1988 by Don Alley and Stafford Lehr (now with CDFG) indicated that a few YOY steelhead were down-migrating in May, but the number greatly increased in June.

2. The management solution for minimizing the time required for sandbar construction is for the City to remain flexible on timing of the work. If rain is in the forecast within two days after the intended starting date for sandbar construction, Public Works should postpone construction until clear weather is forecasted. If 4-5 working days are set aside to construct the sandbar, the sandbar construction may be delayed as late as 4-5 days before the Memorial Day weekend and may still satisfy the tradition of lagoon formation before then.

3. Continue to rake as much kelp and sea grass out of the lagoon as possible before final closure, from the Stockton Avenue Bridge downstream, including plant material trapped under the restaurants and in depressions around the bridge piers. It is best to minimize time required to stockpile sand, rake out the decomposing organic material and prepare the flume inlet for fish passage. This will minimize the number of instances of artificial fluctuation of lagoon water level. Sufficient City staff should be assigned to be ready to enter the estuary at the earliest opportunity each day and quickly rake out decomposing kelp and to clear the sand-filled flume. The 2 days of artificial breaching required for sandbar construction in 2007 was 1 day less than is typical.

4. Dispose of kelp in the Bay rather than bury it in the sandbar. Disperse it up and down the beach. Continue to include this in the Fish and Game permit for sandbar construction. County Environmental Health approved of this method so long as kelp is spread over a wide area (**J. Ricker, personal communication cited in the original 1990 Soquel Creek Lagoon Management and Enhancement Plan**).

5. To provide cover for juvenile fishes, continue to leave any large woody material deposited in the lagoon from winter storms. Allow a clear path from under the bridge to the beach at Venetian Courts to enable seining for juvenile steelhead during fall censusing.

6. Annually evaluate the structural integrity of the flume and its supports. Repair cracks and supports as necessary. (A grant has been secured for flume repair.)

7. During sandbar construction, continue to close the lagoon each day before the incoming

tide can wash salt water and kelp into the lagoon. Re-open the sandbar and unplug the flume, if necessary, each morning to facilitate kelp and sea grass removal.

8. Search under the Stockton Avenue Bridge and in Reaches 2 and 3 for stranded fish to rescue as the lagoon drains each day during raking. It is best to minimize the number of days required to construct the sandbar and rake out the decomposing organic material. This will minimize the artificial fluctuation of lagoon water level. Having a maximum number of personnel to rake decomposing organic material into the bay and to clear the flume of sand will minimize the days needed to prepare the lagoon for the summer.

9. Maintain an underwater portal in the flume intake for out-migration of adult steelhead until June 15, while maintaining a notched top plank for out-migration of smolts until 1 July. However, in dry years such as 2007,when stream inflow is insufficient to fill an underwater portal and allow lagoon filling, opt for a larger notch in the upper boards to accommodate adult kelts and smolts instead of a deeper underwater portal for kelts.

10. Maintain the 1-foot high baffle inside the flume until July 1 for safe entrance of out-migration of smolts into the flume inlet as they enter the Monterey Bay.

11. Continue to cover the visquine and filter fabric around the flume inlet with manually shoveled sand instead of tractor shoveled sand. This will prevent the tractor from displacing the visquine. If light colored filter fabric and clear visquine can be used, covering with sand will be unnecessary, although sand bags will be necessary to secure the visquine.

12. Repair the cracks in the flume so that sinkholes do not form on the beach and water does not leak out of the lagoon under the flume after sandbar closure.

Procedure for Emergency Sandbar Breaching at Soquel Lagoon by the City of Capitola

In 1990, a bolt was set into a wooden piling adjacent to the restaurants at the lagoon. The bolt's elevation was surveyed to coincide with the water surface elevation at which flooding was imminent. The bolt is 1.77 feet above the elevation of the top of the flume inlet. It allowed 1 foot of freeboard at the residence where flooding was identified as a problem. Since then, another low point has been located near the railroad trestle, which will have flooding problems approximately 0.5 feet above the bolt. Another bolt is present on a piling to indicate this elevation. The management goal is to pass stormflow through the flume from the first small storm events in the fall while keeping the lagoon surface below the original bolt. This is done by the City removing boards from the flume inlet prior to and during increased stormflow. Water also flows through the top grate that was constructed in the flume inlet in 2003.

A tractor is used in the fall to cut a notch in the sandbar adjacent to the flume. The intent is to prepare the sandbar so that it will breach at the proper time to prevent flooding. The City cuts the

sandbar notch at the elevation of the piling bolt. However, the notch fills in from foot-traffic on the beach as time goes on. If, despite efforts to pass all of the stormflow through the flume, the water surface reaches the elevation of the piling bolt, then the City is to facilitate sandbar breaching. A tractor is used to re-cut the sandbar notch so that the sandbar breaches prior to flooding. If the flume is able to receive all of the stormflow and flooding does not become a threat, boards are replaced in the flume inlet after the stormflow has passed.

Sandbar Breaching During the 2007-2008 Rainy Season.

17-18 December 2007. From 2300 hr 17 December to 0200 hr 18 December (early Tuesday morning), Morrison and Kotilla from the City were at the beach during a storm event. According to Morrison, by 0130 hr they witnessed the lagoon level rise and the creek gently flow through the notch in the sandbar. By 0600 hr the creek was flowing gently across the beach to the bay, with the estuary level still a few inches over the top of the flume. It had been raining steadily but lightly through the night, with an increase in intensity about 0500hr. At 0615 hr in the morning, 18 December, the discharge estimate at the Soquel Village stream gage was 8.6 cfs (**Figure 20**). The lagoon level had reached approximately 8 inches above the top of the flume before receding, based on the observed bathtub ring around the lagoon. Between 0600 and 1000 hr, streamflow had reached 18.9 cfs at the gage and begun to drop. The biologist arrived at the lagoon at 1000 hr after observing streamflow conditions at Nob Hill of between 10 and 15 cfs. By 1130 hr the estuary level had dropped to more than 2 feet below the top of the flume with a stream inflow of 12 cfs. The channel across the beach varied between 20 and 25 feet wide. 1 board had been removed from the flume inlet prior to breaching. Water had entered the flume through the grating on top of the flume. More boards were not taken out because more rain was anticipated that day and again on Wednesday. Later in the day after steady rainfall, streamflow reached 44 cfs at the gage, which was more discharge than the flume could have passed successfully. So, the creek flowed though the sandbar notch prior to the point that the flume had reached full discharge capacity on Tuesday morning and prior to what would have been potential flooding conditions later in the day. As of Christmas Day, the sandbar remained open for the winter season.

Recommendations Regarding Sandbar Breaching

1. As stated in the Management Plan (**1990**), make sure that parking lots and streets draining into the lagoon are cleaned before the rainy season. This will reduce the pollutants entering the lagoon during the first storm of the season that are lethal to fish. Street sweepers with water and suction may be necessary. In addition, roadwork such as repaving and application of fresh petrochemicals should be done in the early summer to allow sufficient time for penetration and drying before the rainy season.

2. The notch in the sandbar should be cut slightly lower than the piling bolt. *Make the notch at least 20-30 foot wide across the beach to maximize the possibility of maintaining an estuary with some depth after the breach.* The City may have to periodically re-establish the notch if it does not rain or high tides obliterate it. If a storm is predicted, the sandbar needs a notch as preparation.

3. Just as the first storm of the fall season begins, remove boards from each side of the flume if a small storm is anticipated. The number of boards removed will be dictated by the anticipated size of the storm. Remove two boards from either side if a large storm is anticipated. Clear the exit to the flume by removing the plate from one side of the exit. As stated in the 1993 monitoring report, management options to delay sandbar breaching include installation of a perimeter fence around the flume inlet to collect algae. Replace the boards after the stormflow subsides, removing them for each succeeding storm until the sandbar is eventually breached during later, larger storms usually occurring after Thanksgiving. There is now a grated opening on top of the flume inlet. After the stormflow subsides, replace the cover until the next storm.

4. After the first storm of the season with the sandbar still intact, lower the lagoon level to a point where light may penetrate to the lagoon bottom. In doing so, the plant life in the lagoon may continue to photosynthesize and is kept viable. Thus, vegetation mortality and stressfully low oxygen levels are prevented until the water clarity is re-established. Re-install boards to increase lagoon depth after the lagoon clears up.

5. Notify the California Department of Fish and Game 12 hours before the possibility of a sandbar breach and immediately after the breach occurs.

6. If the sandbar breaches early in the rainy season, followed by a period of 2-4 weeks of a reformed sandbar that prevents water exchange with the ocean, attempt to pull the decomposing kelp out of the stagnating lagoon. Open the flume and encourage streamflow out with the shroud installed.

7. If a stagnant, kelp-filled lagoon forms in fall after an early breach and a dry period, do not empty the lagoon by breaching the sandbar. Instead, use the flume and shrouds to pull salt water out. Breaching of the lagoon will increase the opportunity for more kelp to enter and probably will not empty the entire lagoon anyway. Fish passage need not be maintained through the flume because it should be discouraged until sufficient stormflows develop to provide passage up the Creek. If adult salmonids enter too early, they will become stranded and unable to migrate upstream because of insufficient streamflow.

WATER QUALITY MONITORING IN 2007

Rating Criteria

Water quality parameters were rated according to the tolerances of steelhead. This was because they are least tolerant of low oxygen, higher salinity and higher temperatures. Stress to freshwater acclimatized steelhead would probably not occur until conductivity levels reach 12,000 to 15,000 umhos, associated with sudden increases in salinity to 10- 12 parts per thousand. Water temperatures above 22º C (72º F) (**Table 1**) and oxygen levels below 5 parts per million (mg/L) are thought to stress steelhead. However, steelhead have been found surviving in pools in the Carmel River at 1-2 mg/L for 1-2 hours at dawn (**David Dettman, personal observation**). Based on 1988 monitoring, steelhead appear to survive in Soquel Lagoon at water temperatures of 23-25ºC for 1-2 hours toward the end of the day (**Habitat Restoration Group 1990**). Water temperature may rise as much as 3-5ºC during a sunny day from a minimum at dawn.

Oxygen levels critical to steelhead were classified as those measured in the lower 0.25 meters from the bottom, where steelhead would inhabit. Early Morning oxygen levels below 2 mg/l were rated "critical" (**Table 2**). Those levels between 2 and 5 mg/l were rated "poor." Early morning oxygen levels of 5 to 7 mg/l were rated "fair" with above 7 mg/l rated as “good.” Early morning water temperatures in the lower 0.25 meters of the water column of less than 20º C were rated "good" while those 20-21.5º C were rated "fair." Temperatures between 21.5 and 23º C were rated "poor," while those greater than 23º C at dawn were rated "critical." High levels of dissolved carbon dioxide in water will inhibit absorption of oxygen by fish. However, in the alkaline conditions of Soquel Creek Lagoon, carbon dioxide is poorly dissolved and is not a problem (**J. Smith, personal comm**.). Therefore, its monitoring was unnecessary.

Lagoon water level was monitored with the staff gage on the eastern bulkhead, upstream of the Stockton Avenue Bridge (**Figure 1.**) Readings below 1.5 feet were rated "critical" while readings between 1.5 and 1.85 were rated poor (**Table 2**). Readings between 1.85 and 2.2 were rated "fair." Readings above 2.2 were rated "good." These criteria were somewhat arbitrary, being based on an as yet poorly defined relationship between lagoon depth and associated fish cover, water temperature and algal growth. If the upper lagoon becomes too shallow, steelhead habitat is eliminated and algae growth may be stimulated. An important factor not directly under control by the City is change in streambed elevation resulting from winter scour or fill.

Locations and Timing of Water Quality Monitoring

As required under the CDFG permit for 2007, water quality was monitored in late afternoon, as well as in the early morning near first light. Water quality was monitored at four lagoon stations. Station 1 was at the flume inlet (**Figure 1**). Station 2 was on the downstream side of the Stockton Avenue Bridge in the deepest thalweg area. Station 3 was just downstream of the

railroad trestle on the east side. Station 4 was at the mouth of Noble Gulch. Station 5 was monitored in the morning in Soquel Creek near the Nob Hill shopping center, just upstream of where it entered the lagoon. The data at the stream location was used as a point of comparison with lagoon conditions of temperature and oxygen levels in early morning.

In 2007, 6 HOBO temperature loggers were launched on 24 May 2007 just upstream of the railroad trestle in Reach 3 at 1-foot intervals through the water column beginning at 0.5 feet above the bottom and ending 5.5 feet from the bottom, as required by the CDFG permit. This was a deeper portion of the lagoon. Another logger was placed in Soquel Creek near the Nob Hill Shopping Center. All 7 loggers were removed on 31September 2007, prior to anticipated rain.

Water quality in terms of oxygen concentration, temperature, conductivity and salinity was measured at each lagoon station at two-week intervals after the sandbar was constructed until the sandbar breached in the fall. Prior to the first full monitoring, salinity was measured in deeper portions of the lagoon to determine if saltwater had been trapped during sandbar construction. If it had, then the shrouds would be placed on the flume inlet to draw the heavier saltwater off the lagoon bottom to hasten the freshwater conversion in the lagoon. In 2007, the CDFG permit required that monitoring occur in the early morning and late afternoon. Prior to 2003, water quality had been measured in the early morning after dawn because the most limiting factor, oxygen concentration, is at a minimum at that time.

Table 1. Temperature Conversions From Degrees Celsius to Degrees Fahrenheit.

Degrees Celsius	Degrees Fahrenheit
10	50.0
11	51.8
12	53.6
13	55.4
14	57.2
15	59.0
16	60.8
17	62.6
18	64.4
19	66.2
20	68.0
21	69.8
22	71.6
23	73.4
24	75.2
25	77.0
26	78.8
27	80.6
28	82.4
29	84.2
30	86.0

Table 2. Water Quality Criteria for Measurements Within 0.25 Meters Off the Bottom at Dawn and Gage Height Readings.

MORNING RATING	MORNING TEMPERATURE (Celsius)	OXYGEN (mg/L)	GAGE HEIGHT (ft)
Good	< 20	> 7	> 2.20
Fair	20-21.5	5-7	1.85-2.20
Poor	21.5-23	2-5	1.50-1.85
Critical	> 23	< 2	< 1.50

Water Temperature Goals for Soquel Creek and Lagoon

Regarding Soquel Creek Lagoon in summer, where food is more abundant than upstream, a management goal for steelhead should be to maintain water temperature below 20ºC (68ºF) at dawn within 0.25 m of the bottom and the afternoon maximum below 22ºC (71.6ºF) near the bottom. This early morning goal coincides with a "good" rating at monitoring sites (**Table 2**). This lagoon management goal is somewhat higher than the enhancement goal we established for Soquel Creek upstream, where the goal was to maintain water temperature below 20ºC. Maximum daily water temperature in the lagoon should not reach 26.5ºC (79.5ºF). Although Coche (**1967, cited in Kubicek and Price 1976**) determined that temperatures between 20 and 24ºC were responsible for high maintenance requirements and low conversion efficiency of food into growth for his stock of juvenile steelhead, our annual sampling of juvenile steelhead in Soquel Lagoon indicates that growth rate in the lagoon has been greater than in the upstream stream reaches (**Alley 2003**), with nearly all young-of-the-year juveniles in the lagoon reaching smolt size the first summer each year. This indicates that higher water temperature has not prevented relatively rapid growth of juveniles in the lagoon.

Water temperatures above 20ºC (68ºF) are considered limiting to juvenile coho salmon in the presence of steelhead (depending on food abundance), and lagoon temperatures below 16ºC (60.8ºF) are preferred (**J. Smith, personal communication**). Therefore, the management target for making Soquel Creek Lagoon habitable for coho should be to maintain summer water temperature below 20ºC (68ºF). However, we do not believe that Soquel Creek Lagoon may be cooled sufficiently to support juvenile coho salmon.

The management goal for water temperature in stream habitat upstream of the lagoon should be maintenance below 20ºC (68ºF) in April and May when baseflow still remains above summer low-flow and juvenile salmonids are feeding and growing rapidly. From June1 to September 1, the water temperature should not rise above 20ºC (68ºF) more than 4 hours a day (15% of the month) and preferably the maximum daily temperature, averaged weekly, should not rise above

21ºC (70ºF). These goals are based on literature review of physiological relationships between fish metabolic rate and water temperature (**Kubicek and Price (1976); Brett (1959, cited in Kubicek and Price 1976); and Snyder and Blahm (1971, cited in Kubicek and Price 1976**)).

The temperature optimum is a moving target, increasing and decreasing with food supply. According to Moyle (**2002**), Baltz et al. (**1987**) reported that optimal temperatures for growth of rainbow trout (not steelhead) to be around 15-18ºC, a range that corresponded to temperatures selected in Sierran streams when possible. According to Moyle (**2002**), regarding temperature optima, "The optimal temperatures for growth of rainbow trout are around 15-18ºC, a range that corresponds to temperatures selected in the field when possible. Thus, in a section of the Pit River containing a thermal plume from an inflowing cold tributary, rainbow trout selected temperatures of 16-18ºC. However, many factors affect choice of temperatures by trout (if they have a choice), including the availability of food." The Santa Ynez River Technical Advisory Committee (SYRTAC) proposed guidelines with upper limits of 20ºC average daily temperature and 25ºC daily maximum as providing acceptable habitat conditions for steelhead in the Santa Ynez River (**SYRTAC 2000**), further south of Soquel Creek. The SYRTAC (**2000**) decided that a mean daily temperature of 22ºC may be the threshold between acceptable and unsuitable from a long-term perspective. This was based on studies by Hokanson et al. (**1977;** Cited in Santa Ynez River Technical Advisory Committee 2000), who concluded that the highest constant temperature at which the effects of growth and mortality balance out was 23ºC.

The management goal regarding water temperature prior to re-introduction of coho salmon to Soquel Creek should be that water temperature in specified reaches meet the criteria that average daily water temperature (averaged weekly) during summer/fall months (June 1 to October 1) be 16.7ºC (62ºF) or less in the warmest week and that the weekly maximum temperature be 18.0ºC (64ºF) or less during the warmest week (**Welsh et al. 2001**). The targeted stream segments include 1) the mainstem Reaches 7-9 (Moores Gulch confluence to Hinckley Creek confluence on the East Branch), 2) Reaches 11 and 12A (Soquel Demonstration State Forest between the Soquel Creek Water District Weir at the lower end of the canyon and the gradient increase below the Fern Gulch confluence) and 3) Reaches 13 and 14a on the West Branch (downstream of the lowermost Girl Scout Falls I. We do not believe that the mainstem Reaches 1-6, downstream of the Moores Gulch confluence can become sufficiently shaded to reach this goal.

Results of Water Quality Monitoring of the Lagoon After Sandbar Closure

Lagoon Level. **Appendix A** provides detailed data on water quality. **Table 3** rates habitat conditions. **The lagoon level was monitored 17 times in 1 to 2-week intervals from 24 May to 8 December 2007, including September 2, the day of the Begonia Festival.** For 2007, the measurements of lagoon level as measured on the staff gage were rated "good" (**Table 2**) on 13 occasions, "fair" on 2 occasions and "critical" on 2 occasions (**Table 3; Figure 2a**). The critical level on 24 May was the first day after sandbar closure, and the lagoon was still filling in a year with lower than usual lagoon inflow. Lagoon level was maintained in the good range for the remainder of the summer and during the Begonia Festival, except on in mid-October when lagoon levels had been reduced to allow photosynthesis to the bottom. The other critical rating occurred on 8 December when flashboards became dislodged from observed back-flushing from the bay. In the morning the gage height rating was fair at 1.92. By afternoon, the lagoon level had dropped to 1.26, which was critically low. The City biologist notified Morrison, and inserted 3 flashboards. However, the problem was not fully remedied until the next day by Morrison. Boards at the very bottom of the flume had been dislodged and disappeared.

There were 2 small storms in September after the Begonia Festival and a slightly larger one occurred 12 October. Streamflow reached 10 cfs at the Soquel Village gage and lagoon level reached 8 inches above the flume, as reported by Morrison during that storm. Afterwards, turbidity and associated oxygen reduction required a lowering of the lagoon level to allow light penetration to the bottom and maintenance of photosynthesis by lagoon plant life and prevention of oxygen depletion. We monitored oxygen levels during the aftermath of this storm and made recommendations on manipulation of the lagoon level. When water clarity returned, the lagoon level was brought back up on 14 October. On 6 November, inlet boards were removed prior to the storm on 6-7 November (**Figure 19**). Streamflow reached 12-13 cfs overnight at the Soquel Village USGS gage. The boards were replaced and the lagoon level was brought back up when water clarity returned. By 10 November the lagoon level was back into the good range at 2.46 during our scheduled monitoring.

Maintenance of lagoon gage height increased in 2007 compared to 2006 (**Figure 2**). With very minimal saltwater trapped in the lagoon that was flushed through the sandbar quickly in 2007, the shrouds were not needed. There was slight tidal overwash prior to 13 October. Presence of the grated hole in the top of the flume for the 5th year allowed for more secured flashboards than previously.

No vandalism of the flume inlet was detected in 2007. The plywood protected against both back-pressure and vandalism for most of the lagoon season. However, with the several early, small storms, the plywood was not used between storms. On 8 December without plywood or wedges used on the top boards, back-flushing caused lower boards to become dislodged and apparently lost. While the wedges discourage all but the most determined vandals and prevent dislodging of boards, they do not allow easy removal of boards when surface algae and debris near the flume needs to be drained out or when sandbar breaching is to be prevented by increasing the volume through the flume. The grated hole in the top of the flume alleviates the need for rapid board

removal and replacement during small stormflows.

Flume Passability. According to the Management Plans (**1990; 2004**), steelhead smolt passage is to be maintained until July 1. A flume depth of 12 inches or deeper was desired at the entrance until that time. The flume was cleared of sand prior to sandbar construction in 2007. However, the flume outlet boards were left in place for 3 days during sandbar construction, preventing smolt access to the bay during this period. After sandbar construction, sufficient baseflow in 2007 resulted in adequate passage for steelhead smolts with flume closure observed on 10 November (**Table 3**). The baffle near the flume inlet remained from 2006. A 4x6-inch notch was provided in the top flashboard for adult emigration out of the lagoon. There was insufficient stream inflow to allow an underwater portal in 2007. Plywood was nailed to the flashboards on 26 May to bring the lagoon level up. The lagoon level was noted above the top of the flume from 10 June through 9 July.

After the 6-7 November storm, a board was left out on the Esplanade side of the flume inlet. This created a 6.5-inch gap at the top of the flume inlet. No screens were in place. This was deemed adequate for adult passage, assuming that early immigrants would be small male adults (jacks).

Table 3. Morning Water Quality Ratings in Soquel Creek Lagoon, 2007, Within 0.25 M of Bottom.

Date	Flume Passage	Gage Height	Water Temperature	Oxygen	Salin-ity	Lagoon In-flow Visual est. (cfs)
24May07	closed	1.06 critical	- good - -	- good - -	- good - -	
30May07	open	2.60+ good	- good - -	- good - -	- good - -	
10June07	open	2.61 good	good*	good	good	4 cfs
24June07	open	2.57 good	good	good good good fair	good	3 cfs
9Jul07	open	2.56 good	good	good good fair good	good	2.5 cfs
22Jul07	open	2.52 good	poor	good good fair fair	good	2.5 cfs
05Aug07	open	2.52 good	good	good good poor fair	good	2.5 cfs
18Aug07	open	2.48 good	fair fair fair good	good good fair fair	good good good fair	2.5 cfs
01Sep07	open	2.53 good	poor poor poor fair	good	good	2 cfs
02Sep07 Begonia Festival (morning)	open	2.53 good	poor poor poor fair	good	good	
02Sep07 (afternoon)	open	2.55 good	- poor poor poor	- good good good	- good good good	
16Sep07	open	2.56 good	good	good	good	2 cfs
30Sep07	open	2.50 good	good	fair	good	2 cfs
13Oct07	open	2.13 fair	good	fair poor poor poor	good	5.5 cfs
14Oct07	open		good	-	good	

				fair poor -		
27Oct07	open	2.51 good	good	good good good fair	good	3 cfs
10Nov07	closed	2.46 good	good	good	good	3.5 cfs
26Nov07	open	2.36 good	good	good	good	4.5 cfs
08Dec07	open	1.26 critical	good	good fair good good	good	5 cfs

*** Four ratings refer to Monitoring Sites 1-4. One rating represents all sites.**

Water Temperature Results from Two-Week Monitoring. In 2007, the lagoon was consistently warmer near the bottom in morning and afternoon than in 2006 from late July through mid-September and in late October. Water temperatures were similar or cooler in 2007 compared to 2006 from mid-June to early July and from late 30 September through mid-October. In 2007, water temperatures near the lagoon bottom were rated "good" (<20°C at dawn) at all stations from 24 June to 5 August (except 22 July) and from 16 September onward (12 monitorings). However, mostly "poor" ratings (>21.5ºC) occurred on 22 July and immediately before and during the Begonia Festival (1-2 September). On 18 August temperatures were fair to good (**Table 3, Figures 3a-d; Appendix A**). The warmer temperatures in 2007 compared to 2006 occurred despite the higher lagoon levels in 2007 and deeper conditions in 2007 at all sites except at the flume. Warmer lagoon temperatures in July and September in 2007 were consistent with warmer inflow temperatures compared to 2006 (**Figure 3e**). The warmer July lagoon water temperatures occurred in 2007 despite similar average air temperatures recorded in Capitola compared to 2006 (**Table 4**). However, air temperatures in September 2007 were warmer than in 2006 in Capitola and Watsonville, consistent with warmer lagoon temperatures in the lagoon in 2007. In addition, there was undoubtedly less water circulation through the lagoon in 2007 with the lower stream inflow, reducing the cooling effect of the stream inflow at night (**Table 10**). Maintenance of a deep lagoon for most of the summer without tidal overwash usually helps to minimize water temperature near the bottom.

As in 2006, the 2007 water temperature at dawn within 0.25 m of the bottom of the lagoon became warmer as the monitoring stations progressed down the lagoon to the flume (**Figure 3f**). Water temperature of the stream inflow was cooler in the morning than the lagoon with 2-week fluctuations in lagoon inflow temperature mirrored in early-morning lagoon temperatures (**Figure 3f**). The correspondence between inflow fluctuations and lagoon temperature fluctuations indicated that the inflow temperature influenced the lagoon temperature in 2007 as in previous years. In the afternoon near the lagoon bottom, Station 1 at the flume was often the warmest, and Station 4 at the mouth of Noble Gulch was usually the coolest as in previous years

(**Figure 3g**). However, in early August, Station 1 was the coolest in the afternoon near the bottom on a day that was overcast in the morning and sunny in the afternoon. Station 4 often showed the greatest temperature drop down through the water column in the afternoon, presumably due to cool inflow from Noble Gulch. The warmest water temperatures observed near the bottom at the 4 stations during 2-week intervals occurred on 22 July with readings of 22.1, 22.3, 22.1 and 21.6°C in the morning and 23.9, 23.3, 23.3 and 22.4ºC in the afternoon at Stations 1-4, respectively (**Figures 3f-g; Appendix A**). This day also had the warmest morning inflow temperature recorded during the 2-week monitoring at 18.6ºC.

Results from Continuous Temperature Data Loggers. In analyzing temperature data from the 6 data loggers throughout the water column just upstream of the railroad trestle, results were consistent with temperature data collected through the water column at monitoring stations over the past 17 years. However, the following analysis pertains to the vicinity of these data loggers only. Bare in mind that our 2-week monitoring at the 4 sites indicated that Station 4 near the mouth of Noble Gulch had cooler water temperatures near the bottom than Site 3 near the trestle and these continuous data loggers (**Figures 3f-g**).

Juvenile steelhead likely spend most of their time near the bottom, except when feeding on emerging aquatic insects at dusk and dawn. This assumption is based on years of underwater observations of salmonids. Therefore, the water temperature recorded near the lagoon bottom (within 0.25 m) has greatest relevance to assessing habitat quality.

Table 4. Monthly Statistics for Air Temperature in Capitola and at the Watsonville Airport in July through September in 2006 and 2007.

Month/ Year	Max. Temp. ° F Capitola	Avg. Daily Max. Temp. ° F Watsonville	Avg. Temp. ° F Capitola	Min. Temp. ° F Capitola	Avg. Daily Min. Temp. ° F Watsonville	Days with Fog at Watsonville Airport
July 2007	**80.9 (13 July)**	**65**	**61.4**	**48.3**	**54**	**22**
July 2006	86.3	75	61.1	48.3	53	
August 2007	**83.2 (16 Aug)**	**66**	**61.3**	**49.2**	**55**	**22**
August 2006	91.8	76	60.5	51.0	53	
September 2007	**89.9 (26 Sep)**	**69**	**61.5**	**44.8**	**54**	**18**
September 2006	83.6	76	58.9	45.2	52	

Lagoon water temperatures (**Figures 4a- 4l**) closely mirrored temperatures in the stream inflow (**Figures 5a-b**) in 2007, as in past years. Daily temperature *minima* in the lagoon were consistently warmer near the bottom than the stream inflow in 1999-2007 (**Figures 4a-b, 5a-b; Alley 2005**). Daily temperature *maxima* near the bottom were warmer in the lagoon than the stream in 1999 and 2001-2004 and 2007, but were cooler in 2000 and 2005 (**Alley 2006**). In 2006, the daily temperature *maxima* in the stream were similar to that near the lagoon bottom. However, in 2007, the daily lagoon maximum was usually more than 2ºC warmer than the maximum inflow temperature (**Figures 4a and 5a**). The daily stream temperature fluctuated more than the daily lagoon temperature near the bottom.

As in past years, no thermocline was detected by the data loggers or at any of the 4 monitoring stations during the summer in 2007, with complete mixing of the water column on a diurnal cycle. The lagoon was likely 7-8 feet deep at most and subject to daily inland breezes. Water temperature was somewhat cooler at depth compared to nearer the surface by afternoon, being cooler near the bottom in the afternoon in 2007. Each night, water temperature cooled to the

bottom, with the surface often being slightly cooler than deeper layers by early morning (particularly in August), and as indicated on 6 of 11 occasions for comparisons at 10-day intervals, beginning in late June (**Table 5; Figures 4a-b, 4k-l**).

In 2007, the daily maximum water temperature *near the lagoon surface* ranged from a minimum of **17.1°C** (62.8°F) on 30 May to a maximum of **24.0°C** (75.2ºF) on 23 July (**Figures 4k and 4l**). The daily maximum water temperature in 2006 in that location ranged from **15.6°C** (60.1°F) on 29 September–1 October to **22.9°C** (73.2ºF) 23 and 25 July. Daily maxima near the surface were higher in 2007 compared to 2006 in early July, late July and August through September (**Figures 4k and 4m**).

In 2007, the maximum daily water temperature *near the lagoon bottom* ranged between **16.8°C** (62.2°F) on 30 May and **23.2°C** (73.8°F) on 22-24 July (**Figures 4a and 4b**). In 2006, maximum daily water temperature there ranged between **15.2°C** (59.4°F) on 1 October and **22.5°C** (72.5°F) on 12 July (**Alley 2006**). The 2007 lagoon had generally warmer water temperatures near the bottom (1-3ºC warmer) than in 2006 except for a week in early July.

The greatest increase in water temperature recorded from morning to afternoon near the bottom in 2007 was **3.0°C** (5.5°F) on 20 June (**Figures 4a-b**). The greatest increase near the lagoon surface was **5.4°C** (9.7°F) on 16 August (**Figures 4k-l**). There was a questionable minimal measurement of 16.8ºC made on 30 August that was not considered in this determination.

From 29 May through 30 September 2007, the daily maximum water temperature of the stream inflow ranged from a minimum of **14.5°C** (58.0°F) on 29 September to a maximum of **21.0°C** (69.7°F) on 22 July (**Figures 5a-b**). In 2006 from 18 June through 8 October, the daily maximum water temperature of the stream inflow ranged from a minimum of **16.8°C** (62.2°F) on 8 September to a maximum of **22.5°C** (72.5°F) on 23 July (**Alley 2006**). Creek temperatures were generally cooler in 2007 than 2006 in early summer but were warmer in 2007 in August and September (**Figures 5a-5d**), consistent with much reduced streamflow in 2007 (**Table 13**).

Days when lagoon water temperatures exceeded 22ºC (71.6ºF) near the lagoon bottom would likely be stressful for juvenile steelhead. Therefore, the lagoon management goal is to maintain water temperature below 22ºC. In 2007, it was above 22ºC on 20 days, primarily in mid-July (9 successive days) and early September (6 successive days). This was compared to only 4 days (22-25 July) in 2006 (**Alley 2006**). In 2005, water temperature near the bottom never reached this threshold. It only went above 22°C once (12 July) at the surface (**Alley 2005**). In 2004, the <22ºC goal near the bottom was not met for 5 days after tidal overwash on 19 July, 4 days in August and 2 days in early September (**Alley 2005**). But conditions were more stressful in 2001 when there had been two major tidal overwashes. In 2001, daily temperatures near the bottom fluctuated between approximately 23 and 26ºC (73.4–78.8ºF) for 14 days (**Alley 2003c**).

The 2007 lagoon did not meet the steelhead management goal of early morning minimum temperature of less than 20°C near the bottom on 35 of 124 (28%) measured days (29 May–30 September) (**Figure 4a)**. In 2005 and 2006, the management goal was reached during the lagoon

season. In the 2004 lagoon, 27% of the days (34 of 125 days; 1 June–3 October) failed to meet the management goal partially due to tidal overwash. This was compared to 19% in 2003 and 10% in 2002. The coho management goal of keeping maximum water temperatures below 20ºC (68ºF) near the bottom in the presence of steelhead was not met 66% of the days measured (82 if 124 days) compared to17% in 2006. However, coho prefer to have temperatures below 16°C (depending on food abundance) (**J. Smith pers. communication**), and the lagoon temperature near the bottom failed to cool to 16°C in the morning from mid-June to mid-September 2007.

Detailed water temperature measurements expressed at 10-day intervals in 2007 showed that the difference between maximum daily temperatures in the late afternoon at 5.5 feet from the bottom (less than 0.5 feet from the surface) and 0.5 feet from the bottom varied between 1.15°C (2.07° F) and 0ºC (0ºF) from top to bottom (**Table 5**; **Figures 4a-b and 4k-l**). In 2007, the difference in minimum daily temperatures in the morning from top to bottom of the water column was more than the maximum daily temperature difference through the column, ranging from –2.29°C (–4.11°F) to 1.14 ºC (2.06ºF) (**Table 5**). The negative difference came from warmer temperatures on the bottom than the surface and resulted from very cool nights after very warm days.

At the creek site near Nob Hill in 2007, water temperature failed to meet the management goal of *no more than 4 hours a day at greater than 20ºC (68ºF)* on 5 of 124 days (4%; 29 May–30 September) (**Figure 5a**) compared to 14 days in 2006 (**12%**; 19 June–8 October) (**Alley 2006**). At the creek site in 2005, water temperature failed to meet the management goal on 6 of 120 monitored days (**5%**; 10 June–8 October) (**Alley 2005**). In 2004, 9 of 125 monitored days (**7%**; June-early October) did not meet the goal. September was unusually cool in 2004 and 2005 (**Alley 2005**). At the Creek site in 2003, 22 of 127 monitored days (**17%**; June to early October) failed to meet the management goal (**Alley 2005**).

With a water temperature goal of having the *average weekly temperature* of 16.7º C (62º F) or cooler for coho salmon, considerably more stream shading will be required to make lower Soquel Creek habitable for this species. In 2007 the average weekly temperature went as high as 19.1ºC (66.4ºF) in mid-July (**Figure 5a**).

Water temperatures in the lagoon closely mirrored temperatures in the stream inflow in 2003-2007. Daily *minima* in the lagoon near the bottom were consistently warmer than the stream above in 1999-2007 (**Figures 4a, 5a and Alley 2005**). The daily *maxima* near the bottom of the lagoon were also warmer than in the stream in 2007 (1-3ºC) (**Figures 4a-4b and 5a-5b**). The daily stream temperature fluctuated more than the lagoon.

Table 5. 2007 Maximum and Minimum Water Temperatures from Continuous Data Loggers at 0.5 Feet and 5.5 feet from the Bottom (Near Surface) in the Water Column Upstream of the Railroad Trestle, Reach 3 of Soquel Lagoon.

Depth Above Bottom>>>>		Max/Min Temp ºC(ºF)/ ºC(ºF) **5.5 ft**				Max/Min Temp ºC(ºF)/ ºC(ºF) **0.5 ft**	Daily Temp. Difference of Max/ Min Temp. for 5.5 to 0.5 ft from Bottom **ºC(ºF) / ºC(ºF)**
1 June		17.52 (63.54)/ 16.38 (61.48)				17.14 (62.85)/ 16 (60.8)	0.38 (0.69)/ 0.38 (0.68)
10 June		19.81 (67.65)/ 16.38 (61.48)				18.66 (65.59)/ 17.52 (63.54)	1.15 (2.26)/ 0 (0)
20 June		19.42 (66.96)/ 17.52 (63.54)				19.42 (66.96)/ 16.38 (61.48)	0 (0)/ 1.14 (2.06)
30 June		22.48 (72.46)/ 19.81 (67.65)				21.71 (71.08)/ 20.19 (68.33)	0.77 (1.38)/ -0.38 (-0.68)
9 July		19.81 (67.65)/ 18.66 (65.59)				19.42 (66.96)/ 18.28 (64.91)	0.39 (0.69)/ 0.38 (0.68)
19 July		23.24 (73.84)/ 20.57 (69.02)				22.09 (71.77)/ 20.57 (69.02)	1.15 (2.07)/ 0 (0)
29 July		21.71 (71.08)/ 19.04 (66.28)				21.33 (70.39)/ 19.81 (67.65)	0.38 (0.69)/ -0.77 (-1.37)
8 August		20.95 (69.71)/ 17.9/ (64.22)				20.95 (66.71)/ 19.42 (66.96)	0 (0)/ -1.52 (-2.74)
18 August		21.33 (70.39)/ 17.52 (63.54)				20.95 (69.71)/ 19.18 (67.65)	0.38 (0.68)/ -2.29 (-4.11)
28 August		21.71 (71.08)/ 19.42 (66.96)				21.71 (71.08)/ 19.81 (67.65)	0 (0)/ -0.39 (-0.69)
7 September		17.9 (64.22)/ 17.14 (62.85)				17.90 (64.22)/ 16.76 (62.17)	0 (0)/ 0.38 (0.68)
17 September		20.95 (69.71)/ 19.04 (66.28)				20.19 (68.33)/ 19.04 (66.28)	0.76 (1.38)/ 0 (0)
27 September		18.28 (64.91)/ 16.38 (61.48)				17.9 (64.22)/ 17.14 (62.85)	0.38 (0.69)/ -0.78 (-1.37)
29 September		17.9 (64.22)/ 14.09 (57.35)				17.14 (62.85)/ 16 (60.8)	0.76 (1.37)/-1.91 (-3.45)

Table 6. 2006 Maximum and Minimum Water Temperatures from Continuous Data Loggers at 0.5 Feet and 5.5 feet from the Bottom (Near Surface) in the Water Column Upstream of the Railroad Trestle, Reach 3 of Soquel Lagoon.

