SOQUEL LAGOON
Management and Enhancement Plan

PLAN PARTICIPANTS

This plan has been prepared by The Habitat Restoration Group. The following persons have participated in the preparation:

The Habitat Restoration Group

John T. Stanley, John A. Gilchrist, Principals
Donald Alley, Project Manager and Fishery Biologist
Dr. Jerry Smith, Fishery Ecologist
William L. Elsey, Fishery Biologist
Kathleen B. Lyons, Botanist
Mara Noelle, Botanist
William Lapaz, Revegetation Specialist
David L. Suddjian, Wildlife Biologist
William Ihle, Wildlife Biologist
Colleen Pelles, Water Quality Technician
William Vandivere, Hydrologist
Laurel Herter, Drafting Coordinator
Sharon Erspamer, Graphics

City of Capitola

Stephen Burrell, City Manager
Ed Morrison, Public Works Supervisor
Larry Perlin, Former Public Works Director
Susan Tupper, Planning Director

Santa Cruz County

John Ricker, Water Quality Program Manager

California Coastal Conservancy

James King, Project Analyst

California Department of Fish and Game

Randy Benthin, Fishery Biologist
Dean Marsten, Fishery Biologist
Ted Vande Sande, Fish Passage Advisor

California Coastal Commission

Joy Chase, Coastal Planner

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A. Foreword

Soquel Creek Lagoon has been an important summer recreation resource for bathers and boaters in the past, and is presently an important habitat for fish, wildlife and streamside vegetation. Management concerns for the diminished recreational value of the lagoon and its significant natural resource value as aquatic habitat for fish and waterfowl prompted the City of Capitola to request that the Habitat Restoration Group develop a management and enhancement plan for the lagoon. In addition, the City was advised by the California Department of Fish and Game (CDFG) to obtain a permit from the California Coastal Commission to allow the City to continue artificial construction of the sandbar in the spring with artificial breaching in the fall. The Coastal Commission in turn required a CDFG permit. The CDFG also notified the City that it could no longer apply copper sulfate (blue stone) to the lagoon to control aquatic plants nor grade the lagoon bottom prior to sandbar construction. The Habitat Restoration Group was contracted to evaluate lagoon conditions and formulate guidelines for the City which would insure permit issuance for sandbar construction and breaching. The Habitat Restoration Group began the developmental process leading to a management and enhancement plan by identifying the goals to be achieved after discussion with the City and resource agencies.

The City then approached the Coastal Conservancy for funding of the work leading to a lagoon enhancement plan. The Conservancy reviewed the goals of the enhancement plan and provided partial funding, with the City funding the remainder. The Habitat Restoration Group has worked closely with the City of Capitola and Coastal Conservancy personnel in the development of a plan that will guide their future stewardship of the lagoon's important resources, while establishing an appreciation in the community for the lagoon's value and the natural processes that occur there.

B. Management Concerns

1. Lagoon closure: Historically, the sandbar has been closed artificially in spring, just prior to Memorial Day Weekend. Often, this timing interferes with juvenile steelhead attempting to reach the ocean. Lagoon grading prior to closure created poor water quality problems for tidewater goby, steelhead and other fish species.

2. Lagoon opening: In order to prevent flooding around the lagoon, the sandbar was formerly breached artificially in September, soon after the Begonia Festival. This premature opening resulted in environmental problems for juvenile steelhead and tidewater goby using the lagoon.

3. Aquatic plant control: Historically, algae, pondweed and bacteria have been controlled by application of copper sulfate during the summer. This chemical, while effective as a control measure, is also toxic to fish and other aquatic fauna.

4. Health hazards to swimming: In recent years, high coliform bacterial counts have caused closure of the lagoon to human body contact during the summer. It is the intent of the Plan to provide human recreational use of the lagoon while protecting environmental values.

C. Plan Formulation

Once these management concerns had been identified, a detailed survey of the lagoon's resources was undertaken. A species list of fish was developed and species of concern were highlighted. The same procedure was followed for birds, amphibians, reptiles and mammals. Riparian (stream-side) vegetation was mapped. Water quality parameters were monitored and assessed in 1988-89. Parameters included fecal coliform bacterial counts, abundance of algae and pondweed, dissolved oxygen levels, water temperature, salinity concentrations, invertebrate abundance and the effect of kelp and introduced floating plant material from the Begonia Festival on water quality following sandbar closure. An

educational questionnaire was developed and circulated so as to receive citizen input on management issues.

A number of processes were discovered. With the installation of a newly designed shroud/fish gate on the outlet culvert that passes water through the sandbar, the lagoon rapidly converts to freshwater and provides suitable habitat for aquatic organisms while assuring fish passage to the ocean. This is an improvement over natural conditions in which freshwater conversion could take much longer or possibly not occur, resulting in poor water quality conditions for steelhead. Though water temperatures remain high through the summer in the culverted lagoon, steelhead and tidewater goby survive and grow well in a lagoon that exists all summer without sandbar breaching. Dissolved oxygen remains sufficiently high for fish with some reduction after the decomposition of flowers and dead pondweed from the Begonia Festival. This decomposition also stimulates algae growth with some oxygen depletion. Delay of the sandbar breaching in the fall with the use of the outlet culvert improves fish habitat by maintaining the lagoon compared to natural conditions that may cause a series of sandbar breachings and reformations from the first storms of the season.

Bird-feeding is a popular activity around the lagoon. Restaurant customers and employees provide abundant handouts to feral ducks, rock doves (pigeons) and domestic geese, which rely almost totally on handouts for food. The high coliform bacterial counts in summer are primarily caused by bird excrement, though other, as yet, unconfirmed sources may increase the health problem. Wild ducks serve as a biological control for pondweed and submerged algae in the lagoon. Once the algal mats form on the surface, however, they are not fed upon. One application of Aquazine to the lower lagoon effectively controlled algae for the Begonia Festival with no apparent harm to fish, aquatic invertebrates, birds or trees.

With field work completed, and after input from the City, citizens, resource agencies and the Coastal Conservancy, a comprehensive management plan was formulated. The Plan was designed to conform to the guidelines for protection of the

natural resources as outlined by CDFG and to enhance these resources in line with the intentions of the Coastal Conservancy. Great care was taken, as well, to address the aesthetic and recreational concerns of the City.

D. Summary of Adopted Recommendations

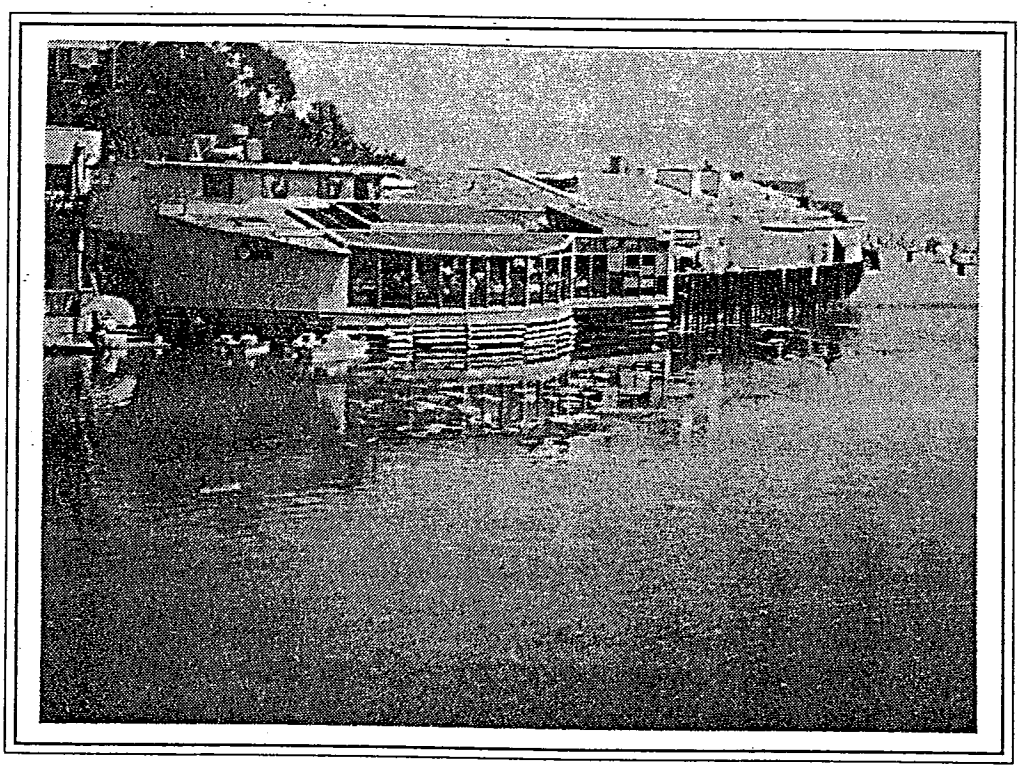
All of the adopted recommendations are contained in sections V. and VI. of the Plan with associated background information to explain the rationale for them. They address procedures and timing for sandbar construction in the week prior to Memorial Day and sandbar breaching in November after the wet season has begun. Guidelines assure that a minimum of saltwater is trapped in the lagoon and a fish gate structure aides in freshwater conversion and fish access to the ocean until July 1. Sandbar breaching is intended to be delayed until after the first fall storms, at a time when baseflow in Soquel Creek is sufficient to create a constant plume of brackish water in the Bay and prevent sandbar formation after breaching. Summertime lagoon levels are intended to be maintained with monitoring to inform the Soquel Creek water master when lagoon inflows become critically low for steelhead access from upstream.

Recommendations are designed to maintain healthy levels of oxygen, water temperature and aquatic plant growth for fishes, minimizing storm runoff of toxic petroleum residues and reducing coliform bacterial levels sufficiently to permit swimming. Methods are provided to reduce algae for aesthetic enhancement and the Begonia Festival along with clean-up afterwards.

Other recommendations for lagoon enhancement involve wildlife enhancement for wild, native waterbirds by removal of domestic geese and ducks, cessation of bird-feeding at the restaurants and access points around the lagoon, restriction of roosting sites for gulls and rock doves (pigeons) on the railroad trestle and Esplanade roofs, placement of nest boxes and enhancement of native riparian vegetation. Eradication of non-native vegetation and revegetation with native riparian vegetation are recommended. An education program has been recommended and designed to provide

interpretive signs around the lagoon and within the Rispin Mansion to inform visitors about the animals and plants that exist at the lagoon. Lesson plans are recommended for teachers to incorporate lagoon experiences into their science curriculum. A pamphlet is recommended for residents regarding revegetation with native plants and enhancement of wildlife habitat.

The intention of the City and the Plan developers was to enhance the lagoon environment for fish, wildlife and native vegetation over past practices and natural extremes, with a desire to enhance recreation where it would not conflict with enhancement of these natural resources.



Paddleboats next to restaurants and beach.

II. INTRODUCTION

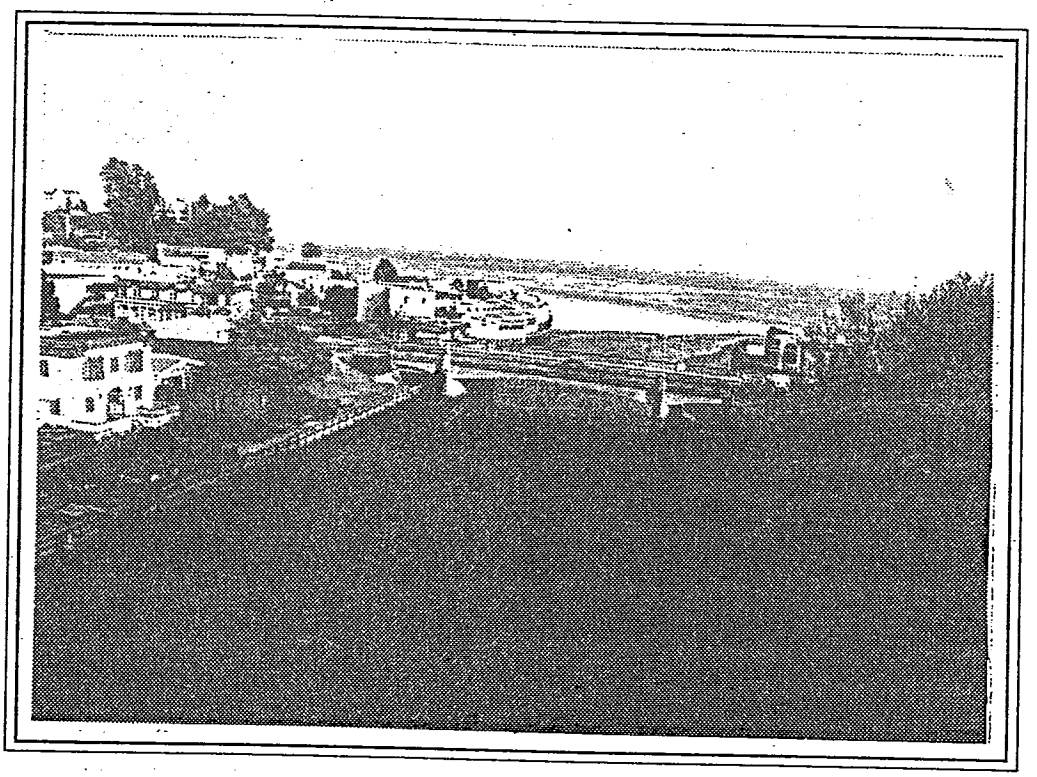
Soquel Creek Lagoon is an important habitat for fish, wildlife and stream-side vegetation. In addition, the lagoon historically has been an important summer recreational resource for the City of Capitola, providing bathing and boating opportunities for both residents and visitors. The intent from the outset of this latest effort of lagoon management and enhancement has been to balance protection of environmental values with recreational values.

In the past, the lagoon has been manipulated to conform to a pattern of human summertime use by artificial construction of the sandbar in the spring and artificial breaching in the fall. This has included grading and contouring of the lagoon bottom prior to sandbar construction.

In an effort to make the lagoon more aesthetically pleasing, the City, until 1988, applied copper sulfate (blue stone) to the lagoon during the summer months to control the growth of algae and pondweed. At that time, the City was enjoined by CDFG from applying this chemical because of its deleterious effect on fish and other aquatic resources. CDFG also required the City to obtain permits from the Army Corps and the Coastal Commission to allow continued artificial sandbar construction and breaching.

The City saw the fulfillment of this permit process as an opportunity not only to comply with the CDFG's requirements but to enhance the attractiveness of the lagoon as the focal point of summer recreational activity and the Begonia Festival in the City of Capitola. To this end, the City hired The Habitat Restoration Group to analyze the lagoon's resources and complete the Management and Enhancement Plan. The City then requested and received funding for a portion of this work from the Coastal Conservancy. The Plan identifies the various management concerns. For each of these concerns, specific recommendations are provided. The Plan also includes recommendations for enhancement ideas with associated cost estimates for each.

The recommendations entail management of natural resources, including fish, wildlife and riparian vegetation. The timing and way in which the sandbar is constructed in spring and breached in fall are important. Adequate fish passage through the sandbar culvert is crucial. Recommendations are provided for the enhancement of wildlife habitat, valuable groves of trees, aesthetics, educational use and recreational benefit of the lagoon and streamside vegetation. The Plan outlines a number of steps to reduce fecal bacterial concentrations to a level that, hopefully, will allow body-contact (swimming and wading) activities in the lagoon.



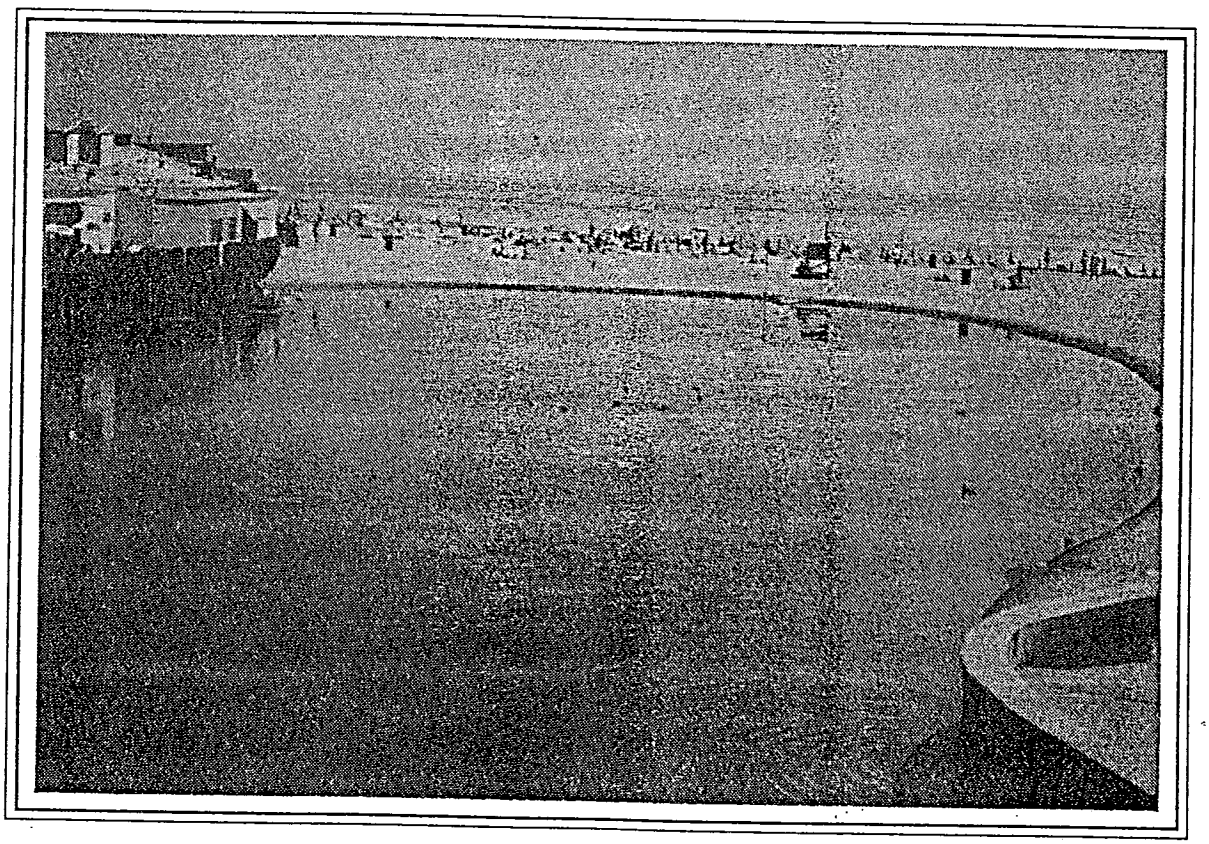
Capitola Village adjacent to the lagoon.

III. EXISTING CONDITIONS AND PAST MANAGEMENT PRACTICES

Description of Past Management Practices and Their Impacts

During the summer, the estuary or tidal mouth of most central California coast streams becomes blocked by a sandbar, producing a brackish or freshwater lagoon. Winter and spring storms affect beach sand dynamics. The storms and spring streamflows determine the timing of natural sandbar closure at the stream mouth. In winters with severe storms, much of the beach sand may be re-deposited offshore, and the sandbar may not naturally form until mid-summer.

Because of the interest in recreational use and aesthetics of an impounded lagoon at Soquel Creek, a sandbar has historically been artificially constructed prior to the Memorial Day weekend and maintained through the summer. This installation has sometimes interfered with the timing of natural processes.



Lower lagoon with summer sandbar.

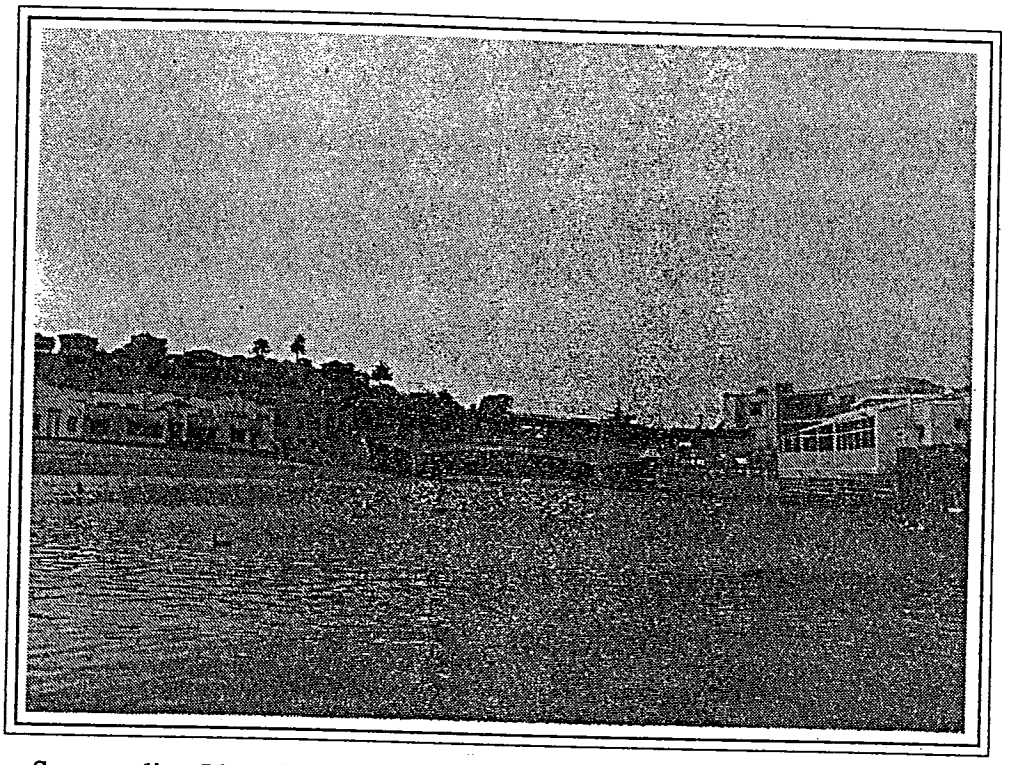
The formation of the lagoon in late spring is beneficial for some wildlife species; it increases foraging opportunities for mallards during June and July, and insures the presence of aquatic plant and invertebrate resources in the late summer and fall.

Coastal lagoons are important resources for wildlife. In their natural state, lagoons support a productive combination of aquatic, wetlands, beach, riparian, and other terrestrial wildlife habitats. In urban settings, such as the Capitola/Santa Cruz area, the natural habitats of coastal lagoons have been altered, reduced in area or eliminated. The wildlife value is significantly less than at lagoons in non-urban environments, and wildlife species diversity is generally lower.

The wildlife habitats of Soquel Creek Lagoon have been and continue to be significantly affected by urban development and other human activities. Natural habitats are limited, thus reducing the area's wildlife species diversity, population sizes, and existing wildlife uses. Extensive residential and commercial development has the greatest impact on Soquel Lagoon's fauna. The wildlife value of the beach is significantly reduced by recreational uses, particularly during the summer.

The lagoon and beach areas receive intense amounts of recreational use, particularly during the spring and summer months. In general, the continuous human activity surrounding the lagoon directly limits wildlife use. Only those species that are tolerant of human presence, or those that can otherwise avoid direct disturbance, use the lagoon in any numbers. In the past, swimming has disturbed the activities of the wildlife in the lagoon. Boating continues to disturb wildlife and probably causes some individuals to move to less disturbed areas.

Factors that limit the lagoon's wildlife value include noise, automobile traffic, night lighting, recreational activity on the beach and east shore of the lagoon and the presence of numerous domestic dogs and cats.



Surrounding Venetian Court and Espalnade with Stockton Avenue bridge in the center.

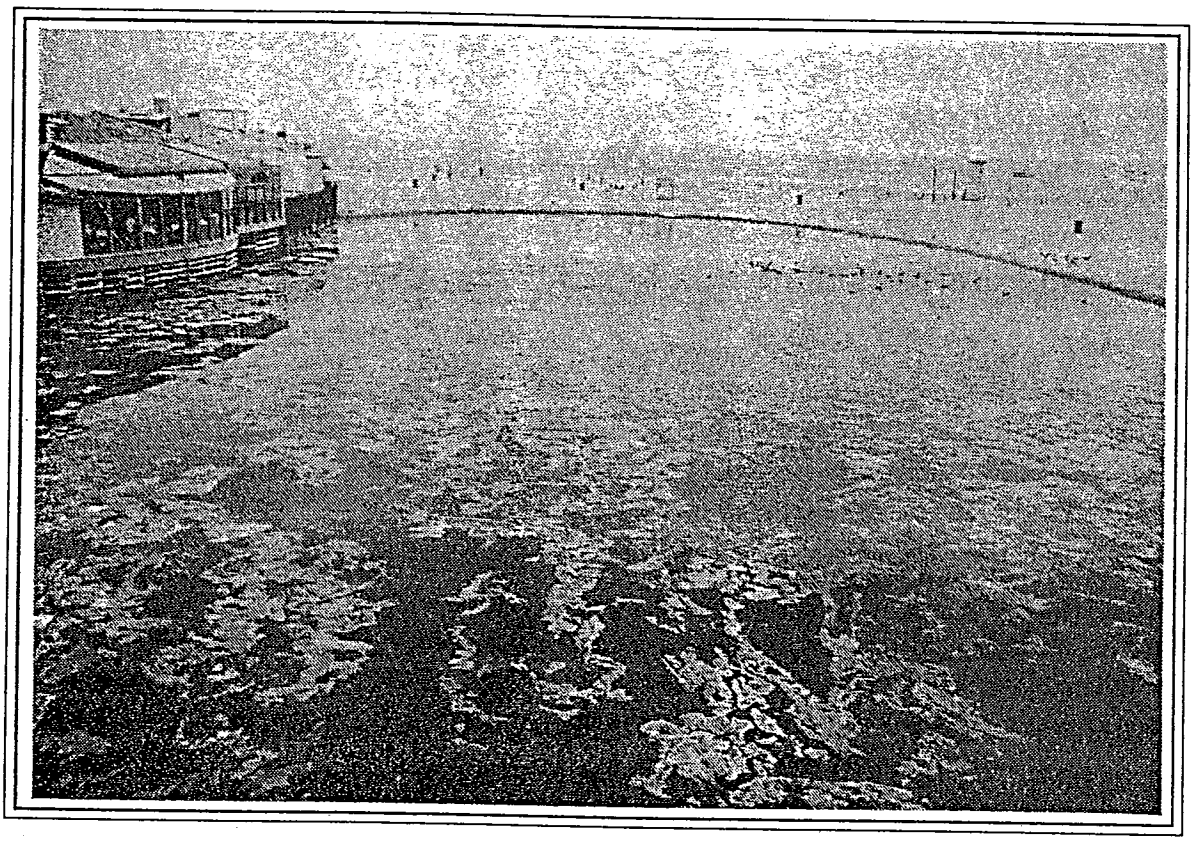
The beach is subject to intense levels of human activity, particularly from May to September, but it is still used by many bird species. Amphibians, reptiles, and mammals are absent at Capitola Beach. Avian use of the beach is related to the lagoon, as many birds which use the beach or littoral zone also use the lagoon.

The lagoon's narrow configuration, lack of substantial wetland vegetation, and the high incidence of human disturbance all limit the diversity of aquatic wildlife species. Those species remaining are tolerant of humans or, by virtue of their behavioral patterns, have little interaction with people.

Historically, summer algae and pondweed growth was controlled by treatment with copper sulfate. The danger of copper sulfate to fish and invertebrates, and its potential to accumulate in the lagoon, resulted in a ban of its use by the Department of Fish and Game in 1988.