Depth Above Bottom>>>>		Max/Min Temp ºC(ºF)/ ºC(ºF) **5.5 ft**				Max/Min Temp ºC(ºF)/ ºC(ºF) **0.5 ft**	Daily Temp. Difference of Max/ Min Temp. for 5.5 to 0.5 ft from Bottom **ºC(ºF) / ºC(ºF)**
20 June		19.04 (66.28)/ 16.00 (60.80)				18.66 (65.59)/ 15.62 (60.11)	0.38 (0.68)/ 0.38 (0.68)
30 June		20.18 (68.33)/ 17.90 (64.21)				19.80 (67.65)/ 17.52 (63.54)	0.38 (0.68)/ 0.38 (0.68)
9 July		19.42 (66.96)/ 17.14 (62.85)				19.04 (66.28)/ 16.76 (62.17)	0.38 (0.68)/ 0.38 (0.68)
19 July		21.71 (71.08)/ 19.04 (66.28)				21.33 (70.39)/ 18.66 (65.59)	0.38 (0.68)/ 0.38 (0.68)
29 July		21.33 (70.39)/ 18.28 (64.91)				20.95 (69.71)/ 19.04 (66.28)	0.38 (0.68) -0.76 (-1.37)
8 August		19.80 (67.65)/ 17.14/ (62.85)				19.80 (67.65)/ 17.52 (63.54)	0 (0)/ -0.38 (-0.68)
18 August		17.90 (64.22)/ 16.38 (61.48)				19.04 (66.28)/ 17.14 (62.85)	-1.14 (-2.06)/ -0.76 (-1.37)
28 August		19.04 (66.28)/ 14.85 (58.73)				18.66 (65.59)/ 16.76 (62.17)	0.38 (0.68)/ -1.91 (-3.44)
7 September		17.9 (64.22)/ 17.14 (62.85)				17.90 (64.22)/ 16.76 (62.17)	0 (0)/ 0.38 (0.68)
17 September		17.9 (64.22)/ 16.0 (60.8)				16.00 (60.8)/ 14.85 (58.73)	1.9 (3.42) 1.15 (2.07)
27 September		17.52 (63.54)/ 14.85 (58.73)				16.38 (61.48)/ 15.23 (59.42)	1.14 (2.06)/ -0.38 (-0.69)
2 October		16.0 (60.80)/ 14.08 (57.35)				15.61 (60.11)/ 14.08 (57.35)	0.39 (0.69)/ 0 (0)
7 October		16.0 (60.8)/14.35 (58.73)				15.23 (59.42/13.70 (56.66)	0.77 (1.38)/0.65 (2.07)

Table 7. 2005 Maximum and Minimum Water Temperatures from Continuous Data Loggers at 5.5 Feet and 0.5 feet from the Bottom (Near Surface) in the Water Column Upstream of the Railroad Trestle, Reach 3 of Soquel Lagoon.

Depth Above Bottom>>>>		Max/Min Temp ºC(ºF)/ ºC(ºF) **5.5 ft**				Max/Min Temp ºC(ºF)/ ºC(ºF) **0.5 ft**	Daily Temp. Difference of Max/ Min Temp. for 5.5 to 0.5 ft from Bottom **ºC(ºF) / ºC(ºF)**
11 June		18.28 (64.91)/ 15.23 (59.42)				18.66 (65.59)/ 16.0 (60.82)	-0.58 (-0.78)/ -0.77 (-1.38)
20 June		19.42 (66.96)/ 14.09 (57.35)				18.66 (65.59)/ 16.0 (60.8)	0.76 (1.37)/ -1.91 (-3.45)
30 June		19.42 (66.96)/ 18.28 (64.91)				19.42 (66.96)/ 17.52 (63.54)	0 (0)/ 0.76 (1.37)
9 July		20.57 (69.02)/ 18.28 (64.91)				20.95 (69.71)/ 18.28 (64.91)	-0.38 (-0.69)/ 0 (0)
19 July		20.95 (69.71)/ 19.04 (66.28)				19.81 (67.65)/ 18.66 (65.59)	1.14 (2.06)/ 0.38 (0.69)
29 July		20.19 (68.33)/ 18.66 (65.59)				19.04 (66.28)/ 18.28 (64.91)	1.15 (2.05) 0.38 (0.68)
8 August		19.81 (67.65)/ 18.66 (65.59)				18.66 (65.59)/ 18.28 (64.91)	1.15 (2.06)/ 0.38 (0.68)
18 August		18.28 (64.91)/ 17.14 (62.85)				17.9 (64.22)/ 17.14 (62.85)	0.38 (0.69)/ 0 (0)
28 August		19.81 (67.65)/ 17.9 (64.22)				18.66 (65.59)/ 17.9 (64.22)	1.15 (2.06)/ 0 (0)
7 September		17.9 (64.22)/ 17.14 (62.85)				17.52 (63.54)/ 16.76 (62.17)	0.38 (0.68)/ 0.38 (0.68)
17 September		17.9 (64.22)/ 16.0 (60.8)				16.76 (62.17)/ 15.62 (60.11)	1.14 (2.05)/ 0.38 (0.69)
27 September		17.52 (63.54)/ 15.62 (60.11)				16.38 (61.48)/ 16.04 (60.8)	1.14 (2.06)/ -0.38 (-0.69)
2 October		17.9 (64.22)/ 16.76 (62.17)				17.52 (63.54)/ 16.38 (61.48)	0.38 (0.68)/ 0.38 (0.69)
8 October		16.0 (60.8)/14.35 (58.73)				16.0 (60.8)/14.85 (58.73)	0 (0)/0 (0)

Table 8. 2004 Maximum and Minimum Water Temperatures from Continuous Data Loggers at 5.5 Feet and 0.5 feet from the Bottom (Near Surface) in the Water Column Upstream of the Railroad Trestle, Reach 3 of Soquel Lagoon.

Depth Above Bottom>>>>		Max/Min Temp ºC(ºF)/ ºC(ºF) **5.5 ft**				Max/Min Temp ºC(ºF)/ ºC(ºF) **0.5 ft**	Daily Temp. Difference of Max/ Min Temp. for 5.5 to 05 ft from Bottom **ºC(ºF) / ºC(ºF)**
1 June		20.19 (68.33)/ 18.28 (64.91)				19.04 (66.28)/ 17.9 (64.22)	1.15 (2.05)/ 0.38 (0.69)
10 June		20.57 (69.02)/ 18.66 (65.59)				19.42 (66.96)/ 18.66 (65.59)	1.15 (2.06)/ 0 (0)
20 June		20.57 (69.02)/ 18.28 (64.91)				20.19 (68.33)/ 18.28 (64.91)	0.38 (0.69)/ 0 (0)
30 June		20.57 (69.02)/ 19.04 (66.28)				19.81 (67.65)/ 18.66 (65.59)	0.76 (1.37)/ 0.38 (0.69)
9 July		19.42 (66.96)/ 17.9 (64.22)				18.66 (65.59)/ 17.14 (62.85)	0.76 (1.38)/ 0.76 (1.37)
19 July		23.63 (74.53)/ 21.71 (71.08)				22.86 (73.15)/ 21.71 (71.08)	0.77 (1.38) 0 (0)
29 July		20.57 (69.02)/ 19.42 (66.96)				20.59 (69.02)/ 18.66 (65.59)	0 (0)/ 0.76 (1.37)
8 August		22.09 (71.77)/ 20.57 (69.02)				22.09 (71.77)/ 20.57 (69.02)	0 (0)/ 0 (0)
18 August		21.33 (70.39)/ 20.57 (69.02)				21.33 (70.39)/ 20.57 (69.02)	0 (0)/ 0 (0)
28 August		21.71 (71.08)/ 20.95 (69.71)				21.71 (71.08)/ 20.95 (69.71)	0 (0)/ 0 (0)
7 September		22.48 (72.46)/ 20.57 (69.02)				22.09 (71.77)/ 20.57 (69.02)	0.38 (0.69)/ 0 (0)
17 September		19.42 (66.96)/ 19.04 (66.28)				19.42 (66.96)/ 19.04 (66.28)	0 (0)/ 0 (0)
27 September		18.66 (65.59)/ 17.52 (63.54)				18.66 (65.59)/ 17.52 (63.54)	0 (0)/ 0 (0)
2 October		17.9 (64.22)/16.38 (61.48)				17.52 (63.54)/16.38 (61.48)	0.38 (0.68)/0 (0)

Table 9. 2003 Maximum and Minimum Water Temperatures from Continuous Data Loggers at 4.5 feet and 0.5 feet from the Bottom (Near Surface) in the Water Column Upstream of the Railroad Trestle, Reach 3 of Soquel Lagoon.

Depth Above Bottom>>>>		Max/Min Temp ºC(ºF)/ ºC(ºF) **4.5 ft**				Max/Min Temp ºC(ºF)/ ºC(ºF) **0.5 ft**	Daily Temp. Difference of Max/ Min Temp. for 4.5 and 0.5 ft from Bottom **ºC(ºF) / ºC(ºF)**
1 June		18.66 (65.59)/ 16.38 (61.48)				18.66 (65.59)/ 16.38 (61.48)	0 (0)/ 0 (0)
10 June		16.76 (62.17)/ 15.62 (60.11)				16.76 (62.17)/ 15.62 (60.11)	0 (0)/ 0 (0)
20 June		19.81 (67.65)/ 16.76 (62.17)				18.66 (65.59)/ 16.76 (62.17)	1.15 (2.06)/ 0 (0)
30 June		20.95 (69.71)/ 18.66 (65.59)				20.57 (69.02)/ 18.66 (65.59)	0.38 (0.69)/ 0 (0)
9 July		20.95 (69.71)/ 18.28 (64.91)				20.19 (68.33)/ 18.28 (64.91)	0.76 (1.38)/ 0 (0)
19 July		19.81 (67.65)/ 19.04 (66.28)				19.42 (66.96)/ 18.66 (65.59)	0.39 (0.69) 0.38 (0.69)
29 July		20.95 (69.71)/ 19.42 (66.96)				20.95 (69.71)/ 19.42 (66.96)	0 (0)/ 0 (0)
8 August		23.24 (73.84)/ 20.95 (69.71)				22.09 (71.77)/ 20.57 (69.02)	1.15 (2.07)/ 0 (0)
18 August		21.71 (71.08)/ 19.81 (67.65)				20.95 (69.71)/ 19.81 (67.65)	0.76 (1.37)/ 0 (0)
28 August		21.71 (71.08)/ 20.19 (68.33)				20.95 (69.71)/ 19.81 (67.25)	0.76 (1.37)/ 0.38 (0.69)
7 September		20.95 (69.71)/ 19.04 (66.28)				20.19 (68.33)/ 18.66 (65.59)	0.76 (1.38)/ 0.38 (0.69)
17 September		20.95 (69.71)/ 19.04 (66.28)				19.81 (67.65)/ 18.66 (65.59)	1.14 (2.06)/ 0.38 (0.69)
27 September		18.66 (65.59)/ 17.90 (64.22)				18.28 (64.91)/ 17.52 (63.54)	0.38 (0.68)/ 0.38 (0.68)
4 October		18.66 (65.59)/17.14 (62.85)				18.28 (64.91)/17.14 (62.85)	0.38 (0.68)/0 (0)

Creek conditions in 1999-2007 had been much cooler than in 1998, despite the much higher baseflow in 1998. In 1998, there was a 20-day period in which water temperature rose above 21º C (69.8º F) for several hours each day in the stream above the lagoon, with a maximum of approximately 23.5º C (74.3º F) on 3 August 1998 (**Alley 2005**). Daily maxima were still approaching 21ºC on 4 September 1998. Considerable riparian vegetation had been removed by El Niño stormflows the previous winter. Despite the warm stream temperatures, lagoon water temperatures in 1998 were relatively cool compared to other years with the high stream inflow (**Alley 2003**).

Aquatic Vegetation. In 2007, unlike most years, a thick layer of decomposing kelp remained on the lagoon bottom after sandbar closure, especially under the Stockton Bridge and upstream. This decaying matter provided greater than usual amounts of nutrients for plant production. The suspended phytoplankton bloom was thicker than other years after sandbar closure, lasted longer, and continued throughout July, reappearing in late September. Filamentous algae was first noted during monitoring on 24 June 2007, approximately 4 weeks after sandbar closure (**Table 10 and Appendix A**); compared to 30 June 2006, 16 days after sandbar closure; compared to 1 July 2005, 3.0 weeks after sandbar closure in 2005 (**Alley 2005**); compared to 27 June 2004, 4.5 weeks after sandbar closure in 2004 (**Alley 2004**); and compared to 7 July 2003, 6 weeks after sandbar closure in 2003 (**Alley 2003**).

Pondweed was first observed on 9 July 2007, 6 weeks after sandbar closure, and was much more abundant than the previous year. Pondweed was possibly observed on 12 August 2006 in Reach 2, 8 weeks after sandbar closure. However, the identification was uncertain. It was not positively identified after that. Pondweed propagates best on sandy substrate. The lagoon bottom has become progressively coarser each year with more cobbles, thus discouraging pondweed. The abundance of organic ooze on the bottom in 2007 may have encouraged pondweed. By 1 September 2007, all algae in Reaches 1 (downstream of Stockton Bridge) and 3 (upstream of the trestle) was associated with and attached to pondweed. Pondweed was first noted on 10 September 2005, 13 weeks after sandbar closure (although it may have gone unnoticed earlier due to its initial scarcity); compared to 6 August 2004, 10 weeks after sandbar closure; compared to 4 August 2003, 10.5 weeks after sandbar closure in 2003. In most years, the pondweed became most abundant in September and continued into October.

In 2007, surface algae was first observed in Reaches 2 and 3 on 24 June, one month after sandbar closure. Then it disappeared until mid-August 2007 when it was observed in all reaches (**Table 10**). In 2006, surface algae was first observed in all reaches on 28 July after a warm month and 5 weeks after sandbar closure (**Table 11**). In 2005, surface algae was observed 4.5 weeks after sandbar closure on 15 July (**Table 12**). In 2004, surface algae occurred 4 weeks after sandbar closure (**Alley 2004**). Surface algae in 2007 varied between 0 and 10% coverage in the different reaches, with a maximum of 30% coverage observed at the mouth of Noble Gulch on 18 August. Surface algae in 2006 varied between 0 and 5% coverage, with the most being present in Reach 3 and near Noble Gulch. By contrast, surface algae in 2005 varied between 0 and 20% coverage of Reach 3, with very little in the lower 2 reaches (maximum was 2%). The most extensive surface

algae in 2007 was observed on 18 August when it was <1% in Reach 1, 7% in Reach 2, 10% in Reach 3 and 30% coverage at the mouth of Noble Gulch. It was detected in smaller amounts for the next month at a time when the lagoon water temperatures were warmest.

Algae mat coverage of the lagoon bottom increased rapidly to 100% by 24 June in the reaches that could be observed (2 and 3), 4 weeks after sandbar closure. It remained at 100% until middle August when pondweed became prominent (**Table 10**). The average thickness of bottom algae in 2007 was thicker in all reaches and at Noble Gulch compared to 2005 and 2006 (**Tables 10-12**). The percent coverage of the bottom was somewhat less in 2007 than the 2 previous years because of the greater prominence of pondweed in 2007.

Table 10. Visually Estimated Algae Coverage and Thickness in the 2007 Lagoon (pondweed with attached algae not included).

Date	Reach 1			Reach 2			Reach 3			Mouth of Noble Gulch		
Month-Day	Avg. Bottom Thickness (ft)	% Bottom Cover	% Surf. Cover	Avg. Bottom Thickness (ft)	% Bottom Cover	% Surf. Cover	Avg. Bottom Thickness (ft)	% Bottom Cover	% Surf. Cover	Avg. Bottom Thickness (ft)	% Bottom Cover	% Surf. Cover
5-30	0	0	0	-	-	-	-	-	-	-	-	
6-10	0	0	0	0	0	0	0	0	0	0	0	0
6-24	? Phyto-plankton too thick	-	0	1.0	100	1	1.0	100	1	1.0	60	7
7-09	? Phyto-plankton too thick	-	0	2.5	100	0	2.5	100	0	? Phyto-plankton too thick	-	0
7-22	? Phyto-plankton too thick	-	0	? Phyto-plankton too thick	100	0	2	100	0	? Phyto-plankton too thick	-	0
8-05	2.0	75	0	2.5	100	0	2.5	100	0	? Phyto-plankton too thick	100	0
8-18	1.5	90	<1	1.5	70	7	0.5	50	10	3.5	80	30
9-01	0 (all pondweed with algae)	0	0	1.0	70	0	1.0	40	0	0 (all pondweed with algae)	0	15
9-16	? Glare too great	-	1	1.0	70	2	2.0	50	2	1.0	20	2
9-30	? High turbidity	-	0	? High turbidity	-	0	? High turbidity	-	0	? High turbidity	-	0
10-13	? High turbidity	-	0	? High turbidity	-	0	? High turbidity	-	0	? High turbidity	-	0
10-27	? Low light	-	<1	? Low light	-	<1	? Low light	-	0	0.2	70	1
11-10	? Low light	-	0	? Low light	-	0	? Low light	-	0	? Low light	-	0
11-26	? Low light	-	0	? Low light	-	0	? Low light	-	0	? Low light	-	0
12-08	? Low light	-	0	? Low light	-	0	? Low light	-	0	? Low light	-	0
Avg-Rch 1 8-05–9-01 Rch 2, 3 and Noble Gulch 6-24–9-16	**1.2**	**55**	**0.1**	**1.6**	**87**	**1.3**	**1.6**	**77**	**1.9**	**1.4**	**52**	**7.7**

Table 11. Visually Estimated Algae Coverage and Thickness in the 2006 Lagoon (pondweed with attached algae not included).

Date	Reach 1			Reach 2			Reach 3			Mouth of Noble Gulch		
Month-Day	Avg. Bottom Thickness (ft)	% Bottom Cover	% Surf. Cover	Avg. Bottom Thickness (ft)	% Bottom Cover	% Surf. Cover	Avg. Bottom Thickness (ft)	% Bottom Cover	% Surf. Cover	Avg. Bottom Thickness (ft)	% Bottom Cover	% Surf. Cover
6-18	0	0	0	-	-	-	-	-	-	-	-	-
6-30	0.3	20	0	0.3	20	0	0.3	10	0	0.3	5	0
7-14	0.3	80	0	0.3	80	0	0.2	70	0	0.2	60	0
7-28	0.5	95	3	0.4	95	5	0.5	95	1	0.8	95	5
8-12	0.8	70	0	3.0	90	0	2.0	90	0	1.0	100	3
8-25	1.5	50	0	1.0	50	0	0.8	35	5	1.5	100	5
9-10	**0.2**	**100**	**0**	**0.8**	**90**	**2**	**1.0**	**90**	**5**	**2.0**	**60**	**5**
9-23	1.0	50	<1	1.5	-	2	1.3	-	5	1.0	60	1
10-5	Brown turbidity	-	0	Brown turbidity	-	0	Brown turbidity	-	1	Brown turbidity	-	0
10-26	0.4	70	<1	0.3	70	0	0.6	90	<1	0.4	Gray turbidity	0
11-09	-	-	0	-	-	0	-	-	0	-	-	0
11-22	<0.2	-	0	-	-	0	0.15	-	0	-	-	0
Avg-6-30 to 9-23	**0.4**	**65**	**0.5**	**1.0**	**70**	**1.5**	**0.9**	**65**	**2.3**	**1.0**	**70**	**3.2**

Table 12. Visually Estimated Algae Coverage and Thickness in the 2005 Lagoon (pondweed with attached algae not included).

Date	Reach 1			Reach 2			Reach 3			Mouth of Noble Gulch		
Month-Day	Ave. Bottom Thickness	% Bottom Cover	% Surf. Cover	Ave. Bottom Thickness	% Bottom Cover	% Surf. Cover	Ave. Bottom Thickness	% Bottom Cover	% Surf. Cover	Ave. Bottom Thickness	% Bottom Cover	% Surf. Cover
6-19	0	0	0	0	0	0	0	0	0	0	0	0
7-01	0.33	80	0	0.33	100	0	0.7	100	0	0.25	100	0
7-15	-	-	0	0.5	100	0	0.5	100	5	0.5	90	3
7-29	1.0	80	0	1.0	90	0	0.5	80	10	0.4	60	<1
8-14	-	-	0	-	85	0	-	60	0	2.0	95	0
8-27	1.0	35	0	1.0	95	0	1.5	100	0	4.0	100	0
9-10	-	-	0	1.5	100	<1	2.5	99	<1	2.0	60	2
9-25	**2.0**	**100**	**2**	**2.0**	**100**	**2**	**3.0**	**99**	**20**	**3.0**	**60**	**60**
10-8	-	-	0	-	-	<1	-	-	<1	3.0	100	20
10-18	-	-	0	-	-	10	-	-	15	0.5	50	3
11-03	-	-	0	-	-	0	-	-	0	-	-	0
11-17	0.15	100	0	0.3	70	0	-	-	0	0.15	60	0
Avg-7-01 to 9-25	**1.1**	**75**	**0.3**	**1.0**	**95**	**0.3**	**1.4**	**90**	**5.8**	**1.7**	**80**	**10.8**

Dissolved Oxygen. Critical oxygen levels are lowest at dawn, or soon after, because oxygen has been depleted by cell respiration over night before plant photosynthesis can begin producing oxygen with the light. This was the time that oxygen levels were most importantly measured and rated. In 2007, oxygen levels for steelhead were either "fair" (between 5 and 7 mg/l) or "good" (greater than 7 mg/l) *near the bottom at dawn* at all stations during monitorings except for "poor" (between 2 and 5 mg/l) ratings in early August at the railroad trestle and 3 of 4 monitoring stations in mid-October after a stormflow that caused tea-colored turbidity and prevented complete light penetration to the lagoon bottom (**Tables 2 and 3, Figure 6a and Appendix A**). The lagoon level was reduced quickly to allow light to penetrate the entire water column. This encouraged photosynthesis and oxygen production. Therefore, oxygen concentration stayed above 5 mg/l at most stations throughout most of the lagoon period at dawn within 0.25 m of the bottom.

Of the early morning monitorings, Station 1 at the flume was rated "good" 86% of the time (12 of 14, 2-week monitorings) and "fair" 14% of the time (**Figure 6b**). Station 2 at Stockton Avenue Bridge was rated "good" 93% of the time (13 of 14 monitorings), "fair" 7% of the time (1 of 14 monitorings) and "poor" 7% of the time (1 of 14 monitorings) (**Figure 6c**). Station 3 near the railroad trestle was rated "good" 86% of the time (12 of 14 monitorings) and "poor" 14% of the time (2 of 14 monitorings) (**Figure 6d**). Station 4 at the mouth of Noble Gulch was rated "good" 50% of the time (7 of 14 monitorings) and "fair" 43% of the time (6 of 14 monitorings and "poor" 7% of the time (1 of 14 monitorings (**Figure 6e**). Like in 2003-2005, the lowest morning oxygen concentrations near the bottom were often least near Noble Gulch (Station 4), such as in most of July through mid-September (**Figure 6a and Appendix A**). Lower oxygen concentration at dawn is usually associated with more algae present. The algae at Noble Gulch was generally thicker in 2007 than elsewhere in the lagoon, though its coverage of the bottom may have been less (**Table 10**). Unlike in 2007, in 2006 there was less algae near the Gulch than in previous years. As in 2006, the flume station in 2007 generally had the highest oxygen concentration at dawn of the 4 lagoon sites and higher concentrations than the stream site on 10 of 14 monitorings through 8 December. On only 4 of 14 monitorings (29%) did the stream site have higher morning oxygen concentrations than any of the lagoon sites, it being in the good range primarily between 7 and 9 mg/l during 13 of 14 monitorings. Station 3 under the trestle is subject to pigeon droppings that encourage algae production and decomposition that lead to greater oxygen depletion at night. It had the lowest morning oxygen concentration on 2 monitorings.

Oxygen concentrations near the bottom at dawn were generally higher in 2007 than 2006 throughout the lagoon period except in mid-October 2007 after the stormflow-generated turbidity (**Figures 6a and 6f**). Thus, with the algae thickness greater in 2007 and the greater prominence of pondweed with algae attached, early morning oxygen levels were higher even though oxygen consumption at night from plant respiration was presumably higher. Apparently, greater oxygen production during the day at these algal densities more than compensated for the respiration loss of oxygen overnight. This phenomenon was also observed between 2006 and 2005 (**Alley 2006**).

On all monitoring days except 13 October (with turbidity caused by stormflow), the oxygen concentration was higher in the afternoon than in the morning at all stations, despite higher afternoon water temperature, and even on cloudy days (**Figures 6b-6e**). The highest oxygen concentration was measured on the afternoon of the Begonia Festival at the Stockton Bridge site (18.7 mg/l) without morning overcast (**Appendix A**). Once the algae and pondweed became established in the lagoon, oxygen concentrations generally increased down the water column in afternoon (9 July–16 September). After mid-September, plant life was on the decline and this pattern did not hold up.

Salinity. Only salinities of 1.3 parts per thousand or less were detected at Stockton Bridge after sandbar construction in 2007 (**Appendix A**). On the morning of 8 December salinities as high as 2.2 parts per thousand were detected at Stockton Bridge during a time of back flushing through the flume from the bay. There had been slight tidal overwash the previous week. Therefore, all stations were rated "good" throughout the lagoon period (**Table 3**).

Conductivity. Conductivity remained low throughout 2007, remaining in the 511-3264 umhos range the entire summer/fall (**Appendix A**). Between 30 May and 26 November, the range was between 418 umhos on 13 October near the surface after stormflow and 776 umhos at the mouth of Noble Gulch on 22 July. Lagoon conductivity was generally higher in 2007 than previous years. Stream conductivity was always slightly lower than in the lagoon except immediately after sandbar closure and on 8 December, when the disparity was greater. The highest lagoon conductivity in 2007 was 3264 umhos at the bottom at the Stockton Bridge on 8 December. The highest conductivity detected in the creek in 2007 was 660 on 22 July. On 2 September, the day of the Begonia Festival, conductivity near the bottom increased very slightly at the Stockton Avenue Bridge from 681 before to 697 umhos after the parade as was the pattern at 2 other measured sites (**Appendix A**). This was little change and not stressful to steelhead.

Stream In-Flow to the Lagoon. The lagoon water quality is generally best when more summer baseflow occurs. When tidal overwash occurs or saltwater back-flushes into the lagoon, with more summer baseflow that passes through the lagoon, the more quickly that saltwater is flushed out of the lagoon to reduce lagoon heating. The year 2001 was most affected by tidal overwash in the last 8 years. In recent years, the sandbar around the periphery of the lagoon has been maintained at a higher elevation to prevent tidal overwash. With proper flume management and the new grated flume ceiling installed in 2003, it should be easier to maintain lagoon depth and prevent fluctuations in lagoon level when the summer begins with high baseflow. To maximize summer baseflow, water percolation into the aquifer during the rainy season must be maximized and surface runoff must be minimized. Summer water diversion and pumping from the underflow of the creek reduce summer baseflow and should be curtailed quickly if surface flow becomes discontinuous in lower Soquel Creek.

Habitat conditions in the 2007 lagoon followed a winter with few storms, with a baseflow at the time of sandbar closure of only approximately 5 cfs (**Table 13; Figure 18**). This was the lowest June baseflow since 1994, another dry year. However, the baseflow did not decline as drastically as in other dry years, presumably because of good aquifer recharge the previous wet winter of

2005-2006. The early summer inflow as of 1 June 2007 (4.7 cfs) was much less than in 2006 (28 cfs), as estimated at the USGS gage in Soquel Village. By 1 September prior to any fall rainfall, streamflow had declined to 1.3 cfs in 2007 compared to 6.6 cfs in 2006 at the USGS gage. The September 2007 baseflow was the 4th lowest in the last 17 years.

Drain Line Test for Restaurants Contiguous with Soquel Creek Lagoon. The 6 restaurants contiguous with the Soquel Creek Lagoon that had accessible plumbing systems were tested for leaks and deficiencies in plumbing connections and repaired as necessary. Confirmation is contained in **Appendix B**.

Begonia Festival Observations and Water Quality Findings. The City's fishery biologist was present during and after the Begonia Festival. The day of the Festival, 2 September, was initially sunny and remained so through the day. The lagoon depth was maintained at an excellent gage height of 2.53–2.55 ft. There were 8 floats in the nautical parade. In conformance with the permit requirements from the California Department of Fish and Game, no floats were propelled by waders. Means of propulsion included electric motor, kayaks, canoes, a rowboat, surfboards and poles. The float using poles had to be hitched to a rowboat to make headway against the typical head-breeze that develops in the afternoon. Thus, the lagoon bottom was not disturbed and increased turbidity was negligible. The secchi depth was to the bottom after the parade. Conductivity near the bottom increased very slightly at the Stockton Avenue Bridge from 681 before to 697 umhos after the parade, as was the pattern at 2 other measured sites (**Appendix A**). This was little change and not stressful to steelhead. There was no odor of hydrogen sulfide, and no fish mortality was observed.

Oxygen concentrations in the afternoon following the nautical parade were higher than the previous day and the highest recorded for the season. This was likely because there was no overcast that day, unlike the previous day, and water temperature was warm to speed up photosynthetic rates of the aquatic plants.

Floats were dismantled on 3 September, and flowers were gathered from the lagoon on 4 September, using a boat. More than 90% of the petals were retrieved. There were much fewer petals in the water in 2007 after the parade than usual.

Water quality measurements and observations on 16 September detected no oxygen depletion resulting from decomposing begonias.

Table 13. Daily Mean Discharge Recorded at the USGS Stream Gage (11160000) in Soquel Village, At One Month Intervals from 1 June to 1 October, 1991-2007 from Graphical Representations (Figure 19).

Year	1 June Streamflow (cfs)	1 July Streamflow (cfs)	1 August Streamflow (cfs)	1 September Streamflow (cfs)	1 October Streamflow (cfs)
1991	4.1	2.6	1.5	0.65	0.37
1992	4.0	4.0	0.6	0.1	0.2
1993	12	5.8	3	1.8	1.6
1994	4.2	1.3	0.7	0.2	0.05
1995	24	17	7.8	4.5	3.7
1996	23	17	8	4.6	3.6
1997	9	7.7	4.2	2.6	2.3
1998	58	22	13	9.7	7.2
1999	16	10	7.4	5.7	4.3
2000	14	9.5	6.2	4.6	7.4
2001	7.2	4.0	3.4	2.6	1.6
2002	9.1	4.9	3.3	2.8	2.2
2003	15	7.2	4	2.2	1.8
2004	5.2	3.3	2.7	1.8	1.4
2005	20	13	7.5	5.1	3.1
2006	28	17	8.7	6.6	7.1
2007	4.7	2.3	2.0	1.4	1.3

Discussion of Options to Improve Water Quality

All storm drains leading to the lagoon should ideally be re-directed away from the lagoon in summer. Included in these is the culvert draining Noble Gulch. Significant quantities of gray water and oily slicks have consistently emptied into the lagoon from Noble Gulch until 2001, and gain in 2005 and 2006 (**Alley 1995; 1996b; 1997-2000; 2005**). There was improvement noted in 2007 with only one instance (30 September) of an observed gray water plume issuing from Noble Gulch out of 14, 2-week monitorings. By comparison, these plumes were observed on 8 of 12, 2-week monitorings in 2006. This improvement may have resulted from replacement of sewage pipes along Riverview Road in the vicinity of Noble Gulch in fall of 2006. In 2005, gray water plumes and sometimes oil slicks were observed on 7 of 13, 2-week monitorings. The gray water problem occurred particularly in late September and October in 2005 and was correlated with the highest surface algae estimates. By contrast, gray water plumes were observed in 2004 on only 1 of 11, 2-week monitorings. As further history of the problem, in 2001 and 2002, no gray water was observed during monitorings, but in 2003, the water was murky on 2 of 12 monitorings. In 2000, gray water plumes were observed on 5 of the 7 monitorings.

Stimulation of algal growth has annually occurred at the mouth of Noble Gulch, with consistently greater growth there compared to elsewhere in the lagoon in most years except 2001. Increased algal growth indicates elevated nutrient inputs probably associated with bacteria. Oxygen depletion noted at dawn has been consistently greater at the mouth of Noble Gulch in 2002-2005, 2007 (**Figure 6a**) and other years, with usually lower oxygen readings at that station (**Alley 2005**). However, in 2006 oxygen depletion at dawn was not consistently greatest at the mouth of Noble Gulch (**Figure 6f**).

Usually, when cloudy water enters the lagoon from Noble Gulch, the water is clear upstream in Noble Gulch at the park beyond Bay Street. This indicates that pollutants enter Noble Gulch from the lower village near Soquel Creek. There are ducks living at the mobile home park up that drainage that could be removed to reduce nutrient influxes and coliform bacterial inputs. A flashboard dam could be constructed in Noble Gulch at Bay Street to impound water to be pumped out for irrigation purposes, provided that lagoon depth is being adequately maintained. Coliform counts greater than 200/ 100 ml are considered a hazard to human health.

By minimizing the stream inflow from Noble Gulch, nutrients and bacteria entering the lagoon would be reduced. Algae production may be reduced. Another drain into the lagoon is situated under the railroad trestle, where slight oxygen depletion has been detected in recent years. This drain could be capped if summer runoff was re-directed into the sewer.

The gulls are a primary source of pollution, both for bio-stimulating nutrients and bacteria. They forage through the human refuge left on the beach. They bathe in the lagoon. They roost on the buildings surrounding the lagoon. Restaurant goers and others feed them. Reducing the gull population at Soquel Creek Lagoon would be a major step in reducing pollution. It is likely that the gull population is artificially high because of the artificial food source and artificial roosting

areas. If these were reduced, then the gull population would probably decline, and pollution would be reduced at Soquel Lagoon. All of the refuse cans on the beach were equipped with gull-proof lids in 2006 (**Ed Morrison, pers. comm.**). Regarding roosting, there are methods available to make buildings' roofs inhospitable to gulls. Gull sweeps are an effective option. Parallel wires covered the roof of the Paradise Grill in 2006 and were effective in keeping gulls off. The remainder of the restaurants would benefit from this application.

Another source of bird pollution is the rock dove (pigeon) population that circulates between the wharf and the railroad trestle over the lagoon. As stated in the original management plan, the trestle could be screened so that roosting areas were eliminated and bird pollution reduced.

Regarding urban runoff, installation and maintenance of silt and grease traps on storm drains is critical to reducing pollution by petrochemicals. All existing and new drainage systems from new development and parking lots should include installation of effective traps and percolation basins to increase percolation of storm runoff.

The storm drain along the Esplanade was connected to the sewer line in 2006 for summer diversion of water in the drain to the sewer system. However, the pump was in manual mode, requiring Public Works staff to turn it on and off. An automatic pump switch connected to a float system would improve the operation.

Recommendations to Maintain Good Water Quality and Fish Habitat in the Lagoon

1. Continue to use gull-proof lids on refuse cans at and around the lagoon and beach. Use enough refuse containers to satisfy the demand for refuse disposal.

2. Consider screening the railroad trestle to discourage roosting and nesting by rock doves.

3. Re-install the 12-inch high wooden baffle inside the flume prior to directing water through the flume, if it was destroyed during the previous winter.

4. Do not allow the pedal boat operator to dictate lagoon level.

5. Maximize lagoon depth throughout the dry season, while maintaining passage through the flume for adult steelhead until June 1 and for steelhead smolts until July 1. If the lagoon level begins to drop below the notch for steelhead smolts on one side of the flume because of the hole for adult steelhead after June 1, close the underwater portal for adults. If there is plenty of flow to maintain lagoon depth with the adult portal open, leave it open throughout the summer. If adult steelhead are seen in the lagoon after June 1 and the adult portal has been closed, then open the portal for a week to allow out-migration.

6. After July 1, leave the flume exit closed once it closes, unless flooding is eminent. Install visquine or plywood on the outside of the flashboards to prevent leakage into the flume. Maximize the number of boards in the flume entrance to maximize lagoon depth.

7. Secure the flume boards at all times to prevent their lifting by vandals or bay back-flushing to drain the lagoon.

8. If the lagoon bottom becomes invisible due to turbidity for more than one day after the rains that do not breach the sandbar, immediately lower the lagoon level to the point where the bottom is visible. This will allow algal growth despite the high turbidity. Plant photosynthesis will produce oxygen and prevent anoxic conditions. A previous recommendation in the original Management Plan (**1990**) should be emphasized to prevent fish mortality; parking lots and streets draining into the lagoon should be cleaned thoroughly before the first fall rains.

9. Road repaving and application of petrochemicals should be done early in the summer. This will allow penetration and drying before fall rains.

10. Do not reduce the lagoon level for the Begonia Festival's nautical parade.

11. Do not allow wading to propel floats during the Begonia Festival's nautical parade.

12. Check the gage height at the lagoon once a week (preferably the same day each week) and keep a log of measurements so that the biologist may contact the City to obtain a weekly update.

13. "Gull Sweeps" sold by West Marine Products should be installed on Esplanade roofs to test their effectiveness in deterring gulls. According to the catalogue, "Powered by the slightest breeze, the Gull Sweep's motion will deter the most determined bird." These were successfully used on San Diego restaurants (**Y. Sherman, pers. communication**).

14. Complete the hookup with PG&E to automate the switch on the pump in the Esplanade storm drain to transfer water to the sewer during the dry season.

15. Regarding the nautical parade during the Begonia Festival, we continue to recommend that float propulsion by surfboard paddling or rowboat or electric outboard motor be required by the City rather than allowing pulling and pushing by waders. The latest CDFG permit prohibits wading. Allow float passage in one direction only, presumably downstream, before dismantling near the Stockton Avenue Bridge. In the past, floats were taken down the lagoon and then back up before dismantling back at the bridge.

16. The City should influence planners, architects and property owners through the permit review to maximize water percolation and to filter out and collect surface runoff pollutants from new and existing land development within the City and upstream.

17. The City should request from the responsible flood control district that sediment and grease traps leading into lower Soquel Creek be annually inspected and cleaned.

18. The City should continue to fund activities to permanently remove invasive Arundo from residences along the lagoon and other non-native plants in the riparian corridor between Highway 1 and the lagoon in order to maximize stream shading, minimize water temperature of inflow water and protect aquatic and wildlife habitat.

FISH CENSUSING

Steelhead Plantings in Soquel Creek

No steelhead were planted in Soquel Creek in 2007, as was the case in 2003–2006. CDFG allowed juvenile planting only in streams where captured adult steelhead brood stock were descendents of juveniles from those streams (San Lorenzo River and Scott Creek). No adult steelhead were captured from Soquel Creek for the hatchery. Therefore, no juveniles were planted there.

Results of Fish Sampling in Soquel Creek Lagoon

Our steelhead population estimate based on mark and recapture for fall 2007 was 6,064 +/-1,671 compared to 992 juveniles +/- 125 in 2006 and 1,454 juveniles +/- 347 in 2005 (**Table 14, Figure 16**) (methods in **Ricker 1971**). This was the largest estimate thus far and well above our 15-year average of 1,488 juveniles. The other species captured in Fall 2007 were threespine sticklebacks, staghorn sculpins, juvenile Sacramento suckers and starry flounders. No PIT-tagged juveniles from 2007 NOAA Fisheries tagging less than a mile upstream were captured on either sampling day in 2007. We would expect more juveniles to use the lagoon in 2007 than 2006 because there were lower adult passage flows late in the spawning season in 2007, encouraging more spawning in the lower creek to seed the lagoon with more young-of-the-year steelhead. Past calculations indicated that lagoon production represented nearly 1/3 of the smolt-sized steelhead production in the lower 7.2 miles of mainstem Soquel Creek in both 1999 and 2000. In 1993, the lagoon production estimate of nearly 2,800 fish represented 10% of the smolt production in the 16.6 miles of steelhead habitat in the mainstem, East and West Branches. The 2004 production estimate of 3,900 fish represented an estimated 47% of the smolt production for the 16.6 miles of habitat. Though we do not have 2007 population estimates for Soquel Creek, the lagoon population of larger smolt-sized fish was likely a significant percent of the total watershed population. The lagoon provides valuable habitat through proper management.

Even with a freshwater lagoon created by the City of Capitola, the water temperature sometimes approaches the upper tolerance limit of steelhead for 1-2 hours per day when morning fog is absent and stream inflow is warm. If sufficient saltwater were present in the lagoon, water temperatures could become lethal for steelhead. Although tidal overwash occurred in 2001 and 2004, it was prevented in 2007 except for slight overwash in early December. In 2004, lagoon water temperature reached 24ºC (75.2ºF) on 20 July after tidal overwash on 19 July. However,

the elevated condition lasted only 4 days with quick flume management. The shroud was installed on the flume inlet and the adult portal was opened to encourage draining of saltwater from the lagoon. However, due to 2 tidal overwashes in July 2001, daily water temperature fluctuated between approximately 23 and 26ºC for 14 days near the bottom in Reaches 1-3. This likely forced juveniles higher in the water column or further upstream where water depth was less. This would increase vulnerability to predation. Also, the higher temperature increased fish metabolic rate, possibly reducing growth rate in 2001.