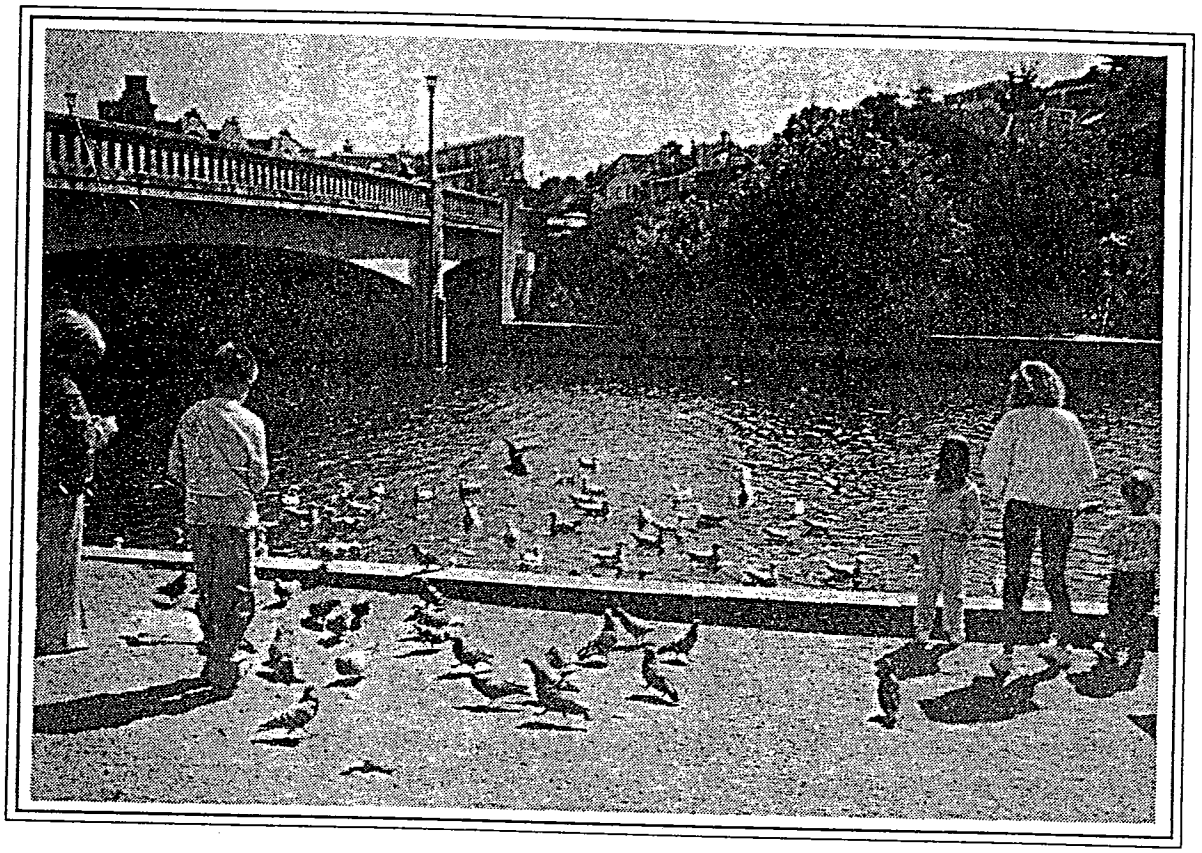
The historical use of copper sulfate to reduce aquatic plant

growth has significantly reduced the lagoon's wildlife value. The plants, and their associated invertebrates, are the primary food source for the mallards and American coots that use the lagoon. In addition, the copper sulfate had negative impacts on the lagoon's fish populations, further decreasing the foraging opportunities for wildlife.



Lagoon with algae in late summer.

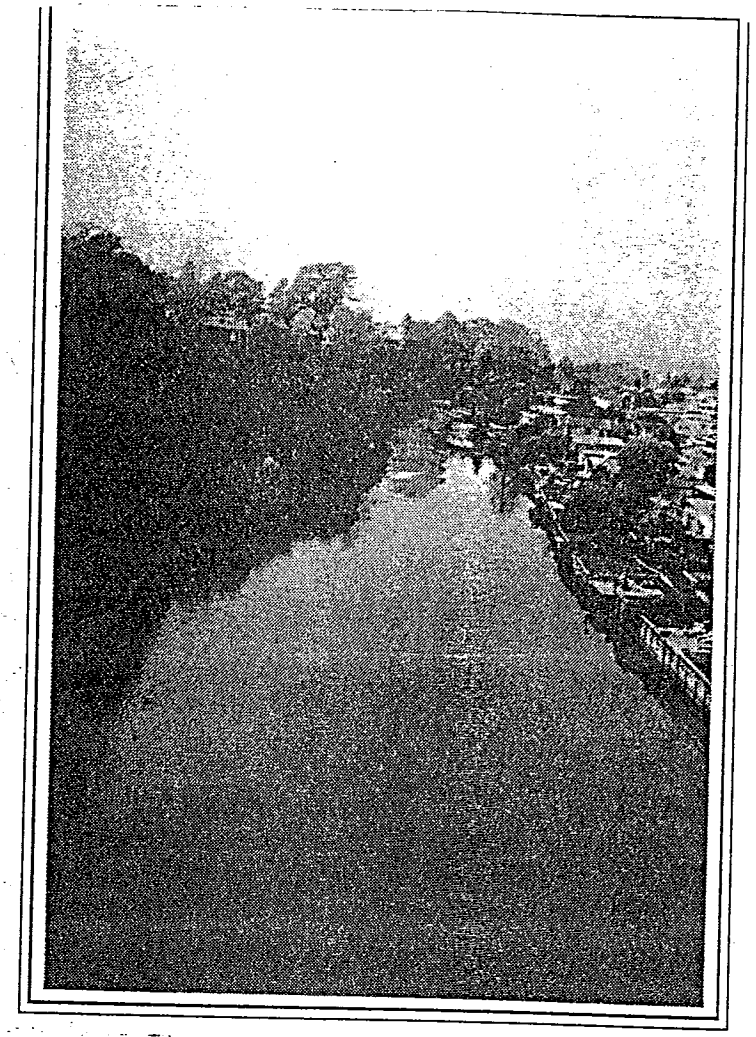
The offering of food to wild birds and resident domestic species is a common activity at Soquel Lagoon. Handouts probably form a large portion of the diet of the lagoon's populations of rock doves, domestic geese and feral ducks. But other species (e.g. wild mallards, gulls, and coots) also depend on natural food sources. Most foods offered to the birds are nutritionally poor relative to naturally-available foods. They contain preservatives and do not contribute to a healthy diet. Therefore, handouts may negatively affect the health of the lagoon's bird populations.



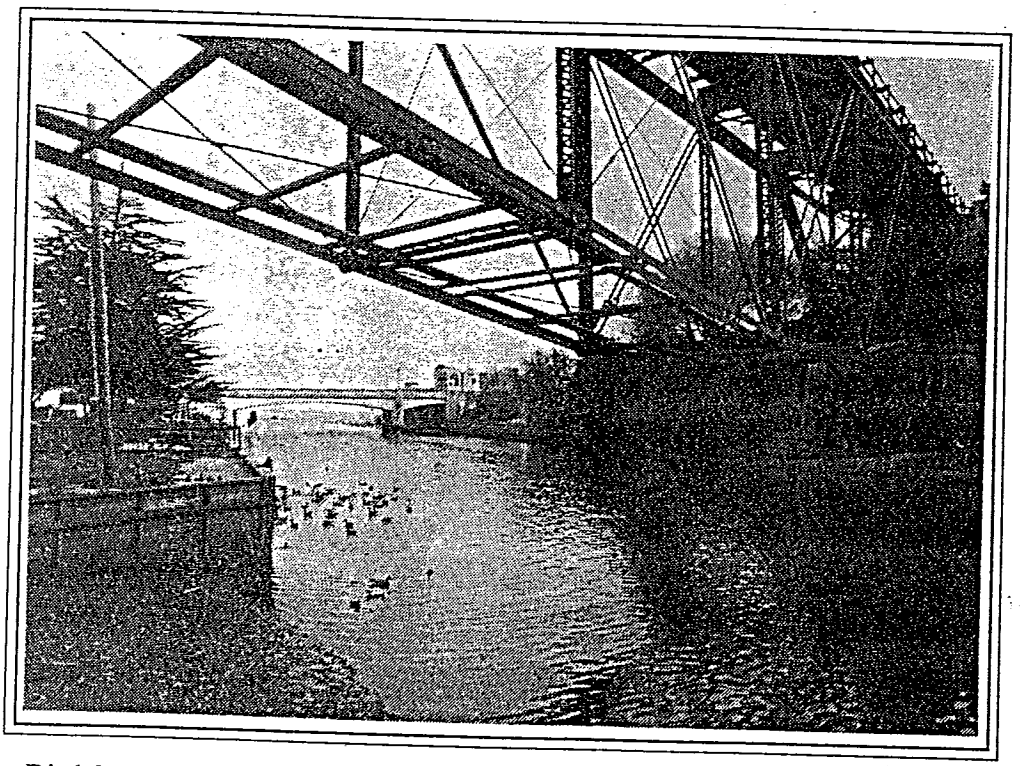
Feeding birds at Stockton Avenue Park.

The riparian corridor upstream of the lagoon is less disturbed, and supports most of the wildlife species normally associated with riparian habitat in Santa Cruz County. The proximity of this productive area to the lagoon enhances the value of the habitat bordering the lagoon. Sound resource management of the lagoon requires protection of the habitat upstream of the lagoon.

The value of the riparian habitat has been greatly reduced by past vegetation removal and alteration. Its wildlife value is further degraded by its closeness to residential and commercial development and activity. In spite of its reduced wildlife value, this habitat supports the greatest diversity of wildlife of any of the lagoon's habitats. The dense vegetation provides cover, and attracts many insects, providing food for wildlife. Significant riparian habitat for wildlife occurs upstream of the lagoon, and the value of the lagoon's riparian habitat is enhanced by the productive upstream area.



The upper estuary in winter.



Bird feeding beneath the railroad trestle in winter.

IV. RESOURCE INVENTORY

A. Fishery and Aquatic Resources

The lagoon provides spring and summer rearing habitat for steelhead trout (*Oncorhynchus mykiss*), which move downstream from spawning areas. The Soquel Creek Lagoon also provides a migrational passage way for adult steelhead and silver salmon (*Oncorhynchus kisutch*) and summer rearing habitat for juvenile starry flounder (*Platichthys stellatus*) and staghorn sculpin (*Leptocottus armatus*), which enter from the ocean. Shiner perch (*Cymatogaster aggregata*) is an occasional visitor from the ocean. Resident species in the lagoon/estuary are tidewater goby (*Eucyclogobius newberryi*) and threespine stickleback (*Gasterosteus aculeatus*). Sacramento sucker (*Catostomus occidentalis*), prickly sculpin (*Cottus asper*) and California roach (*Lavinia symmetricus*) are present in Soquel Creek and occasionally enter the lagoon.

Lagoon invertebrates (primarily isopods and the amphipod, Corophium) are generally most abundant in the upstream portions of the lagoon, where concentrations of pondweed and algae are sparser. However, mayflies and gammarid amphipods, which are more available as food for steelhead than is Corophium, are most abundant in the moderate algae and pondweed growth of the middle portion of the lagoon and provide more food for steelhead. The dense algae downstream of the Stockton Avenue bridge generally has the lowest invertebrate abundance. Fish abundance is greatest in the deepest portions of the lagoon, and predation by fish may be partially responsible for the progressive downstream decline in observed invertebrates within the lagoon.

Rare, Threatened or Endangered Fish Species. The tidewater goby is a candidate for state rare/endangered and federal threatened/endangered species status.

B. Wildlife Resources

Riparian habitat along the lagoon's edge and upstream has high

wildlife value. The structural diversity of this habitat, with well-developed tree canopy, mid-canopy, and understory, provides habitat for many species. The mature cottonwood tree canopy from the lagoon upstream to Highway 1 is one of the last remaining in urbanized vicinity of central Santa Cruz County.

Appendix A provides an in-depth description of wildlife that inhabit the beach, aquatic and riparian habitats. A summary of the importance of riparian habitat for wildlife is provided in Appendix B. Appendix C lists wildlife species observed or predicted to occur at Soquel Creek Lagoon and the adjacent shoreline. Eight amphibian species, 11 reptile species, 192 bird species, and 36 mammals species were observed or predicted to occur. Birds are the only wildlife known to occur in large numbers.

Rare, Threatened, and Endangered Wildlife, and Species of Special Concern. Eighteen sensitive vertebrate wildlife species are known or potential users of Soquel Lagoon. These were identified by field visits and a literature search. The record of Santa Cruz County bird sightings maintained by the Santa Cruz Bird Club were helpful. Their listed status and known or predicted occurrence in the vicinity of the lagoon is presented in Appendix C.

C. Vegetation Resources

Several plant communities are present along the lagoon and upstream. Two of these communities, the central coast riparian shrub and the central coast live oak riparian forest, are described in California Department of Fish and Game's Preliminary Descriptions of the Terrestrial Natural Communities of California (Holland, 1986). By definition, this live oak riparian forest occurs on drier outer floodplains along perennial streams in between the wetter sites where cottonwood or willow dominate and drier sites. The central coast cottonwood-willow riparian community found creek-side is a modified version of one of Holland's plant community descriptions. The remaining plant communities are dominated by horticultural (introduced) species and are defined as redwood grove, eucalyptus grove, horticultural

plantings, and invasive non-natives. Appendix D provides an in-depth description of the dominant plant species that are found in the various plant communities.

The major native plant communities and non-native plant associations between the Esplanade and the Highway 1 bridge are delineated on the project map (Figure 1). All plants were identified using A California Flora and Supplement (Munz and Keck, 1968) and A Flora of the Santa Cruz Mountains (Thomas, 1961). A plant species list is contained in Appendix E. There were no rare or endangered plant species observed in the study area.