Fall sampling for steelhead occurred on 7 and 14 October 2007, from just upstream of the Stockton Avenue Bridge, downstream. A bag-seine with dimensions 106 feet long by 6 feet high by 5/16-inch mesh was used. The seine was set perpendicular to shore, parallel to the Stockton Avenue Bridge and just upstream of it. Juvenile steelhead congregate in the shade under the bridge. The seine was pulled to the beach in front of Venetian Court. With this larger, coarser-meshed seine, no tidewater gobies were captured. A total of 559 unclipped juvenile steelhead were captured on the 2 days (compared to 300 in 2006, 294 in 2005, 447 in 2004, 204 in 2003 and 509 in 2002) ranging from 85 to 260 cm Standard Length (SL). A total of 226 juveniles from 5 effective seine hauls were marked on 7 October. There was 1 steelhead mortality. On 14 October, 320 unmarked (unclipped) steelhead and only 12 marked (clipped) steelhead were captured from 2 effective seine hauls. There were 2 steelhead mortalities. The lagoon level had been lowered to allow light to penetrate to the lagoon bottom, which apparently made our seine more effective than usual. Ten small young-of-the-year steelhead with light-to-moderate trematode parasitism on their bodies were captured on 14 October. These fish were not used in calculations because they were assumed to be fish that had moved into the lagoon as a result of the 12 October storm. The lagoon fish on 7 October lacked trematodes or had very few, as did larger fish captured on 14 October. The median size of juvenile steelhead captured the first day was 125-129 mm SL (**Figure 7**) (155-159 mm SL in 2006 (**Figure 8**)). The median size captured steelhead on 14 October was 125-129 mm SL (145-149 mm SL (unclipped only) in 2006).

We concluded from the size distributions of juveniles captured that steelhead grew slower in 2007 than 2006 in the summer lagoon, consistent with more competition from a much larger juvenile population in 2007. Comparison of size distributions and the median size in each of the last 9 years, young-of-the-year growth rate was similarly lower in 2002-2005, with intermediate growth rates in 1998-1999 and 2001 and 2007, with faster growth rates in 2000 and 2006.

On 7 October 2007, 3 seine hauls were made for tidewater gobies with a 30-foot x 4-foot x 1/8-inch mesh beach seine in lower Soquel Lagoon near the beach. On 14 October, another 2 seine hauls were made. The sampling was adjacent to Venetian Court, around to the flume. The sheer drop off at the lagoon margin prevented more seining. This is the only location where a seine could be adequately beached to capture tidewater gobies. Threespine sticklebacks were abundant with no tidewater gobies captured. The last capture of tidewater gobies was one in fall, 1997. The low number captured in 1992-1997, and their absence since the El Niño stormflows in winter 1997-98, probably indicated a lack of backwater areas to be used as refuges during high winter stormflows. This species was plentiful in Soquel Lagoon during the last drought of the late 1980's and early 1990's. Tidewater gobies have been recently reported in adjacent lagoons

(Moran Lake and Aptos) by Jerry Smith (**pers. communication**). They may re-populate Soquel Lagoon in the future from these sources.

In order to maintain good steelhead nursery habitat in Soquel Creek Lagoon, the sediment input from the watershed must be reduced. Stream shading must be increased to provide cooler stream inflow. The City must maintain the water level as high as possible throughout the summer until sandbar breaching, without large fluctuations. It is potentially easier to maintain good water quality and water depth when there is higher streamflow into the lagoon in summer (known as summer baseflow). The ceiling grate constructed in 2003 makes it easier to maximize lagoon depth because a portion of the flow can spill over the boards into the ceiling opening with all of the flashboards in place. However, even with the grate, it was difficult to maximize lagoon depth in 2006 because of the seepage of water and sand under the flume (**Figure 2**). Seepage was prevented in 2007, and lagoon depth was maintained except when adjustments were necessary to maintain light penetration to the bottom (detected on 13 October) and when inlet boards were dislodged and lost from back-flushing on 8 December. The inlet boards had not been adequately secured. In 2007, a group of 1-7 cormorants roosted on redwood stumps in the lagoon from mid-September onward, and 1-2 mergansers and 1-3 grebes were observed throughout the summer. Maintenance of lagoon depth is important to make feeding more difficult for these piscivorous birds.

If the lagoon becomes too shallow, steelhead habitat in the upper lagoon is lost. This is another reason to keep the lagoon as deep as possible during summer. The flume's flashboards must be secured against vandal's intent on draining the lagoon and against tidal backpressure that may dislodge the boards.

Maintenance of the lagoon in the fall after the first small storms is important. If the sandbar opens with the first small stormflows and closes again, kelp and seagrass may become trapped to rot and create an anoxic lagoon leading to a fish kill. Minimizing pollutant input from early fall storms is also important for reducing biological oxygen demand and avoiding fish kills.

Table 14. Estimates of Juvenile Steelhead Numbers in Soquel Creek Lagoon for the Years 1988 and 1992-2006.

Year Steelhead Population Estimate for Soquel Creek Lagoon

1988- Rough estimate of a few hundred. No mark/recapture activity done. 157 juveniles captured in 5 seine hauls.

1992- Rough estimate of a few hundred. No mark/recapture activity was done. 60 juveniles captured in 4 seine hauls.

1993- 2,787 +/- 306 (standard error). 1,046 fish marked from two seine hauls.

1994- 1,140 +/- 368 (standard error). 76 fish were marked from two seine hauls.

1995- 360 +/- 60 (standard error). 59 fish were marked from 4 seine hauls.

1996- 255 +/- 20 (standard error). 105 fish were marked from 3 seine hauls.

1997- 560 +/- 182 (standard error). 53 fish were marked from 3 effective seine hauls.

1998- 671 +/- 74 (standard error). 164 fish were marked from 3 effective and one snagged seine haul.

1999- 928 +/- 55 (standard error). 397 fish were marked in 4 effective seine hauls.

2000- 875 +/-156 (standard error).185 fish were marked in 4 effective seine hauls.

2001- 454 +/- 27 (standard error). 186 fish were marked in 4 effective seine hauls.

2002- 1,042 +/-84 (standard error). 363 fish were marked in 4 effective seine hauls.

2003- 849 +/-198 (standard error). 109 fish were marked in 5 effective seine hauls.

2004- 3,869 +/-1,009 (standard error). 281 fish were marked in 4 effective seine hauls.

2005- 1,454 +/-347 (standard error). 212 fish were marked in 5 effective seine hauls and one with rope tangled around one pole.

2006- 992 +/- 125 (standard error). 178 fish were marked in 5 effective seine hauls.

2007- 6,064 +/- 1,671 (standard error). 226 fish were marked in 5 effective seine hauls

Recommendations Regarding Fish Management

1. If the streamflow in Soquel Creek in the vicinity of Soquel Village approaches the point of losing surface flow, notify nurseries having surface diversions upstream and the Fish and Game Department of the streamflow conditions so that direct water diversion of surface flow may be reduced or discontinued until flow returns. Pumping by the Soquel Creek Water District from the Main Street well may also need to be curtailed. Complete loss of surface flow should be avoided.

2. Maximize lagoon depth by maximizing the number of flashboards in the flume inlet as streamflow declines and by sealing the boards with visquine and/or plywood, as was done in the past.

3. Secure the flume boards at all times so that vandals cannot pry them up and drain the lagoon. This will prevent tidal surges through the flume from doing the same thing, as occurred in 2007. Installation of a louver system on one side of the flume inlet would eliminate the need to deal with boards all summer. The design and installation of a louver system is recommended.

4. Do not unplug the flume exit after 1 July unless flooding is eminent.

5. Do not remove flume boards for the Begonia Festival's nautical parade or prior to taking fall vacation time.

6. Remove flume boards as the first small storms begin in fall and replace the boards after the stormflow has subsided. The effort should be to minimize lagoon fluctuation until the sandbar actually breaches. Many forecasts for rain and storm intensities are incorrect in the early fall. It is harmful to steelhead to drop the lagoon level in anticipation of a storm that fails to develop and then fail to re-install the flume board afterwards.

7. Maintain the lagoon in fall until streamflow has increased enough (20-25 cfs) to prevent stranding of spawning adult steelhead or coho salmon and to prevent osmotic stress to lagoon- inhabiting steelhead. If necessary, install a perimeter fence with 2"x 4" mesh with 6-foot panels around the flume entrance by October to prevent plugging of the flume's screen with aquatic vegetation during the first minor storms. The goal should be to maintain the lagoon until approximately Thanksgiving in late November, before allowing stormflow to breach the sandbar. By this time, the winter storm pattern has usually developed to keep the sandbar open.

8. If sufficient turbidity occurs after the first small storms of the season to prevent light from penetrating to the bottom of the intact lagoon for more than one day,

reduce lagoon depth temporarily to insure that light reaches the bottom. This will prevent death of aquatic vegetation and increased biological oxygen demand, with the associated loss of oxygen production that would have occurred from photosynthesis. Thus, anoxic conditions will be prevented. When the lagoon clears up, re-establish the maximum lagoon depth.

9. If the sandbar is still in place after November 15, maintain an opening in the flume inlet to allow early spawning adults to pass through the flume from the bay.

10. Continue to census the juvenile steelhead in the fall to monitor the use of the lagoon as an important nursery area under varying management scenarios and restoration efforts.

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FIGURES

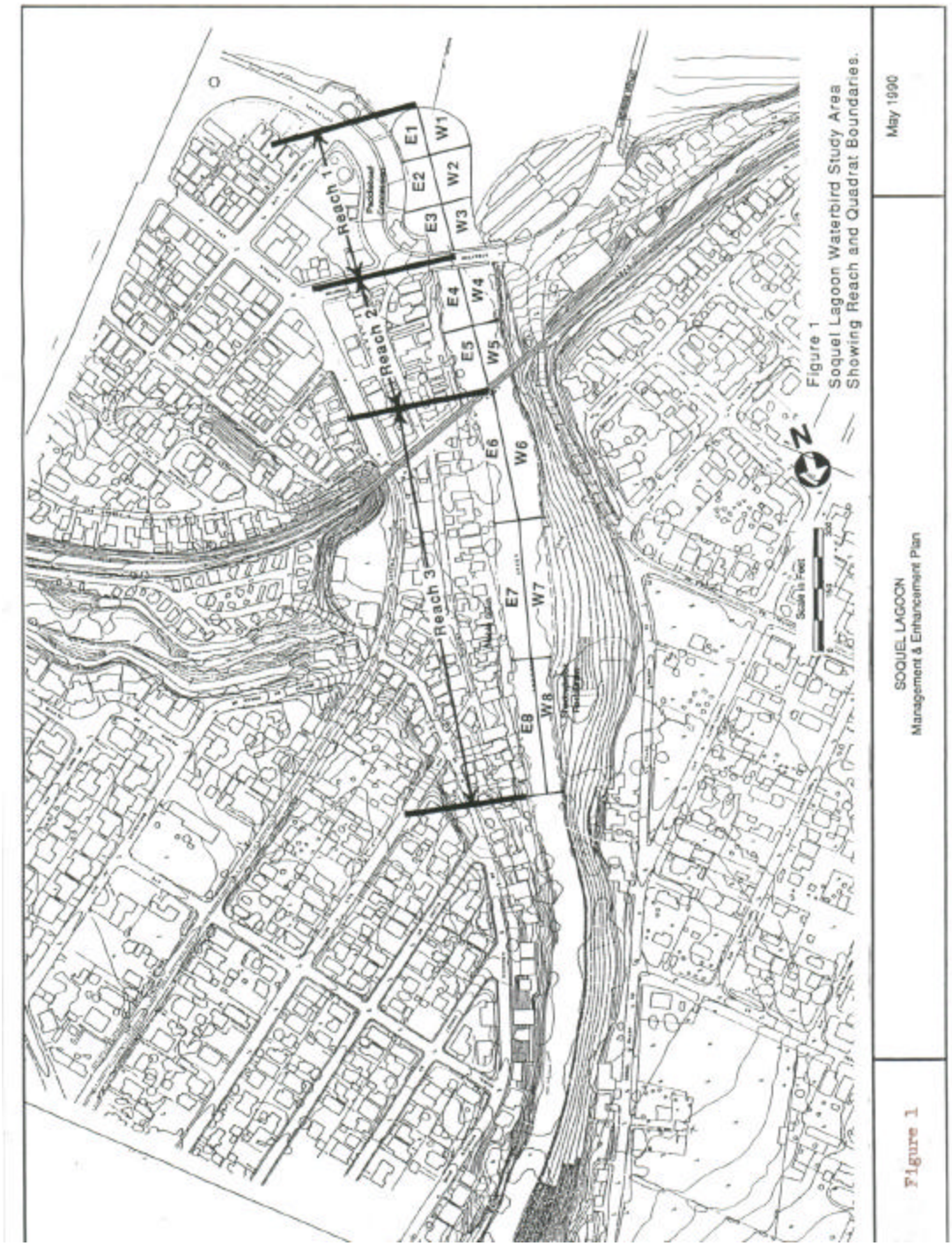
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Figure 1
Soquel Lagoon Waterbird Study Area
Showing Reach and Quadrat Boundaries.
May 1990
SOQUEL LAGOON
Management & Enhancement Plan
Figure 1

Figure 2. Soquel Lagoon Gage Height at Stockton Avenue Bridge, From 24 May to 8 Decenber 2004- 2007.

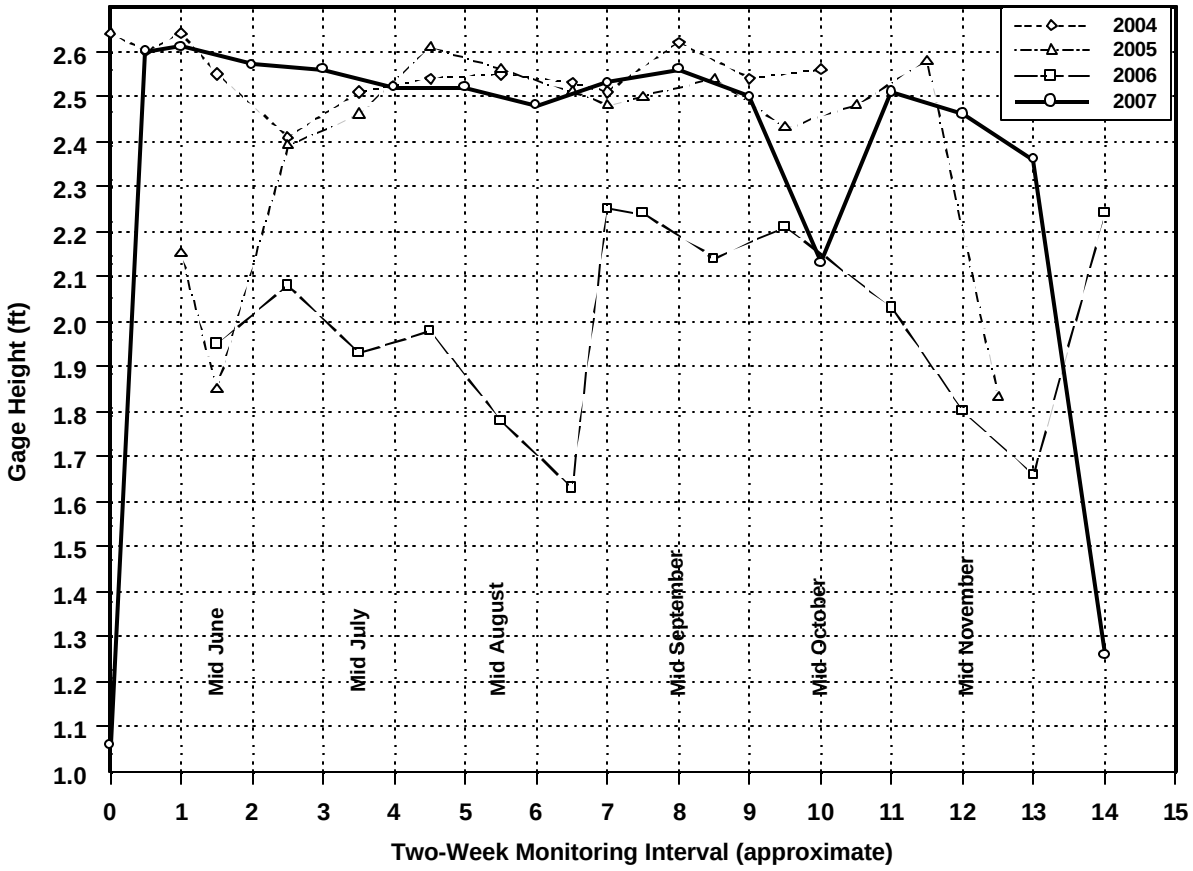


Figure 3a. 2006 and 2007 Soquel Lagoon Water Temperature at the Flume (Station 1) Near the Bottom at Dawn and in the Afternoon after 1500 hr from 10 June to 8 December.

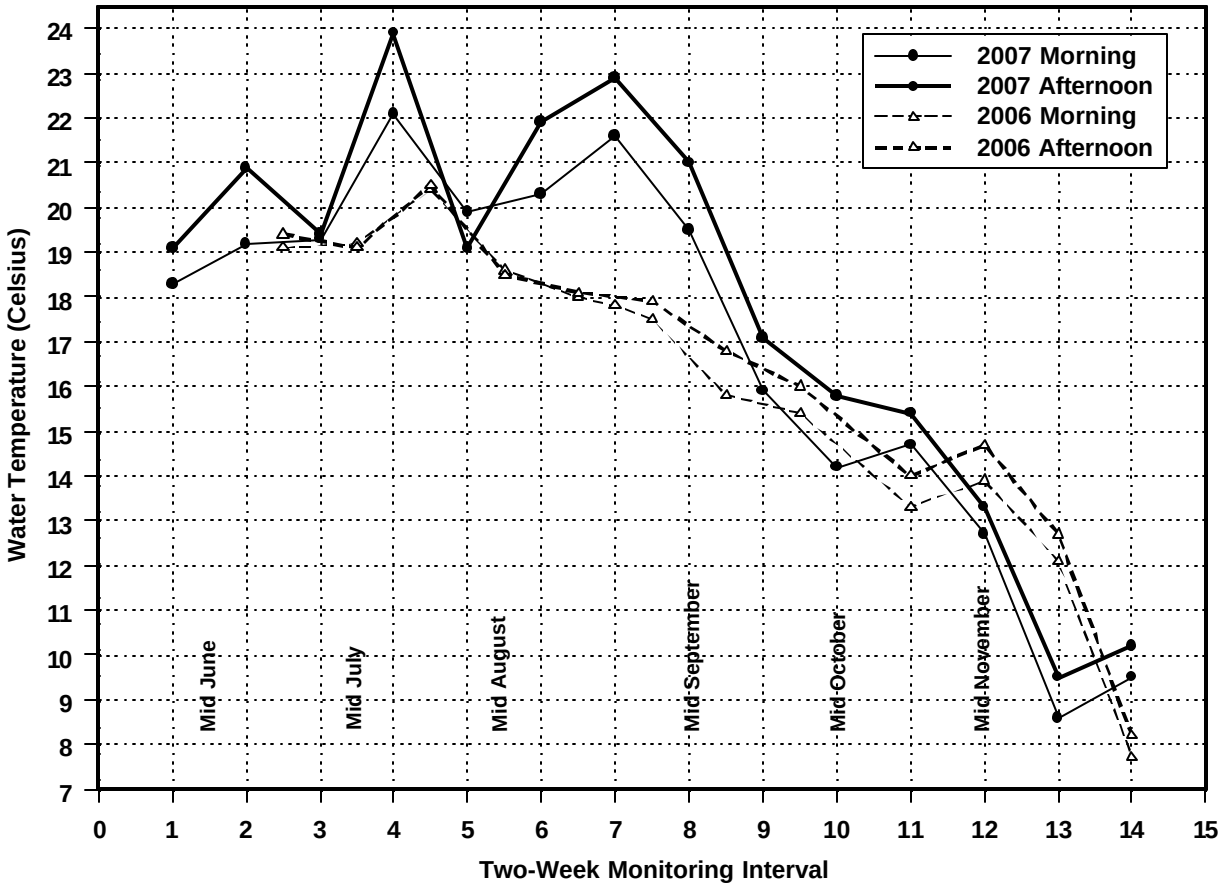


Figure 3b. 2006 and 2007 Soquel Lagoon Water Temperature at Stockton Avenume Bridge Near the Bottom at Dawn and in the Afternoon after 1500 hr from 10 June to 8 December.

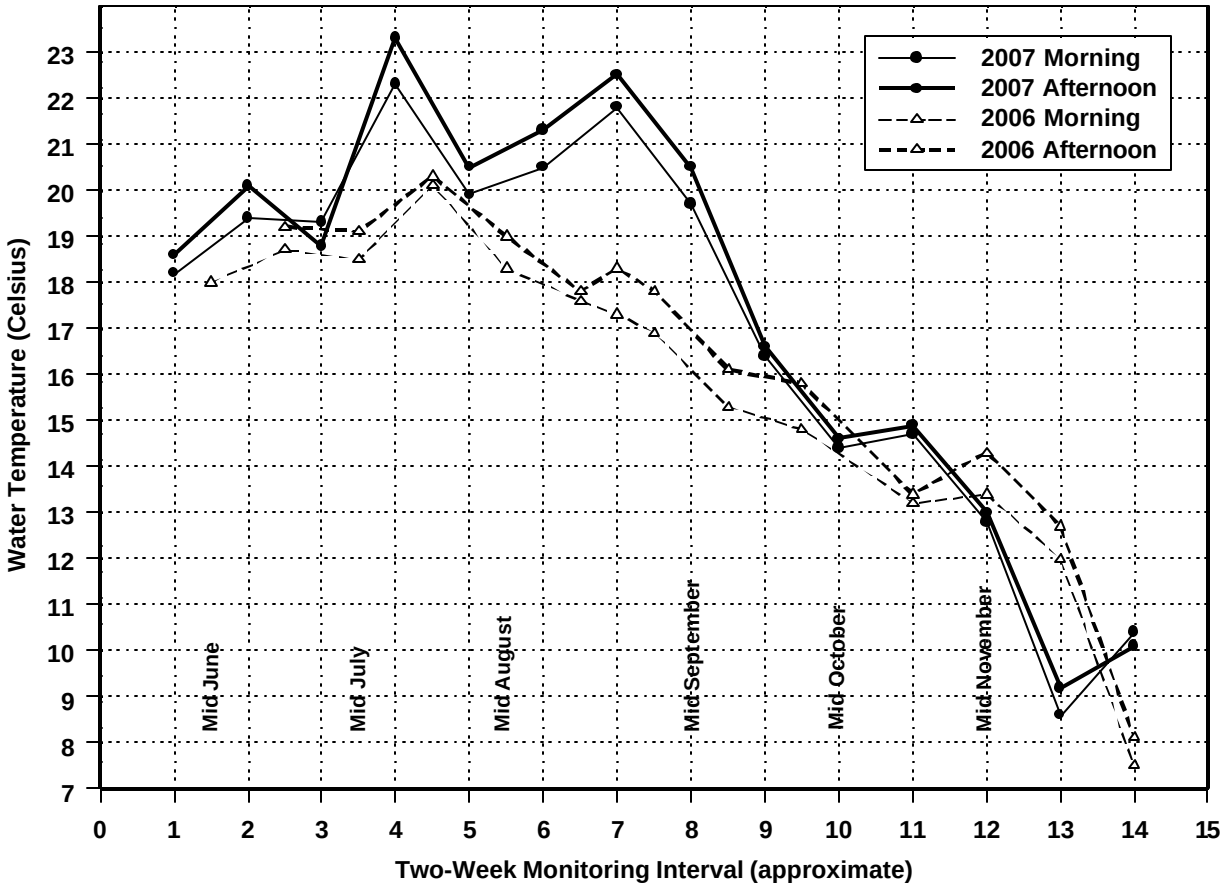


Figure 3c. 2006 and 2007 Soquel Lagoon Water Temperature at the Railroad Trestle (Station 3) Near the Bottom at Dawn and in the Afternoon after 1500 hr from 10 June to 8 December.

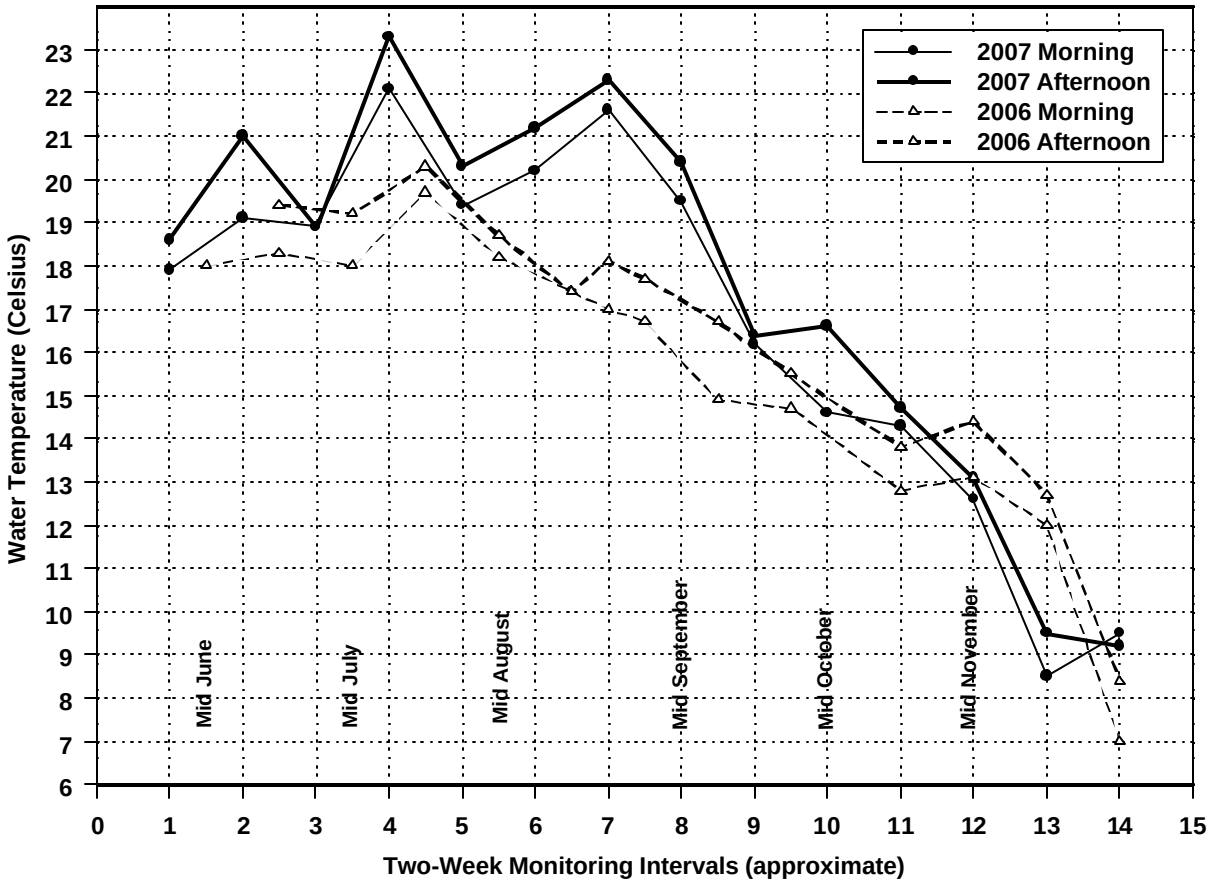


Figure 3d. 2006 and 2007 Soquel Lagoon Water Temperature at Noble Gulch Near the Bottom at Dawn and in the Afternoon after 1500 hr from 10 June to 8 December.

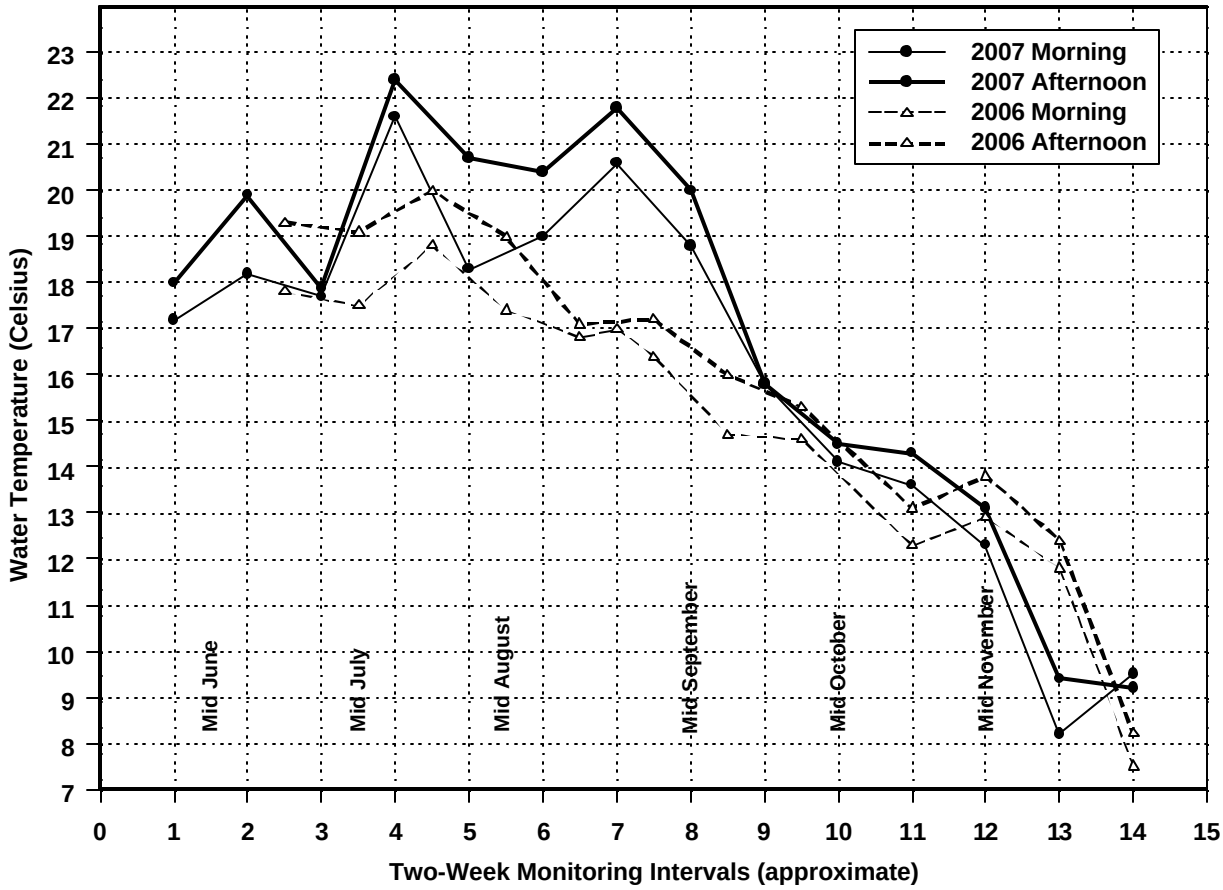


Figure 3e. Soquel Creek Water Temperature at Nob Hill Above the Lagoon in 2005- 2007, Measured Between 0800 hr and 0930 hr From 10 June to 8 December.

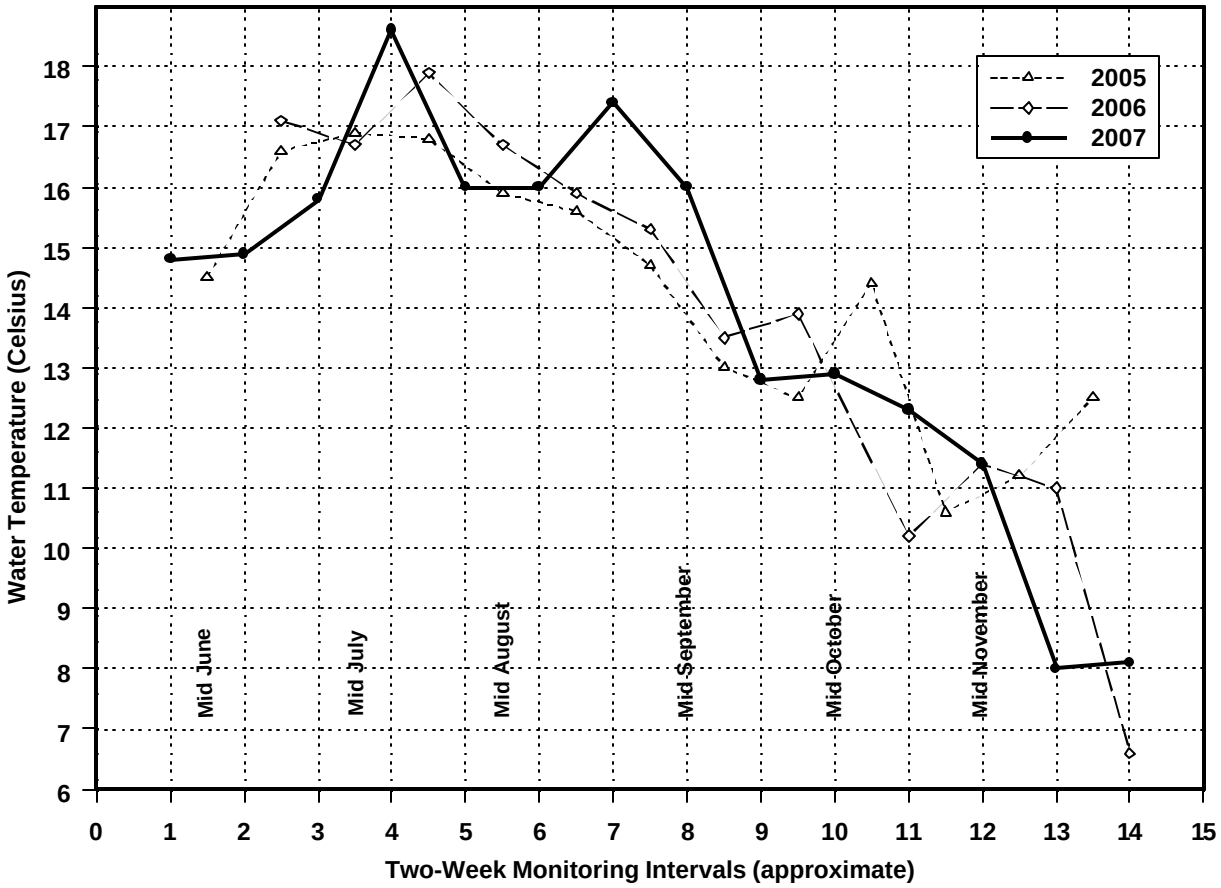


Figure 3f. Water Temperature at Dawn at Four Lagoon Stations Near the Bottom and Upstream in Soquel Creek from 10 June to 8 December 2007.

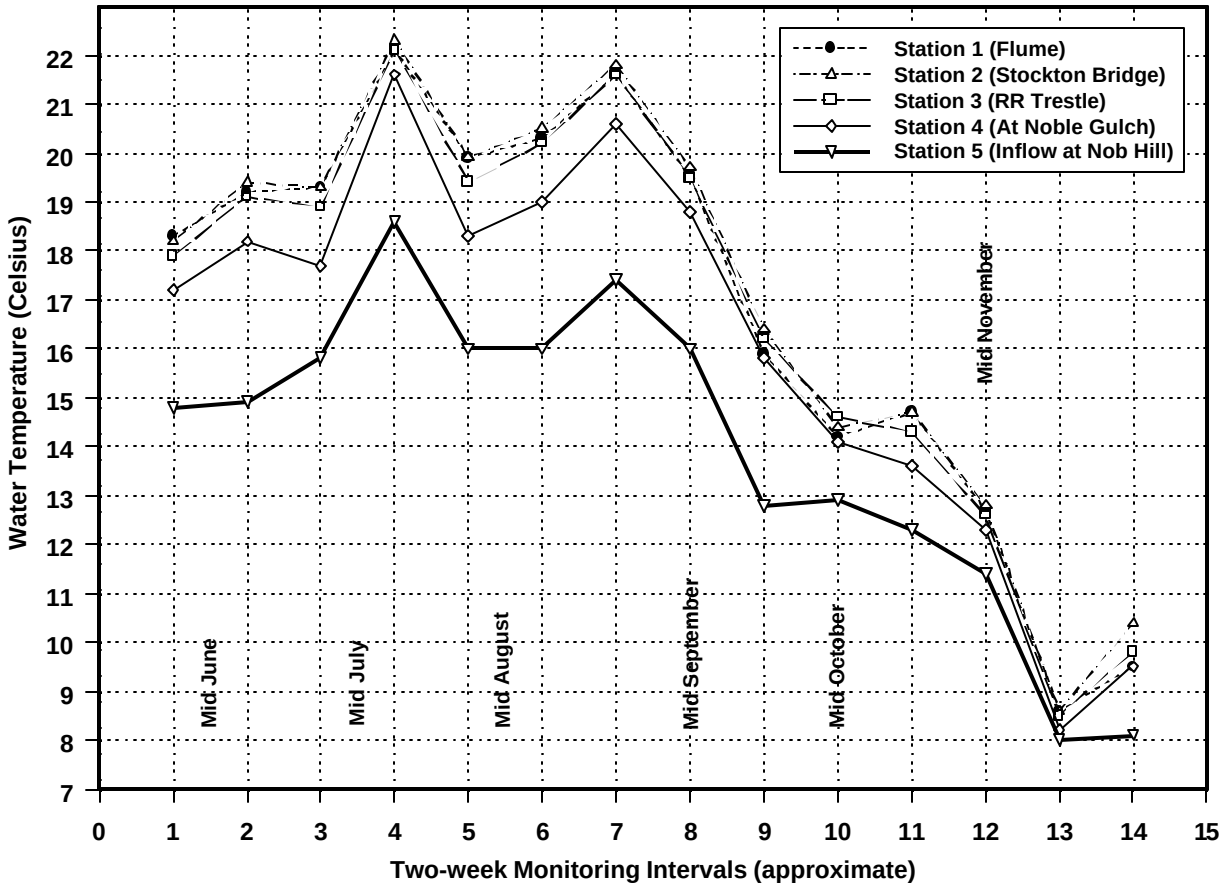


Figure 3g. Water Temperature in the Afternoon at 4 Lagoon Stations Near the Bottom Between 1500 and 1630 hr from 10 June to 8 December 2007.