V. ADOPTED RECOMMENDATIONS FOR LAGOON CLOSURE, SANDBAR BREACHING, AQUATIC VEGETATION CONTROL AND WATER QUALITY MAINTENANCE

Summary of the Benefits of the Adopted Recommendations

The City of Capitola began studies of lagoon ecology and management in 1988 because of several concerns; public health, the lagoon's overall aesthetic and ecological condition, and actions of environmental regulatory agencies. There was environmental concern about the adverse impacts to steelhead and tidewater goby when the lagoon area was drained, graded and artificially closed before sandbar closure in spring. Studies associated with development of the Plan demonstrated that the lagoon's natural resource value greatly enhanced and its recreational value improved with relatively simple changes in management policies and procedures. With the installation of a newly designed shroud/fish gate on the outlet culvert that passes water through the sandbar, the lagoon rapidly converts to freshwater and provides suitable habitat for aquatic organisms while assuring fish passage to the ocean. This is an improvement over natural conditions in which freshwater conversion could take much longer or possibly not occur, resulting in poor water quality conditions for steelhead. Delay of the sandbar breaching in the fall with the use of the outlet culvert improves fish habitat by maintaining the lagoon compared to natural conditions that may cause a series of sandbar breachings and reformations from the first storms of the season. The studies indicated, however, that use of the lagoon for swimming and wading may be restricted because of elevated bacterial levels, primarily caused by inputs of bird excrement and other potential sources.

Control measures for domestic waterfowl will enhance the biological control of excessive algae by native ducks in conjunction with manual removal of algae, resulting in improved water quality for fish in the lower lagoon and improved aesthetics. One, low concentration application of the herbicide, Aquazine, to reduce algae in the lower lagoon before the Begonia Festival will have no adverse affect on valuable pondweed, fish, wildlife and riparian vegetation. Prompt clean-up after the Begonia Festival will prevent any adverse effects.

In order to assess the level of management success, additional monitoring of lagoon bacterial levels and community cooperation related to implementation of the Plan will be needed. Additionally, further analysis of bacterial monitoring of Noble Gulch will be required to determine the cause of occasional contamination and remedies for it.

A. Sandbar Closure

How Things Work. The California Department of Fish and Game and the California Coastal Commission require permits for artificially moving the sand on Capitola Beach at the times of sandbar construction in the spring and sandbar breaching in the fall. The City seeks to obtain an long-term permit for these activities.

Early construction of the sandbar, as has been practiced by the City, presents potential problems for steelhead and silver salmon smolts, which migrate from upstream rearing areas to the ocean during April, May, and early June. In addition, the procedures involved in building the sandbar often have caused lagoon water quality problems, which in turn can affect lagoon aesthetics and conditions for fish and other aquatic life. If substantial salt water remains in the lagoon at the time of sandbar formation, the saltwater will form a layer on the bottom that prevents circulation of oxygenated water in the lagoon. This layering also results in a "solar collector" effect, which heats the lagoon to levels unsuitable for steelhead and much of the food on which they feed. In some years, streamflows after the time of natural sandbar formation would be too low to flush the salt water and prevent persistent layering of the lagoon.

Grading of the channel downstream of the Stockton Avenue Bridge, a typical component of past management actions intended to prevent dangerously sharp drop-offs into the lagoon, requires substantial lowering of the lagoon water level to allow heavy equipment to enter the channel to perform grading. With a lowered water level, the lagoon suffers both extensive loss of

habitat and severe water quality problems; populations of invertebrates, and possibly sensitive fish species, are sharply reduced. After the sandbar has been installed, outflow and lagoon water level have been regulated by a permanent concrete culvert with flashboards at the culvert's inlet.

Kelp is washed into the estuary (a lagoon with an open sandbar) by winter and spring storms, and, if remaining in the lagoon after sandbar installation, will rapidly decompose. The decomposed kelp depletes lagoon oxygen, reduces populations of lagoon invertebrates and fish, and results in odor and an aesthetic problem. As long as the decomposing kelp lasts, which may be a month or more, it also provides a medium for the support and multiplication of bacteria. Covering of the kelp with sand does not prevent bacterial decomposition or elevated bacterial counts in the lagoon.

Adopted Recommendations for Sandbar Closure

1. The City may install an artificial sandbar at the mouth of Soquel Creek in the week prior to the Memorial Day weekend. The City shall notify CDFG of the date of closure and obtain the necessary CDFG 1603 agreement to close the estuary. After the 1603 agreement is made, the City will notify the Coastal Commission, Army Corps of Engineers, the monitoring group and streamside businesses/residents of the date of closure. In order to prevent adverse impacts of artificial sandbar installation, **the City shall follow the procedures outlined below:**

1a. Perform all grading from the beach only. No grading of the channel bottom in the area of the summer lagoon embayment will be undertaken except to eliminate sharp dropoffs within 25 feet of the culvert entrance and immediately along the sandy shore for the first 10 linear feet of the lagoon bottom (below the elevation of the top of the culvert), from Venetian Courts on the west to the pilings adjacent to the restaurants on the east side. Kelp will not be buried in the lagoon. Heavy tracked equipment will not be used in the lagoon area for kelp removal.

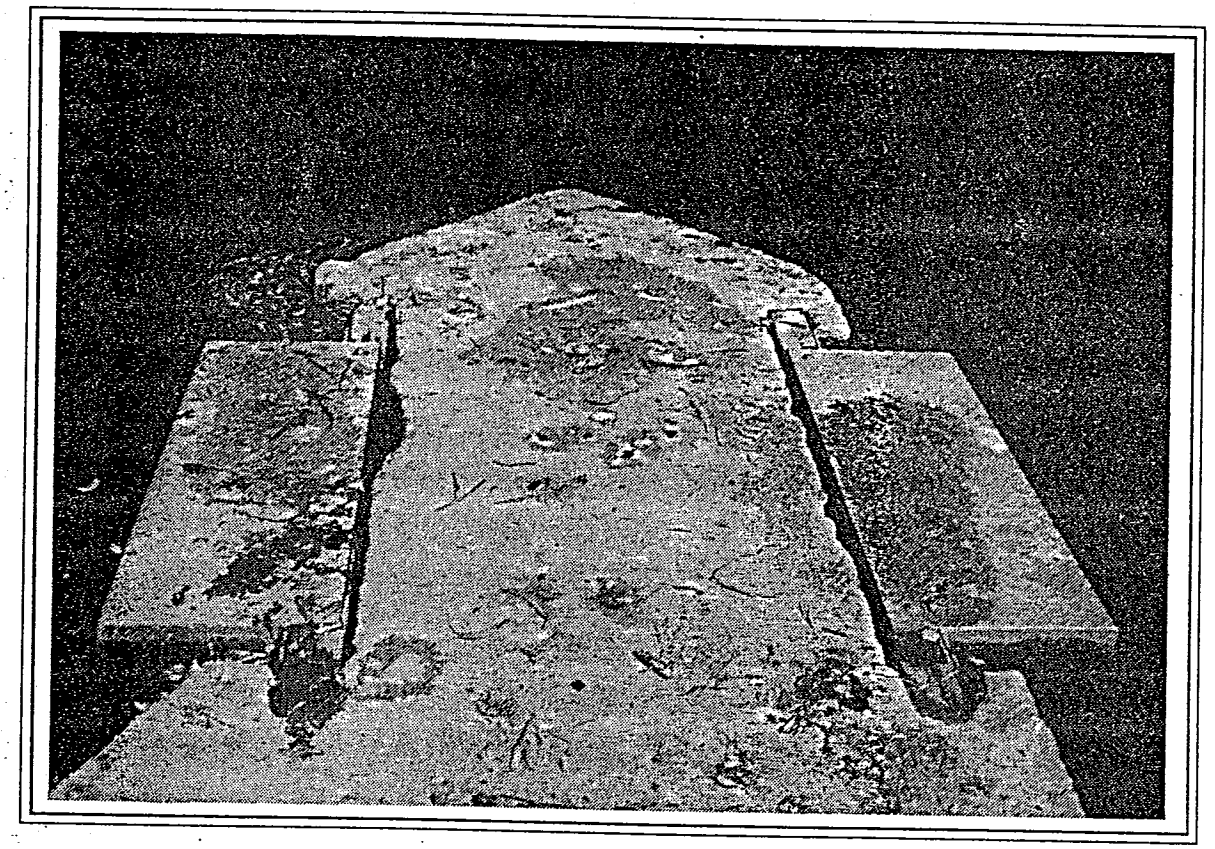
1b. From approximately April 1 until sandbar closure, the City

will weekly monitor the lagoon and remove kelp from the lagoon area before it begins to decay (using City staff and public volunteers). The area of concern extends from the outlet culvert upstream to Noble Gulch. This will be done at low tide when most kelp is left exposed on the sand and can be removed with rakes and hand tools most readily. Large mats of kelp will be removed from the lagoon immediately prior to sandbar installation. If the sandbar partially closes before the planned sandbar construction, any trapped kelp will be removed at that time. Small equipment (i.e. small tractor with attached rake or small all-terrain vehicles with wagons or a drag line attached to a winch on equipment stationed on the beach) will be used in such a way that the inundated channel bottom is left undisturbed. Kelp will be removed before any sandbar construction causes ponding of the lagoon. A deeper cut in the existing sandbar will not be made to drain the lagoon prior to, during or after the time of sandbar construction unless late storms create a potential flooding problem after a sandbar is in place.

1c. The sandbar will be installed during the lowest tide occurring within the week prior to the Memorial Day weekend, when the estuary is at its minimum depth, in order to reduce the amount of salt water present after sandbar installation. This requires grading of the beach at the mouth and stockpiling of sand adjacent to the outlet prior to the final effort to plug the mouth.

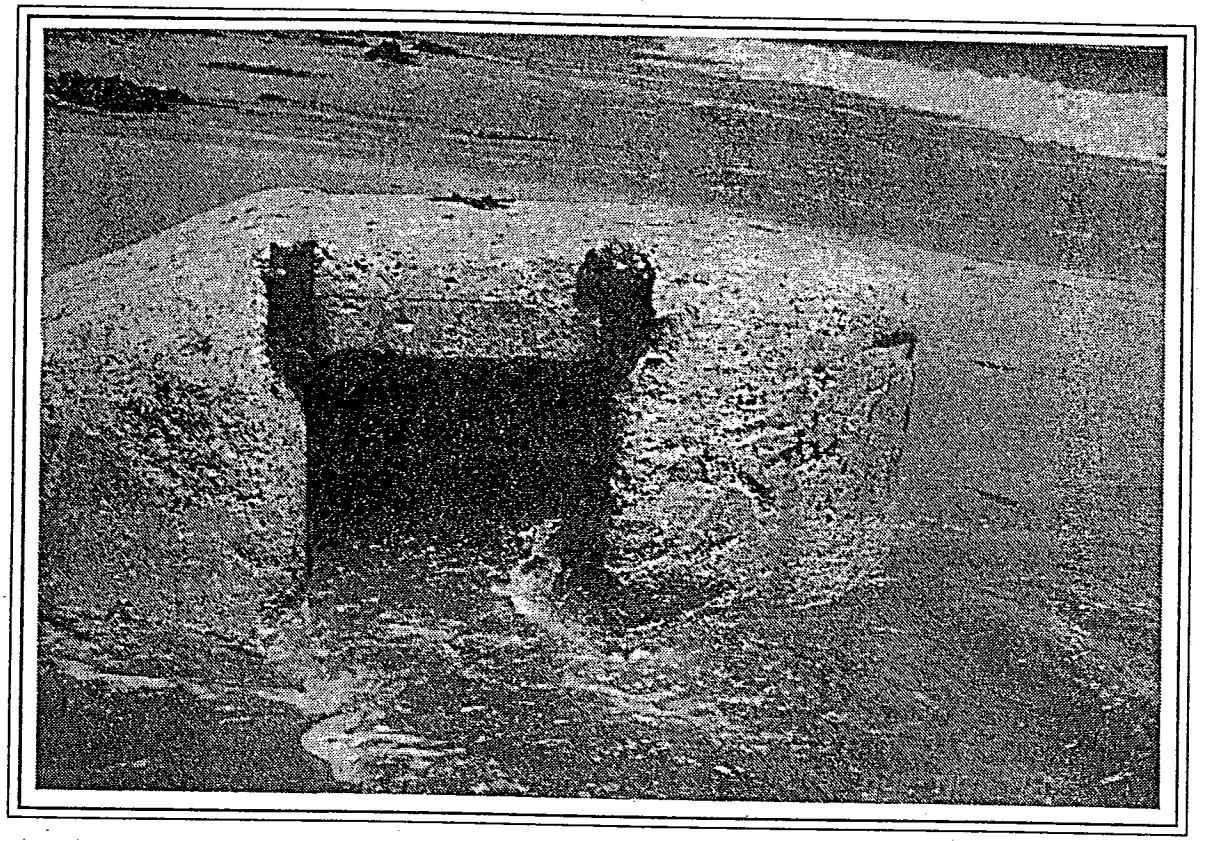
1d. After the sandbar is closed, sand will be removed from the culvert as soon as possible so as to allow passage of water and the prevention of flooding. The City shall use the fish gate/shroud that was designed by Fish and Game (Figure 6) and tested by the City at the entrance to the culvert. Public Works shall install it over the flashboards on the culvert entrance in order to draw salty outflow water from the bottom of the lagoon for **one to two continuous weeks after sandbar closure.** This will speed the conversion of the lagoon to freshwater. If adults are seen in the lagoon at this point, the shroud may be removed from one side of the culvert for up to a week with a notch 8 inches deep from the top of the flashboards on that side to allow adult out-migration. Opening up the one side may be

very important to adult passage after rare late May storms that occur after the sandbar is in place. After this week period, Public Works shall reinstall the shroud with the original flashboard. The shroud shall remain in place until at least **June 30th.** The shroud may serve to pull poor-quality water off the bottom and out of the lagoon if left in place longer, provided there is sufficient flow to keep the culvert open.



Outlet culvert with fish gate/shroud.