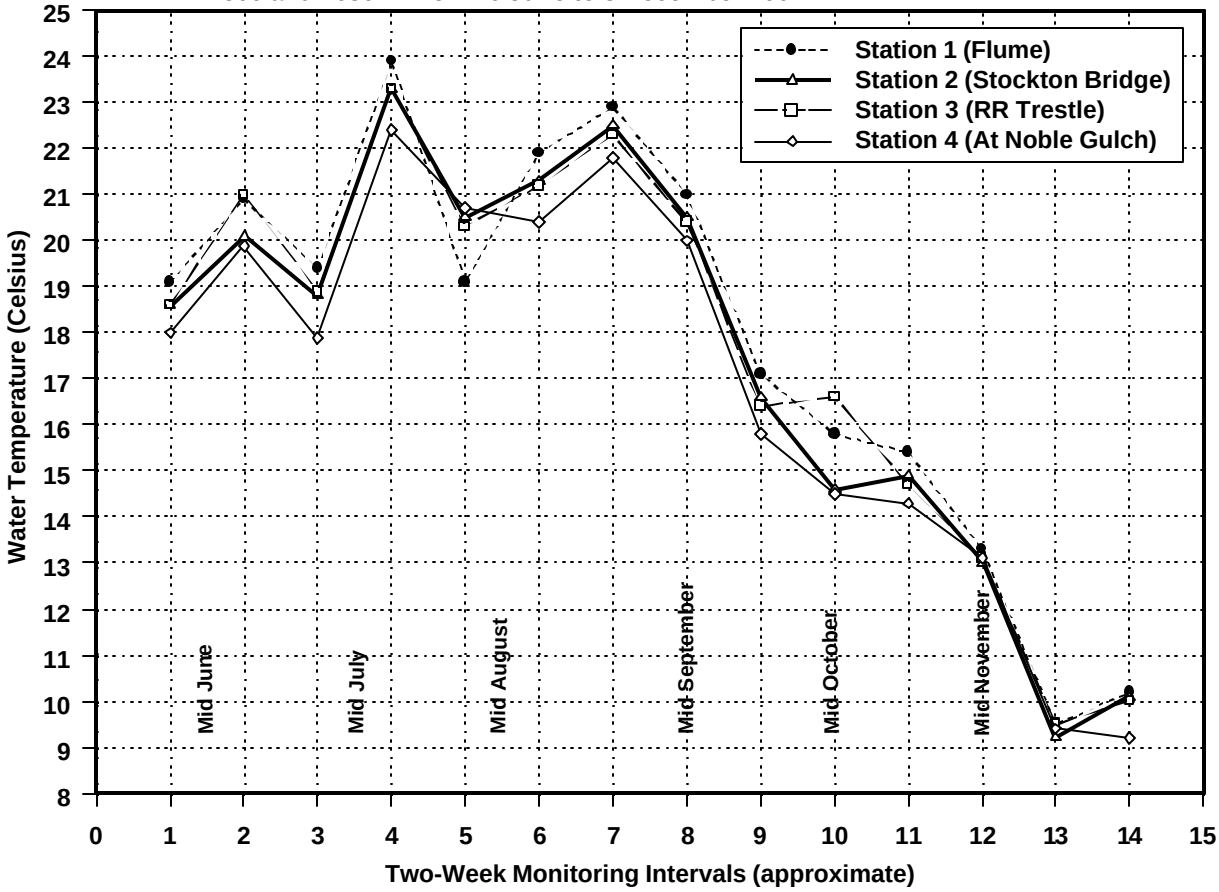


Figure 4a. Water Temperature (*C) Above Trestle, 0.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

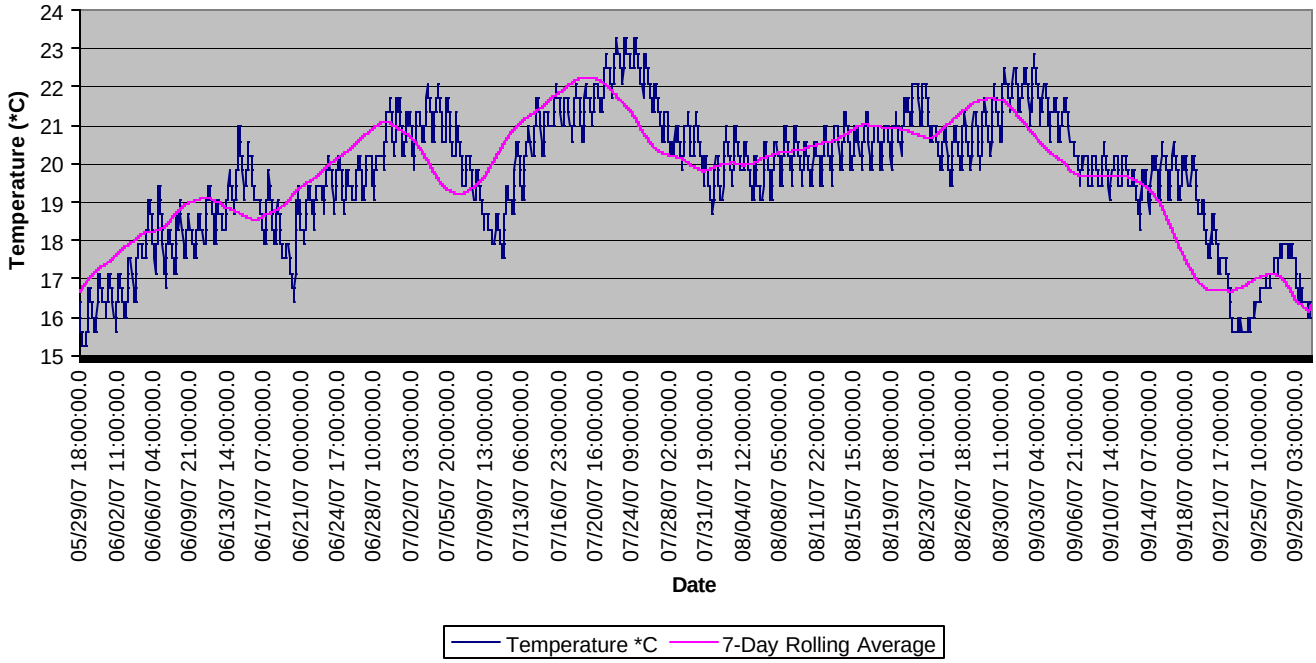


Figure 4b. Water Temperature (*F) Above Trestle, 0.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

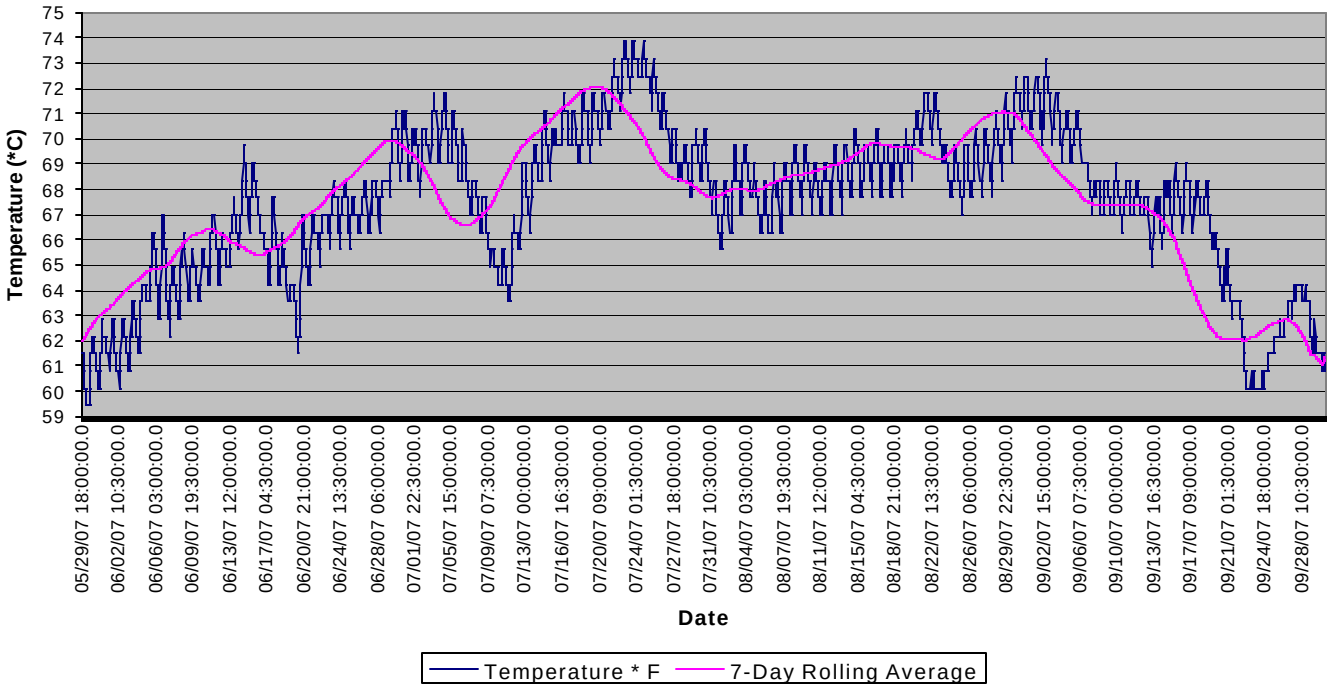


Figure 4c. Water Temperature (*C) Above Trestle, 1.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

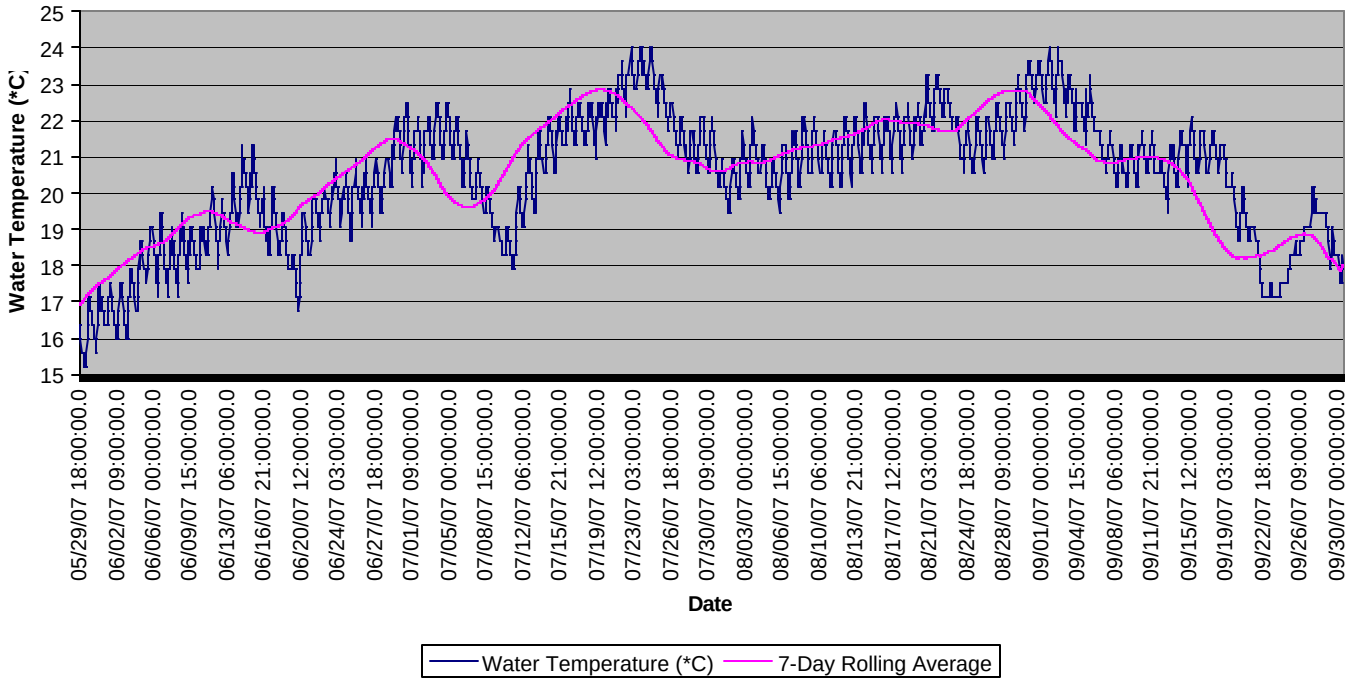


Figure 4d. Water Temperature (*F) Above Trestle, 1.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

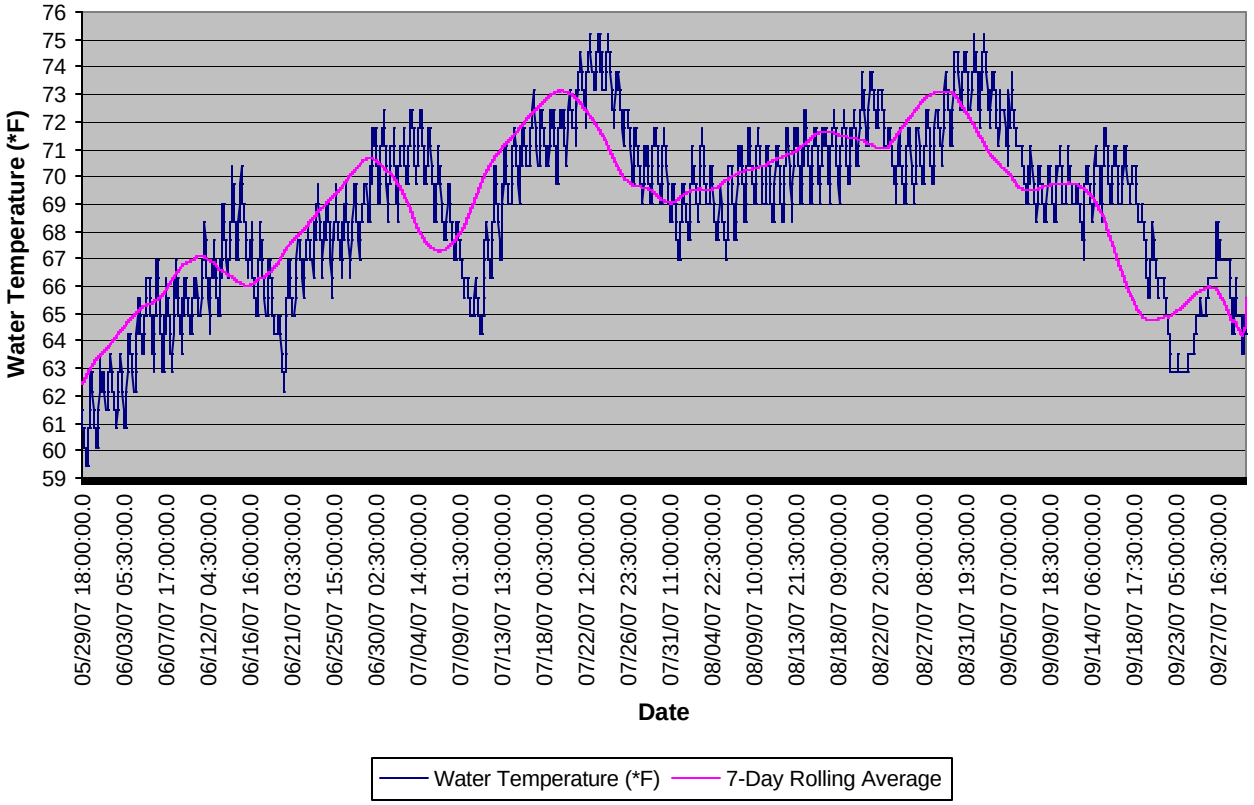


Figure 4e. Water Temperature (*C) Above Trestle, 2.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

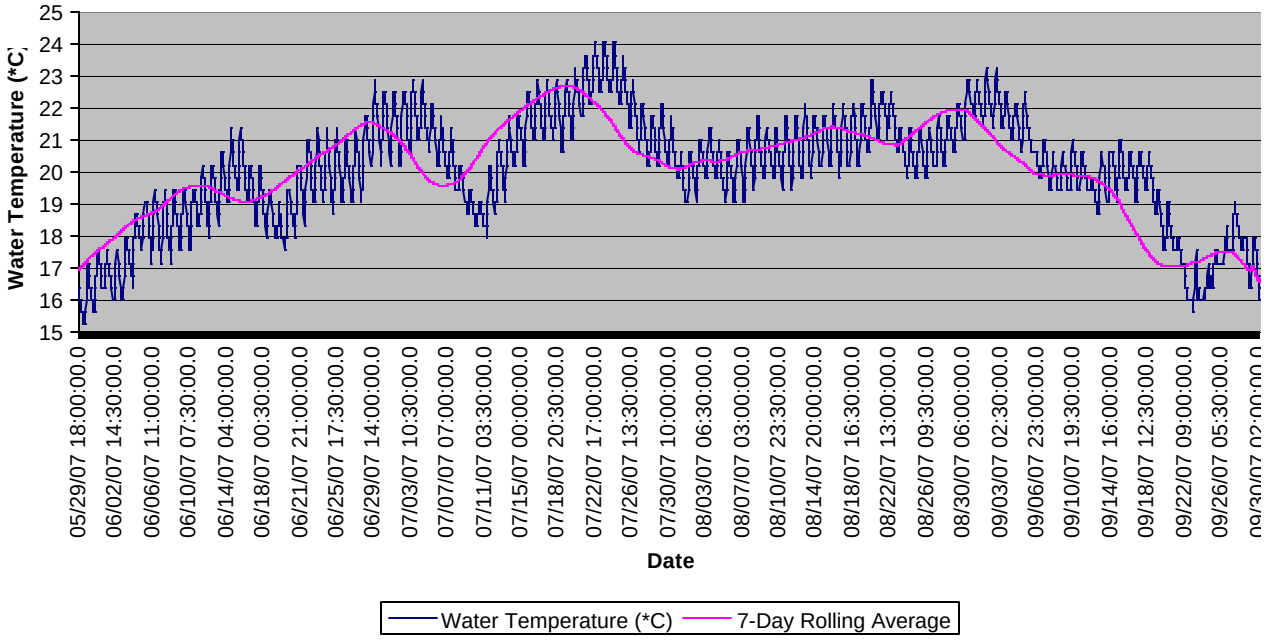


Figure 4f. Water Temperature (*F) Above Trestle, 2.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

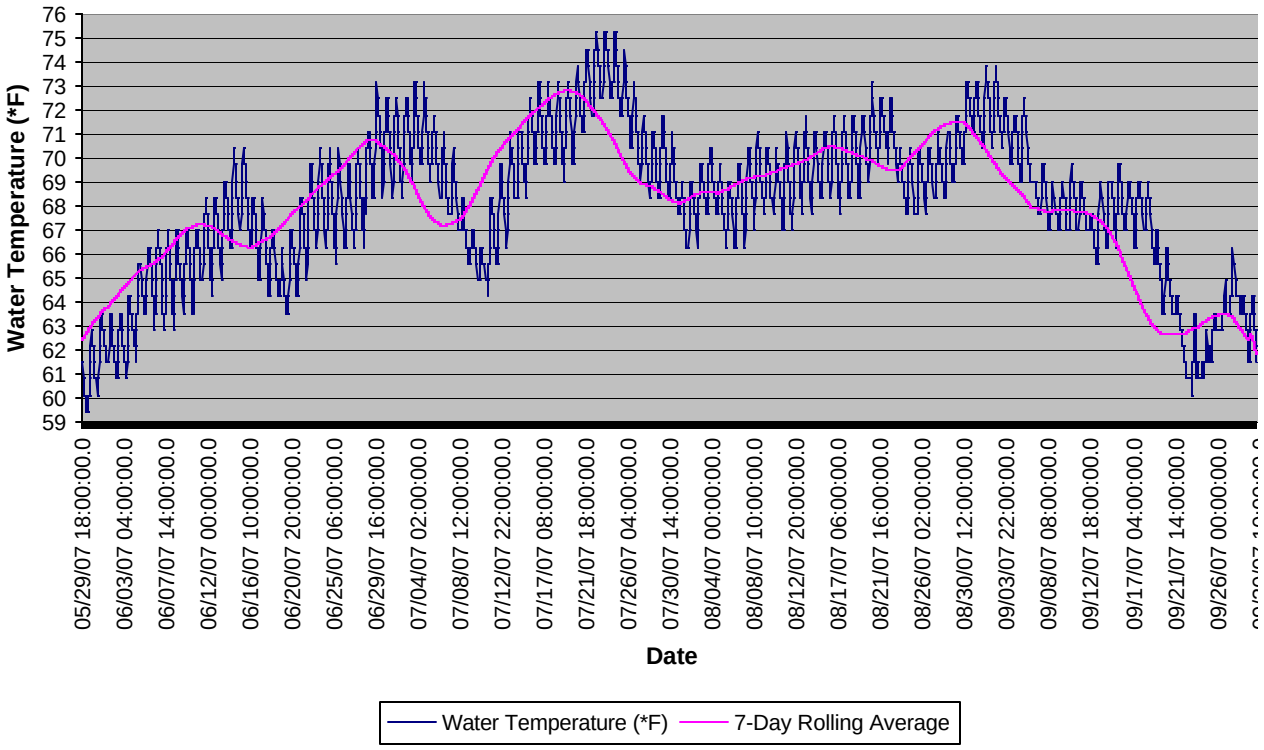


Figure 4g. Water Temperature (*C) Above Trestle, 3.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

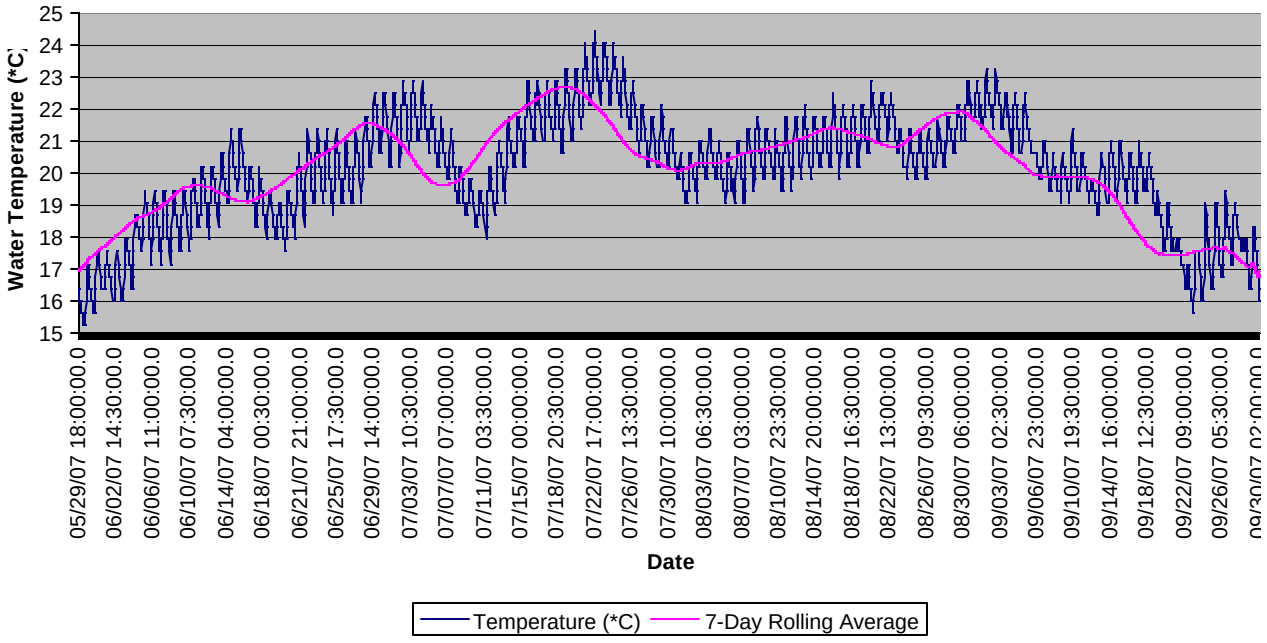


Figure 4h. Water Temperature (*F) Above Trestle, 3.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

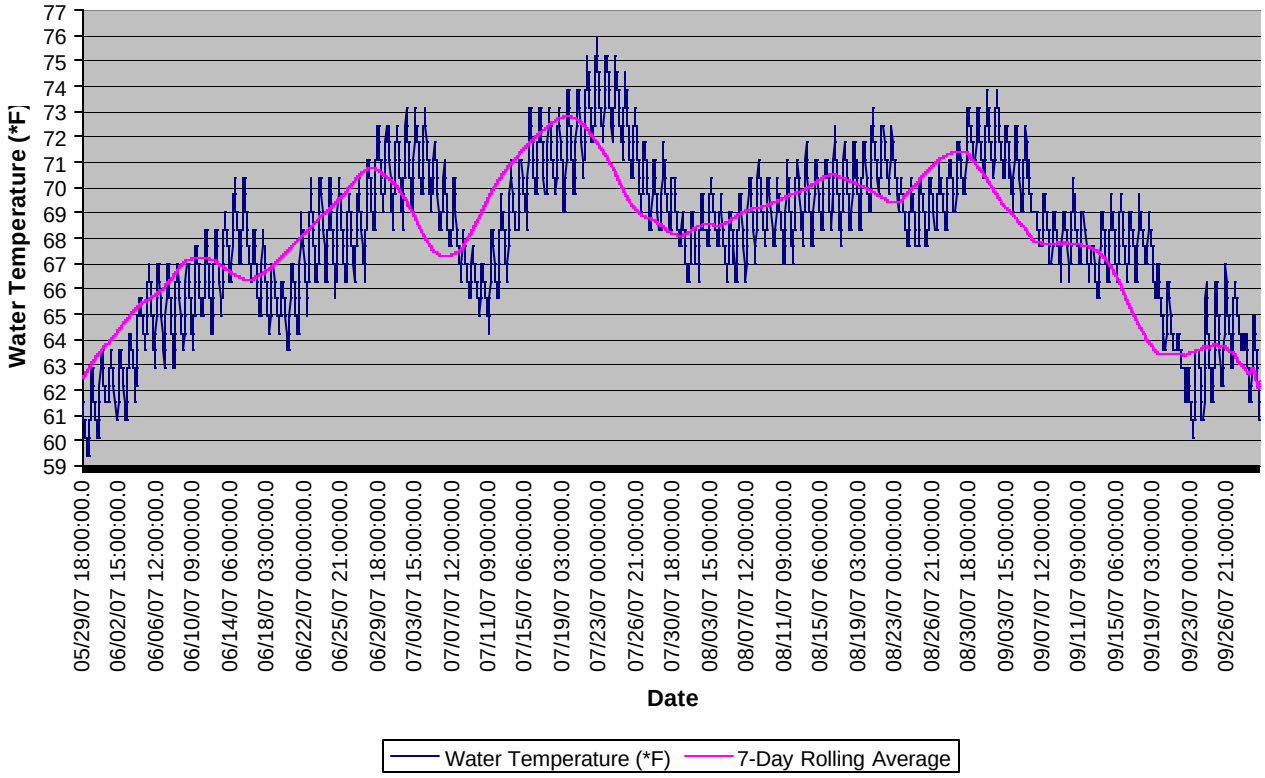


Figure 4i. Water Temperature (*C) Above Trestle, 4.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

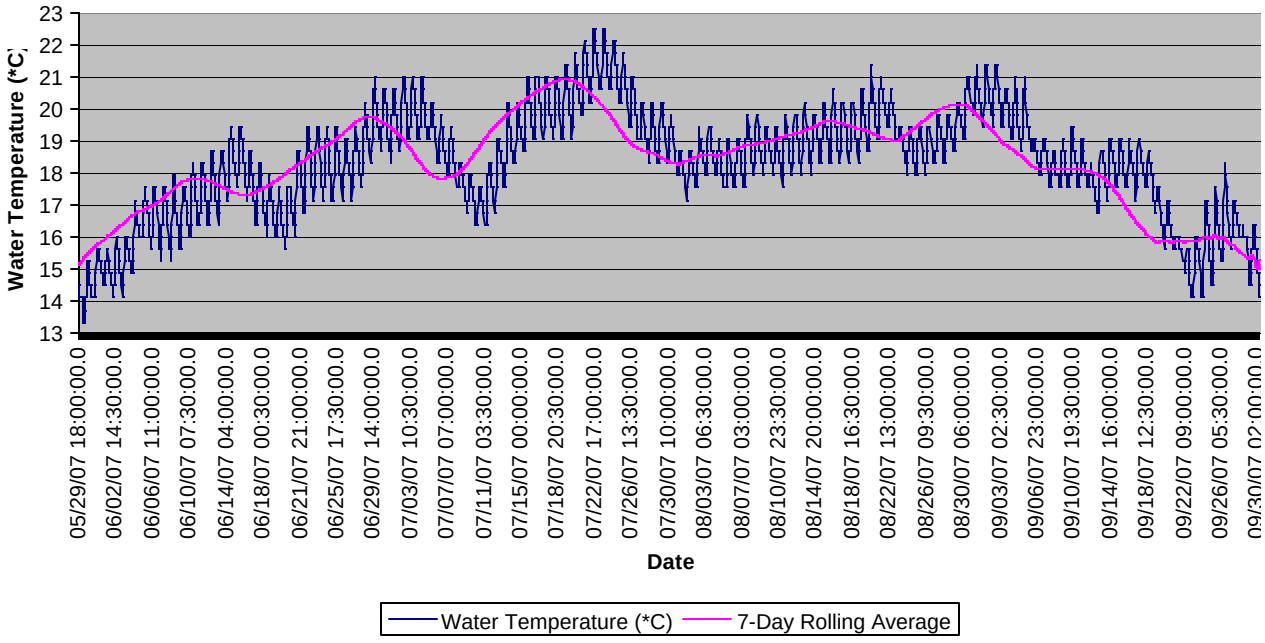


Figure 4j. Water Temperature (*F) Above Trestle, 4.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

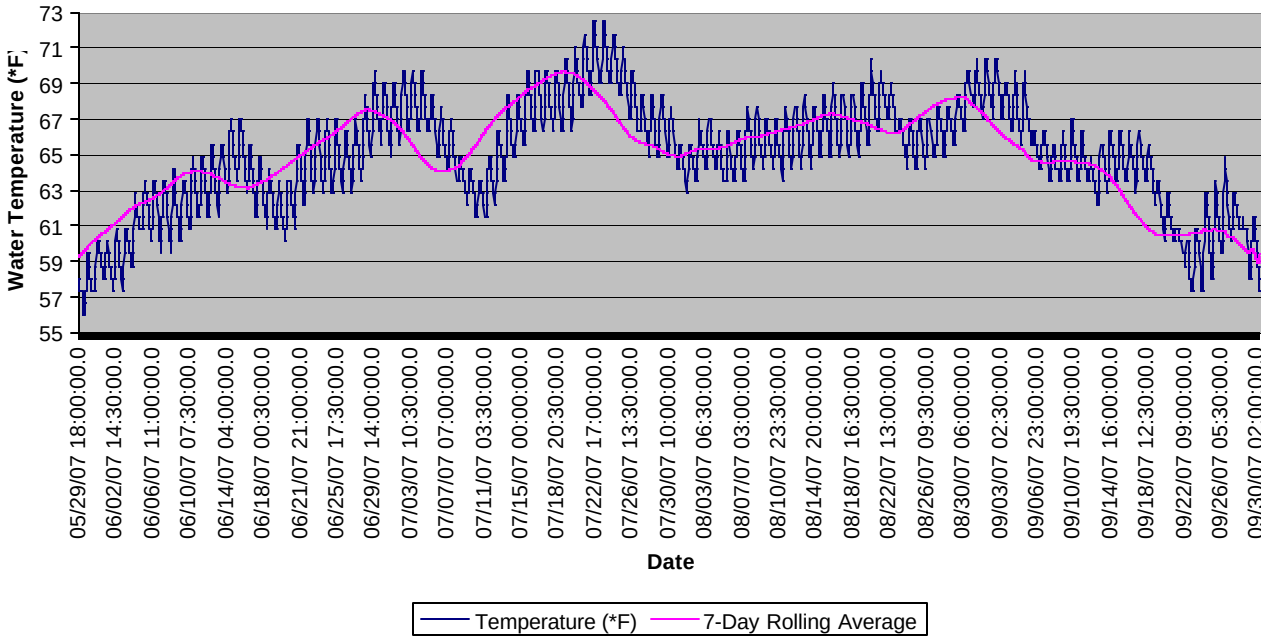


Figure 4k. Water Temperature (*C) Above Trestle, 5.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

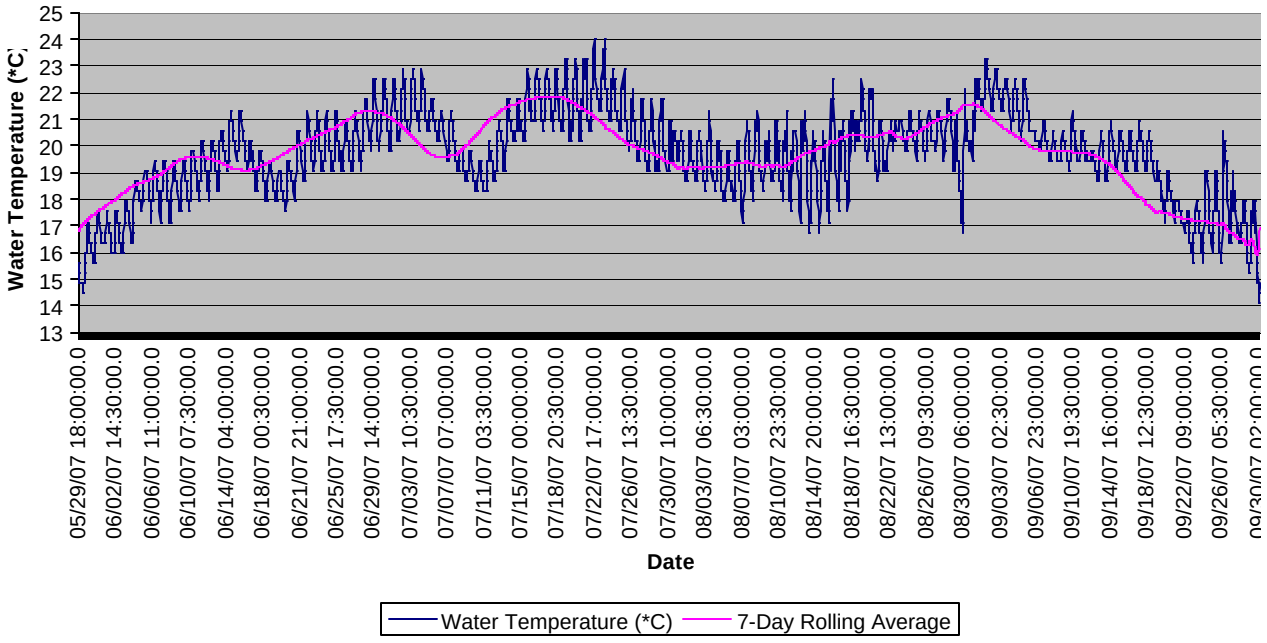


Figure 4l. Water Temperature (*F) Above Trestle, 5.5 ft from Bottom, 29 May- 30 September 2007 (30-minute interval).

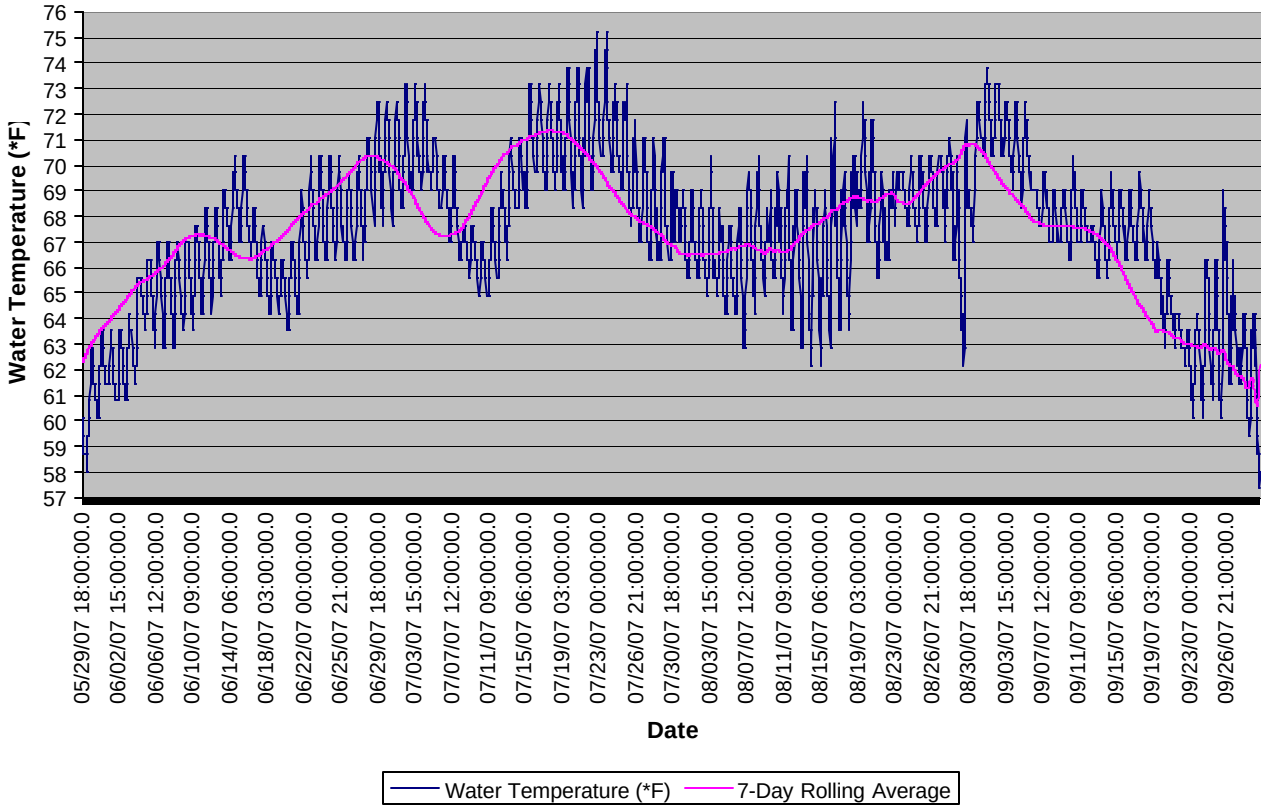


Figure 4m. Water Temperature (*C) Above Trestle, 5.5 ft from Bottom, 18 June- 8 October 2006 (30-minute interval).

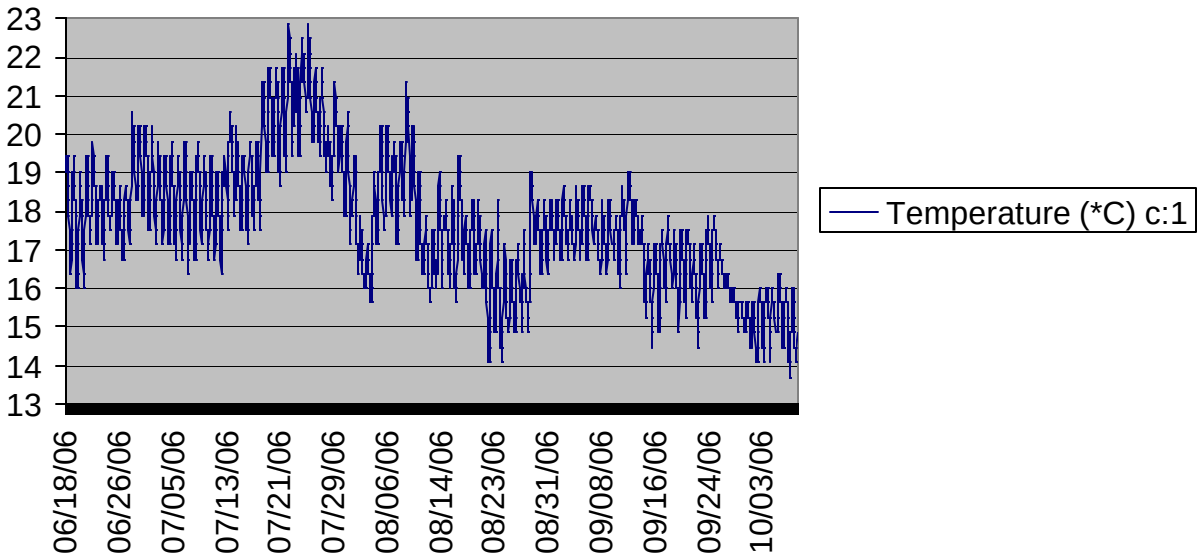


Figure 4n. Water Temperature (*C) Above Trestle, 0.5 ft from Bottom, 18 June- 8 October 2006 (30-minute interval).

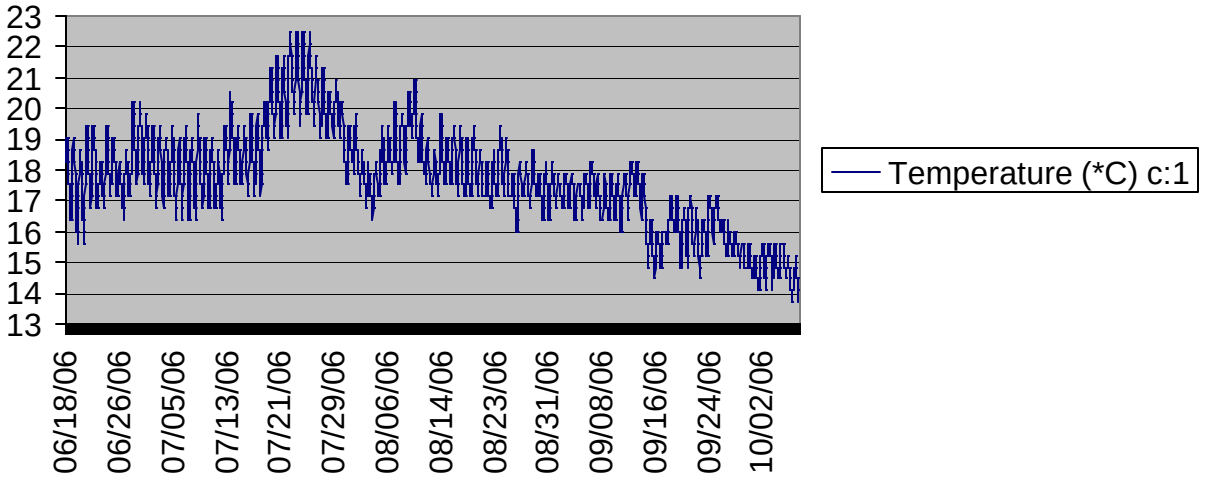


Figure 5a. Water Temperature (*C) Above the Lagoon (Nob Hill) in Soquel Creek, 29 May-30 September 2007 (30-minute interval).

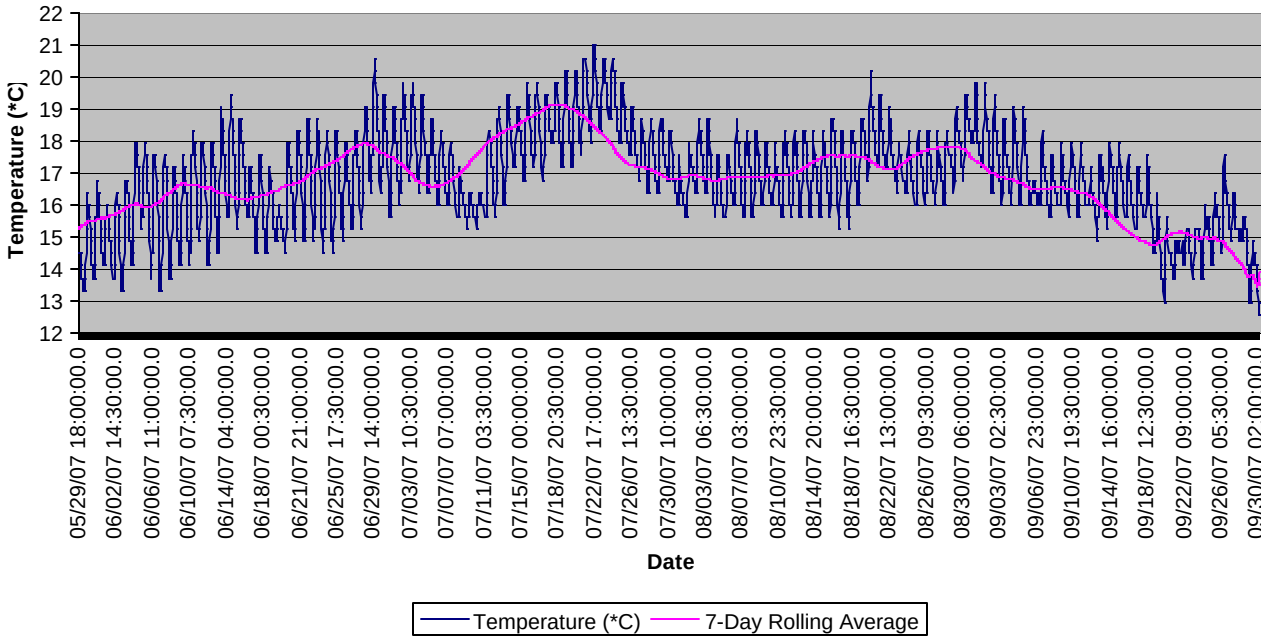


Figure 5b. Water Temperature (*F) Above the Lagoon (Nob Hill) in Soquel Creek, 29 May-30 September 2007 (30-minute interval).

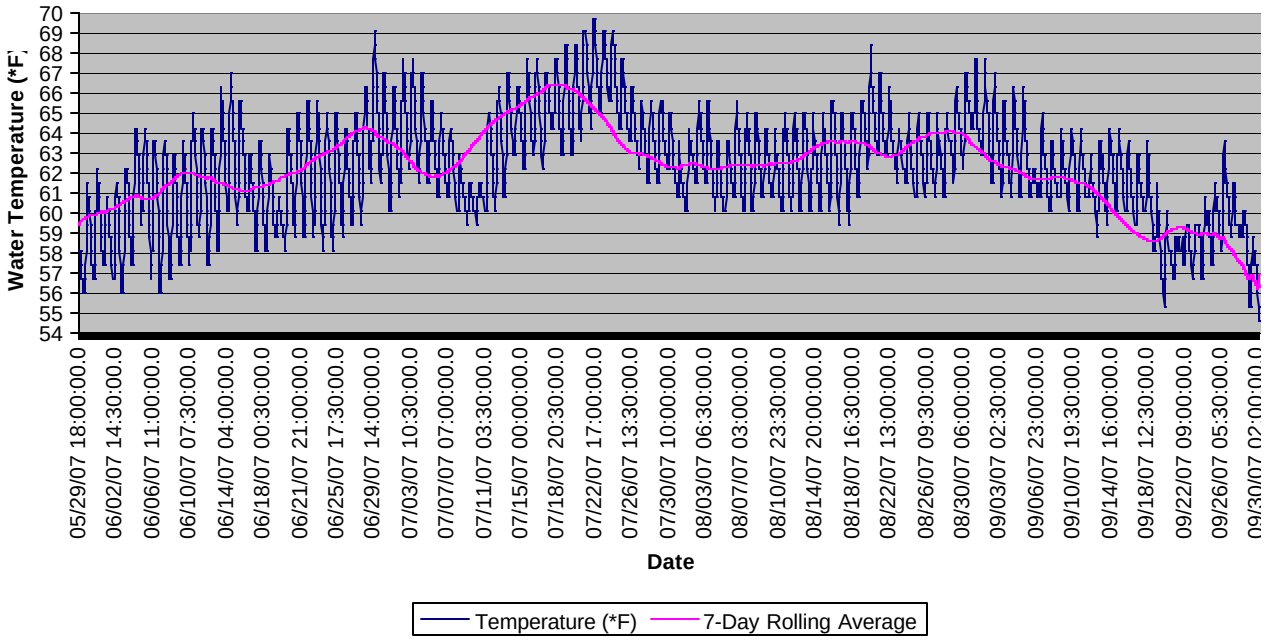


Figure 5c. Water Temperature (*C) Above the Lagoon (Nob Hill) in Soquel Creek, 8 June- 12 September 2006 (30-minute interval).

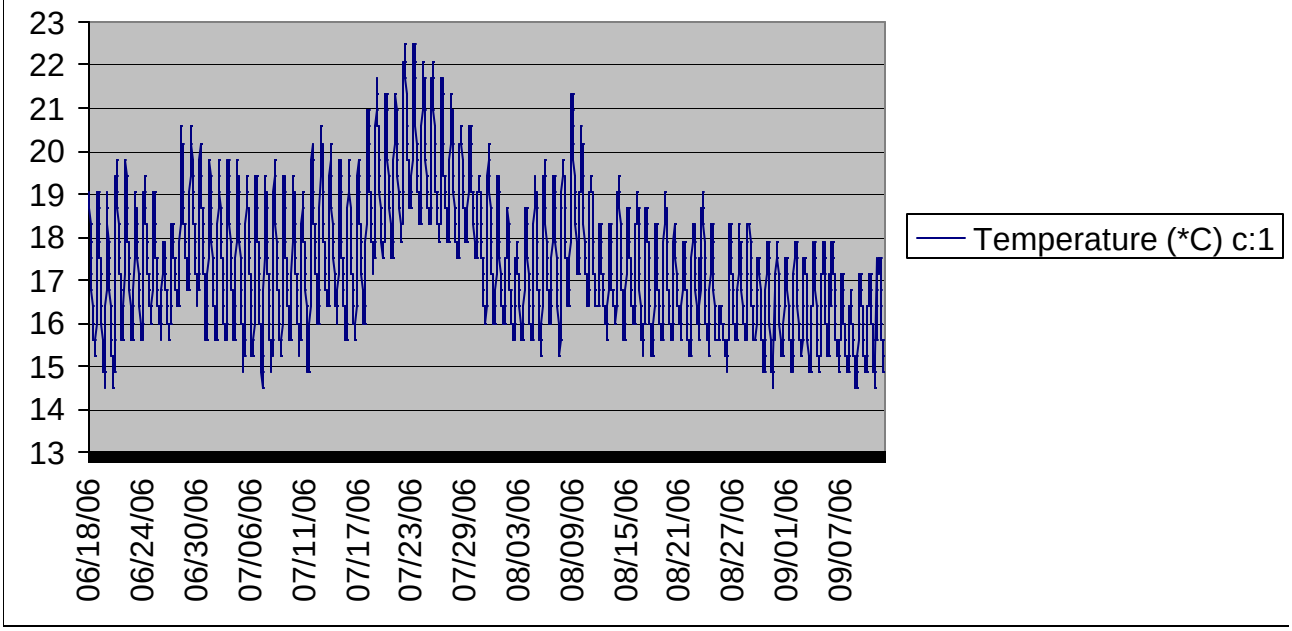


Figure 5d. Water Temperature (*F) Above the Lagoon (Nob Hill) in Soquel Creek, 8 June- 12 September 2006 (30-minute interval).

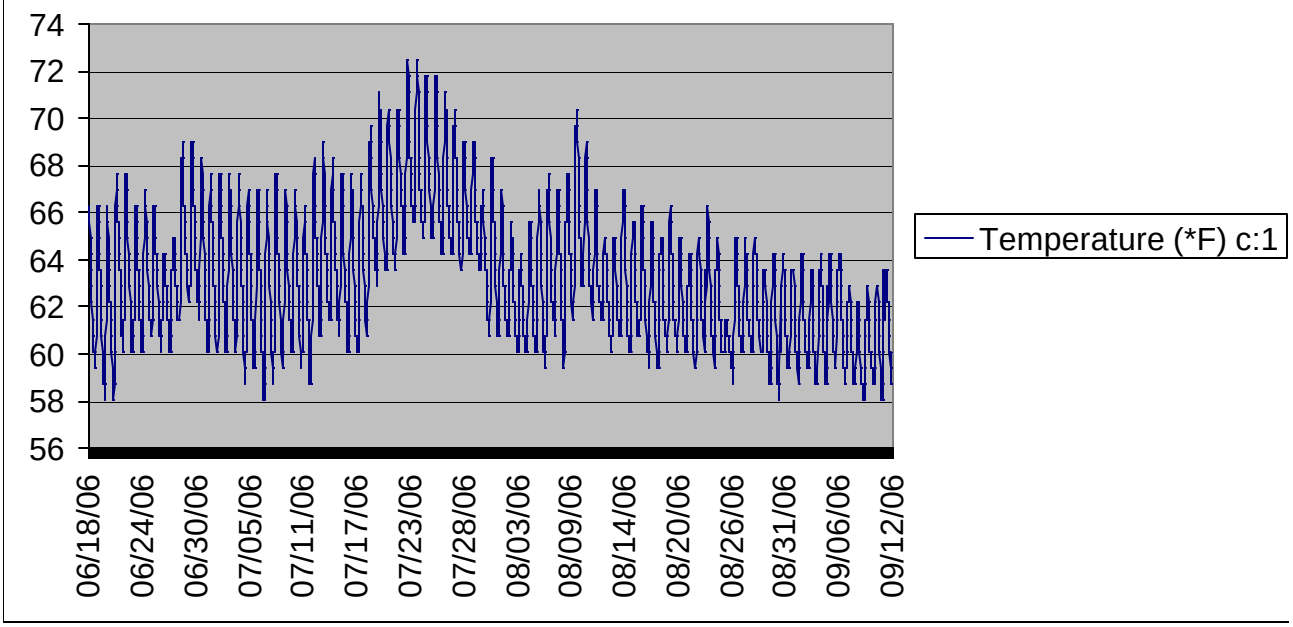


Figure 6a. Soquel Lagoon/Stream Oxygen Concentrations at Dawn within 0.25 Meters of the Bottom at Five Stations, June 10 - December 8, 2007.

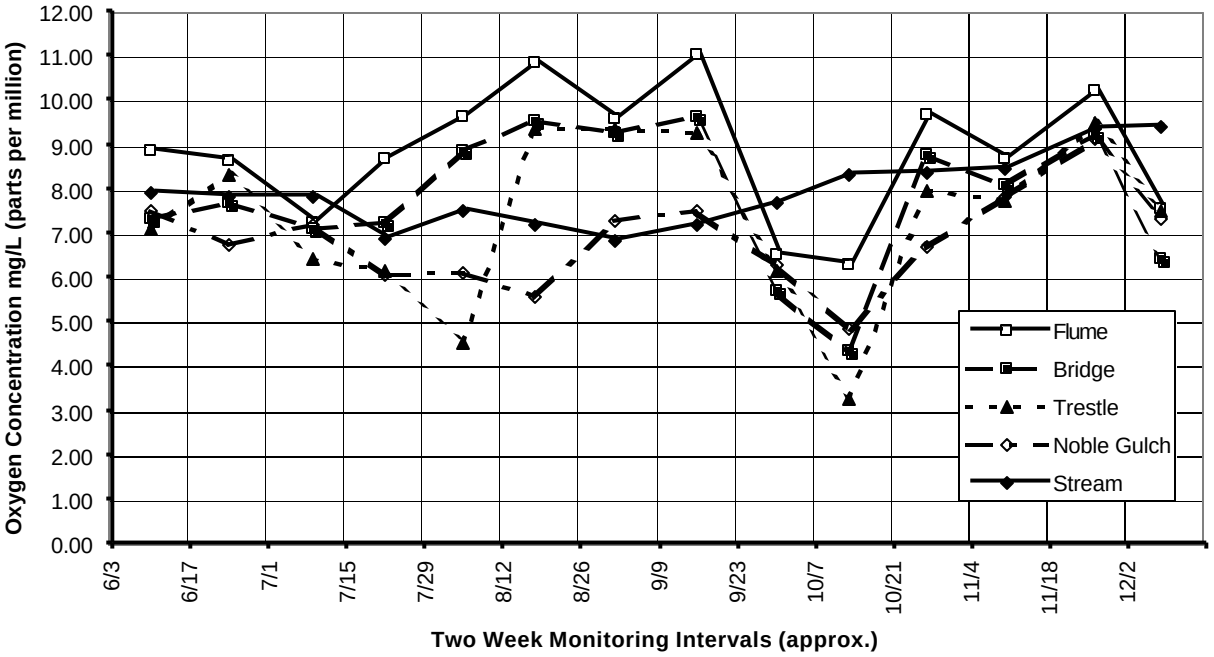


Figure 6b. Soquel Lagoon Oxygen Concentrations in the Morning and Afternoon within 0.25 Meters of the Bottom at Station 1, the Flume, June 10 - December 8, 2007.

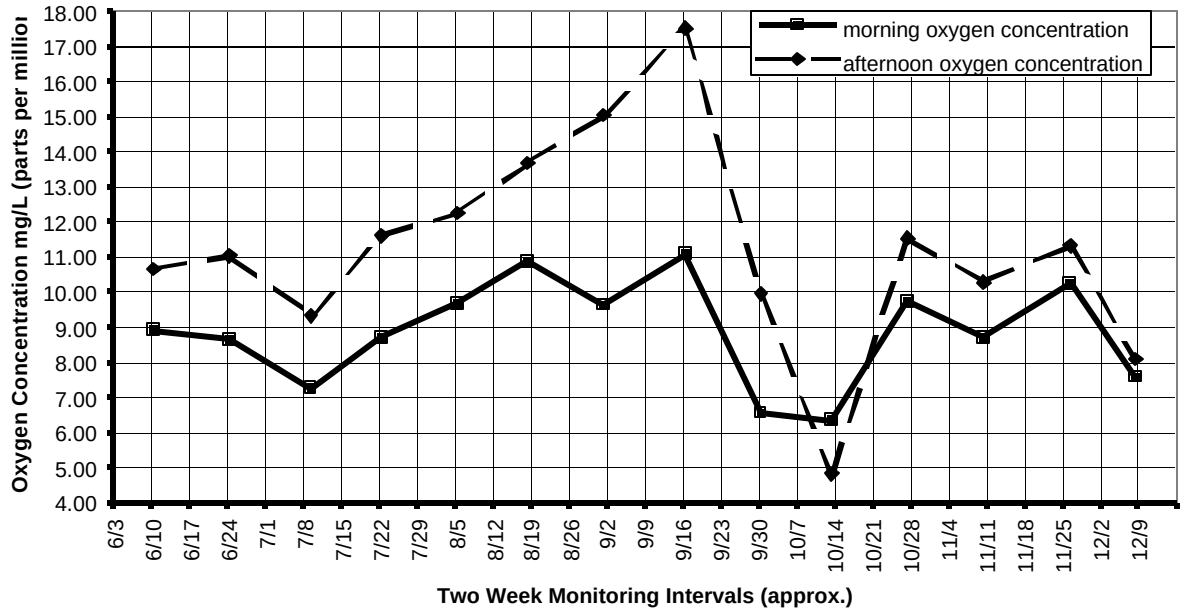


Figure 6c. Soquel Lagoon Oxygen Concentration in the Morning and Afternoon within 0.25 Meters of the Bottom at Station 2, the Stockton Avenue Bridge, June 10 - December 8, 2007.

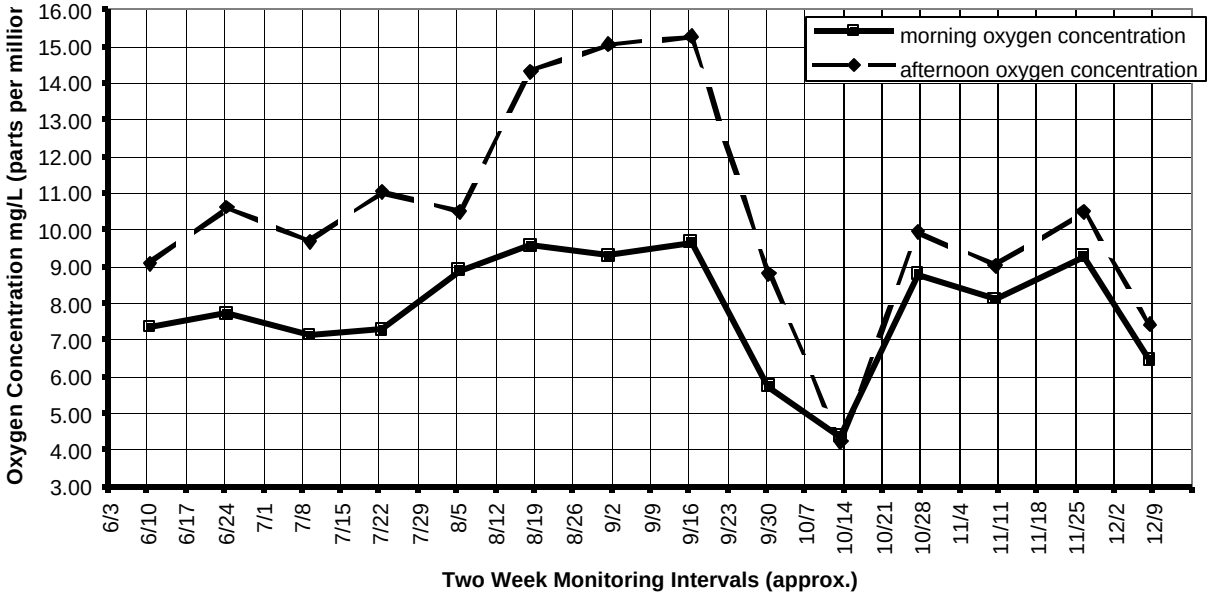


Figure 6d. Soquel Lagoon Oxygen Concentrations in the Morning and Afternoon within 0.25 Meters of the Bottom at Station 3, the Railroad Trestle, June 10 - December 8, 2007.

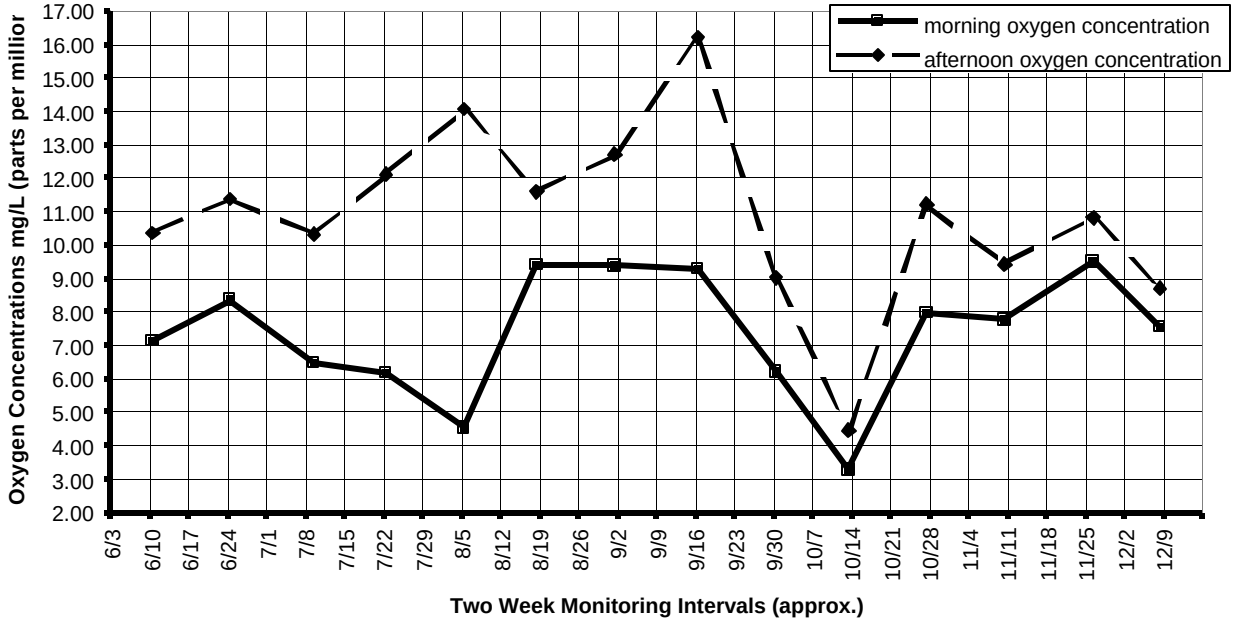


Figure 6e. Soquel Lagoon Oxygen Concentrations in the Morning and Afternoon within 0.25 Meters of the Bottom at Station 4, the Mouth of Noble Gulch, June 10 - December 8, 2007.

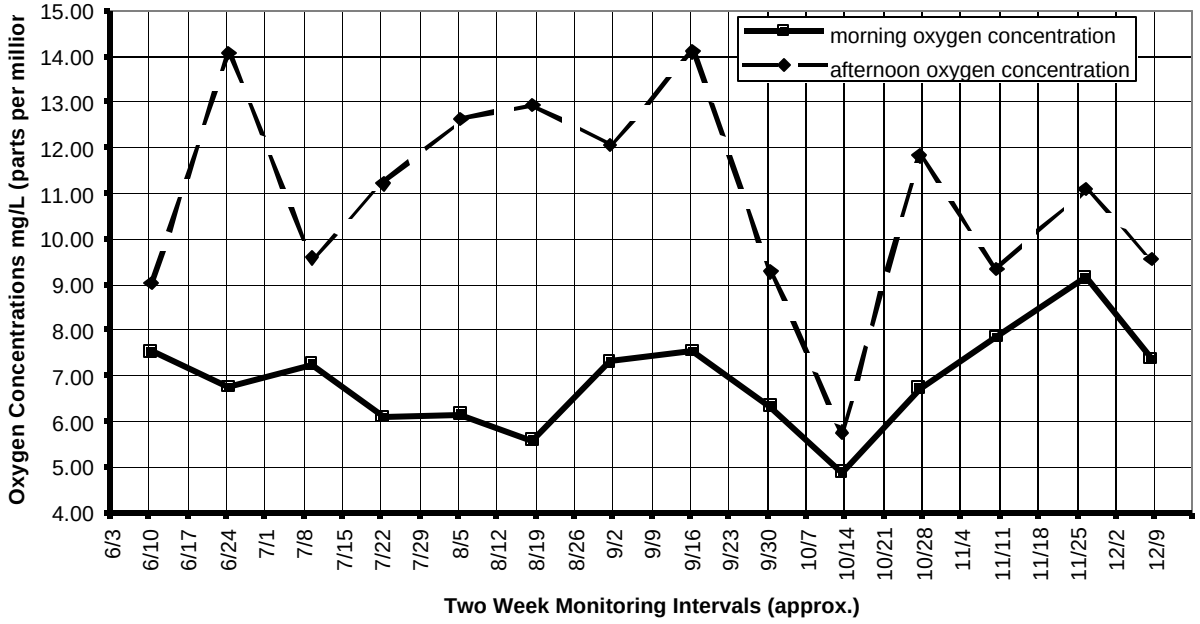


Figure 6f. Soquel Lagoon/Stream Oxygen Concentrations at Dawn Within 0.25 Meters of the Bottom at 5 Stations, 30 June - 6 December 2006

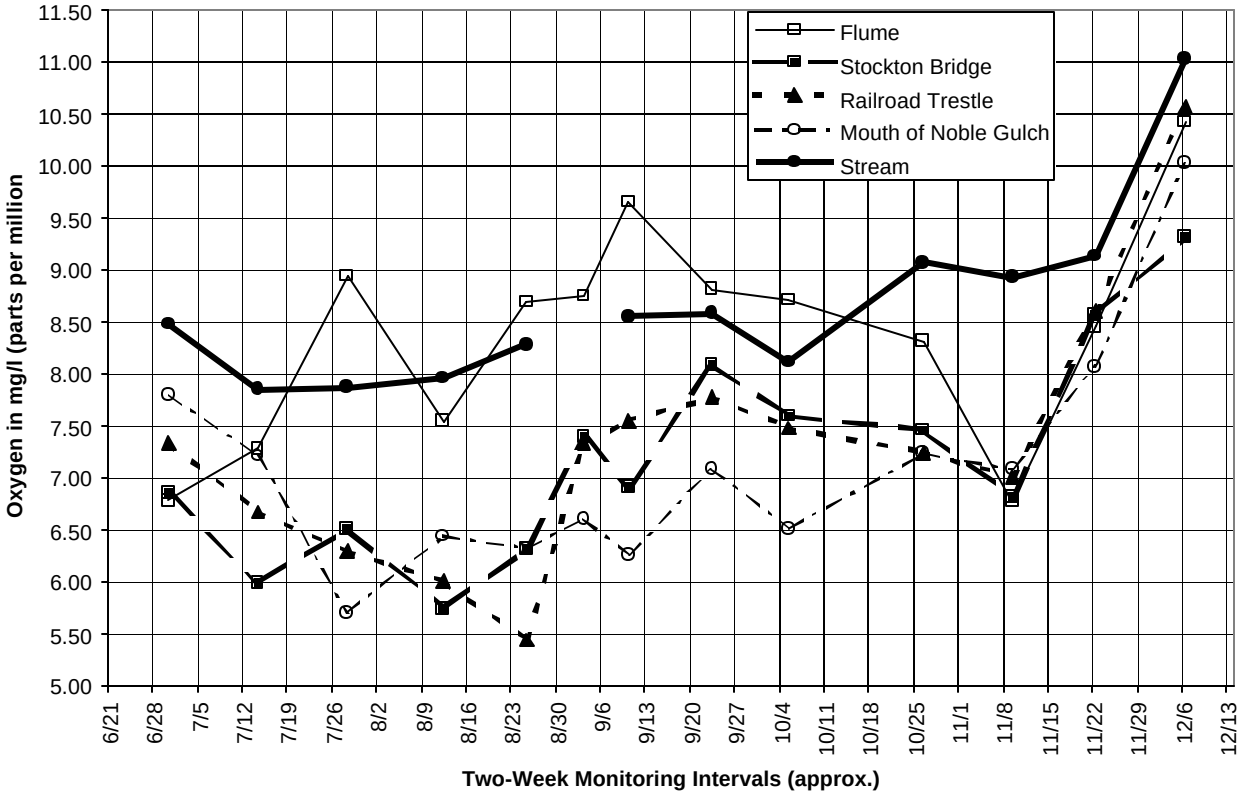


Figure 6g. Soquel Lagoon Oxygen Concentrations in the Morning and Afternoon Within 0.25 Meters of the Bottom at Station 1, the Flume, 30 June - 6 December 2006.

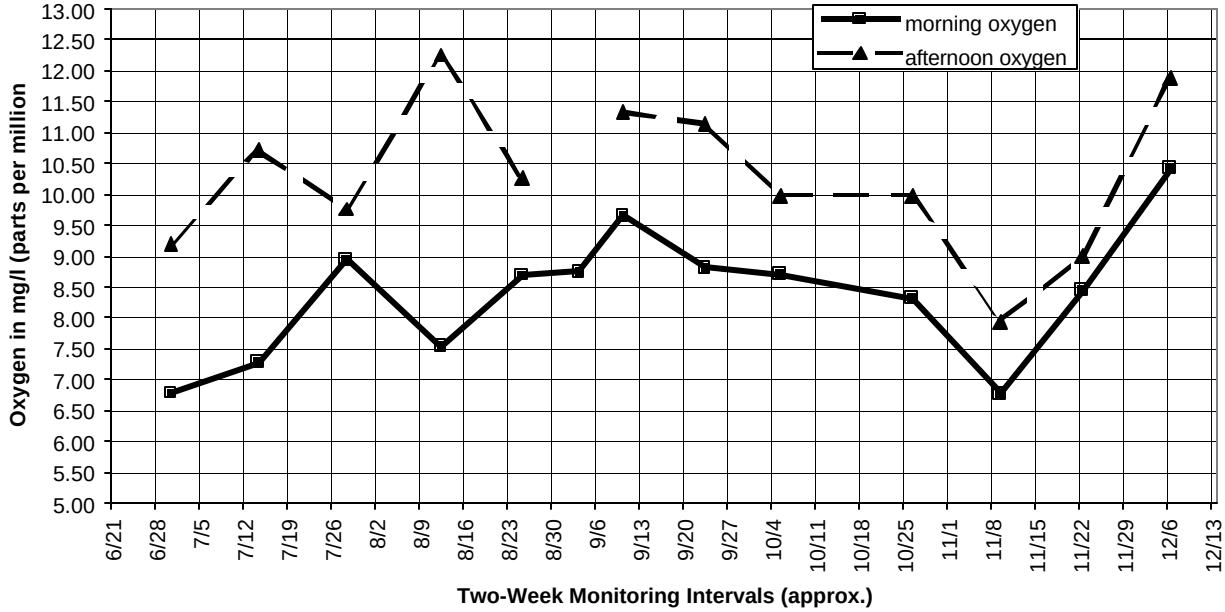


Figure 6h. Soquel Lagoon Oxygen Concentrations in the Morning and Afternoon Within 0.25 Meters of the Bottom at Station 2, the Stockton Avenue Bridge, 30 June - 6 December 2006.

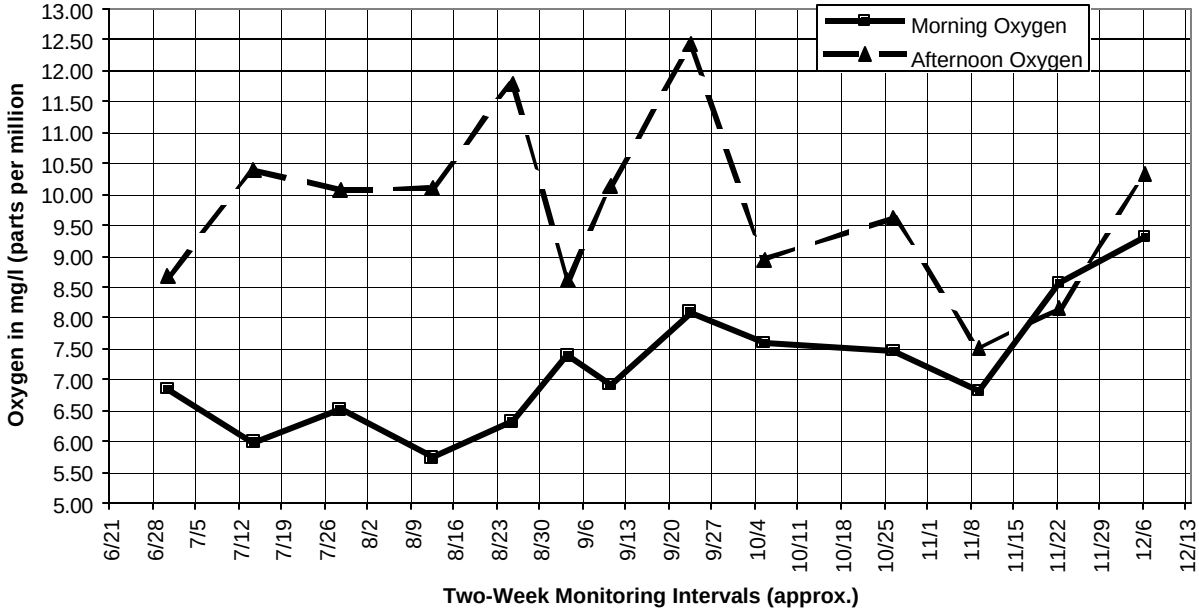


Figure 6i. Soquel Lagoon Oxygen Concentrations in the Morning and Afternoon Within 0.25 meters of the Bottom at Station 3, the Railroad Trestle, 30 June - 6 December 2006.

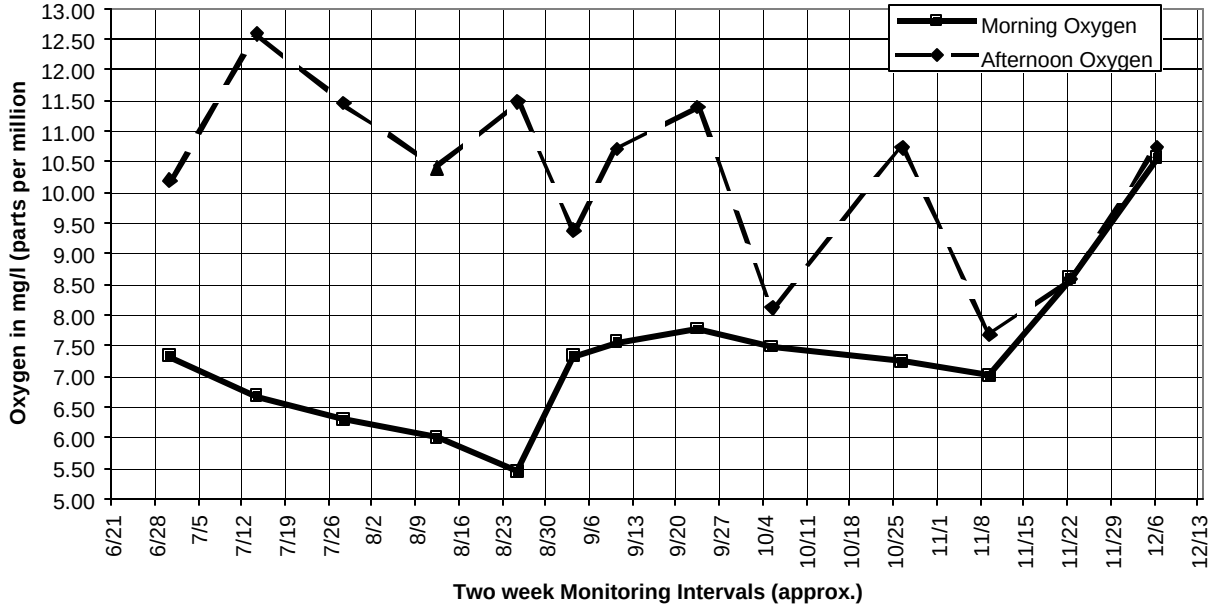


Figure 6j. Soquel Lagoon Oxygen Concentrations in the Morning and Afternoon Within 0.25 Meters of the Bottom at Station 4, the Mouth of Noble Gulch, 30 June - 6 December 2006.

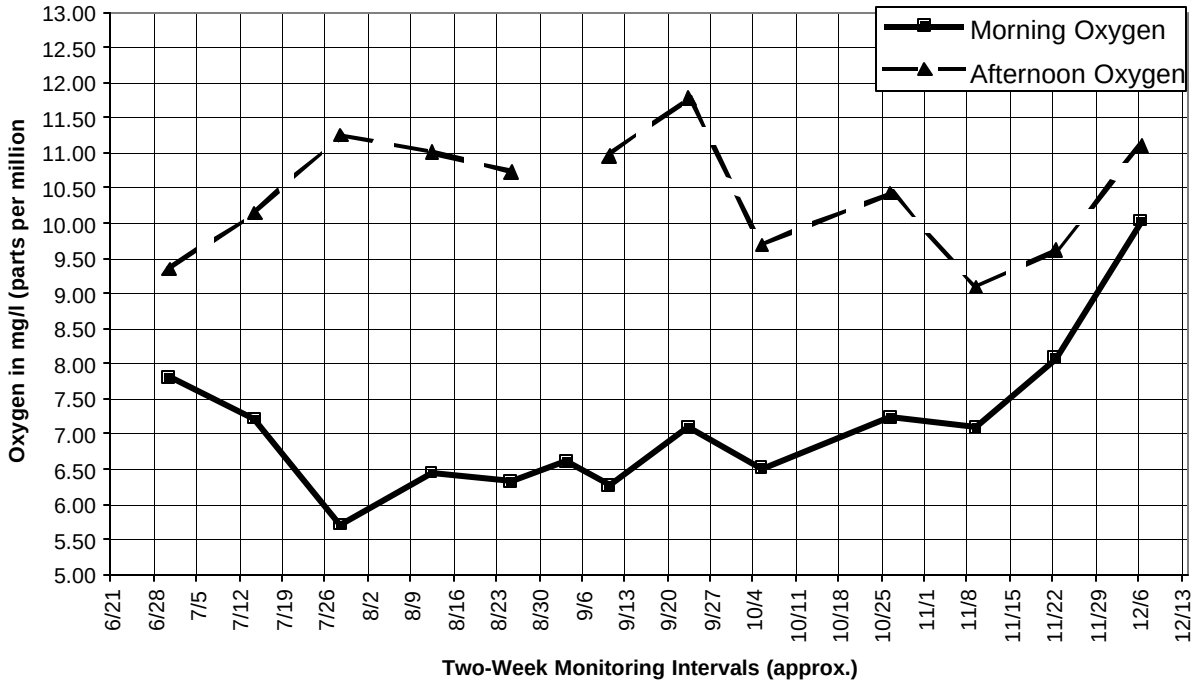


Figure 7. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 7 & 14 October 2007 in the Soquel Lagoon

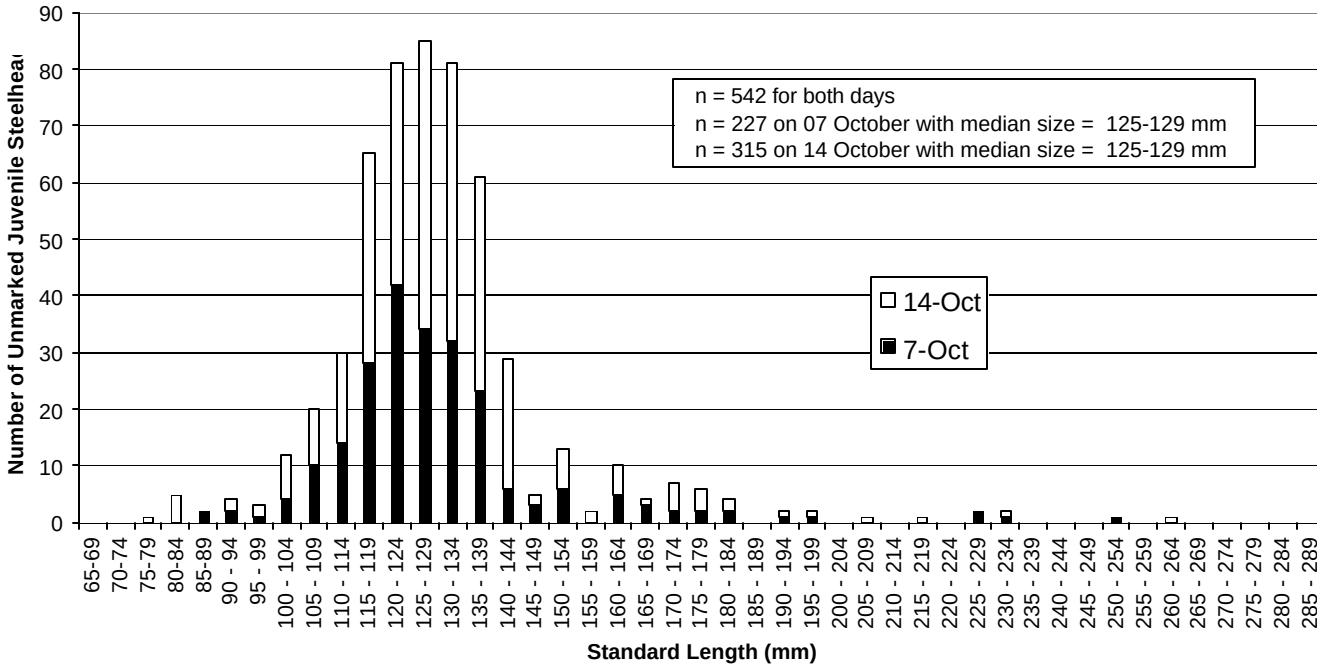


Figure 8. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 30 September and 8 October 2006 in Soquel Lagoon.