1e. Out-migration to the ocean for steelhead smolts shall be insured through the culvert until June 30th. This requires openings of sufficient size (4-5 inches) at the entrance to the culvert and over the top flashboards to allow steelhead smolts to easily pass from the lagoon into the culvert. The top flashboards below the shroud shall be cut to create a notch at least 5-6 inches deep and approximately 6 inches wide to focus water and make the shroud passable to smolts. Sufficient water depth (at least 0.6 feet) will be maintained in the culvert by installing baffles inside, if necessary. Sand will be removed at the ocean end of the culvert (daily, if necessary) through June 30th in order to assure fish passage.



Culvert outlet at the ocean.

1f. In the event that a storm is forecasted for the Soquel Creek watershed in spring after sandbar closure, the fish gate/shroud shall be removed on one side of the culvert along with 2 or more flashboards in order to increase the flow capacity of the culvert. For public safety, the culvert opening will be covered with 4-inch x 6-inch meshed screening, with the longest dimension in the vertical direction. Further, the manhole cover situated on top of the culvert, closest to the flashboards will be removed. For public safety, the opening will be covered with screening of mesh size 4-inch x 6-inch, minimum, in order to allow passage of fish through the manhole. If the storm front does not materialize or once the streamflow has subsided after the storm, all screening will be removed, the manhole will be covered, and the flashboards and fish gate/shroud will be reinstalled as soon as possible.

B. Lagoon Inflows, Depth and Water Level

How Things Work. Relatively small inflows of approximately 0.2 cubic feet per second (90 gallons per minute), from Soquel Creek and Noble Gulch combined (Appendix F), are necessary to maintain adequate lagoon levels for fish and riparian vegetation. Therefore, except for extreme droughts, the lagoon water level can be regulated by the flashboards at the culvert. Variation in winter scour can also affect lagoon depth, but when the water level is at the top of the flashboards, the maximum lagoon depth, downstream of the Stockton Avenue Bridge, is usually in the range of 4 to 4.5 feet. Upstream of the Shadowbrook Restaurant the lagoon is less than 2 feet deep, with much of it less than 15 inches deep. The upper portion of the lagoon is not heavily used by juvenile steelhead, but does support the tidewater goby, a candidate for state and federal rare or threatened status.

Young-of-the-year steelhead continue to migrate down Soquel Creek to the lagoon for rearing in summer. When lagoon inflows go below 1/4 cfs, the creek approaches intermittency, which strands these steelhead. High mortality then occurs.

It was observed that flows of somewhat less than 0.5 cubic feet per second maintained ample depth within the culvert to allow fish passage without baffles. Two or three baffles with staggered notches at alternating sides of the culvert at the inlet of the culvert will insure ample water depth.

Operation of the pedal boat concession requires sufficient lagoon water height to enable customers to easily climb in and out of the boats. High lagoon water levels are also needed to allow easy retrieval of stored boats. During the Begonia Festival, slight lowering of the lagoon water level makes it easier for people to push decorated floats downstream to the beach.

In drought years, streamflows upstream of the lagoon decline in late spring and early summer, isolating many juvenile steelhead in drying pools and preventing their migration to the lagoon.

2. Through June 30th, the City shall insure fish passage through the culvert, even if it requires lagoon water levels other than those desired for pedal boat launching. The City shall encourage the pedal boat proprietor to modify the launching ramp and boat storage area, if necessary. The City shall not allow the pedal boat proprietor to close off or otherwise manipulate the inlet to the culvert. The prescribed baffles within the culvert will maintain the required depth for fish passage (at least 0.6 feet) as long as water is allowed to flow through the culvert.

3. On and after July 1st, the culvert can be plugged or modified by the City only, to raise the lagoon to any desired level.

4. The lagoon water level can be lowered by the City for the Begonia Festival, up to 8 inches below the level produced when all flashboards are in place. Reinstall flashboards afterwards.

5a. After the fish gate/shroud has been removed, the City may replace the top flashboards with unnotched boards or even plug up the inlet to the culvert. Then the City will monitor lagoon water surface levels daily with the use of a permanent staff gauge. These data will be recorded in a log book to be reviewed by consultants during the monitoring of the Plan. If the lagoon water level begins to drop, the City will begin to daily monitor the presence of streamflow at Nob Hill and the Porter Street crossing upstream of Highway 1 to determine if the stream goes intermittent. The City will alert CDFG and the water master when the lagoon water level begins to drop and when stream intermittency is observed, recording the date at which intermittency is first observed. Encourage CDFG and the water master to then check for possible upstream diversions that do not meet bypass flow requirements.

5b. The City will examine the extent of well pumping by the Shadowbrook Restaurant and the potential impacts to lagoon water levels and lagoon water quality that this well pumping may have.

6. In drought years, the City shall cooperate with Department of Fish and Game-supervised volunteers in efforts to capture stranded steelhead in Soquel Creek for transport to the lagoon for summer rearing.

C. Fishing Regulations

How Things Work. The lagoon is closed to summer fishing by the California Department of Fish and Game regulations designed to protect juvenile steelhead. However, young fishermen regularly fish the lagoon in summer, especially near the culvert from Noble Gulch where large numbers of juvenile steelhead congregate. Summer poaching may have significant negative impacts on the steelhead population in the lagoon.

Adopted Recommendations for Fishing Regulations

7. The City shall obtain "No Fishing" signs from CDFG and post them at strategic locations along the lagoon throughout the off-season, particularly at the mouth of Noble Gulch where young steelhead congregate. The City shall seek instruction from the CDFG on fishing regulations and timing of the no fishing period. The CDFG is responsible for enforcement.

8. The City shall install interpretive signs near the lagoon, explaining the importance of the lagoon as a rearing habitat for juvenile steelhead, starry flounder and staghorn sculpins, and as habitat for resident tidewater goby and threespine stickleback. Coastal Conservancy funding shall be requested.

D. Lagoon Water Quality as It Affects Aquatic Life

How Things Work. The major potential summer water quality problems for juvenile steelhead are high water temperature and low dissolved oxygen concentration. However, water temperatures and dissolved oxygen are not likely to be problems for steelhead if the lagoon fully converts to freshwater soon after sandbar closure and if kelp accumulations are removed. Appendix G

contains the raw data for water quality and aquatic plant growth in the lagoon and experimental enclosures, as well as aquatic invertebrate distribution and fish sampling. Water quality measurements included depth profiles of water temperature, dissolved oxygen and salinity. Water clarity was also measured. This lengthy appendix is available upon request from the City. Figure 2 indicates the water quality sampling sites.

In summer, dense algae and pondweed growth results in large daily variations in dissolved oxygen, due to the interplay of heavy plant respiration and heavy daytime oxygen production by photosynthesizing plants. However, the only occasional dissolved oxygen problems have been at the lagoon bottom and within portions of dense pondweed and algae in the downstream half of the lagoon. Even during persistent overcast periods, the lagoon water quality generally remains good from a fishery resource point of view. However, from a recreational point of view, there are persistently high levels of fecal bacteria from apparently nonhuman sources (birds primarily), which create a public health problem for swimmers and waders. Figures 1 and 2 of Appendix K graph bacterial counts by station and through time.

The first storms in fall rinse accumulated dirt, motor oils and other refuse from the paved areas, through the storm drains, and into the lagoon. A major input comes from the drain below Highway 1, which drains the 41st Avenue businesses and parking lots. Noble Gulch receives urban runoff as well as a storm drains entering the lagoon from either side of the Stockton Avenue Bridge, near the railroad trestle and at Nob Hill. In September 1989, urban runoff from an unusually early storm killed most of the invertebrates in the lagoon, downstream of Noble Gulch. This negatively affected fish populations.

Adopted Recommendations for Managing Water Quality for Aquatic Life

9. In early fall, the City Public Works Department shall use vacuum-type street sweepers to thoroughly clean paved surfaces, including public parking lots, in order to reduce the toxic and oxygen-demanding substances on streets draining to the lagoon.

This thorough cleaning shall be done a few days before the first storm of the fall season, which will probably occur sometime in September. For approval of all future permits, the City will include as part of the project approval that there be scheduled cleaning of parking lots to mitigate negative impacts of runoff into creeks.

10. The City shall initiate a Soquel Creek watershed analysis which results in solutions to minimizing water pollution from sources of bacteria, silt and petrochemicals (oil and grease) that enter the lagoon.

11. The City shall undertake a program (using volunteers) of labeling storm drains which drain to the creek/lagoon. Spray-painted warnings ("Dump no toxic materials. This storm drain enters **OUR** creek and lagoon.") may discourage dumping of motor oil and other refuse and increase public awareness of lagoon water quality problems. The City shall circulate information related storm drain stencils. (Example in Appendix K).

12. The City shall require the Zone 5 Flood Control District to enforce maintenance of silt and grease traps in storm drains that empty into Soquel Creek. Require the District to install silt and grease traps in all older storm drains lacking them (Table 3). The City shall require the District to annually monitor all silt and grease traps in storm drains that empty into Soquel Creek and Noble Gulch to confirm adequate maintenance. The City shall require responsible parties to perform maintenance on neglected traps, especially at the Highway 1 outfall. Condition any future storm drain development to include annual monitoring and cleaning of silt and grease traps. Require energy dissipaters at drain outlets as they enter the lagoon, thus preventing erosion.

E. Algae and Pondweed Control

How Things Work. Filamentous algae and rooted pondweed become quite abundant in the lagoon in late summer. Pondweed is the better competitor where the bottom is siltier, because of its

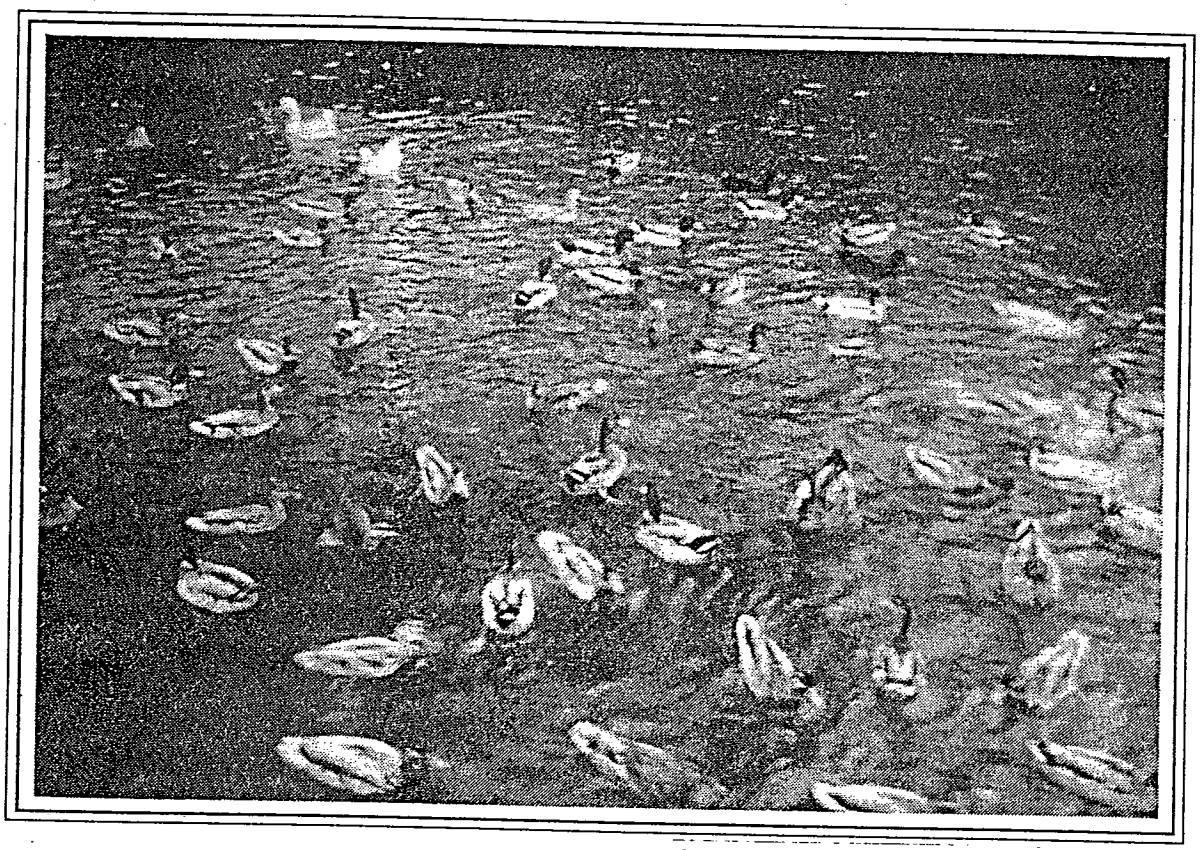
ability to take up nutrients from the substrate. Filamentous algae is more abundant in sandy portions of the lagoon or in years of extensive winter scouring. Nitrogen is usually not detected in lagoon waters, but nutrient availability in the lagoon (including from birds) is sufficient to support abundant plant growth. Conversion of the lagoon to fresh water, and the resultant improved mixing and cooler water temperatures, substantially retards the rate of algae and pondweed growth. In 1988-89, maximum growth of algae and pondweed was not achieved until August in the freshwater lagoon, but heavy algal growths did occur in saltwater-layer pockets by mid-June.

In September 1989, prior to the Begonia Festival, a single, low-dose treatment with Aquazine was used to reduce filamentous algae downstream of the Stockton Avenue bridge. No reduction in invertebrates was detected and no mortality or avoidance by fish was observed in the treatment area. However, normal onshore winds did spread the chemical upstream of the Stockton Avenue Bridge, and reduction in algae was detected at least half-way to the trestle. The low dose of Aquazine that was used did not reduce pondweed, and actually resulted in a compensatory increase in pondweed in the treated areas, 2 weeks after the algae was reduced. No effect was noted on adjacent vegetation near the trestle.

Aquazine is the least toxic herbicide that can be used to control filamentous algae growth in the lagoon and meets the requirements of the permit. Aquazine may impact plants that have roots extending into the lagoon, including trees within 50 feet of the bank if it accumulates in the lagoon-side soil. However, one annual application of Aquazine at low concentration in the area downstream of Stockton Avenue Bridge, where no riparian vegetation exists, will prevent damage to riparian vegetation. Monitoring will be carried out to confirm this judgment. If the City should desire to increase the number of Aquazine applications per year, more extensive bio-monitoring will be necessary than planned in order to detect any possible impacts.

In the summer of 1988, pondweed dominated the aquatic plant life of the lagoon. But in 1989, filamentous algae was generally more

abundant than pondweed. In both years, plant abundance was effectively controlled by the approximately 70-100 ducks in the lagoon in late summer. Browsing by ducks limited most aquatic vegetation to approximately one foot to sixteen inches below the surface. Pondweed was kept below this "neck reach" limit, but filamentous algae occasionally reached the surface, especially downstream of the Stockton Avenue Bridge, where pondweed was scarce, paddleboat activity was heaviest, aggressive geese were present, and wild ducks were least abundant.



Ducks feeding on pondweed and algae.

Ducks did not feed on algae once it formed surface mats. City employees periodically removed surface mats by using hand tools with good success. However, they could not effectively "harvest" sizable amounts of submerged algae except at the periphery because the lagoon was too deep. In the lagoon upstream of the bridge, cropping of algae by ducks kept vegetation from interfering with boating and also largely prevented the excessive plant growth, which could result in problems of aesthetics and water quality.

13. The City shall manually remove surface algal mats, primarily downstream of the Stockton Avenue Bridge, when they appear in late summer. Two maintenance personnel using a boat or rubber waders will be required. The frequency of algae removal will vary from year to year, depending on the level of algae production and the aesthetic judgment of the City. At most, the frequency would probably be twice a month for August and September.

14. If algae concentrations are deemed excessive by the City prior to the Begonia Festival, the City shall apply a single, low dose treatment of Aquazine (5 pounds for the area downstream of the bridge). The Aquazine shall be applied only downstream of the Stockton Avenue Bridge, approximately 7-10 days prior to the Festival.

15. The City recognizes native ducks as a valuable biological control on excessive lagoon vegetation, and will monitor their population status (numbers, reproductive success) annually for 5 years after the plan is enacted. Coastal Conservancy funding shall be requested. (Appendix L.).

16. The City shall remove domestic geese from the lagoon to allow the ducks, which feed more heavily on algae and pondweed, to make heavier use of the area downstream of the Stockton Avenue Bridge. Coastal Conservancy funding will be requested (Appendix L.).

F. Management of the Begonia Festival

How Things Work. One highlight of the Begonia Festival, which is held in early September, is the Nautical Parade of floats to the beach. The lagoon is slightly lowered, and the begonia-covered floats are pushed down the lagoon by people wearing rubber waders. This disturbance did not affect lagoon invertebrates in 1988 or 1989, but did break off portions of much of the pondweed through which the waders passed. After the festival, floating

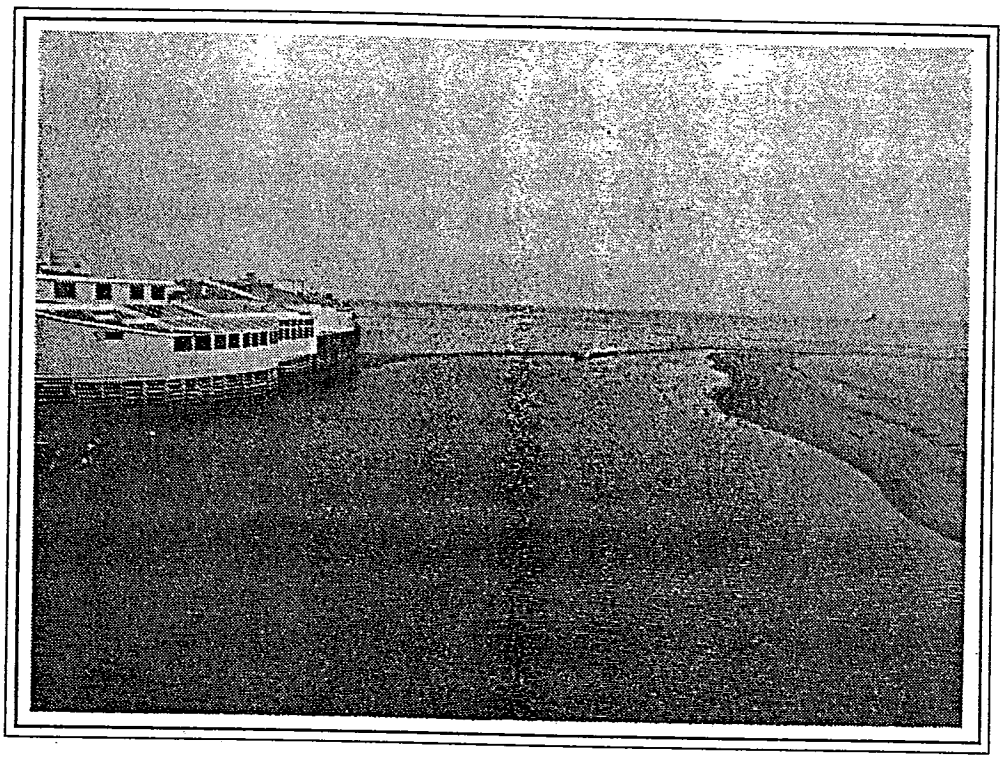
rafts of pondweed fragments and begonias covered a substantial portion of the lagoon. Filamentous algae began to grow within and beneath the pondweed rafts, and the algae, along with the rapidly decomposing begonias, resulted in an aesthetic and water quality (dissolved oxygen) problem for the lagoon. The onshore wind concentrated the rafts along the edges and upstream portions of the lagoon.

Adopted Recommendations for Managing the Begonia Festival

17. The City shall issue a permit to the organizers of the Begonia Festival that will stipulate the following: 1) allow only the partial dismantling floats in the lagoon to the extent needed to carefully remove floats from the water, 2) the remainder of the dismantling will be done away from the lagoon, 3) begonias at the dismantling site will be disposed of off-site, and 4) remaining pondweed fragments and begonias will be removed from the lagoon within 48 hours after the end of the Begonia Festival and disposed of off-site. The City Public Works Department shall insure that these steps are taken to prevent water quality problems in the lagoon.

G. Fall Breaching of The Sandbar

How Things Work. Historically, the City has artificially breached the sandbar after the Begonia Festival. However, early breaching eliminates most steelhead rearing habitat and possibly kills many juvenile steelhead by flushing them into the bay before they are ready to adapt to salt water. The one to three months between the Festival and the first heavy rains provide additional time for juvenile steelhead to grow, increasing their likelihood of ocean survival. The CDFG requires maximum delay of artificial sandbar breaching, this being consistent with flood control.



The winter estuary.

Small storms in early fall usually do not produce much sustained runoff. Although the lagoon level may rise slightly (up to one foot) with the inflow of urban runoff, the rise can be of short duration if some flashboards are removed to increase culvert capacity. If artificial breaching is done before early, small storms, the sandbar usually reforms quickly. Lagoon fish mortality is high as steelhead are flushed out into high salinity water without adequate freshwater to dilute the ocean water long enough to allow fish acclimation. Water quality in the reformed lagoon is normally poor, due to salt water layering.

As an alternative to premature sandbar breaching, the beach can be notched and a number of flashboards can be removed from the culvert so that larger, later storms and lagoon inflows will breach the sandbar prior to any flooding around the lagoon. The notch (trench) would run the full width of the sandbar (lagoon to ocean) to focus water once the lagoon reaches the trench's level. Then down-cutting of the beach is rapid, and potential flooding is alleviated. The lagoon elevations associated with flood

prevention have been surveyed and marked at various locations around the lagoon. A line has been painted on the Shadowbrook Restaurant bulkhead, and a large bolt has been screwed into a piling at the beach on the east side at the elevation that the sandbar notch will initiate breaching. This notching successfully initiated breaching in 1989 without flooding. By postponing the breaching until later in the fall, once the breaching occurs, there is sufficient flow in the creek to send a plume of freshwater into the bay to allow lagoon fish to slowly acclimate to the salinity change and keep the sandbar open.

Adopted Recommendations for Fall Breaching of the Sandbar

18. The City shall remove several flashboards (approximately 8-10 inches in height) prior to the approach of the first storms in fall in order to lower the lagoon water level and to increase outflow capacity of the culvert. This will delay the need for sandbar breaching until the arrival of larger winter storms and runoff capable of keeping the lagoon open, thus mimicking or even enhancing natural conditions and reducing maintenance.

19a. Public Works shall notch the sandbar in fall on the west side of the outlet culvert at the pre-determined elevation that prevents flooding (approximately 1.77 feet = 21 inches above the top of the upstream end of the culvert). A bolt has been attached at that elevation to a piling adjacent to the restaurants. Until bank erosion occurs adjacent to the property with the greatest flooding potential, this elevation will allow 1.3 feet of free board to the top of the berm that presently prevents flooding. By notching the sandbar, runoff from a larger, late fall storm will breach the sandbar prior to flooding with little additional effort needed to artificially breach the bar during the storm. The City shall notify the monitoring group before any anticipated emergency breaching and/or facilitated natural breaching.

19b. The City shall post warning signs to instruct the public to avoid the trench and surrounding beach when sandbar breaching appears imminent.

VI. ADDITIONAL ADOPTED RECOMMENDATIONS FOR ENHANCEMENT

A. Domestic Waterfowl Control

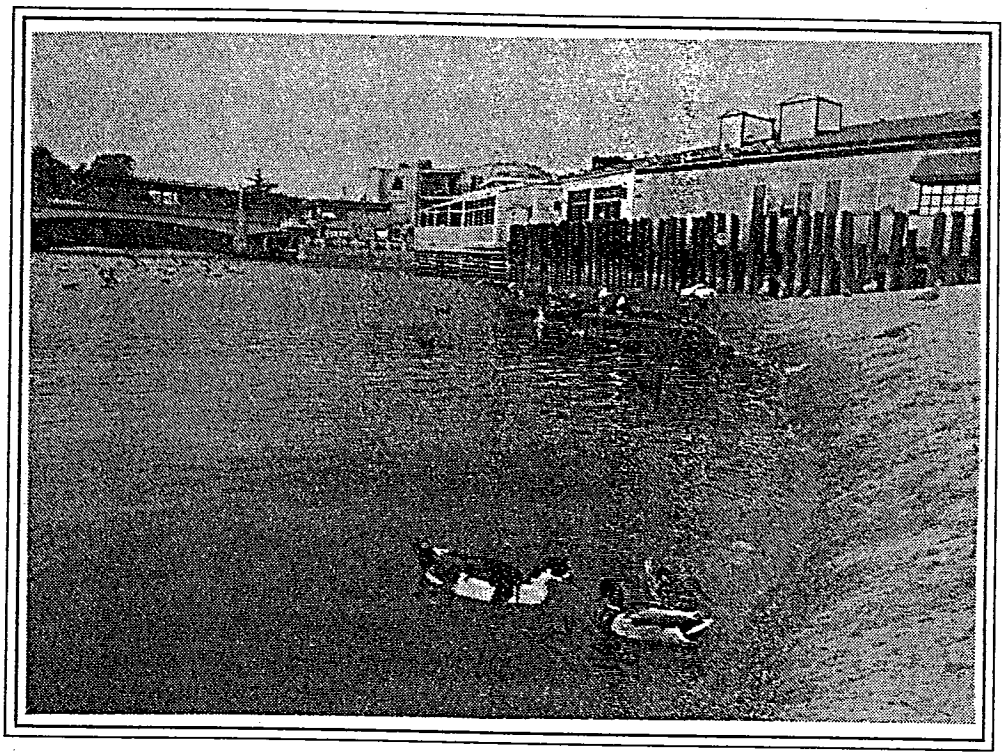
An in-depth discussion of wildlife management and enhancement is contained in Appendix H. Figures 1-6 of that Appendix show the observed quadrats within the lagoon and the distribution of bird species. That discussion will be summarized here and followed with enhancement recommendations.

How Things Work. The domestic geese and feral ducks are unnatural, introduced members of the Soquel Lagoon fauna, and are primarily dependent upon human food sources. These geese and ducks represent a potential threat to the lagoon's wildlife, as they may carry pathogens that could affect the health of wild birds, and they can potentially interbreed with wild ducks. The geese present a further problem for the wild Mallards and other waterbirds that currently use the lagoon. Domestic geese are aggressive and may attack other waterbirds, thus hindering their use of the lower lagoon.

Analyses indicated that birds contribute substantially to the elevated fecal bacterial counts in summer. The continual abandonment of ducks and geese at the lagoon will reduce the effectiveness of efforts to reduce bacterial levels and the public health hazard. Waterfowl are popular gifts at Easter in some circles. Many of these pets are abandoned at local lakes and lagoons where they magnify public health problems.

The offering of handouts to wild birds is detrimental to their health. Most of the foods that are offered are nutritionally poor. Higher densities of domestic waterfowl and rock doves probably congregate at the lagoon because of the added food supply provided by bird-feeding. The domestic geese and feral ducks depend heavily on handouts. Wild Mallards take advantage of the easily available food offered by handouts, but they also feed extensively on natural foods. An in-depth discussion of bird activity and human bird-feeding activities is contained in Appendix I. Restaurant customers were a major source of handouts. Restaurant workers commonly feed waterfowl, with geese

commonly congregating at the back doors of restaurants, waiting for handouts. Restaurant decks are hosed off into the lagoon.



Duck's eye view of the Esplanade.

Adopted Recommendations for Waterfowl Control

20. The City shall cull or relocate feral ducks (and domestic geese as previously recommended). Options include providing opportunities for private adoption, relocation to farm ponds or quarry ponds in the area, and donation as food to programs that propagate rare and endangered birds. Coastal Conservancy funding shall be requested (Appendix L.). The City shall adopt an ordinance to prohibit future abandonment of ducks and geese to the lagoon.

21. The City shall adopt an ordinance to prohibit the sale of ducks and geese in Capitola pet shops and feed stores, and shall exert pressure on surrounding cities to pass similar legislation.