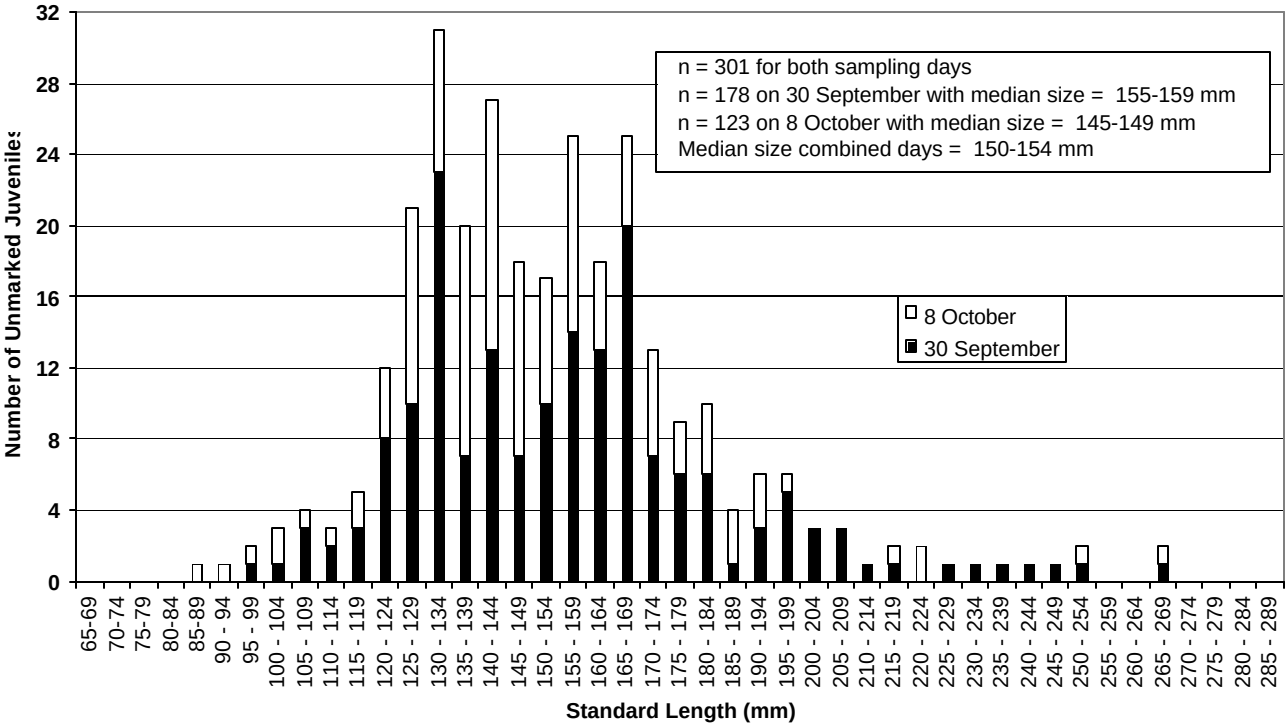


Figure 9. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 2 and 9 October 2005 in Soquel Lagoon.

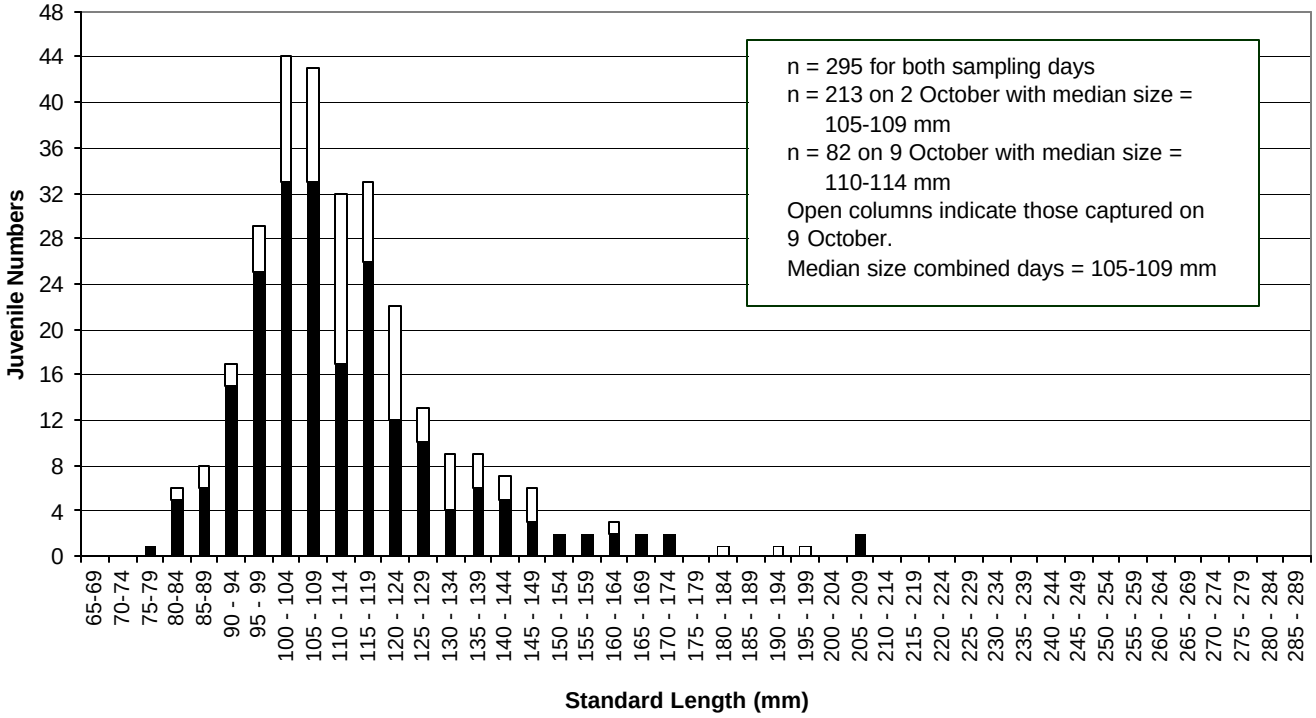


Figure 10. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 3 and 12 October 2004 in Soquel Lagoon.

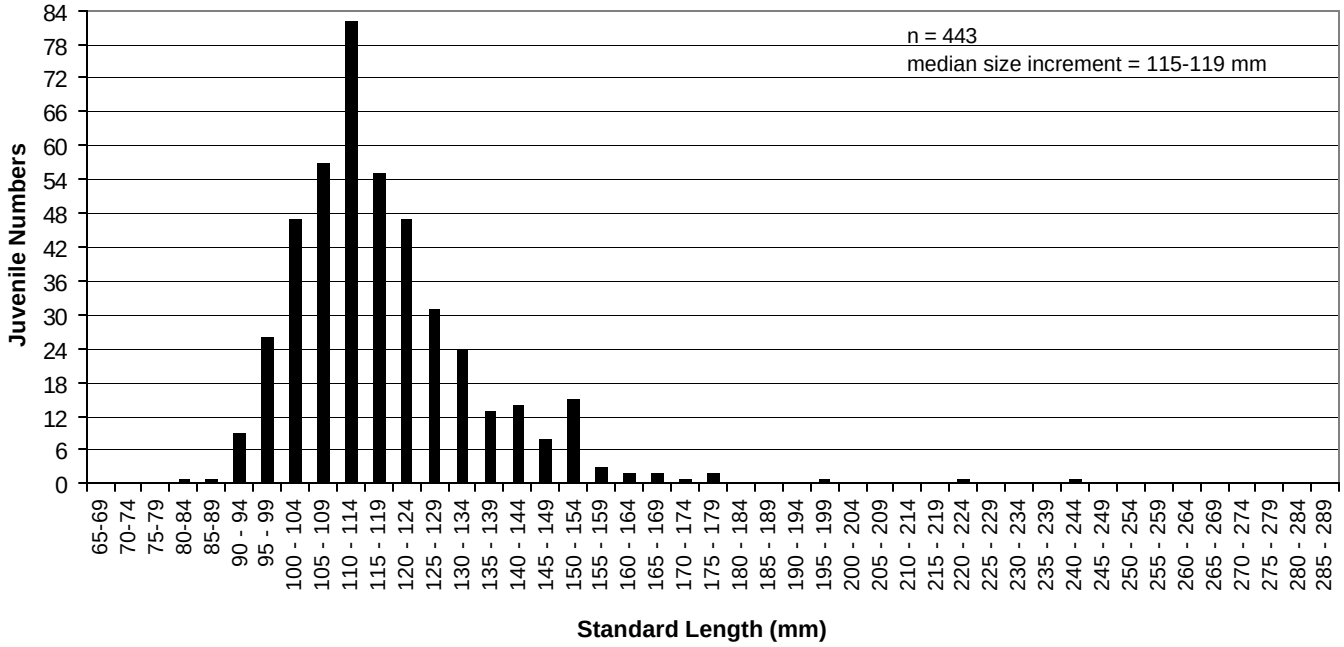


Figure 11. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 5 and 12 October 2003 in Soquel Lagoon.

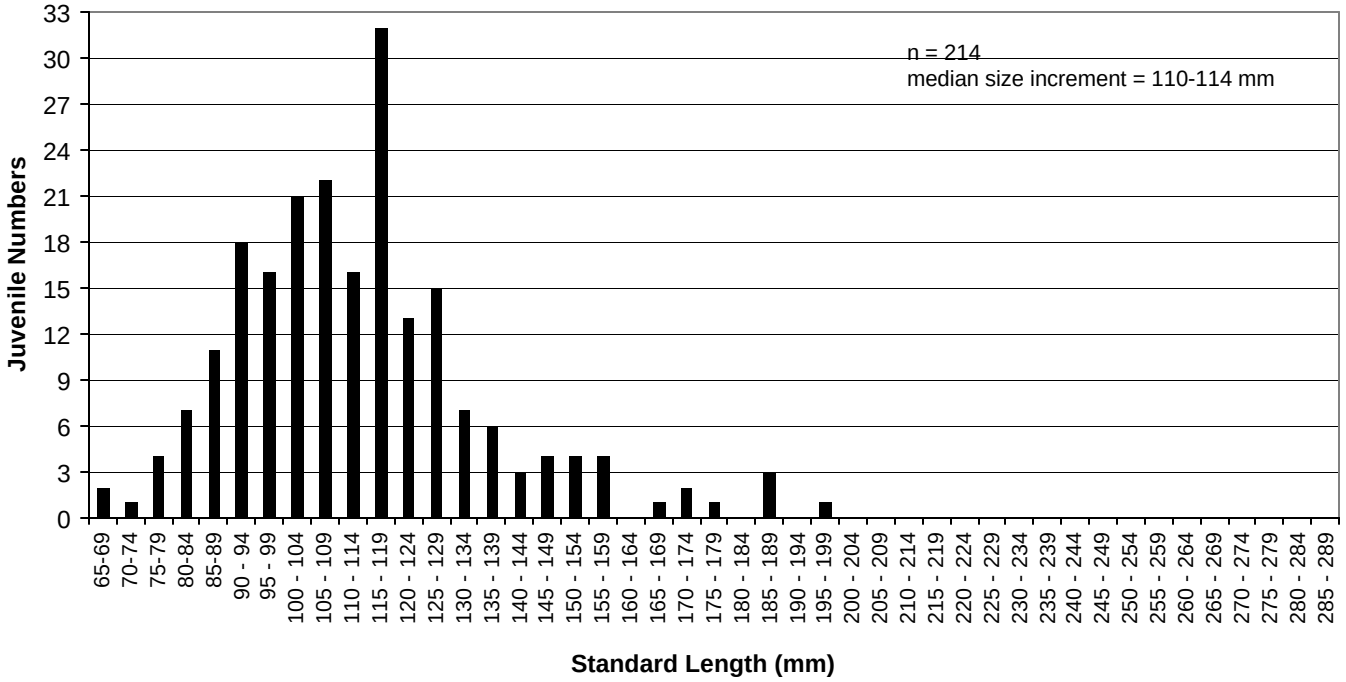


Figure 12. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 6 and 13 October 2002 in Soquel Lagoon.

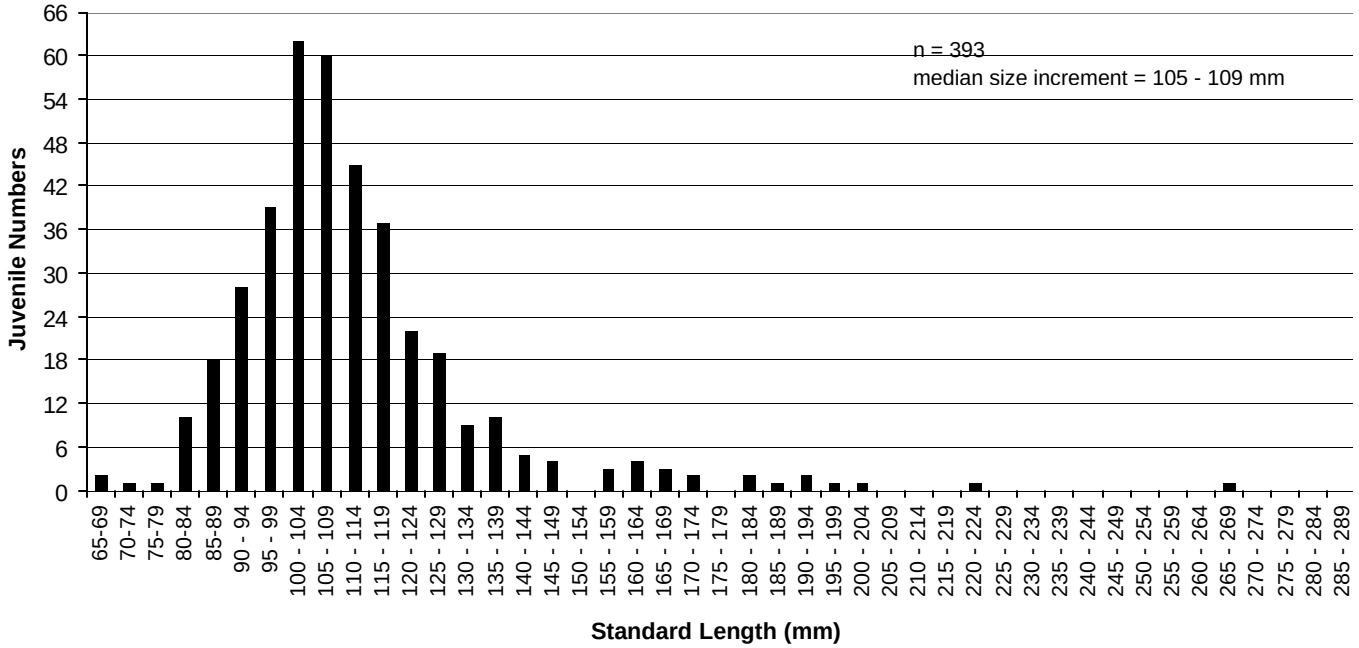


Figure 13. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 7 and 14 October 2001 in Soquel Lagoon.

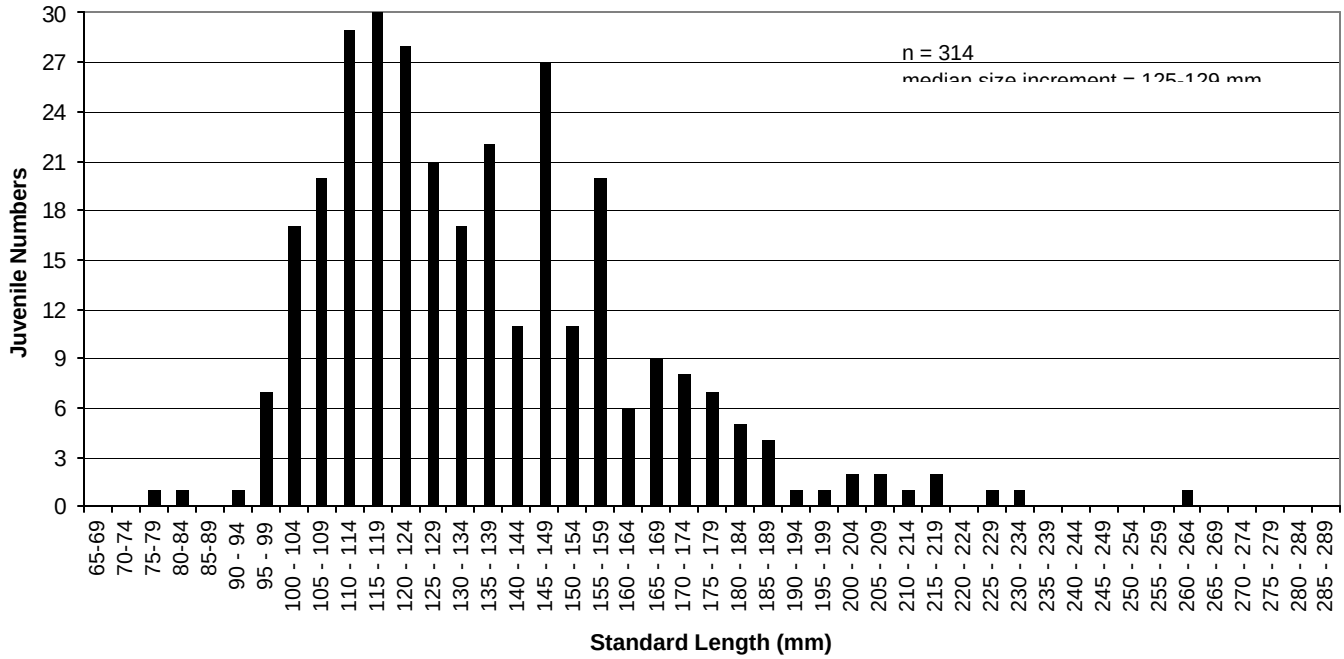


Figure 14. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 1 and 8 October 2000 in Soquel Lagoon.

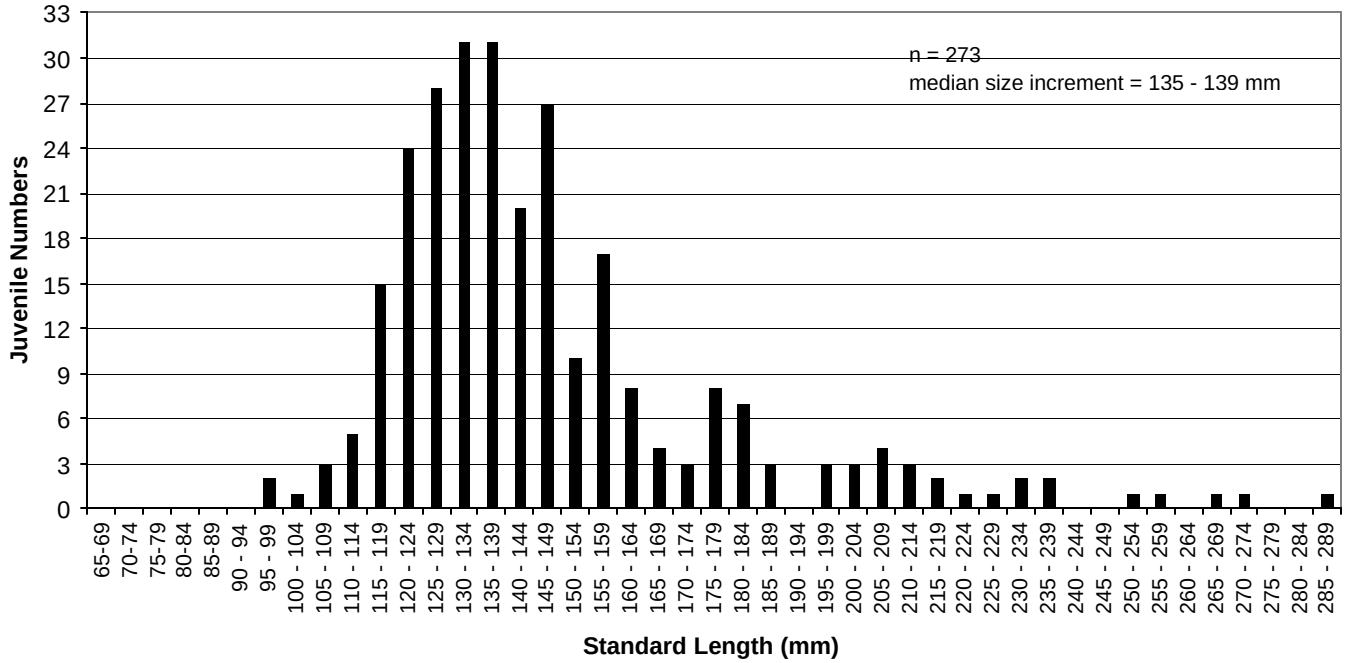


Figure 15. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 3 October 1999 (only) in Soquel Lagoon.

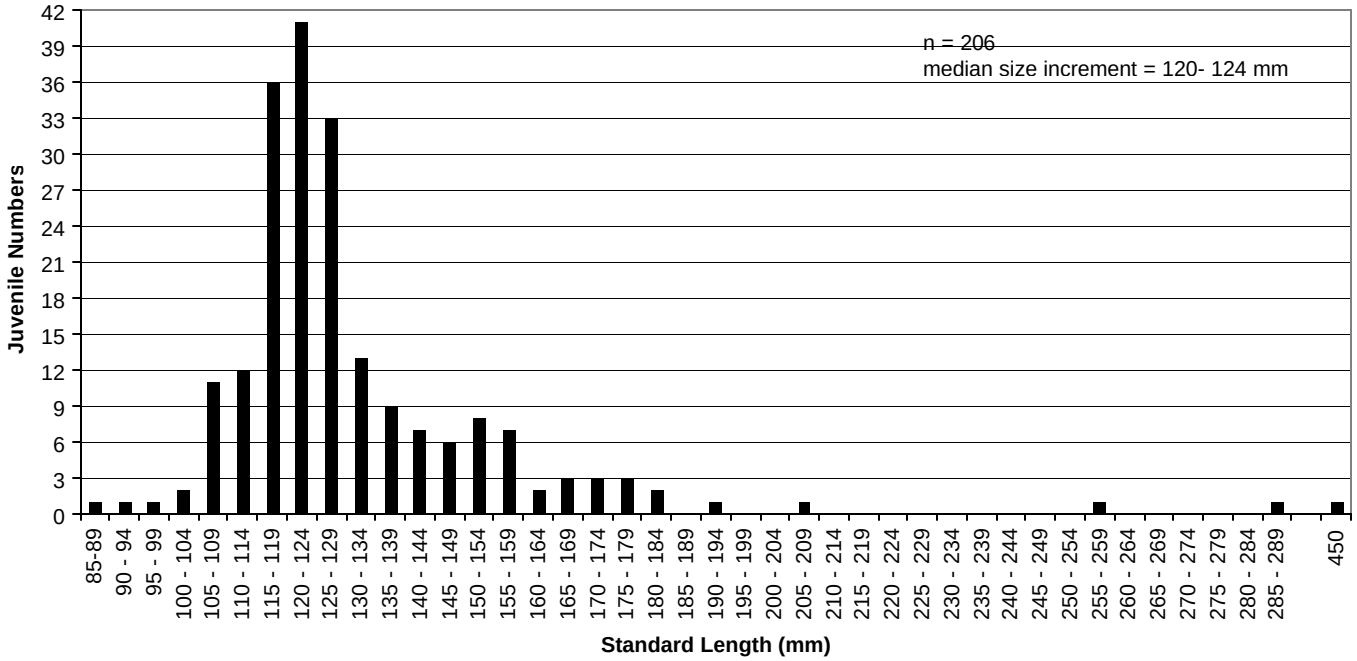


Figure 15. Size Frequency Histogram of Unmarked Juvenile Steelhead Captured on 4 and 11 October 1998 in Soquel Lagoon.

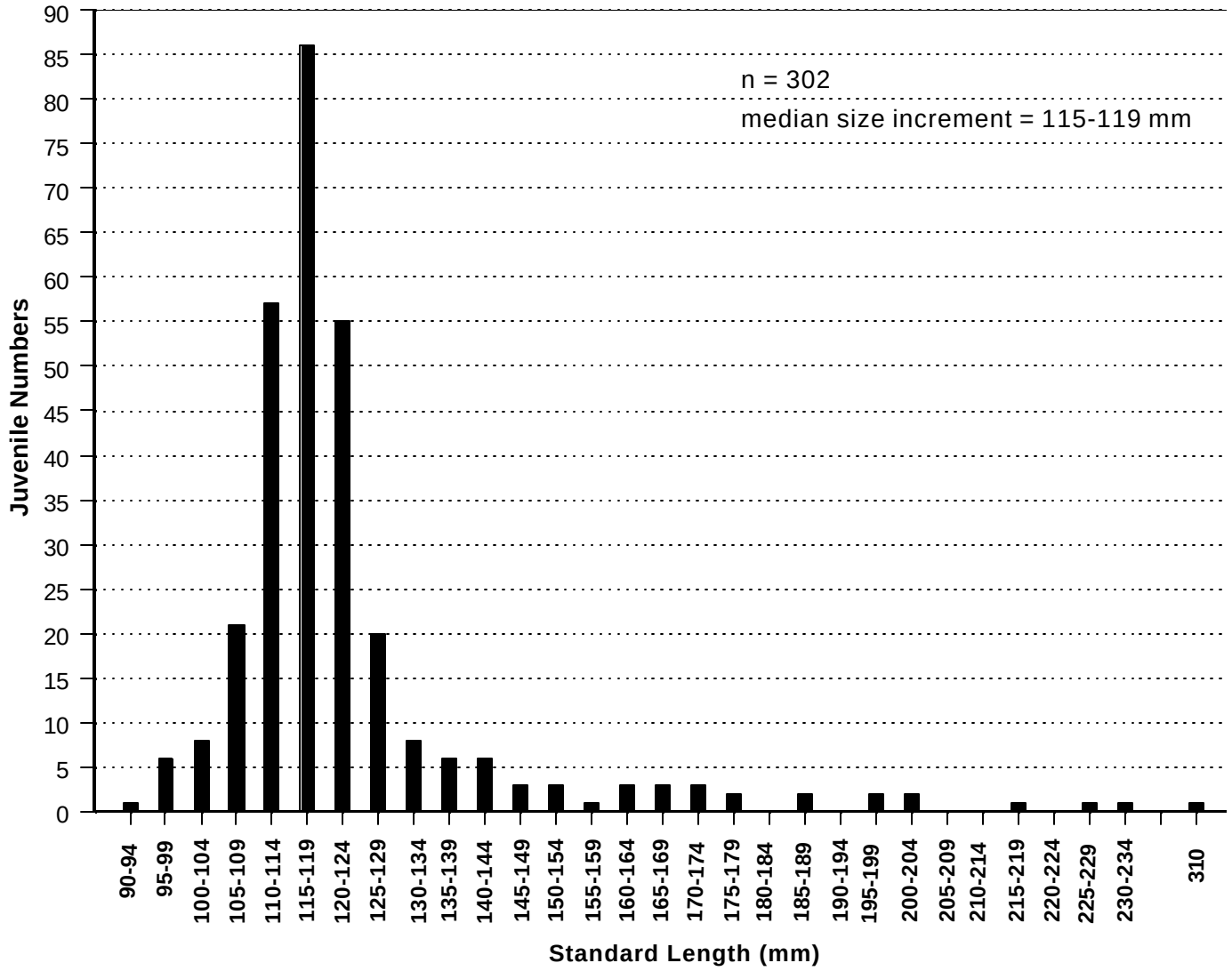


Figure 17. Juvenile Steelhead Production in Soquel Creek Lagoon, 1993 - 2007, Estimated by Mark and Recapture Experiment.

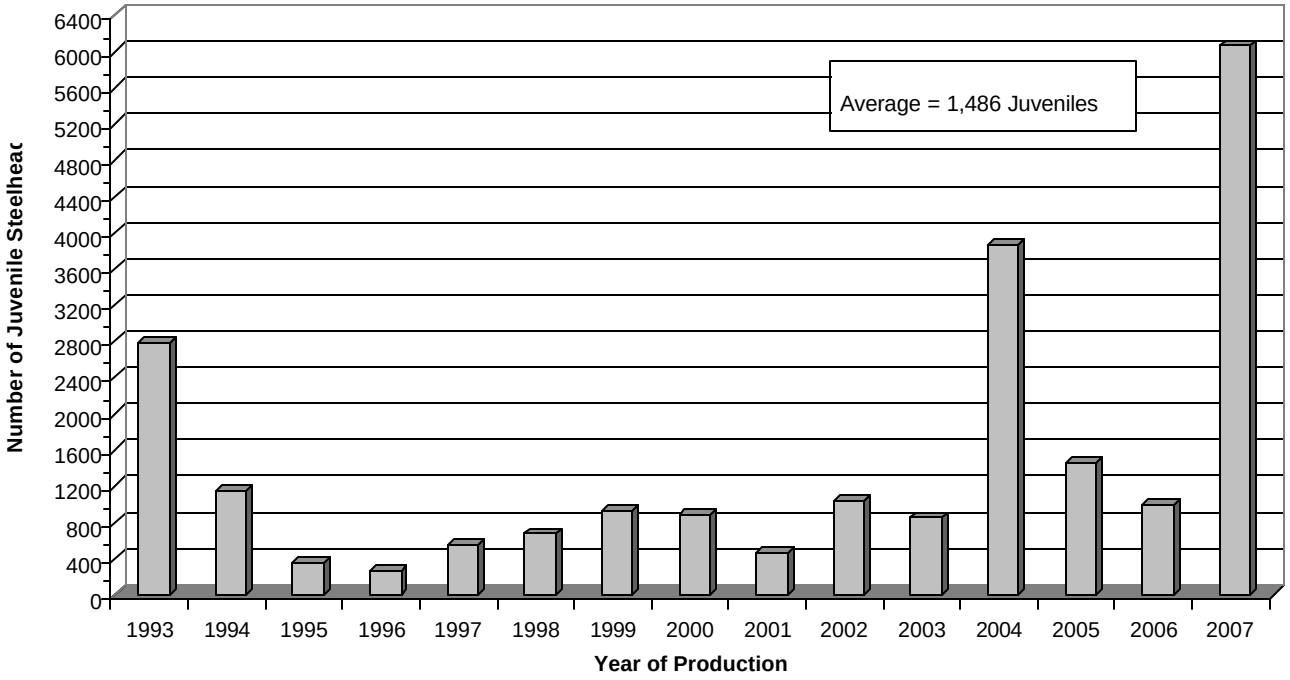


Figure 18. Soquel Creek Mean Daily Streamflow Data for the USGS Gage in Soquel, CA, 1 October 2006 – 1 July 2007.

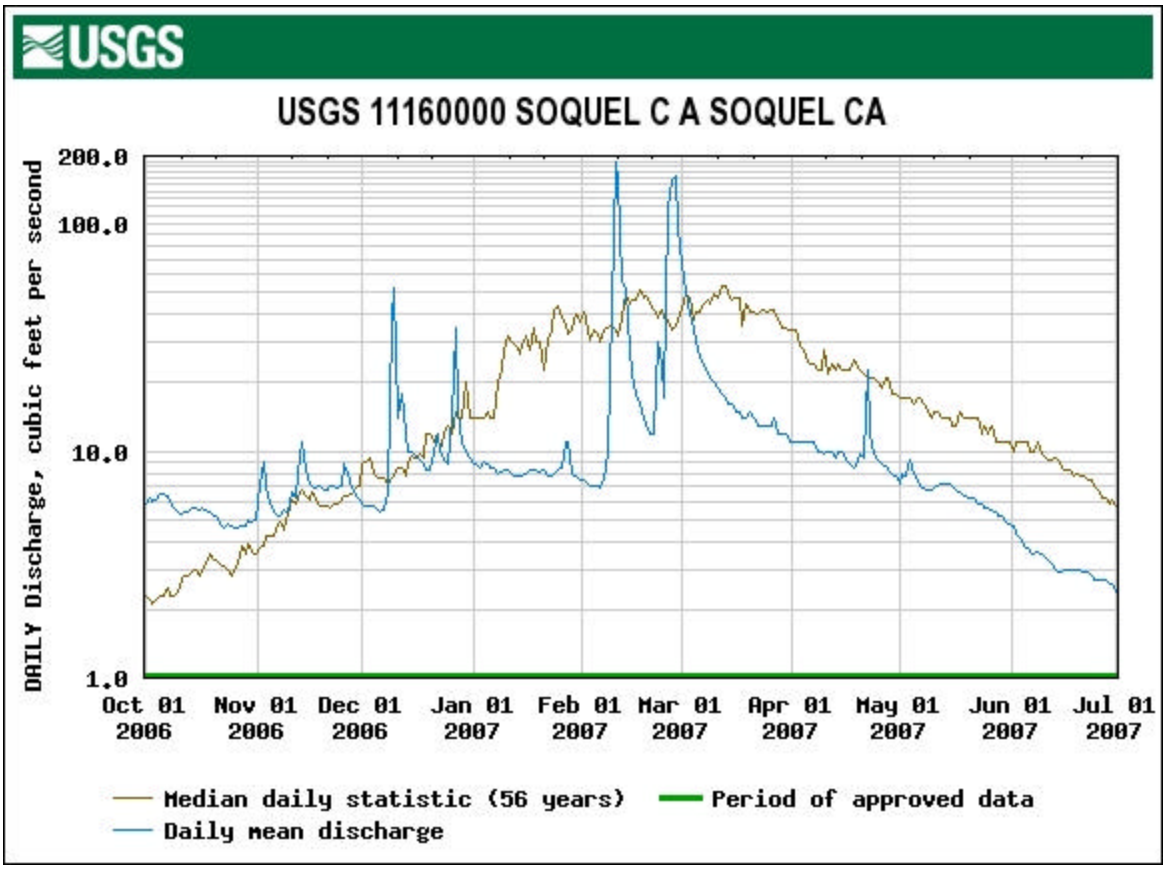


Figure 19. Soquel Creek Mean Daily Streamflow Data for the USGS Gage at Soquel, CA, 1 June – 20 December 2007.

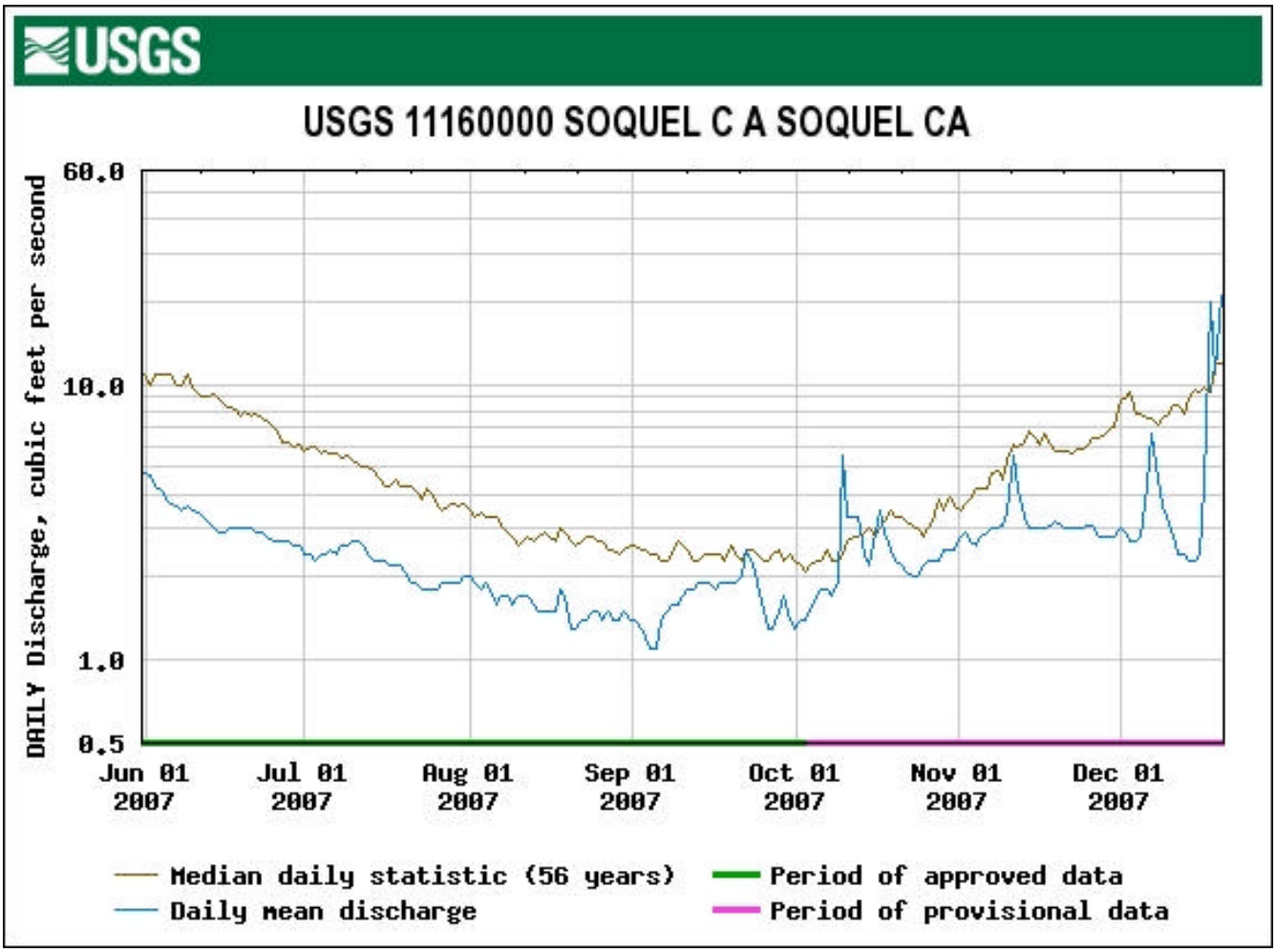
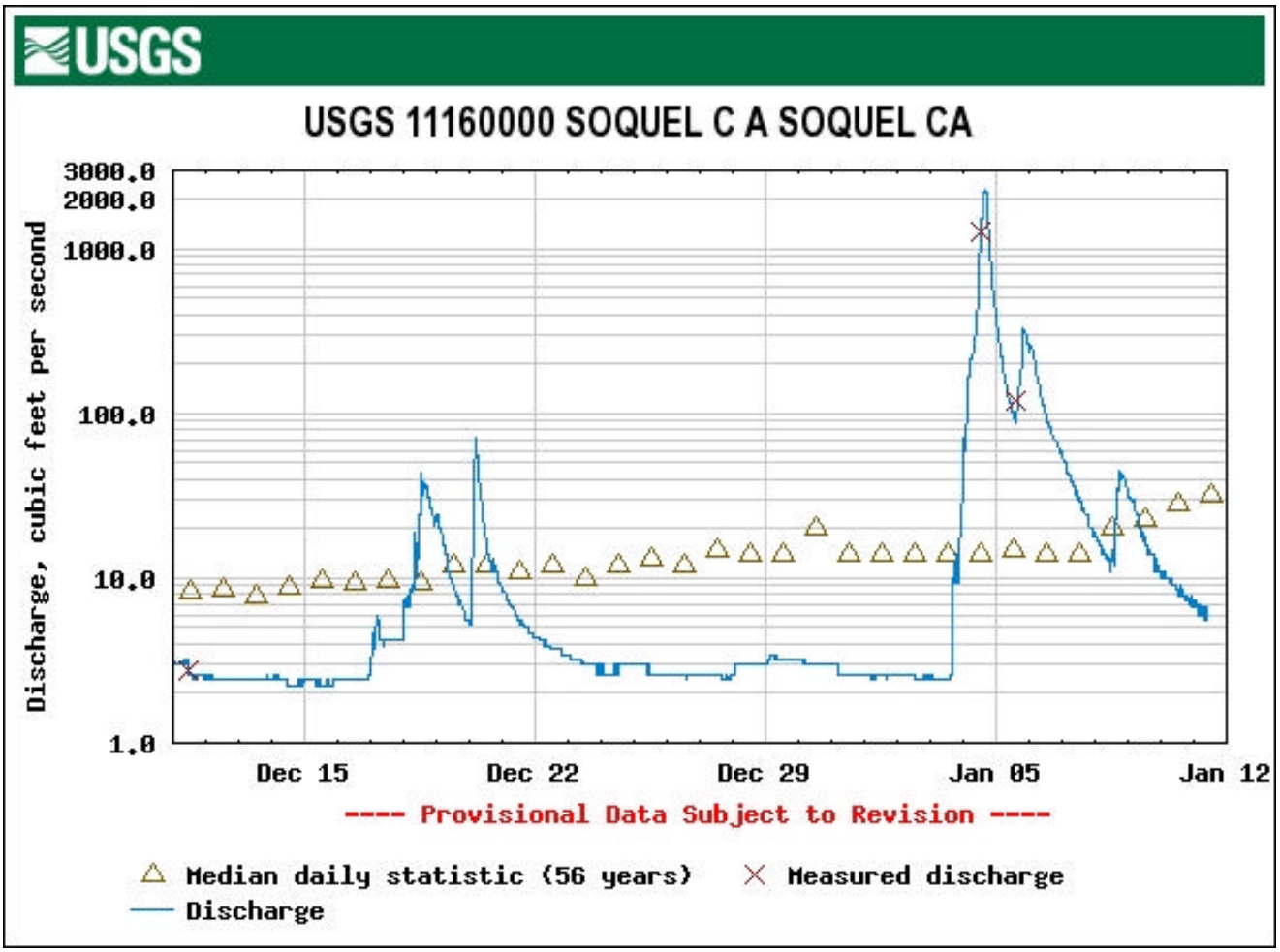


Figure 20. Soquel Creek Real-Time Streamflow at the Gage in Soquel, CA, 11 December – 11 January 2007.