22. The City shall attempt to reduce bird-feeding at the lagoon with educational signs, warning signs and adoption of an ordinance (examples in Appendix K). Coastal Conservancy funding

shall be requested. (Appendix L.). Examples of a sign and ordinance are in Appendix K.

23. The City shall require that the restaurants adjacent to the lagoon adopt a "no bird-feeding policy" on their menus and signs on their decks to that effect.

24. The City shall require that the restaurants adjacent to the lagoon properly dispose of food scraps from decks.

25. The City shall develop and implement a 5-year monitoring program of bird-feeding, bird numbers and bird composition to evaluate the success of management efforts. (The methodology has been developed by the Habitat Restoration Group). The City shall evaluate the success of the program to discourage bird-feeding after the signs have been in place for one full season of sandbar closure. The program will be modified as needed to improve success. Coastal Conservancy funding will be requested for this program (Appendix L.).

B. Management and Revegetation of Riparian Habitat for Fish and Wildlife Enhancement

How Things Work. The riparian (creek side) plant community that grows along Soquel Creek/Lagoon should be maintained. Riparian plant species that live in parks, backyards, and behind businesses should be protected. Appendix E contains a detailed discussion of the high value of riparian forests for wildlife. The many wildlife species that inhabit the vegetation along the lagoon and upstream rely on it for cover and nesting sites, as well as habitat for the insects that are fed upon. Overhanging vegetation provides cover for fish so that they can avoid predation. Riparian trees provide shade to help maintain cooler water temperatures. Requirements for maintenance of riparian habitat is contained in the City's Local Coastal Plan. Non-native plant species generally provide less productive resources for wildlife than native species. However, non-native riparian vegetation is better than no vegetation at all. Therefore, eradication of non-natives should be immediately followed by revegetation with native species. An in-depth discussion of maintenance of riparian vegetation is contained in Appendix J.

Dead tree snags are used extensively by wildlife and are scarce at Soquel Creek Lagoon. Nest boxes and nest shelves provide nest sites for cavity-nesting birds and den-sites for small mammals. Nest sites are in short supply at Soquel Creek Lagoon. Placement of nest boxes would enhance habitat for swallows, chickadees, titmice, wrens, woodpeckers and finches. Mice and bats may also use the boxes. Night lighting disrupts the behavior of species that are active at night (nocturnal).

Extensive boating and swimming disrupt wildlife use of the lagoon. The upper lagoon above the Shadowbrook Restaurant, where wildlife habitat is best, should be left undisturbed as much as possible in order to maximize its wildlife value. Foot traffic through the riparian forest destroys valuable understory species used by birds for cover and food resources. Regarding trail design, stairs are preferable to switch backs in steep areas. Illegal fishing is encouraged when access to the stream is improved. Lower Soquel Creek has few undisturbed stretches of

streamside vegetation remaining, though a significant and locally unique native riparian forest exists on the Rispin Mansion side of the creek upstream of the lagoon.

Adopted Recommendations for Protection and Enhancement of the Riparian Habitat for Fish and Wildlife

26. Upon completion of an environmental impact report regarding the development of the Rispin Mansion and associated trail system, the City shall implement a non-native plant eradication program in the open space north of the Rispin Mansion. The City shall eradicate non-native riparian vegetation on City property along the lagoon and upstream of the lagoon to Highway 1 (except for the eucalyptus groves used by the monarch butterflies in the vicinity of the Rispin Mansion) and revegetate with native species during the earliest, appropriate growing season. Recommended revegetation sites are listed in Table 2 and designated on Figure 1. The City shall encourage private property owners to allow the City to revegetate on their property as well. Refer to Appendix L for budgetary details.

27a. The City shall discourage pruning of trees bordering the creek and lagoon so that branches overhang the water as is consistent with the Local Coastal Plan (LCP).

27b. The City shall minimize excavation or construction that impede or destroy the growth of riparian vegetation as is consistent with the LCP, such as on the Rispin Mansion property.

27c. The City shall educate the creek/lagoon-side residents about the value of riparian vegetation and encourage them to preserve and enhance it. Residents will be encouraged to remove non-native vegetation on private property with subsequent landscaping, using only native plants.

27d. The City shall prohibit the dumping of garden debris onto the banks of the creek/lagoon and along Noble Gulch.

28. Regarding the planned foot bridge that would connect Peery Park and the Rispin Mansion, the City will develop a plan to

minimize impacts and access to the surrounding cottonwood-willow riparian forest with the bridge's and associated trails' design, placement and construction Minimize the opportunity for illegal fishing from the bridge as well.

29. Regarding the proposed loop trail that would head upstream from Peery Park to a crossing near Highway 1 and back to the Rispin Mansion, the City shall develop a plan to minimize the impact of human traffic to wildlife and vegetation adjacent to the trail. To minimize the impact, the City shall do the following:

29a. Establish signs along the trail which explain the value of the riparian forest and discourage leaving the trail.

29b. Position the trail on the Peery Park side such that off-trail traffic through the riparian forest is minimized. On the Rispin Mansion side of the creek, position the trail such that impacts to the valuable cottonwood-willow forest is minimized.

29c. Position the trail leading down to the upstream foot bridge near Highway 1 such that impact to native vegetation is minimized.

29d. Make the trail unpaved and avoid removal of native trees. Stairs are preferable to switch-backs in steep sections.
e. Place any picnic tables in areas where impacts to wildlife and vegetation will be minimized.

30. The City shall publish a pamphlet for lagoon/creek residents that describes the non-native vegetation, reasons for its removal, methods for eradication, and recommendations for revegetation. The pamphlet will list the non-native and appropriate native plant species that are appropriate for Soquel Creek, as well as a short description of propagation and long-term maintenance. Suggestions for enhancement of wildlife habitat will be provided. Coastal Conservancy funding will be requested (Appendix L.).

31. The City shall preserve tree snags on public property when they do not create a hazard for residential units.

32. The City shall encourage residents to allow it to install nest boxes on private property. Install nest boxes on City property. Coastal Conservancy funding will be requested (Appendix L.).

33. The City shall restrict night lighting, and direct public lights away from the lagoon and riparian habitat. Residents shall be encourage residents to do the same.

34. The City shall insure that signs are posted that restrict pedal boats/rental boats to the lagoon downstream of the upstream extent of the Shadowbrook Restaurant. If coliform bacterial counts reach safe levels, the City shall post signs that restrict public swimming to the lower lagoon, downstream of Stockton Avenue Bridge.

C. Protection of Monarch Butterfly Habitat

How Things Work. A valuable grove of eucalyptus is present downstream and adjacent to the Rispin Mansion that is used by monarch butterflies as an overwintering site. Monarchs require special microclimates that contain the proper protection from wind with the appropriate air temperature and humidity, which this grove possesses. The redwoods nearby may aid in producing this microclimate.

Adopted Recommendations for Protection of Valuable Groves of Trees

35. The City shall manage the eucalyptus/monarch grove and adjacent redwood grove near the Rispin Mansion for the control of non-native vegetation (other than the eucalyptus trees) to prevent the spread of undesirable, invasive vegetation. The County shall be encouraged to limit or avoid tree-cutting for the planned storm drain.

D. Improvement of Water Quality for Recreational Use

How Things Work. Recommendations have been designed to reduce coliform bacteria sufficiently to permit swimming in the lagoon. The goal is to reduce fecal coliform counts below the 200/100 ml level, which is deemed a hazard to health by the EPA. However, there is no guarantee that these measures will be successful. Some measures listed elsewhere may also reduce bacterial counts, particularly those related to waterfowl control.

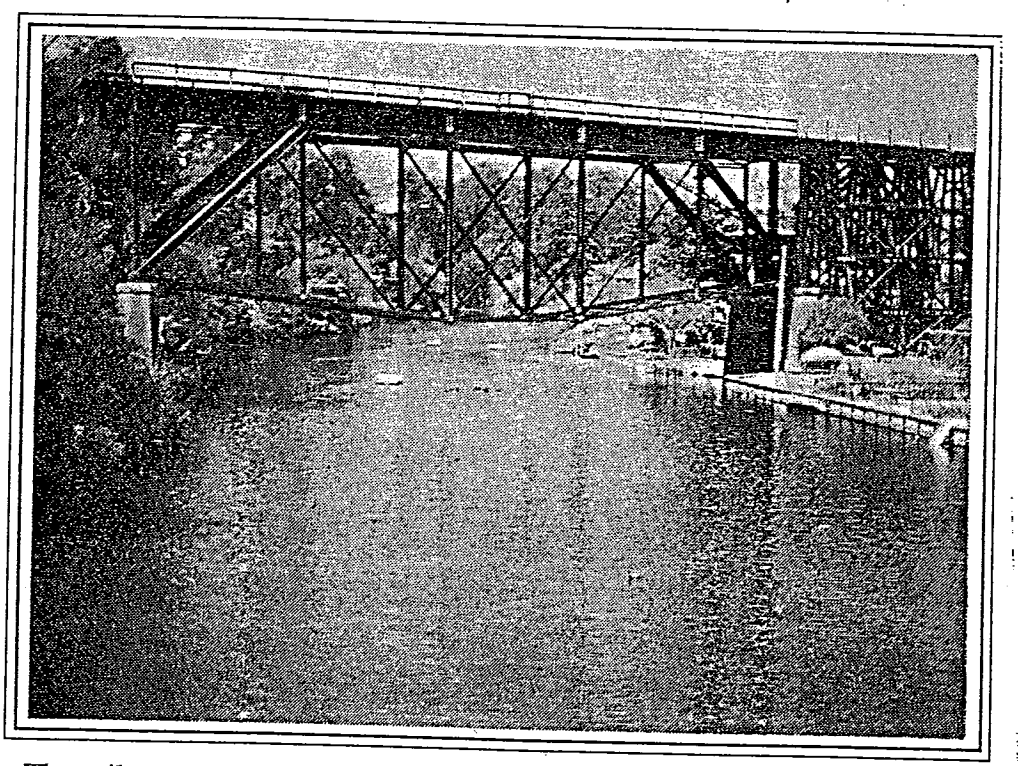
Several courses of action may be required to accomplish this reduction in fecal bacterial counts. An in-depth discussion of the sources of fecal bacteria and levels measured in the lagoon is contained in Appendix K.

Both the sources of bacteria and the material that they decompose require reduction. Major sources of coliform and streptococcus bacteria include human and nonhuman excrement. The coliform/streptococcus ratio in samples taken by the County Health Department and the City at various stations in the summer lagoon indicate that the source is nonhuman excrement. The highest coliform counts were found from Noble Gulch downstream, with much higher counts near the culvert, which correlates with the activity of waterbirds/waterfowl. The obvious source of nonhuman excrement to the lagoon in summer is the birds.

Any food that enters the lagoon is decomposed by these bacteria if not eaten by animals. Dead plant material, such as dead kelp or dead algae that settles on the bottom, is decomposed by these bacteria. Coliform bacteria are not considered a health hazard in themselves, but are used as an indicator of pathogens in the water. Bird excrement, which is a major source of these bacteria, is known to contain pathogens that cause human illness. Coliform bacteria also naturally occur in the environment, particularly in the ooze on the lagoon bottom. In locations where the bottom ooze becomes stirred up into the water column, water samples taken for fecal bacterial counts may not be good indicators of pathogens. In an effort to permit swimming, the amount of material that settles into the bottom ooze must be reduced, whether it is animal feces or other decomposing

material. To improve water quality, the sources of animal feces (birds) and dead plant material (kelp and algae) must be reduced. Most actions would be aimed at reducing domestic geese, rock doves (pigeons) and feral ducks which currently use the lagoon.

Elimination of popular roosting sites in the vicinity of the lagoon may reduce numbers of rock doves at the lagoon if human feeding is curtailed. Pigeons commonly roost on the railroad trestle over the lagoon and fly between there and the handout areas. Therefore, excrement input to the lagoon is maximized from this roost site. A large number of pigeons roost and nest at the Capitola Wharf. However, if they were restricted from using the Wharf, they would find other areas to live and would still travel to the lagoon as long as there was a good food source in the form of handouts.



The railroad trestle upstream of the Stockton Avenue bridge.

High bacterial counts in the water entering the lagoon from Noble Gulch have been recorded during previous monitoring. Discharge of domestic wastewater is a possible source of these high bacterial counts. Flows in Noble Gulch appeared to increase on some weekends and the Monday after. There have been previous

discharges of human wastewater into Noble Gulch, but they have been eliminated and bacterial counts do not indicate wastewater input at present. Another source may be feral ducks living in ponded areas on Noble Gulch in the uppermost mobile home park.

The lagoon is a sink for organic pollution of surface runoff in the watershed. Periodic sewage spills occur into Soquel Creek from the Soquel area along Wharf Road, north of Highway 1 (pers. obs.). Although very few, if any, of the bacteria that would be present in such sewage reach the lagoon in summer, these spills add nutrients to the lagoon to encourage algae and fecal bacterial growth. Garbage and other biodegradable residues that enter the lagoon are decomposed by bacteria which raise the coliform bacterial counts above the acceptable level for swimming. Dog and cat excrement, if disposed of improperly may increase the fecal bacterial count in localized areas sufficiently to contaminate Health Department water samples.

Measures suggested here may not successfully reduce fecal bacteria in the lagoon sufficiently to meet health standards for swimming because gulls are the most common birds of the lagoon, and cannot be legally removed (CDFG regulations) and probably cannot be harassed away from the lagoon to any significant degree. In the meantime, the high coliform bacterial counts indicate a chronic public health hazard, and swimming and wading should not be allowed in the lagoon until this problem is remedied. In the past, the signs that have been posted at the request of the County Health Department have been subject to vandalism and frequent removal. At times the notification to the public of the hazard has been sporadic. Conspicuous, durable signs are needed to insure public awareness and safety.

Adopted Recommendations to Reduce Fecal Bacterial Counts for Body-Contact Recreation in the Lagoon

36. The City shall prepare a design plan to be submitted to Southern Pacific Railroad for enclosure of the trestle. After permission is granted, fund the construction of the enclosure to discourage nesting and roosting of rock doves (pigeons).