APPENDIX A.

WATER QUALITY DATA AND GENERAL OBSERVATIONS OF BIRDS AND AQUATIC VEGETATION 24 MAY – 25 DECEMBER 2007.

24 May 2007. Launched temperature probes in the lagoon and upstream. The sandbar had bee closed for the summer on 14 June. Lagoon filling after sandbar closure. Gage height 1.06. Sky clear. Secchi depth to bottom. Lagoon water level 2 boards below notched board. Flume closed to bay. Salinity at bottom near bridge abutment 1.4 ppt.

	24-May-07							
	Flume Inlet				**Stockton Ave Bridge Thalweg**			1456 hr
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 Umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**
0.00					19.6	0.9	8.59	1689
0.25					19.6	0.9	8.50	1690
0.50					19.2	0.9	8.52	1690
0.75					19.2	0.8	8.35	1644
1.00					18.8	0.8	8.31	1489
1.25					18.7	0.9	1.54	1583
1.35					19.5	1.3	6.75	2260
1.50								
1.75								

	Railroad Trestle				**Mouth of Noble Gulch**			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**
0.00								
0.25								
0.50								
0.75								
1.00								
1.25								
1.50								

25 May 2007. Morrison called at 0930 hr. Water flowing out of flume to bay. Water 2 inches deep through notched board in flume inlet.

26 May 2007. Morrison called at 1030 hr. Lagoon water level up 1 inch from previous day. Morrison called at 1730 hr. Lagoon water level was within 2 inches of top of flume. Kotilla installed plywood against inlet flashboards earlier in the day.

30 May 2007. Gage height above 2.60. Sky overcast. Secchi depth to bottom. Salinity at the bottom adjacent bridge abutment 0.4 ppt. Slight salinity present on 24 May had been flushed out.

30-May-07

	Flume Inlet				Stockton Ave Bridge Thalweg				1130 hr
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 Umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00					16.0	0.4	8.80	642	
0.25					16.0	0.4	8.91	641	
0.50					16.0	0.4	8.85	641	
0.75					15.9	0.4	8.77	641	
1.00					15.8	0.4	8.78	640	
1.25					15.8	0.4	8.77	639	
1.50					15.7	0.4	8.94	639	
1.65					16.0	0.4	4.95	639	
1.75									

	Railroad Trestle				Mouth of Noble Gulch			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**
0.00								
0.25								
0.50								
0.75								
1.00								
1.25								
1.50								

10-June-07									
	Flume Inlet 0708 hr				**Stockton Ave Bridge Thalweg** 0705 hr				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 Umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	18.1	0.4	9.04	677	18.3	0.4	8.34	679	
0.25	18.2	0.4	8.90	677	18.3	0.4	8.37	679	
0.50	18.3	0.4	8.97	677	18.3	0.4	8.20	679	
0.75	18.3	0.4	8.89	677	18.3	0.4	8.03	678	
0.95 b	18.3	0.4	6.38	677					
1.00					18.3	0.4	7.99	679	
1.25					18.3	0.4	7.88	678	
1.50					18.2	0.4	7.35	581	
1.65 b					18.3	0.4	2.92	677	

	Railroad Trestle 0738 hr				**Mouth of Noble Gulch** 0751 hr				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**	
0.00	17.9	0.4	8.25	671	17.3	0.4	8.31	661	
0.25	17.9	0.4	8.28	671	17.3	0.4	8.10	660	
0.50	17.9	0.4	8.32	671	17.3	0.4	8.18	660	
0.75	17.9	0.4	8.31	671	17.3	0.4	8.11	659	
1.00	17.9	0.4	8.35	671	17.2	0.4	7.52	654	
1.15					16.7	0.4	3.74	636	
1.25	17.9	0.4	7.12	670					
1.45 b	17.8	0.4	1.08	670					

10 June 2007. Gage height 2.61. Sky partly cloudy. Air temperature 13.5 C at 0708 hr. Lagoon water level 1 inch above flume. Reach 1- 9 gulls along margin. No surface algae. Bubbles surfacing downstream of Stockton Avenue Bridge.

Station 2: Stockton Avenue Bridge at 0722 hr. Secchi depth not determined. Reach 2- swallows feeding.

Station 3: Railroad Trestle at 0738 hr. Reach 3- 3 mallards on redwood stump. 1 merganser and 2 mallards in water.

Station 4: Mouth of Noble Gulch at 0751 hr. No gray water observed from Noble Gulch. 2 mallards and 2 pond turtles on downed cottonwood.

Station 5: Nob Hill at 0816 hr. Water temperature 14.8°C. Conductivity 611 umhos. Oxygen 7.94 mg/l. Streamflow 4 cfs.

				10-Jun-07						
	Flume			1535 hr	**Stockton Avenue Bridge**			1513 hr		
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 umhos**		
0.00	19.7	0.4	10.29	695	20.0	0.4	9.54	703		
0.25	19.7	0.4	10.40	694	19.9	0.4	9.71	702		
0.50	19.6	0.4	10.42	685	19.8	0.4	9.62	698		
0.75	19.1	0.4	10.65	685	19.5	0.4	9.70	692		
0.95 b	19.1	0.4	9.22	685						
1.00					19.0	0.4	9.96	682		
1.25					18.8	0.4	9.87	678		
1.50					18.6	0.4	9.07	678		
1.65 b					18.5	0.4	3.22	678		
1.75										

	Railroad Trestle			1501 hr	**Mouth of Noble Gulch**			1445 hr		
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**		
0.00	20.3	0.4	10.08	707	20.1	0.4	9.52	706		
0.25	20.1	0.4	9.86	706	20.3	0.4	9.38	703		
0.50	19.9	0.4	9.79	701	20.3	0.4	9.03	696		
0.75	19.8	0.4	9.60	695	19.4	0.4	8.92	669		
1.00	18.6	0.4	10.46	676	18.0	0.4	9.03	662		
1.15 b					17.8	0.4	4.62	662		
1.25	18.5	0.4	10.36	676						
1.45 b	18.5	0.4	6.32	676						
1.50										

10 June 2007. Gage height of 2.62 in afternoon. Hazy sunshine. Flume inlet approx. 1 foot depth. Flume exit 1 foot.
Station 1: Flume at 1535 hr. Reach 1- 105 gulls bathing. 1 pelican.
Station 2: Stockton Avenue Bridge at 1513 hr. Secchi depth to bottom. Reach 2- 1 male merganser roosting on redwood stump below trestle.
Station 3: Railroad Trestle at 1501 hr. Reach 3- thick planktonic algal bloom throughout lagoon.
Station 4: Mouth of Noble Gulch at 1445 hr. 1 goose on downed cottonwood. No ducks around.

24-June-07

	Flume Inlet 0705 hr				Stockton Ave Bridge Thalweg 0715 hr			
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 Umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**
0.00	19.0	0.4	8.77	688	19.3	0.4	8.19	692
0.25	19.1	0.4	8.72	688	19.4	0.4	8.15	693
0.50	19.2	0.4	8.72	688	19.4	0.4	8.16	693
0.75	19.1	0.4	8.65	688	19.4	0.4	8.15	693
0.90	6.60	0.4	6.60	688				
1.00					19.4	0.4	8.05	693
Bottom1.25					19.4	0.4	7.82	693
1.50					19.4	0.4	7.70	695
Bottom1.60					19.5	0.4	1.46	695

	Railroad Trestle 0740 hr				Mouth of Noble Gulch 0755 hr			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**
0.00	18.9	0.4	8.50	687	18.2	0.43	7.78	675
0.25	19.0	0.4	8.43	687	18.3	0.4	7.66	675
0.50	19.1	0.4	8.42	687	18.3	0.4	7.62	675
0.75	19.1	0.4	8.36	687	18.3	0.4	7.58	675
1.00	19.1	0.4	8.33	687	18.2	0.4	6.75	673
1.20 b					18.2	0.4	2.37	664
1.25	19.1	0.4	8.33	687				
1.45 b	19.1	0.4	1.94	687				

24 June 2007. Gage height 2.57 in morning. Clear, cool and breezy. Air temperature 11.3 C at 0705 hr. Reach 1- no ducks.
Station 2: Stockton Avenue Bridge at 0715 hr. Reach 2- no ducks.
Station 3: Railroad Trestle at 0740 hr. 2 piles of dog feces on path. No ducks.
Station 4: Mouth of Noble Gulch at 0755 hr. Reach 3- 1 cormorant.
Station 5: Nob Hill at 0820 hr. Water temperature 14.9°C. Conductivity 611 umhos. Oxygen 7.85 mg/l. Streamflow 3 cfs.

				24-Jun-07					
	Flume			1605 hr	**Stockton Avenue Bridge**			1545 hr	
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 umhos**	
0.00	21.1	0.4	10.93	717	21.5	0.4	10.07	722	
0.25	21.1	0.4	10.99	717	21.4	0.4	10.25	720	
0.50	21.1	0.4	10.95	715	21.3	0.4	10.27	719	
0.75	20.9	0.4	11.04	713	21.2	0.4	10.13	718	
0.95 b	20.9	0.4	7.07	712					
1.00					21.1	0.4	10.37	714	
1.25					20.5	0.4	11.14	703	
1.50					20.6	0.4	10.61	704	
1.60 b					20.1	0.4	4.10	704	
2.00									
2.25									

	Railroad Trestle			1530 hr	**Mouth of Noble Gulch**			1512 hr	
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**	
0.00	21.7	0.4	10.53	725	22.2	0.4	9.83	722	
0.25	21.6	0.4	10.38	724	22.0	0.4	9.42	716	
0.50	21.5	0.4	10.36	720	21.4	0.4	9.63	710	
0.75	21.5	0.4	10.25	718	19.9	0.4	9.07	686	
1.00	21.0	0.4	10.20	702	19.9	0.4	14.07	666	
1.20 b					19.4	0.4	10.17	664	
1.25	19.9	0.4	11.37	697					
1.45 b	19.9	0.4	4.11	699					
1.75									

24 June 2007. Gage height of 2.58 in afternoon. Sunny. Flume inlet 1 foot deep. Flume exit 2 feet depth. Air temperature 23.4 C at 1513 hr at Noble Gulch.

Station 1: Flume at 1605 hr. Reach 1- no surface, too green soupy to see algae. 84 gulls bathing. Gulls avoiding to roost on Paradise Beach Restaurant because it was covered with wires.

Station 2: Stockton Avenue Bridge at 1545 hr. Secchi depth to bottom. Reach 2- thick plankton soup. <1% surface algae; bottom 100% covered with algae –0.5- 3 ft thick, averaging 1.0 ft. No birds observed.

Station 3: Railroad Trestle at 1530 hr. Reach 3- 1% surface algae, 100% of bottom with algae 0.5- 3 ft, averaging 1 ft. Thick pea-green phytoplankton present. 5 mallards dabbling.

Station 4: Mouth of Noble Gulch at 1512 hr. 7% surface algae, thick plankton soup, 60% of the bottom covered with algae 0.5- 2 ft, averaging 1 ft. 5 mallard ducks roosting on downed cottonwood. 2 mallards in water.

9-July-07									
	Flume			0702 hr	**Stockton Avenue Bridge**			0714 hr	
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 umhos**	
0.00	19.1	0.4	7.58	687	19.3	0.4	7.45	687	
0.25	19.3	0.4	7.39	687	19.3	0.4	7.40	687	
0.50	19.3	0.4	7.31	687	19.3	0.4	7.32	688	
0.75	19.3	0.4	7.25	687	19.4	0.4	7.03	687	
0.90	19.3	0.4	5.11	687					
1.00					19.4	0.4	7.13	687	
1.25					19.4	0.4	7.13	687	
1.50					19.3	0.4	7.12	687	
1.70 b					19.3	0.4	3.41	688	
1.75									
2.00									

	Railroad Trestle			0732 hr	**Mouth of Noble Gulch**			0747 hr	
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**	
0.00	18.9	0.4	7.07	682	18.1	0.4	7.73	667	
0.25	19.0	0.4	6.99	681	18.2	0.4	7.89	667	
0.50	19.0	0.4	6.97	681	18.2	0.4	8.13	666	
0.75	19.0	0.4	6.90	680	18.1	0.4	7.99	663	
1.00	18.9	0.4	6.09	677	17.7	0.4	7.24	657	
1.20 b					17.9	0.4	0.82	658	
1.25	18.6	0.4	6.46	677					
1.43 b	18.7	0.4	3.55	677					

9 July 2007. Gage height of 2.56 in morning. Overcast, misty. Air temperature of 14.8°C at 0702 hr. Reach 1- Cormorant feeding, 15 gulls bathing, **restaurant worker feeding gulls**. Reach 2- 3 mergansers on redwood stump and 1 in water. Reach 3- 14 mallards. 6 mallards roosting on downed cottonwood. **Station 5: N**ob Hill at 0814 hr. Water temperature 15.8°C. Conductivity 613 umhos. Salinity 0.4 ppt. Oxygen 7.87 mg/l (79% full saturation). Streamflow 2.5 cfs.

				09 July-07					
	Flume			1555 hr	**Stockton Avenue Bridge**			1531 hr	
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 umhos**	
0.00	19.6	0.4	8.92	691	19.9	0.4	8.86	693	
0.25	19.7	0.4	8.90	688	19.9	0.4	8.87	693	
0.50	19.5	0.4	8.99	687	19.8	0.4	8.57	693	
0.75	19.4	0.4	9.31	686	19.8	0.4	8.64	692	
0.88 b	19.5	0.4	5.13	685					
1.00					19.4	0.4	9.00	687	
1.25					19.0	0.4	9.30	677	
1.50					18.8	0.4	9.67	674	
1.70 b					18.8	0.4	4.27	674	
1.75									
2.00									

	Railroad Trestle			1520 hr	**Mouth of Noble Gulch**			1506 hr	
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**	
0.00	19.8	0.4	9.07	692	19.8	0.4	8.47	690	
0.25	19.8	0.4	8.92	691	19.8	0.4	8.51	688	
0.50	19.7	0.4	8.83	690	19.2	0.4	8.62	680	
0.75	19.7	0.4	8.86	687	18.4	0.4	8.39	665	
1.00	18.9	0.4	10.12	670	17.9	0.4	9.58	657	
1.20					18.1	0.4	3.31	657	
1.25	18.6	0.4	10.30	669					
1.43 b	18.7	0.4	4.50	671					
1.50									

09 July 2007. Gage height of 2.56 in afternoon. Overcast. Air temperature of 17.3°C at 1555 hr. Flume inlet approx. 1.5 ft depth. Flume exit depth 0.5 ft on both sides.

Station 1: Flume at 1555 hr. Reach 1- no surface algae, bottom invisible. 70+ gulls bathing in Reach 1 in afternoon.

Station 2: Stockton Avenue Bridge at 1531 hr. Secchi depth to bottom. Reach 2- no surface algae, 100% of bottom covered with algae and some pondweed, 2-3 ft thick. 2 mallards. On beach, 30 ft of sand flagged off over flume nearest exit, indicating sinkholes.

Station 3: Railroad Trestle at 1520 hr. Reach 3- no surface algae, 100% of bottom covered with algae and some pondweed, 2-3 ft thick.

Station 4: Mouth of Noble Gulch at 1506 hr. No surface algae, bottom invisible. No gray water was entering lagoon from Noble Gulch. 3 pond turtles on downed cottonwood with 7 mallards and 1 goose. 18 mallards in the water (7 ducklings).

0716hr				22-Jul-07				0726hr
	Flume				**Stockton Avenue Bridge**			
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**
0.00	22.0	0.4	8.80	732	22.3	0.4	7.32	739
0.25	22.0	0.4	8.80	733	22.4	0.4	7.02	739
0.50	22.1	0.4	8.75	732	22.4	0.4	7.12	739
0.75	22.1	0.4	8.69	732	22.4	0.4	7.43	739
0.95 b	22.1	0.4	4.31	730				
1.00					22.4	0.4	7.26	738
1.25					22.3	0.4	6.99	738
1.50					22.3	0.4	7.28	738
1.70 b					22.3	0.4	2.76	738
1.75								

0749hr				22-Jul-07				0810hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**
0.00	22.1	0.4	6.24	736	21.7	0.4	6.68	728
0.25	22.1	0.4	6.12	736	21.7	0.4	6.65	728
0.50	22.1	0.4	6.31	735	21.7	0.4	6.51	728
0.75	22.1	0.4	6.29	735	21.7	0.4	6.54	727
1.00	22.1	0.4	6.30	735	21.6	0.4	6.09	725
1.20 b					21.3	0.4	2.37	721
1.25	22.1	0.4	6.16	735				
1.45 b	22.1	0.4	1.41	736				
1.50								

22 July 2007. Gage height of 2.52 morning. Air temperature of 18.0°C at 0748 hr.
Station 1: Flume at 0716 hr. Reach 1- no surface algae. 7 mallards and 4 ducklings, 10 gulls in water.
Station 2: Stockton Avenue Bridge at 0726 hr. Reach 2- no surface algae.
Station 3: Railroad Trestle at 0749 hr. Reach 3- no surface algae in morning. 11 mallards under trestle and 4 mallards roosting on redwood stump. 1 coot.
Station 4: Mouth of Noble Gulch at 0810 hr. no surface algae. 10 mallards plus 2 mergqansers plus 1 goose roosting on downed cottonwood.

Station 5: Nob Hill at 0832 hr. Water temperature 18.6°C. Conductivity 660 umhos. Oxygen 6.89 mg/l. Salinity 0.4 ppt. Streamflow approx. 2.5 cfs.

1619 hr					22-Jul-07					1607 hr
	Flume					**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**		**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	24.2	0.4	11.39	759		24.2	0.4	10.79	763	
0.25	24.2	0.4	11.52	758		24.3	0.4	10.63	763	
0.50	24.1	0.4	11.50	756		24.2	0.4	10.31	762	
0.75	23.9	0.4	11.59	754		24.1	0.4	10.22	758	
0.90 b	23.8	0.4	8.02	754						
1.00						24.1	0.4	9.98	749	
1.25						23.6	0.4	10.48	748	
1.50						23.3	0.4	11.03	746	
1.72 b						23.1	0.4	4.05	748	
1.75										

1520hr					22 Jul-07					1535hr
	Railroad Trestle					**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**		**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**	
0.00	24.9	0.4	10.39	768		25.1	0.4	10.13	776	
0.25	24.7	0.4	10.28	768		25.0	0.4	9.65	774	
0.50	24.5	0.4	9.96	767		24.8	0.4	9.29	771	
0.75	24.4	0.4	9.87	765		23.7	0.4	7.91	753	
1.00	23.7	0.4	7.78	757		22.4	0.4	11.20	734	
1.20 b						22.4	0.4	7.03	738	
1.25	23.3	0.4	12.10	752						
1.45 b	23.3	0.4	3.15	752						

22 July 2007. Gage height of 2.52. Sunny. Air temperature of 23.1°C at 1535 hr. Flume inlet 1.0 ft. Flume outlet 0.8 ft.

Station 1: Flume at 1619 hr. Reach 1- 84 gulls bathing. No surface algae.

Station 2: Stockton Avenue Bridge at 1607 hr. Secchi depth to bottom. Reach 2- No surface algae. 20% of the bottom an algae-pondweed forest, 2-3 ft thick. Remainder invisible due to thick plankton bloom. 2 adult female mallards with 8 ducklings between them. 8 mallards roosting with 1 gull on redwood stump downstream of trestle.

Station 3: Railroad Trestle at 1520 hr. Reach 3- no surface algae, 100% bottom algae 1.0- 4.0 ft thick, averaging 2.0 ft. 9 mallards and 1 goose in water.

Station 4: Mouth of Noble Gulch at 1535 hr. 7 mallards and 2 mergansers on downed cottonwood. Soupy green plankton bloom at mouth of gulch. No gray water from Gulch.

0715 hr				05-Aug-07				0728 hr
	Flume				**Stockton Avenue Bridge**			
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 umhos**
0.00	19.6	0.4	9.70	680	19.8	0.4	9.59	681
0.25	19.8	0.4	9.69	680	19.9	0.4	9.25	681
0.50	19.9	0.4	9.64	680	19.9	0.4	9.34	681
0.75	19.9	0.4	9.67	680	19.9	0.4	9.29	681
0.90 b	19.9	0.4	4.87	680				
1.00					19.9	0.4	9.12	681
1.25					19.9	0.4	9.04	681
1.50					19.9	0.4	8.89	681
1.75					19.9	0.4	3.40	682

0750hr				05-Aug-07				0805 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**
0.00	19.6	0.4	7.73	680	18.6	0.4	8.68	664
0.25	19.6	0.4	7.66	680	18.6	0.4	8.67	664
0.50	19.6	0.4	7.78	680	18.6	0.4	8.87	664
0.75	19.6	0.4	7.14	681	18.6	0.4	8.70	665
1.00	19.5	0.4	4.12	680	18.3	0.4	6.15	666
1.12 b					18.1	0.4	2.51	641
1.25	19.4	0.4	4.54	680				
1.37	19.4	0.4	1.62	680				

05 August 2007. Gage height of 2.52 (morning) and 2.52 (afternoon). Overcast at 0715 hr with air temperature at 14.7°C. Air temperature 17.6ºC at 1606 hr and sunny.

Station 1: Flume at 0715 hr. Reach 1- 8 gulls bathing with 1 goose and 8 mallards.
Station 2: Stockton Avenue Bridge at 0728 hr. Secchi depth to the bottom. Reach 2- 21 mallards in water (some from Reach 1). 3 mergansers under trestle.
Station 3: Railroad trestle at 0750 hr. Reach 3- 2 mother mallards with 3 each ducklings plus 7 mallards near Noble Gulch.
Station 4: Mouth of Noble Gulch at 0805 hr. 7 mallards near Gulch.
Station 5: Nob Hill at 0837 hr. Water temperature at 16.0°C. Conductivity 607 umhos, Oxygen 7.52 mg/l. Salinity 0.4 ppt. Visually estimated flow of 2.5 cfs.

1606 hr					05-Aug-07					1635 hr
	Flume					**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**		**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	20.9	0.4	11.83	692		21.1	0.4	11.34	695	
0.25	20.8	0.4	12.30	698		21.1	0.4	11.23	695	
0.50	20.8	0.4	12.55	698		21.0	0.4	11.08	694	
0.75	20.7	0.4	12.25	688		21.0	0.4	10.62	693	
0.90 b	20.9	0.4	7.02	688						
1.00						20.9	0.4	10.64	692	
1.25						20.7	0.4	10.58	688	
1.50						20.5	0.4	10.48	687	
1.75 b						20.4	0.4	4.55	687	
1620hr					05-Aug-07					1650 hr
	Railroad Trestle					**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**		**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**	
0.00	20.9	0.4	11.78	693		21.1	0.4	10.27	696	
0.25	20.9	0.4	11.66	693		20.9	0.4	9.59	693	
0.50	20.9	0.4	11.93	692		20.7	0.4	9.16	688	
0.75	20.8	0.4	11.79	690		19.7	0.4	10.90	675	
1.00	20.5	0.4	11.23	685		19.1	0.4	12.62	658	
1.12 b						19.1	0.4	6.90	656	
1.25	20.3	0.4	14.05	679						
1.50 b	20.4	0.4	6.52	681						

Station 1: Flume at 1650 hr. Reach 1- no surface algae. Could not see lagoon bottom very well. Estimated about 90% bottom covered with algae. Pondweed covering about 10% of bottom at 3.5 ft height.
Station 2: Stockton Avenue Bridge at 1635 hr. Secchi depth to the bottom. Reach 2- No surface algae. 100% of bottom covered by algae with some pondweed 0.3- 3.5 ft thick, averaging 2.5 ft. 8 mallards.
Station 3: Railroad trestle at 1620 hr. Reach 3- no surface algae. 90% of bottom covered by algae 0.5-3.5 ft thick, averaging 2.5 ft. 10% pondweed with algae attached, 0.5-3.5 ft thick, averaging 2.5 ft. 10 adult ducks and 3 ducklings in water. 1 mallard and 1 gull on redwood stump.
Station 4: Mouth of Noble Gulch at 1606 hr. No surface algae. 75% of bottom covered by algae 0.5-3 ft thick, averaging 2.0 ft. 5 mallards, 1 goose and one pond turtle on downed cottonwood.

0714hr					18-Aug-07					0730 hr
	Flume					**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**		**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 umhos**	
0.00	20.0	0.4	10.46	672		20.5	0.4	9.94	677	
0.25	20.2	0.4	10.87	672		20.5	0.4	9.75	677	
0.50	20.2	0.4	10.88	672		20.5	0.4	9.87	678	
0.75	20.3	0.4	10.86	672		20.5	0.4	9.82	677	
0.90 b	20.3	0.4	5.60	672						
1.00						20.5		8.82	677	
1.25						20.5	0.4	9.55	677	
1.50						20.5	0.4	9.56	678	
1.65 b						20.6	0.4	5.48	678	
1.75										

0749hr					18-Aug-07					0808hr
	Railroad Trestle					**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**		**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**	
0.00	20.1	0.4	9.56	678		19.1	0.4	6.69	664	
0.25	20.2	0.4	9.60	678		19.1	0.4	6.78	664	
0.50	20.2	0.4	9.57	678		19.1	0.4	6.78	664	
0.75	20.2	0.4	9.56	678		19.1	0.4	6.76	669	
1.00	20.2	0.4	9.50	678		19.0	0.4	5.58	659	
1.15 b						18.9	0.4	1.46	660	
1.25	20.2	0.4	9.40	678						
1.37 b	20.2	0.4	3.70	678						
1.50										

25 August 2006. Gage height of 2.48 (morning) and 2.51 (afternoon). Clear in morning and sunny all day. Air temperature of 11.3ºC at 0714 hr and 24.2ºC at 1450 hr. Flume inlet at 1.0 ft. Flume outlet at 1.1 feet.

Station 1: Flume at 0714 hr. Reach 1- 12 gulls bathing, 1 adult female mallard and 3 ducklings. No surface algae. Flume at 1537 hr. Reach 1- <1% surface algae. 90% of bottom with algae 1-3 ft thick, averaging 1.5 ft thick. 10% pondweed and algae 3-4.5 ft thick, averaging 4 ft. 130 gulls bathing. Area flagged off over the flume on the beach.
Station 2: Stockton Avenue Bridge at 0730 hr. Secchi depth to bottom. 2% surface algae. 2 mallards in the water, 3 mallards on redwood stump. A greenback heron perched on overhanging willows. **Lady with infant feeding birds near Stockton Bridge on east side.** Reach 2 at 1517 hr. 7% surface algae. 70% of bottom covered with algae 1.0- 2 ft thick, averaging 1.5 ft. 30% pondweed and algae 2-4.5 ft thick, averaging 3.5 ft. 2 mergansers and 1 gull on redwood stump.
Station 3: Railroad trestle at 0749 hr. Reach 3- 15% surface algae. 9 mallards, 1 pied-billed grebe and 1 coot in water. At 1504 hr, 16 mallards in water; 1 gull and 2 merganser roosting on redwood stump in

Reach 3 above trestle. 10% surface algae; 50% of bottom covered with algae 0.2- 1.0 ft thick, averaging 0.5 ft. Remainder pondweed and algae 2- 4.5 ft thick, averaging 3 ft.

Station 4: Mouth of Noble Gulch at 0808 hr. 20% surface algae. 13 mallards, 1 pond turtle and 2 mergansers on downed cottonwood; 5 other mallards on smaller log. At 1450 hr, 30% surface algae. 80% of bottom with algae 1- 4 ft thick, averaging 3.5 ft. 1 goose, 8 mallards and 2 domestic ducks on downed cottonwood.

Station 5: Nob Hill at 0839 hr. Water temperature 16.0°C. Oxygen 7.20 mg/l. Conductivity 604 umhos. Salinity 0.4 ppt. Visually estimated streamflow of 2.5 cfs. 4 mallards in stream.

1537hr					18-Aug-07				1517hr
	Flume				**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 umhos**	
0.00	22.0	0.4	12.99	696	22.5	0.4	12.81	703	
0.25	22.0	0.4	13.07	695	22.3	0.4	12.82	701	
0.50	22.0	0.4	13.56	691	22.1	0.4	12.61	696	
0.75	21.9	0.4	13.67	690	22.1	0.4	12.44	696	
0.90	22.2	0.4	8.04	689					
1.00					22.0	0.4	12.10	696	
1.25 b					21.6	0.4	13.23	691	
1.50					21.3	0.4	14.31	686	
1.75 b					21.5	0.4	7.23	681	

1504hr					18-Aug-07				1450hr
	Railroad Trestle				**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**	
0.00	22.7	0.4	12.29	703	22.8	0.4	11.60	708	
0.25	22.3	0.4	12.10	703	22.6	0.4	11.38	704	
0.50	22.3	0.4	11.99	701	21.6	0.4	11.56	695	
0.75	21.9	0.4	11.97	697	20.7	0.4	11.07	687	
1.00	21.4	0.4	12.92	690	20.4	0.4	12.93	673	
1.12 b					20.6	0.4	7.65	663	
1.25	21.2	0.4	11.59	688					
1.40 b	21.0	0.4	2.68	689					
1.50									
1.75									

0720hr			01-Sep-07				0732 hr
	Flume				**Stockton Avenue Bridge**		
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 umhos**
0.00	21.5	0.4	9.86	676	21.7	0.4	10.07	681
0.25	21.6	0.4	9.70	676	21.8	0.4	9.93	681
0.50	21.6	0.4	9.72	676	21.8	0.4	9.58	681
0.75	21.6	0.4	9.63	676	21.8	0.4	9.84	681
0.90 b	21.6	0.4	4.10	676				
1.00					21.8		9.42	681
1.25					21.8	0.4	9.58	681
1.50					21.8	0.4	9.29	681
1.65 b					21.9	0.4	2.38	682
1.75								

0746hr			01-Sep-07				0805hr
	Railroad Trestle				**Mouth of Noble Gulch**		
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**
0.00	21.6	0.4	10.04	683	20.9	0.4	9.03	675
0.25	21.7	0.4	9.86	683	20.9	0.4	9.13	676
0.50	21.6	0.4	9.73	683	20.9	0.4	9.09	686
0.75	21.7	0.4	10.04	683	20.8	0.4	8.40	677
1.00	21.6	0.4	9.96	838	20.6	0.4	7.30	659
1.20 b					20.3	0.4	2.99	664
1.25	21.6	0.4	9.38	683				
1.38 b	21.7	0.4	2.51	684				
1.50								

01 September 2007. Gage height of 2.53 (morning) and 2.55 (afternoon). Foggy and cool in morning and sunny in afternoon. Air temperature of 16.8ºC at 0720 hr and 18.5ºC at 1532 hr. Flume inlet at 1.5 ft. Flume outlet at 0.5 feet and nearly closed.

Station 1: Flume at 0720 hr. Reach 1- 35 gulls bathing, 1 merganser and 2 mallards. Flume at 1532 hr. Reach 1- no surface algae. 50% of bottom with pondweed and algae 1-4.5 ft thick, averaging 2.0 ft. Could not see other vegetation. 103 gulls bathing.
Station 2: Stockton Avenue Bridge at 0732 hr. 5 mallards on redwood stump. 2 mergansers on trestle abutment. 1 cormorant in water. Reach 2 at 1510 hr. No surface algae. 70% of bottom covered with algae 0.5- 2 ft thick, averaging 1.0 ft. 30% pondweed and algae 3- 4.0 ft thick. 4 mallards in water. 7 mallards and greenback heron on trestle abutment.
Station 3: Railroad trestle at 0746 hr. Reach 3- 23 mallards, 2 pied-billed grebe in water. 1 cormorant, a gull and 2 mallards on the redwood stump. At 1448 hr, 17 mallards and 2 coots in water; 1 gull and 2 merganser roosting on redwood stump in Reach 3 above trestle. No surface algae; 40% of bottom covered with algae 0.5- 2.0 ft thick, averaging 1.0 ft. Remaining 60% with pondweed and algae 2- 4.5 ft thick,

averaging 3 ft.

Station 4: Mouth of Noble Gulch at 0805 hr. 5 mallards, 2 domestic ducks, 1 merganser and 1 goose on downed cottonwood. 11 mallards in water in vicinity of gulch. Resident reported seeing many juvenile steelhead hits. At 1435 hr, 15% surface algae. 70% of bottom with algae and pondweed 0.5- 3.5 ft thick, averaging 2 ft. 1 goose, 13 mallards and 1 turtle on downed cottonwood.

Station 5: Nob Hill at 0850 hr. Water temperature 17.4°C. Oxygen 6.86 mg/l. Conductivity 620 umhos. Visually estimated streamflow of 2.0 cfs. 4 mallards, 1 egret and 1 greenback heron in stream.

1532hr					01-Sep-07					1510hr
	Flume					**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**		**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 umhos**	
0.00	23.3	0.4	12.87	696		23.5	0.4	12.38	698	
0.25	23.2	0.4	13.51	693		23.5	0.4	12.02	697	
0.50	23.0	0.4	14.59	688		23.4	0.4	11.91	696	
0.75	22.9	0.4	15.04	681		23.3	0.4	11.82	696	
0.90	23.2	0.4	6.75	680						
1.00						23.2	0.4	11.30	693	
1.25 b						22.7	0.4	14.09	684	
1.50						22.5	0.4	15.04	683	
1.65 b						22.7	0.4	6.42	685	

1448hr					01-Sep-07					1435hr
	Railroad Trestle					**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**		**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 umhos**	
0.00	23.8	0.4	11.50	707		24.1	0.4	10.86	713	
0.25	23.6	0.4	11.53	706		23.8	0.4	11.07	711	
0.50	23.5	0.4	11.17	703		23.1	0.4	10.08	704	
0.75	23.0	0.4	11.25	698		22.4	0.4	10.46	681	
1.00	22.5	0.4	12.44	694		21.8	0.4	12.05	670	
1.20 b						21.7	0.4	3.45	669	
1.25	22.3	0.4	12.69	687						
1.50 b	22.3	0.4	3.82	691						
1.75										

0911hr	Begonia	Festival	02-Sep-07	Begonia	Festival	0855hr
	Flume			**Stockton Avenue Bridge**		
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**
0.00	21.5	0.4	10.77	674	21.8	0.4	9.67	683
0.25	21.5	0.4	10.72	674	21.8	0.4	9.61	682
0.50	21.5	0.4	10.68	674	21.8	0.4	9.46	681
0.75	21.5	0.4	10.73	674	21.7	0.4	9.66	681
0.90 b	21.7	0.4	5.16	676				
1.00					21.7	0.4	9.79	679
1.25					21.7	0.4	9.04	678
1.50					21.6	0.4	11.72	681
1.65 b					22.0	0.4	5.21	681
0841 hr			02-Sep-07			0825hr
	Railroad Trestle			**Mouth of Noble Gulch**		
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**
0.00	21.5	0.4	9.53	683	20.4	0.4	8.70	678
0.25	21.6	0.4	9.38	683	20.5	0.4	8.72	676
0.50	21.5	0.4	9.35	683	20.5	0.4	8.70	676
0.75	21.5	0.4	9.20	683	20.5	0.4	8.57	673
1.00	21.5	0.4	9.14	683	20.5	0.4	8.49	673
1.12 b					20.5	0.4	2.62	665
1.25	21.5	0.4	8.82	683				
1.38 b	21.5	0.4	3.10	684				

			02-Sep-07			1417hr
	Flume			**Stockton Avenue Bridge**		
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**
0.00					23.2	0.4	12.49	695
0.25					23.1	0.4	12.13	695
0.50					23.1	0.4	11.73	694
0.75					23.1	0.4	11.67	694
1.00					22.9	0.4	12.17	690
1.25					22.6	0.4	11.88	690
1.50					22.7	0.4	18.70	697
1.65 b					23.2	0.4	3.68	720
1441 hr			02-Sep-07			1502hr
	Railroad Trestle			**Mouth of Noble Gulch**		
Depth	**Temp 3**	**Salin 3**	**O2 3**	**Cond 3**	**Temp 4**	**Salin 4**	**O2 4**	**Cond 4**

(m)	(C)	(ppt)	(mg/l)	umhos	(C)	(ppt)	(mg/l)	Umhos
0.00	23.4	0.4	9.24	620	23.7	0.4	13.06	710
0.25	23.2	0.4	9.34	621	23.4	0.4	13.12	705
0.50	23.1	0.4	9.43	620	23.2	0.4	13.24	704
0.75	23.0	0.4	9.54	621	23.0	0.4	12.47	703
1.00	22.9	0.4	9.38	620	22.6	0.4	12.41	690
1.13 b	22.6	0.4	4.70	620				
1.20 b					22.2	0.4	1.35	678

02 September 2007. Begonia Festival Day. Gage height of 2.53 (morning) and 2.55 (afternoon). Sunny in morning and through day. Water temperatures were very warm but oxygen levels were also very high. 26 gulls were bathing in Reach 1 of the lagoon at 0911 hr. No ducks were in Reach 2. 10 mallards roosting on the west side of trestle abutment at 0855 hr. In Reach 3- no ducks in the water at 0841 hr. 13 mallards and 1 merganser roosting on logs across from Noble Gulch at 0825 hr. 8 floats were floated down the lagoon. Waders were not allowed this year, and the lagoon bottom was not disturbed. 6 of the floats were towed by boats, kayaks, canoes and surf boards. One float used an electric powered propeller. One float started out being propelled with poles but could not make head way against a slight breeze. It was hitched up to a boat and towed the rest of the way. There were very few flowers left in the lagoon after the procession, the least ever observed. Hydrogen sulfide measurements were discontinued after 2005 because city staff assumed that there would be no more waders during the Begonia Festival, as was the case in 2005. This was not the case in 2006 but was in 2007. The secchi depth was to the bottom after the float procession. Oxygen levels were supersaturated in a warm lagoon. Conductivity was slightly higher after the procession than before, indicating slightly more dissolved minerals in the water. If wading had occurred with all of the decomposing plant material on the bottom this year, conductivity and hydrogen sulfide concentrations likely would have increased significantly. Flower petals were collected on Tuesday by Begonia Festival staff.

0755 hr					16-Sep-07				0810 hr
	Flume				**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	19.4	0.4	11.10	651	19.7	0.4	10.24	657	
0.25	19.5	0.4	11.11	651	19.7	0.4	9.90	657	
0.50	19.5	0.4	11.05	651	19.7	0.4	10.16	657	
0.75	19.5	0.4	11.06	651	19.7	0.4	9.92	657	
0.95 b	19.6	0.4	4.35	652					
1.00					19.7	0.4	9.61	657	
1.25					19.7	0.4	9.22	659	
1.50					19.7	0.4	9.65	668	
1.70 b					20.1	0.4	3.46	667	

0828 hr					16-Sep-07				0849 hr
	Railroad Trestle				**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**	
0.00	19.4	0.4	9.23	656	18.8	0.4	8.37	648	
0.25	19.5	0.4	9.33	656	18.9	0.4	8.69	648	
0.50	19.5	0.4	9.34	656	18.9	0.4	8.58	648	
0.75	19.5	0.4	9.30	656	18.8	0.4	8.57	649	
1.00	19.5	0.4	9.23	656	18.8	0.4	7.53	653	
1.20 b					18.8	0.4	0.70	648	
1.25	19.5	0.4	9.28	656					
1.43 b	19.5	0.4	1.74	656					

16 September 2007. Gage height of 2.56 (morning) and 2.56 (afternoon). Membrane on equipment probe malfunctioned, causing delay in measurements in the morning. Overcast in the morning and sunny in afternoon. Air temperature of 14.8°C at 0755 hr and 16.4°C at 1630 hr. Flume entrance at 1.0 ft. Flume outlet at 0.5 feet with incoming tide.

Station 1: Flume at 0755 hr. Reach 1- <1% surface algae. 12 gulls bathing. No ducks.
Station 2: Stockton Avenue Bridge at 0810 hr. Reach 2- 2% surface algae. No ducks. 1 cormorant on redwood stump, drying its wings.
Station 3: Railroad Trestle at 0828 hr. Reach 3- 27 mallards and 5 coots in water.
Station 4: Mouth of Noble Gulch at 0828 hr. 8 mallards roosting on downed cottonwood.
Station 5: Nob Hill at 0908 hr. Water temperature of 16.0°C. Conductivity of 594 umhos. Oxygen 7.23 mg/l. Salinity 0.4 ppt. Visually estimated streamflow 2.0 cfs.

1630 hr					16-Sep-07					1609 hr
	Flume					**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**		**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	21.1	0.4	16.16	668		21.3	0.4	15.75	673	
0.25	21.1	0.4	16.27	668		21.3	0.4	14.94	672	
0.50	21.1	0.4	16.36	668		21.2	0.4	14.68	671	
0.75	21.0	0.4	17.51	666		21.0	0.4	14.43	671	
0.95 b	21.1	0.4	10.96	664						
1.00						20.9	0.4	14.27	666	
1.25						20.6	0.4	14.66	663	
1.50						20.5	0.4	15.26	662	
1.70 b						20.5	0.4	5.82	661	

1553 hr					16-Sep-07					1530 hr
	Railroad Trestle					**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**		**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**	
0.00	21.4	0.4	14.72	678		21.9	0.4	13.68	683	
0.25	21.4	0.4	14.83	676		21.7	0.4	13.06	681	
0.50	21.2	0.4	14.69	674		21.1	0.4	11.75	674	
0.75	21.0	0.4	13.83	671		20.3	0.4	14.39	664	
1.00	20.5	0.4	16.63	665		20.0	0.4	14.10	662	
1.25 b	20.4	0.4	16.18	665		20.1	0.4	3.08	646	
1.43 b	20.5	0.4	7.42	664						

16 September 2007.

Station 1: Flume at 1630 hr. Reach 1- 1% surface algae. 15% of bottom covered by pondweed and algae 4- 5 ft thick, averaging 4 ft. Remainder of lagoon bottom invisible. 50+ gulls bathing.

Station 2: Stockton Avenue Bridge at 1609 hr. Reach 2- 2% surface algae. 70% of bottom covered by algae 1-4.0 ft thick, averaging 1.0 ft thick. 30% of bottom covered by pondweed and algae 3-4 ft thick, averaging 3.5 ft. 1 gull in Reach 2.

Station 3: Railroad Trestle at 1553 hr. Reach 3- 50% of bottom covered by algae 1.0- 4.0 ft, averaging 2.0 ft thick. 50% of bottom covered by pondweed and algae, 3-4 ft thick, averaging 3.5 ft. 24 mallards and 1 coot in water, concentrated from downed cottonwood to Shadowbrook.

Station 4: Mouth of Noble Gulch at 1530 hr. 2% surface algae. 20% of bottom covered by algae 1.0-4.0 ft thick, averaging 1.0 ft. 12 mallards, 2 domestic ducks and 1 goose roosting on downed cottonwood.

0725 hr					30-Sep-07				0739 hr
	Flume				**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	15.5	0.4	6.70	597	16.2	0.4	6.23	604	
0.25	15.8	0.4	6.63	596	16.3	0.4	6.18	604	
0.50	15.9	0.4	6.66	596	16.3	0.4	6.10	604	
0.75	15.9	0.4	6.55	597	16.4	0.4	6.16	604	
0.95 b	15.9	0.4	3.30	600					
1.00					16.4	0.4	6.06	604	
1.25					16.4	0.4	5.98	604	
1.50					16.4	0.4	5.72	605	
1.65 b					16.4	0.4	0.36	606	

0806 hr					30-Sep-07				0822 hr
	Railroad Trestle				**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**	
0.00	16.1	0.4	6.07	606	15.7	0.4	6.21	609	
0.25	16.2	0.4	6.09	606	15.8	0.4	6.14	609	
0.50	16.2	0.4	6.09	606	15.8	0.4	6.14	609	
0.75	16.2	0.4	6.08	606	15.8	0.4	6.29	608	
1.00	16.2	0.4	6.10	606	15.8	0.4	6.32	609	
1.20 b					16.0	0.4	0.52	611	
1.25	16.2	0.4	6.20	606					
1.45	16.2	0.4	2.94	607					

30 September 2007. Gage height of 2.50 (morning) and 2.52 (afternoon). Clear and cool in morning. Sunny and warm in afternoon. Air temperature of 7.1°C at 0725 hr and 21.1°C at 1514 hr. Flume inlet 2.0 ft deep. Flume outlet 0.7 ft at top of flume exit. Remainder filled with sand.
Station 1: Flume at 0725 hr. Reach 1- 1 cormorant, 14 gulls bathing. 1 great blue heron along margin.
Station 2: Stockton Avenue Bridge at 0739 hr. Reach 2- 14 mallards just below trestle. 3 mallards roosting on redwood stump. 3 coots.
Station 3: Railroad Trestle at 0806 hr. Reach 3- 18 mallards, 18 coots, 1 pied-billed grebe.
Station 4: Mouth of Noble Gulch at 0822 hr. 11 mallards and 1 goose on cottonwood log. **Station 5:** Nob Hill at 0852 hr. Water temperature of 12.8°C. Conductivity of 587 umhos. Oxygen 7.70 mg/l. Visually estimated streamflow 2 cfs.

1514 hr					30-Sep-07					1538 hr
	Flume					**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**		**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	18.0	0.4	9.87	623		18.1	0.4	10.05	625	
0.25	17.5	0.4	9.53	622		18.1	0.4	10.14	625	
0.50	17.4	0.4	9.44	622		17.9	0.4	9.93	624	
0.75	17.1	0.4	9.95	619		17.7	0.4	9.75	621	
0.95 b	17.0	0.4	5.93	611						
1.00						17.0	0.4	9.85	620	
1.25						16.6	0.4	8.94	618	
1.50						16.6	0.4	8.81	619	
1.75 b						16.7	0.4	0.70	620	

1603 hr					30-Sep-07					1616 hr
	Railroad Trestle					**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**		**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**	
0.00	18.6	0.4	13.31	629		19.9	0.4	12.67	647	
0.25	18.3	0.4	12.25	629		18.8	0.4	12.80	636	
0.50	18.2	0.4	11.92	628		18.4	0.4	12.08	631	
0.75	18.1	0.4	11.84	626		17.9	0.4	10.06	608	
1.00	17.2	0.4	8.49	622		15.8	0.4	9.28	620	
1.20 b						16.0	0.4	0.25	625	
1.25	16.4	0.4	9.02	624						
1.47 b	16.4	0.4	2.93	625						

30 September 2007.

Station 1: Flume at 1514 hr. Reach 1- brown-green soup to the bottom. Bottom invisible. 22 gulls and 1 cormorant.

Station 2: Stockton Avenue Bridge at 1538 hr in Reach 2- Green soup from algal bloom. Secchi depth 1 meter. Bottom invisible. No birds.

Station 3: Railroad Trestle at 1603 hr- Reach 3- Thick green-pea soup; bottom invisible. No ducks in water. 11 coots and 1 pied-billed grebe in water, concentrated from Noble Gulch to Shadowbrook.

Station 4: Mouth of Noble Gulch at 1616 hr- Gray plume at Gulch mouth into green-pea soup. Bottom invisible. 16 mallards roosting on cottonwood log.

9 October 2007. Prior to storm, 2 boards removed from east side. Notch in sandbar was cut. Sand from the notch was placed along lagoon margin on Venetian side to create a higher berm to discourage tidal overwash. Some tidal overwash occurred prior to this.

0745 hr			13-Oct-07					0804 hr
	Flume				**Stockton Avenue Bridge**			
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**
0.00	14.0	0.3	6.47	449	14.5	0.3	5.20	481
0.25	14.2	0.3	6.28	448	14.4	0.3	5.11	481
0.50	14.2	0.3	6.29	448	14.4	0.3	4.98	476
0.75	14.2	0.3	6.33	448	14.4	0.3	5.06	471
0.90 b	14.2	0.3	5.54	449				
1.00					14.3	0.3	5.25	471
1.25					14.3	0.3	5.30	474
1.50					14.4	0.3	4.37	476
1.65 b					14.4	0.3	0.98	495

0841 hr			13-Oct-07					0858 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**
0.00	14.3	0.3	5.27	473	14.2	0.3	5.75	418
0.25	14.3	0.3	5.39	474	14.2	0.3	5.45	435
0.50	14.3	0.3	5.32	476	14.1	0.3	5.44	438
0.75	14.3	0.3	5.29	474	14.1	0.3	5.42	438
1.00	14.3	0.3	5.21	476	14.1	0.3	4.88	450
1.20 b					14.4	0.3	1.19	502
1.25	14.6	0.3	3.28	481				
1.45 b	14.6	0.3	0.57	542				

13 October 2007. Rained the previous day. Gage height of 2.51 (morning) and 2.13 (afternoon). Clear in morning and partly cloudy then clear in afternoon. Air temperature of 11.3°C at 0745 hr, 18.6ºC at Flume at 1605 hr. 3 mats of blackberry clippings floating in the lagoon, resulting from clearing by City personnel up Noble Gulch. Washed into the lagoon during storm. I recommended to Morrison during morning monitoring that he remove 2 more boards (one board already removed) to allow light to penetrate to the bottom so that plants on bottom could photosynthesize. Morrison removed the boards later in the day (on a Saturday).

Station 2: Stockton Avenue Bridge at 0804 hr. Reach 2- Secchi depth 0.5 m (20 inches) at Stockton Bridge. 4 coots.
Station 3: Railroad Trestle at 0841 hr. Reach 3- Secchi depth 0.5 m (19.5 inches). 14 mallards and 2 domestic ducks in water. 5 coots adjacent Shadowbrook. 4 cormorants sunning on redwood stump.
Station 4: Mouth of Noble Gulch at 0858 hr. 7 mallards and 1 coot roosting on downed cottonwood. Secchi depth 0.43 m (17 inches).
Station 5: Nob Hill at 0927 hr. Water temperature of 12.9°C. Conductivity of 595 umhos. Oxygen 8.36 mg/l. Salinity 0.4 ppt. Streamflow visually estimated at 5.5 cfs.

1605 hr				13-Oct-2007				1543 hr
	Flume				**Stockton Avenue Bridge**			
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**
0.00	16.5	0.3	5.98	487	17.0	0.3	6.35	492
0.25	16.1	0.3	5.99	485	17.0	0.3	6.15	490
0.50	15.8	0.3	4.82	478	16.5	0.3	5.75	479
0.75 b	14.6	0.3	3.98	470	14.9	0.3	4.37	473
1.00					14.6	0.3	4.33	473
1.25					14.6	0.3	4.22	472
1.40 b					14.6	0.3	0.28	477
1524 hr				13-Oct-2007				1502 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**
0.00	17.4	0.3	6.55	488	18.6	0.3	5.55	480
0.25	17.1	0.3	6.56	488	17.5	0.3	5.64	458
0.50	16.9	0.3	5.97	474	16.1	0.2	4.84	411
0.75	16.2	0.3	3.96	481	14.5	0.3	5.75	559
1.00 b	16.6	0.3	4.45	542	14.4	0.3	0.31	590
1.25 b	14.7	0.3	1.72	544				

13 October 2007.

Station 1: Flume at 1605 hr. Reach 1- Secchi depth 0.6 m (24 inches). 11 gulls and 2 coots. **Station 2:** Stockton Avenue Bridge at 1543 hr. Reach 2- Secchi depth 0.6 m (24 inches) at Stockton Bridge. 9 coots. **Station 3:** Railroad Trestle at 1524 hr. Reach 3- Secchi depth 0.6 m (23 inches) at trestle and Noble Gulch. 2 mallards, 3 coots and 1 gull in water.

Station 4: Mouth of Noble Gulch at 1502 hr. 23 mallards and 1 goose roosting on cottonwood log and others nearby.

0819 hr				14-Oct-07				1403 hr
	Stockton Avenue Bridge				**Stockton Avenue Bridge**			
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**
0.00	14.8		4.39		17.1		6.24	
0.25	14.8		4.36		17.0		6.06	
0.50	14.8		4.41		16.8		5.92	
0.75	14.8		4.40		16.5		5.95	
1.00	14.8		4.41		15.2		6.31	
1.10 b	14.9		0.68					
1.25					15.2		6.20	
1.35 b					15.2		2.23	

14 October 2007. I recommended that another 1-2 boards be removed. Ed removed 1 board.
18 October 2007. 4 boards out by 18 October with light penetrating to bottom. Rain forecasted for 19 October.

0739 hr				27-Oct-2007				0750 hr
	Flume				**Stockton Avenue Bridge**			
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**
0.00	14.4	0.4	9.85	660	14.8	0.4	9.62	664
0.25	14.6	0.4	9.67	661	14.8	0.4	9.26	664
0.50	14.6	0.4	9.71	662	14.8	0.4	9.55	664
0.75	14.7	0.4	9.72	662	14.8	0.4	9.34	664
0.90 b	14.7	0.4	5.05	659				
1.00					14.8	0.4	9.06	664
1.25					14.7	0.4	8.96	664
1.50					14.7	0.4	8.78	664
1.65 b					14.7	0.4	3.74	665
0805 hr				27-Oct-2007				0817 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**
0.00	14.3	0.4	8.06	658	13.6	0.4	7.06	614
0.25	14.3	0.4	8.05	657	13.7	0.4	7.00	646
0.50	14.3	0.4	7.97	657	13.7	0.4	6.87	653
0.75	14.3	0.4	7.97	657	13.7	0.4	6.78	653
1.00	14.3	0.4	8.00	657	13.6	0.4	6.72	653
1.13 b					13.8	0.4	3.08	654
1.25	14.3	0.4	7.97	657				
1.37	14.3	0.4	0.08	658				

27 October 2007. Gage height of 2.51 (morning) and 2.52 (afternoon). Partly cloudy and breezy in

morning and sunny in afternoon. Air temperature of 10.1°C at 0739 hr and 15.7ºC at 1555 hr. Flume inlet 1 ft, flume outlet 0.8 ft with outlet fully exposed. All boards in flume inlet with top board notched 6 inches wide and 4 inches deep.

Station 1: Flume at 0739 hr. Reach 1- 100+ gulls, 36 coots, 3 mallards, 1 cormorant, 1 kingfisher overhead.

Station 2: Stockton Avenue Bridge at 0750 hr. Secchi depth to bottom. Reach 2- 13 coots (some from Reach 1).

Station 3: Railroad Trestle at 0805 hr. Reach 3- 42 coots, 23 mallards, 2 domestic ducks, 1 small Canada goose.

Station 4: Mouth of Noble Gulch at 0817 hr. 1 goose roosting on cottonwood log.

Station 5: Nob Hill at 0845 hr. Water temperature of 12.3°C. Conductivity of 612 umhos. Oxygen 8.40 mg/l. Salinity 0.4 ppt. Visually estimated streamflow 2.75 cfs.

1555 hr					27-Oct-2007				1535 hr
	Flume				**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	15.8	0.4	11.42	676	15.9	0.4	12.20	678	
0.25	15.7	0.4	11.13	676	15.9	0.4	11.54	676	
0.50	15.6	0.4	11.02	674	15.7	0.4	10.90	674	
0.75	15.4	0.4	11.52	672	15.6	0.4	10.70	672	
0.95 b	15.5	0.4	6.90	671					
1.00					15.4	0.4	10.20	667	
1.25					14.9	0.4	10.11	664	
1.50					14.9	0.4	9.94	664	
1.65 b					14.9	0.4	4.60	665	
1.75									

1519 hr					27-Oct-2007				1503 hr
	Railroad Trestle				**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**	
0.00	15.8	0.4	11.04	678	16.0	0.4	10.04	681	
0.25	15.8	0.4	11.00	674	15.8	0.4	9.79	668	
0.50	15.5	0.4	10.79	672	15.3	0.4	9.38	602	
0.75	15.2	0.4	10.26	668	14.5	0.4	10.05	657	
1.00	14.9	0.4	10.47	664	14.3	0.4	11.81	654	
1.25 b	14.7	0.4	11.21	660	14.5	0.4	5.49	658	
1.50	14.8	0.4	4.32	661					

27 October 2007.

Station 1: Flume at 1555 hr in Reach 1, 100 gulls bathing frantically with 30 coots separate. <1% surface algae and 15-20% pondweed and algae 3-4 ft thick. Bottom not visible for vegetation, though secchi depth was to bottom.

Station 2: Stockton Avenue Bridge at 1535 hr in Reach 2, <1% surface algae and 20% of bottom pondweed and algae 3-4 ft thick. Could not see the rest of the vegetation due to shading. 24 coots and 7 gulls.

Station 3: Railroad Trestle at 1519 hr. Reach 3- No surface algae and could not see other vegetation due to shading. 22 coots, 4 mallards and 1 small Canada goose. 3 cormorants and 1 gull roosting on redwood stump.
Station 4: Mouth of Noble Gulch at 1503 hr, 1% surface algae and bottom 70% covered with algae 0.1-0.3 foot thick. Bottom algae bright green! 1 goose, 12 mallards and 1 coot roosting on cottonwood log and others.

0713 hr					10-Nov-07				0724 hr
	Flume					**Stockton Avenue Bridge**			
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**		**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**
0.00	12.6	0.4	8.78	622		12.7	0.4	8.48	624
0.25	12.7	0.4	8.80	623		12.7	0.4	8.28	624
0.50	12.7	0.4	6.69	623		12.8	0.4	8.33	624
0.75	12.7	0.4	8.70	623		12.8	0.4	8.24	624
0.95 b	12.7	0.4	3.96	623		12.8	0.4	8.23	624
1.00									
1.25						12.8	0.4	8.37	624
1.50						12.8	0.4	8.11	624
1.60 b						12.8	0.4	0.22	624
1.75									

0741 hr					10-Nov-07				0756 hr
	Railroad Trestle					**Mouth of Noble Gulch**			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**		**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**
0.00	12.6	0.4	7.77	621		12.3	0.4	7.89	618
0.25	12.6	0.4	7.76	621		12.3	0.4	7.84	619
0.50	12.6	0.4	7.72	621		12.3	0.4	7.83	620
0.75	12.6	0.4	7.78	621		12.3	0.4	7.77	619
1.00	12.6	0.4	7.79	621		12.3	0.4	7.85	620
1.10 b						12.3	0.4	2.52	622
1.25	12.6	0.4	7.76	622					
1.32 b	13.0	0.4	0.56	632					

10 November 2007. Gage height of 2.46 (morning) and 2.65 (afternoon). Partly cloudy in morning and cloudy and lightly sprinkling in afternoon. Air temperature of 10.3°C at 0713 hr and 13.3ºC at 1528 hr. Notch freshly re-cut in beach with 2 berms, one near lagoon and one near surf. In afternoon, flume inlet underwater and outlet completely buried. Left message with Kotilla. Rain forecasted for evening with Morrison assumed to be out of town.

Station 1: Flume at 0713 hr. Reach 1- 57 gulls and 7 gulls.

Station 2: Stockton Avenue Bridge at 0724 hr. Reach 2- Secchi depth to bottom. 10 coots. 2 mallards on trestle abutment.

Station 3: Railroad Trestle at 0741 hr. Reach 3- 12 coots, 1 pied-billed grebe and 26 mallards. 2 cormorants and 1 gull roosting on redwood stump.

Station 4: Mouth of Noble Gulch at 0756 hr. 1 goose and 5 mallards roosting on cottonwood log.

Station 5: Nob Hill at 0825 hr. Water temperature of 11.4°C. Conductivity of 597 umhos. Oxygen 8.50 mg/l. Salinity 0.4 ppt. Visually estimated streamflow 3.5 cfs.

1528 hr					10-Nov-07				1514 hr
	Flume				**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	13.4	0.4	10.69	633	13.5	0.4	9.77	635	
0.25	13.4	0.4	10.48	632	13.5	0.4	9.63	634	
0.50	13.3	0.4	10.41	632	13.4	0.4	9.66	633	
0.75	13.3	0.4	10.28	632	13.3	0.4	9.46	632	
1.00 b	13.3	0.4	7.16	632	13.3	0.4	9.44	630	
1.25					13.1	0.4	9.38	628	
1.50					13.0	0.4	9.02	628	
1.75 b					13.0	0.4	4.61	629	
2.00									

1458 hr					10Nov-07				1445 hr
	Railroad Trestle				**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**	
0.00	13.6	0.4	10.31	606	13.5	0.4	9.18	635	
0.25	13.6	0.4	9.79	606	13.4	0.4	8.83	632	
0.50	13.5	0.4	9.59	606	13.3	0.4	8.82	625	
0.75	13.5	0.4	9.61	607	13.2	0.4	8.83	626	
1.00	13.3	0.4	9.20	607	13.1	0.4	9.33	636	
1.20 b					13.0	0.4	0.12	638	
1.25	13.1	0.4	9.42	607					
1.37 b	13.1	0.4	0.23						

10 November 2007.

Station 1: Flume at 1528 hr. Reach 1- No surface algae. Could not observe lagoon bottom due to low sun angle and shade. 75 gulls, 8 coots.

Station 2: Stockton Avenue Bridge at 1514 hr, secchi depth to bottom. Reach 2- No surface algae. Could not see bottom. 8 coots, 2 gulls and 1 pied-billed grebe.

Station 3: Railroad Trestle at 1458 hr. Reach 3- No surface algae. Could not see bottom. 27 coots and 18 mallards and 1 cormorant in water (later roosting on redwood stump with 1 gull).

Station 4: Mouth of Noble Gulch at 1445 hr. 8 mallards roosting on downed cottonwood. No surface algae. Glimpses of algae on bottom about 0.2 ft thick and spotty.

11 November 2007. Kotilla called back and stated that Morrison had returned and removed boards from the flume outlet prior to the storm. This allowed the sandbar to remain intact.

0745 hr				26-Nov-07				0757 hr
	Flume				**Stockton Avenue Bridge**			
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**
0.00	8.4	0.4	10.35	578	8.7	0.4	9.84	579
0.25	8.6	0.4	10.28	578	8.7	0.4	9.73	580
0.50	8.6	0.4	10.29	578	8.7	0.4	9.60	579
0.75	8.6	0.4	10.24	578	8.7	0.4	9.54	579
0.90 b	8.7	0.4	6.10	578				
1.00					8.6	0.4	9.50	579
1.25					8.6	0.4	9.44	579
1.50					8.6	0.4	9.26	579
1.60 b					8.7	0.4	5.08	579
1.75								
2.00								

0815 hr				26-Nov-07				0838 hr
	Railroad Trestle				**Mouth of Noble Gulch**			
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**
0.00	8.6	0.4	9.61	575	8.4	0.4	9.47	570
0.25	8.5	0.4	9.58	575	8.3	0.4	9.38	572
0.50	8.5	0.4	9.49	575	8.3	0.4	9.42	571
0.75	8.5	0.4	9.54	574	8.2	0.4	9.42	571
1.00	8.5	0.4	9.52	575	8.2	0.4	9.14	572
1.12b					8.4	0.4	3.83	574
1.25	8.5	0.4	9.50	576				
1.35 b	8.5	0.4	1.20	576				

26 November 2007. Gage height of 2.36 (morning) and 2.36 (afternoon). Clear, cool, sunny. Air temperature of 5.0°C at 0745 hr and 11.2ºC at 1552 hr. In afternoon, flume inlet 1.0 ft and outlet 0.8 ft deep from side to side. 1 board had been removed from the restaurant side of the flume inlet. A double berm was in place on the beach with a 25-foot wide swath depression cut between.

Station 1: Flume at 0745 hr. Reach 1- No surface algae. 54 gulls bathing with 26 coot, 4 pelicans and 1 cormorant fishing. At 1552 hr, Reach 1- No surface algae. Bottom not visible due to low light conditions. 132 gulls bathing, 18 coots and 1 cormorant not feeding.

Station 2: Stockton Avenue Bridge at 0757 hr. Reach 2- No surface algae. Secchi depth to bottom. 3 coots. At 1535 hr, Reach 2- No surface algae. 4 coots, 3 gulls. Bottom not visible-low light.

Station 3: Railroad Trestle at 0815 hr. Reach 3- No surface algae. 39 mallards in water, 11 coots, 1 pied-billed grebe. On redwood stump there were 3 coots, 1 merganser and 6 cormorants. Later, 2 cormorants were feeding in Reach 3. At 1520 hr. Reach 3- No surface algae. Too little light to see bottom. 6 cormorants, 1 coot and 1 gull roosting on redwood stump above trestle; In water- 18 coots (12 near Noble Gulch), 1 merganser, 1 cormorant fishing and 5 mallards upstream of redwood stump.

Station 4: Mouth of Noble Gulch at 0838 hr. No surface algae. 1 black-crowned night heron on overhanging willow across lagoon. At 1504 hr, no surface algae. 1 goose and 6 mallards on cottonwood

log.

Station 5: Nob Hill at 0908 hr. Water temperature of 8.0°C. Conductivity of 560 umhos. Oxygen 9.39 mg/l. Salinity 0.4 ppt. Streamflow visually estimated to be 4-5 cfs. Soap suds were present in creek.

1552 hr					26-Nov-07				1535 hr
	Flume				**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	9.8	0.4	11.44	592	9.7	0.4	11.34	593	
0.25	9.6	0.4	11.32	591	9.7	0.4	11.17	593	
0.50	9.5	0.4	11.25	591	9.7	0.4	11.16	593	
0.75	9.5	0.4	11.32	591	9.6	0.4	10.93	593	
0.90b	9.6	0.4	7.59	592					
1.00					9.6	0.4	10.90	591	
1.25					9.3	0.4	10.53	586	
1.50					9.2	0.4	10.48	586	
1.60 b					9.3	0.4	4.39	587	
1.75									
2.00									

1520 hr					26-Nov-07				1504 hr
	Railroad Trestle				**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**	
0.00	10.0	0.4	11.38	594	10.4	0.4	10.82	597	
0.25	9.9	0.4	11.16	594	10.0	0.4	10.80	594	
0.50	9.7	0.4	10.92	592	9.8	0.4	10.89	594	
0.75	9.6	0.4	10.88	592	9.7	0.4	10.92	593	
1.00	9.6	0.4	11.05	592	9.4	0.4	11.09	592	
1.10 b					9.5	0.4	5.08	594	
1.25	9.5	0.4	10.81	592					
1.35 b	9.4	0.4	3.57	592					

0751 hr					08-Dec-07				0802 hr
	Flume				**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	9.4	0.4	7.76	548	9.6	0.4	7.81	559	
0.25	9.5	0.4	7.68	548	9.6	0.4	7.65	559	
0.50	9.5	0.4	7.58	548	9.7	0.4	7.62	560	
0.75 b	9.6	0.4	6.86	548	9.7	0.4	7.51	558	
1.00					9.7	0.4	7.33	592	
1.25					10.4	1.6	6.44	2194	
1.50 b					11.3	2.2	1.76	3264	
1.75									
1.80b									

0826 hr					08-Dec-07				0843 hr
	Railroad Trestle				**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**	
0.00	9.7	0.4	7.57	572	9.4	0.3	7.63	511	
0.25	9.8	0.4	7.52	570	9.5	0.4	7.49	560	
0.50	9.7	0.4	7.56	572	9.5	0.4	7.48	563	
0.75	9.7	0.4	7.55	583	9.5	0.4	7.36	569	
0.95 b					9.8	0.5	0.80	662	
1.00	9.8	0.5	7.54	673					
1.25 b	10.6	0.8	0.13	1093					
1.30b									

8 December 2007. Gage height of 1.92 (morning). Clear and cool, breezy. Air temperature of 4.7°C at 0751 hr. Some tidal overwash occurred the previous week.

Station 1: Flume at 0751 hr. Reach 1- No surface algae. Bottom invisible due to low light. Reach 1 with 102 gulls, 10 coots. Intense back-flush observed through flume inlet from incoming tide.

Station 2: Stockton Avenue Bridge at 0802 hr. Reach 2- No surface algae. Bottom invisible. Secchi depth unknown in morning. 6 mallards near trestle. 1 mallard roosting on redwood stump downstream of trestle.

Station 3: Railroad Trestle at 0826 hr. Reach 3- No surface algae. Lagoon bottom invisible. 42 mallards (27 near Noble Gulch and 5 near Shadowbrook Restaurant), 6 coots (4 near Noble Gulch) and 1 horned grebe near Noble Gulch.

Station 4: Mouth of Noble Gulch at 0843 hr. No surface algae. Bottom invisible. 1 goose and 2 mallards roosting on cottonwood log.

Station 5: Nob Hill at 0910 hr. Water temperature of 8.1°C. Conductivity of 552 umhos. Oxygen 9.45 mg/l. Salinity 0.4 ppt. Visually estimated streamflow at 5 cfs.

1551 hr				08-Dec-07					1525 hr
	Flume				**Stockton Avenue Bridge**				
Depth (m)	**Temp 1 (C)**	**Salin 1 (ppt)**	**O2 1 (mg/l)**	**Cond 1 umhos**	**Temp 2 (C)**	**Salin 2 (ppt)**	**O2 2 (mg/l)**	**Cond 2 Umhos**	
0.00	10.1	0.4	8.15	625	10.1	0.4	8.31	586	
0.25	10.2	0.4	8.09	622	10.1	0.4	8.46	587	
0.50 b	10.2	0.4	7.66	622	10.0	0.4	8.44	587	
0.75					10.0	0.4	8.45	600	
1.00					10.1	0.5	7.41	662	
1.25 b					11.0	1.6	1.15	2221	
1.50									
1.75									

1502 hr				08-Dec-07					1440 hr
	Railroad Trestle				**Mouth of Noble Gulch**				
Depth (m)	**Temp 3 (C)**	**Salin 3 (ppt)**	**O2 3 (mg/l)**	**Cond 3 umhos**	**Temp 4 (C)**	**Salin 4 (ppt)**	**O2 4 (mg/l)**	**Cond 4 Umhos**	
0.00	10.0	0.4	8.82	585	9.7	0.4	9.18	566	
0.25	10.0	0.4	8.72	585	9.5	0.4	9.38	581	
0.50	10.0	0.4	8.75	584	9.2	0.4	9.55	584	
0.75 b	10.0	0.4	8.70	585	9.7	0.4	1.51	592	
1.00 b	10.9	0.9	0.94	1226					
1.25									

8 December 2007. Gage height of 1.26 (afternoon). Clear and breezy. Air temperature of 8.0°C at 1551 hr. Too shaded to see bottom. Lower boards in flume inlet had been dislodged from tidal back-flush. I pushed boards back down and replaced 3 boards on restaurant side after talking with Morrison by phone. However, there was still a hole at the bottom with water going under boards.
Station 1: Flume at 1551 hr. Reach 1- No surface algae. Reach 1 with 40 gulls, 12 coots.
Station 2: Stockton Avenue Bridge at 1525 hr. Reach 2- No surface algae. Secchi depth to bottom. 1 coot and 1 fishing cormorant. 2 mallards roosting under overhanging willows on branches.
Station 3: Railroad Trestle at 1502 hr. Reach 3- No surface algae. 9 coots, 22 mallards, 1 horned grebe, 1 cormorant fishing. 2 cormorants roosting on redwood stump.
Station 4: Mouth of Noble Gulch at 1440 hr. No surface algae. Bottom invisible due to low light. 5 mallards on cottonwood log. 1 goose on bank near cottonwood.

9 December 2007. Morrison discovered at 0800 hr that narrow boards at the very base of the flume inlet were completely missing. He replaced them and replaced all of the longer flashboards on the restaurant side.

10 December 2007. According to Morrison, lagoon had filled to within 3-4 inches of the top of the flume.

18 December 2007. Morrison called and reported that at 0600 hr this Tuesday morning the creek was flowing gently across the beach to the bay, with the estuary level a few inches over the top of the flume. It

had been raining steadily but lightly through the night, with an increase in intensity about 0500hr. Morrison and Kotilla had been at the beach from 2300 hr to 0200 hr the previous night, preparing the notch for the expected sandbar breach. By 0130 hr, a stream of water extended from the lagoon across the beach to the bay. At 0615 hr this morning, the discharge estimate at the Soquel Village stream gage was 8.6 cfs.

I arrived at 0945 hr I observed the creek at Nob Hill and visually estimated a streamflow between 10 and 15 cfs. I arrived at the lagoon at 1000 hr and met with Morrison. Jesberg called Morrison and reported the streamflow to currently be 12 cfs at the gage in Soquel Village. It had reached 18.9 cfs earlier in the morning. At 1000 hr the estuary level was approximately 4-6 inches below the top of the flume. By 1130 hr the estuary level had dropped to more than 2 feet below the top of the flume. The channel across the beach varied between 20 and 25 feet wide. 1 board had been removed from the flume inlet prior to breaching. Water had entered the flume through the grating on top of the flume. More boards were not taken out because more rain was anticipated that day and again on Wednesday. The lagoon level had reached approximately 8 inches above the top of the flume prior to breaching. Later in the day, streamflow increased to 44 cfs at the stream gage due to steady rain. Streamflow in the San Lorenzo River had reached 370+ cfs.

25 December 2007. The estuary has remained open since 18 December.

Appendix B.

2007 Drain Line Test for Restaurants Contiguous with Soquel Creek Lagoon.

DRAIN LINE TEST FOR RESTAURANTS CONTIGUOUS WITH SOQUEL CREEK-2007				
RESTAURANT	**INITIAL CONTACT**	**TEST DATE**	**COMMENTS**	**SIGN OFF**
BEACH HOUSE 207 ESPLANADE	Leona Loveall 465-8530	16-May-07 passed		16-May-07 passed MSW
BAY BAR & GRILL 209 ESPLANADE	Raylene McKenzie 477-0749	7-May-07 NO ACCESS		11-May-07 passed MSW
PIZZA MY HEART 209-A ESPLANDE	RickiStautz 475-5714	7-May-07 passed		7-May-07 passed MSW
FOG BANK 211 ESPLANDE	Kimberley 462-1881	9-May-07 failed	Grease and sanitary lines leaked.	9-May-07 passed DJK
PARADISE BAR & GRILL 215 ESPLANADE	Stephan Hanecak 476-4900	7-May-07 passed		7-May-07 passed MSW
ZELDA'S 203 ESPLANADE	Ed Leipelt 475-4900	7-May-07 passed		7-May-07 passed MSW

Appendix C.
Photographs of Steelhead Sampling taken by Lois Robins and Carol Whitehill.

Preparing the holding pen.

Explaining the method of beach seining prior to pulling in the seine net.

Going to set the seine net beyond the Stockton Bridge.

Pulling in the seine.

Beaching the seine.

Guiding the 106-foot beach seine with central bag to shore.

Pulling on the lead line and float line.

Removing the filamentous algae before beaching the central bag of the seine.

Placing captured steelhead into dip nets.

Placing captured steelhead into dip nets.

Transferring captured steelhead from the dip nets to the livecars.

Transporting captured steelhead in livecars to the holding pen.

Transferring the steelhead from the livecar into the holding pen.

Securing the holding pen cover before making another seine haul.

Learning around the livecar between seine hauls.

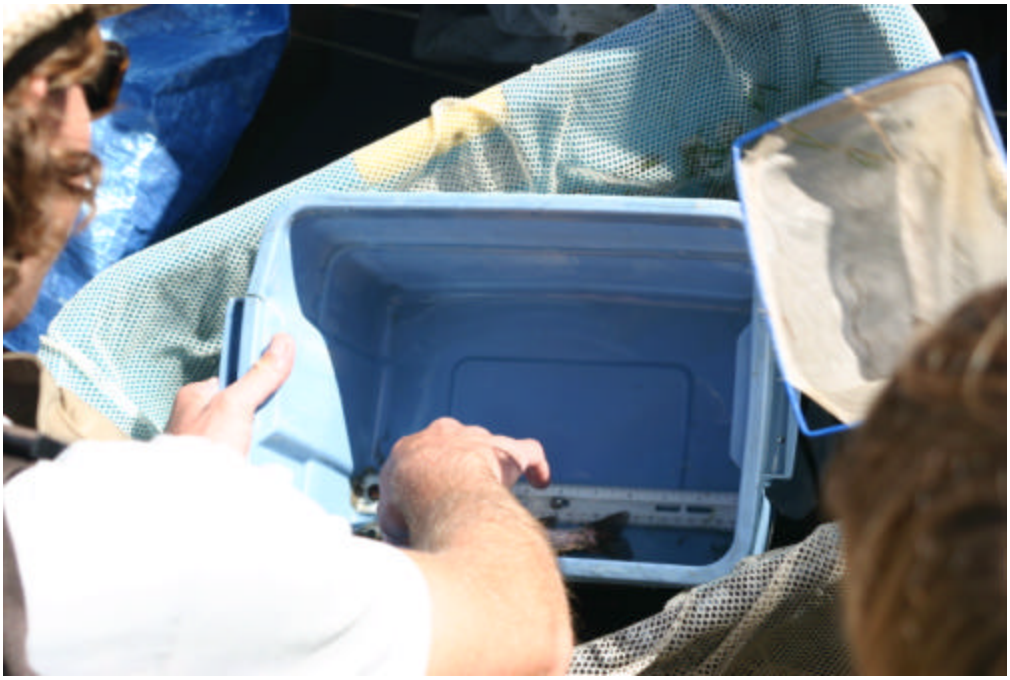
Seine haul with smaller beach seine yields only threespine sticklebacks.

Placing steelhead back into the livecar from the holding pen for measuring.

NOAA Fisheries processing table ready for any electronically tagged steelhead.

Scanning each steelhead for electronic tags placed in steelhead near the Soquel Grange by NOAA fishery biologists.

Juvenile steelhead in measuring bucket.



Measuring the steelhead length.

Juvenile steelhead to be fin-clipped for marking, recapture and population estimate.

Grouping of steelhead lengths into size histogram and individually into tables.

Steelhead released back to the lagoon after measurement.