37. The City shall request that the Environmental Health Department continue to monitor bacterial counts in Soquel Lagoon, Soquel Creek, Noble Gulch and surrounding areas to identify any sources of bacterial contamination. Then control measures will be implemented.

38. The City shall educate the proprietor and tenants of the Brookvale Terrace mobile home park on Noble Gulch so that they will allow the City to remove feral ducks and discourage feeding of ducks at the park.

39. The City shall encourage the County Sanitation District to move sewer lines that could potentially leak sewage, where possible, away from Noble Gulch.

40. The City shall encourage the County Sanitation District to seriously re-evaluate the sewer line capacities in the town of Soquel along Wharf Road to minimize the potential for periodic sewage spills in Soquel Creek.

41. The City shall encourage the reduction of inputs of dog and cat excrement into the lagoon by the following means:

41a. Require that people who walk dogs to clean up excrement in parks and on paths and trails that are adjacent to the lagoon. Post signs to that effect. Seek Coastal Conservancy funding.

41b. Educate the residents who live around the lagoon of the importance of properly disposing of pet excrement.

42. Pending reduction of bacterial counts to safe levels, the City shall mount durable signs around the periphery of the lagoon, warning people not to swim or wade in the lagoon.

E. Improvement of Lagoon Aesthetics

How Things Work. Considerable kelp is deposited within and adjacent to the creek channel after high tides. This kelp begins to decompose and smell during warm weather. Unless

removed, it adds to the decaying matter in the lagoon after sandbar closure.

Gulls use the rooftops of restaurants along the Esplanade for roosting. Their fecal wastes on the roofs and surrounding structures and grounds may detract from the aesthetics of the lagoon, by some people's standards. Other people enjoy seeing gulls on the roofs and ignore the excrement. Circulation of a questionnaire may give the City guidance on aesthetic enhancement. A copy of our preliminary questionnaire and some results from limited distribution are contained in Figures 4 and 5. These results are preliminary, limited and should not be used to make management decisions. However, it may prove informative to circulate this, or something similar, to residents throughout the City. Results from a limited sample of respondents to our questionnaire indicated that, of those polled (primarily lagoon-side residents, restaurant managers, recreational users of the beach and lagoon, and Santa Cruz Bird Club members), half felt that algae and pondweed had no impact on recreation, more than half felt that either algae and pondweed had no impact on the lagoon's beauty or actually added to its beauty, and 3/4 felt that lagoon management should focus primarily on preservation rather than recreation.

Control of domestic geese has been discussed as part of wildlife enhancement. Their removal will also add to the aesthetic appearance of the paved walkways around the lagoon area. Fecal wastes are presently common on sidewalks. Removal of kelp from the lagoon waters before sandbar closure has been mentioned in the fishery management section. This, too will improve aesthetics by reducing foul odors of decaying plant material. Manual removal of surface filamentous algae during summer and application of Aquazine before the Begonia Festival will improve lagoon aesthetics in the opinion of some. Clean up after the Begonia Festival will also improve the appearance of the lagoon.

Adopted Recommendations to Improve Aesthetics

43. The City shall remove beached kelp from the sandy margins of

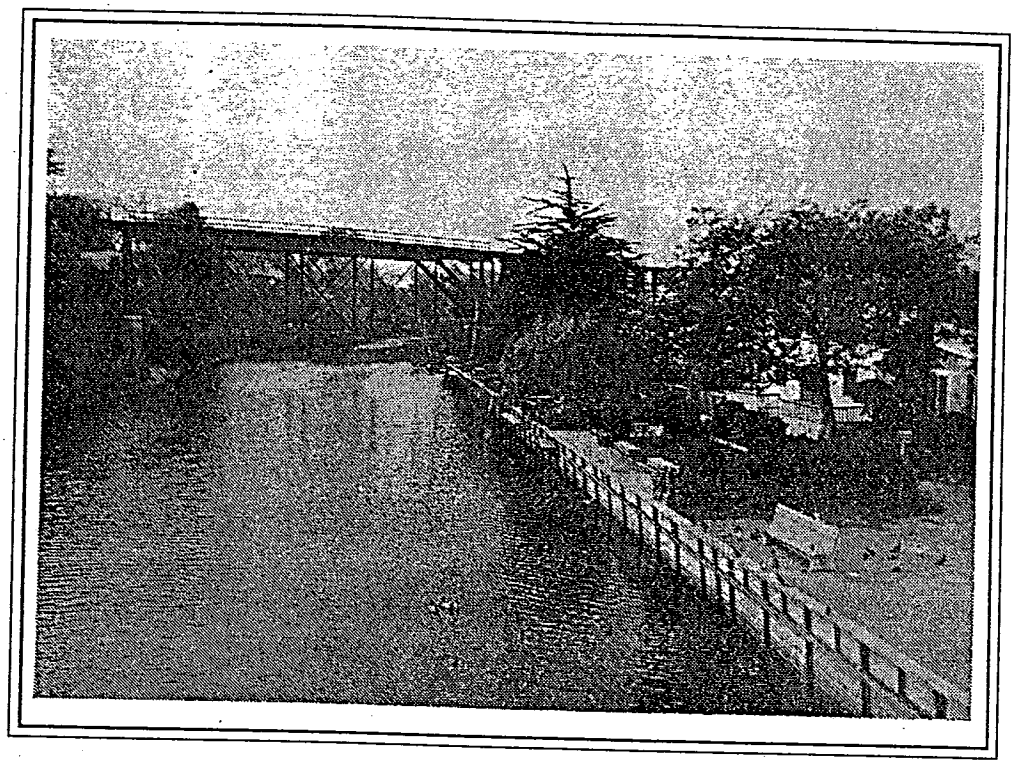
the creek during the winter when the sandbar is open.

44. The City shall request property owners to discourage gull use of the Esplanade rooftops by installing closely-spaced, fine wires over the rooftops.

F. Enhancement of the Educational Potential of the Lagoon and Riparian Forest Upstream.

How Things Work. The success of any management and enhancement plan depends on the cooperation of the community to follow the guidelines of the plan. The best way to gain cooperation is to inform and educate the community with regard to the reasoning behind the guidelines. As evidenced by the responses to a preliminary questionnaire (Figure 4), there is a lack of understanding about the kinds of organisms that use the lagoon and the negative impacts of bird-feeding. Once people realize the cause and effect relationships and learn more about the rich diversity of living things supported by the lagoon and creek, they may be more cooperative. Young people are often a source of vandalism and poaching, thus making their education about lagoon values very important. The lagoon may be used by teachers for field trips where students may observe wildlife and vegetation, as well as collect data and aquatic samples to be analyzed in the laboratory.

Results from the questionnaire are contained in Figures 4 and 5. Of the 119 respondents, more than 3/4 felt that some kind of bird control method was necessary, albeit most preferred educational signs, with 1/3 supporting bird removal. Circulation of the preliminary questionnaire or something similar throughout the City would be educational, and the responses would be informative. Only 11 % of the respondents desired swimming as a future recreational use of the lagoon. Before any bird-removal programs, significant educational efforts must be implemented.



Park at Stockton Avenue bridge with flood control bulkhead.

Adopted Recommendations for Enhancement of Recreation and Education

45. The City shall establish educational signs and an interpretive display. Coastal Conservancy funding will be requested (Appendix L.). The following suggestions shall be considered:

45a. Interpretive signs will educate the public about the plants and animals of Soquel Creek and Lagoon.

45b. Educational panels will show seasonal changes which feature the plants and animals of Soquel Creek/Lagoon. They should be displayed around the lagoon and in public buildings. Locations for signs/panels are mapped on Figure 3.

46. Upon completion of the Rispin Mansion environmental impact report, the City shall establish self-guided nature trails. Suggested areas are listed below:

a. A nature trail in the vicinity of the Rispin Mansion (not in the Rispin open space) could be located in the upper bank area, within the eucalyptus/monarch grove, and through the redwood grove, thus limiting the impact to the streamside vegetation.

b. The proposed loop trail could be developed into a self-guided, interpretive trail.

47. The City shall provide teachers in local elementary and middle schools with lesson plans which can be used on field trips to the lagoon. Coastal Conservancy funding shall be requested (Appendix L.). The following topics will be covered:

a. Sources of water pollution to the lagoon, including storm drain runoff and the relationship between bird-feeding and water pollution.

b. Ecological relationships between lagoon organisms.

c. A description of fish, wildlife and plants that use the lagoon, including their appearances and habitat needs.

48. The City shall use a portion of the Rispin Mansion as a natural history facility with educational displays and exhibits that explain the environmental value of the lagoon and the threats to its well-being.

49. The City shall develop and circulate a questionnaire to residents which educates, and indicates community opinions regarding lagoon aesthetics and enhancement. Coastal Conservancy funding will be requested (Appendix L.).

50. Organize volunteers, possibly called "Friends of Soquel Creek Watershed and Lagoon," to assist with enhancement.

G. Monitoring of the Plan's Effectiveness

How Things Works. The California Environmental Quality Act requires that management of the sandbar does not cause negative

impacts to the environment. Monitoring is now required to confirm that the Management and Enhancement Plan prevents environmental damage. Water quality for aquatic organisms requires monitoring. The abundance of wild birds that use the lagoon requires monitoring.

The Plan should be a living document that can be modified if recommendations prove to be ineffectual or unnecessary. The Plan may require future expansion due to unforeseen factors. The success of the waterfowl removal activity and the no bird-feeding policy need to be evaluated. Bacterial levels in the lagoon and their sources should be evaluated after the Plan is in place. The maintenance of the storm drains requires evaluation. Community satisfaction with enhancement should be measured.

Adopted Recommendation

51. The City shall develop and initiate a 5-year monitoring program with an annual report completed by the end of each calendar year to determine the level of success attained by the Management and Enhancement Plan. Coastal Conservancy funding will be requested (Appendix L.). The following aspects of the Plan will be monitored and evaluated:

a. Water quality for aquatic organisms.

b. Fecal bacterial counts in the lagoon that will be obtained from the County.

c. Sandbar construction and breaching.

d. Public cooperation with the no bird-feeding policy and health of the native waterbird population.

e. Questionnaire developed and circulated to evaluate public satisfaction with the Plan.

H. Long-term Management and Enhancement

Adopted Recommendation

52. After City Council approval of the final lagoon management and enhancement plan, the City shall request a 5-year permit from the Coastal Commission and an annual 1603 permit from the Department of Fish and Game to construct the sandbar in spring and artificially encourage the natural breaching of the sandbar in late fall after creek baseflow has increased due to the rainy season. The City shall comply with all of the requirements under these permits.

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Table 1. Measures to Reduce Bird Use of Soquel Creek Lagoon

Species or Type of Bird	Direct Limitation of Bird Numbers By Removal From Soquel Lagoon			Alter Habitat or Food Resources		Disturb or Disrupt Activities		
	Cull	Relocate	Limit Reproduction	Depress Aquatic Plant Growth*	Stop Handout Feeding	Sound	Physical or Chemical Devices	Harassment
Gulls	Not a possible option	Not a possible option	Not a possible option	No effect	Moderate effect on distribution at lagoon; minor effect on numbers using the lagoon	Temporary effect, and not suitable for site	Difficult to implement, with limited potential effectiveness	Temporary effect, and difficult to implement
Domestic Geese and Feral Ducks	Can remove entire population	Possible, but difficult to implement	Possible, but with very limited effect on numbers at the lagoon	Limited effect; primarily would affect feral ducks	Major effect on the site's suitability for these types of birds	Temporary effect, and not suitable for site	Impractical for site	Temporary effect, and difficult to implement
Rock Doves (Pigeons)	Possible, but would not result in net reduction in numbers at the site	Difficult to implement, no net effect on numbers at site	Not possible at site; possible (but difficult to implement) at adjacent areas; probably no net effect on numbers at the site	No effect	Moderate effect on distribution and numbers at site	Temporary effect, and not suitable for site	Could limit use of trestle if bottom and sides are fenced; limited effect on numbers at site	Temporary effect, and difficult to implement
Wild Mallards And American Coots	Not a possible option for Mallards; very unlikely to be a possible option for coots	Difficult to implemnt; temporary effect	Possible for Mallards, but very limited net change in numbers at site; not a possible option for coots	Possibly a major effect on numbers and distribution of both species at the site	Moderate effect on distribution at site; minor effect on numbers at site; would primarily affect Mallards	Temporary effect, and not suitable for site	Not possible for coots; impractical for Mallards	Temporary effect, and difficult to implement

* Reductions in aquatic plant growth would negatively impact fishery resources.

TABLE 2. SOQUEL LAGOON REVEGETATION SITES (Mapped on Figure 1.)

SITE NUMBER	TASK	REVEGETATION
1*	eradicate pampas grass	natural revegetation
2	remove French broom	natural revegetation
3*	eradicate pampas grass	natural revegetation
4	eradicate giant reed	plant willow
5	remove pampas grass	plant willow
6	remove eucalyptus trees	plant coast live oak, buckeye, elderberry, coffeeberry, blackberry
7	remove acacia	natural revegetation
8	remove French broom	natural revegetation
9	remove acacia	natural revegetation
10	remove acacia	natural revegetation
11*	remove cherry, acacia, pampas grass, and French broom	plant black cottonwood, coast live oak, blackberry, gooseberry, and current
12*	remove German ivy, giant reed, pampas grass, periwinkle, acacia, and French broom	plant red alder, black cottonwood, and willow
13	remove acacia	natural revegetation
14	remove eucalyptus	plant black cottonwood

* indicates sites with more than one mapped non-native plant species

Maintenance and monitoring of the revegetation sites should be conducted for 3 years after installation. Truck watering would be the easiest and most cost effective method. The vegetation should be maintained from April through October, unless the spring and fall seasons are particularly wet. The plants should be watered once per week for the first year (32 days), once every 2 weeks the second year (16 days), and once every three weeks the final year (10 days).

TABLE 3. STORM DRAINS THAT REQUIRE SILT AND GREASE TRAPS.

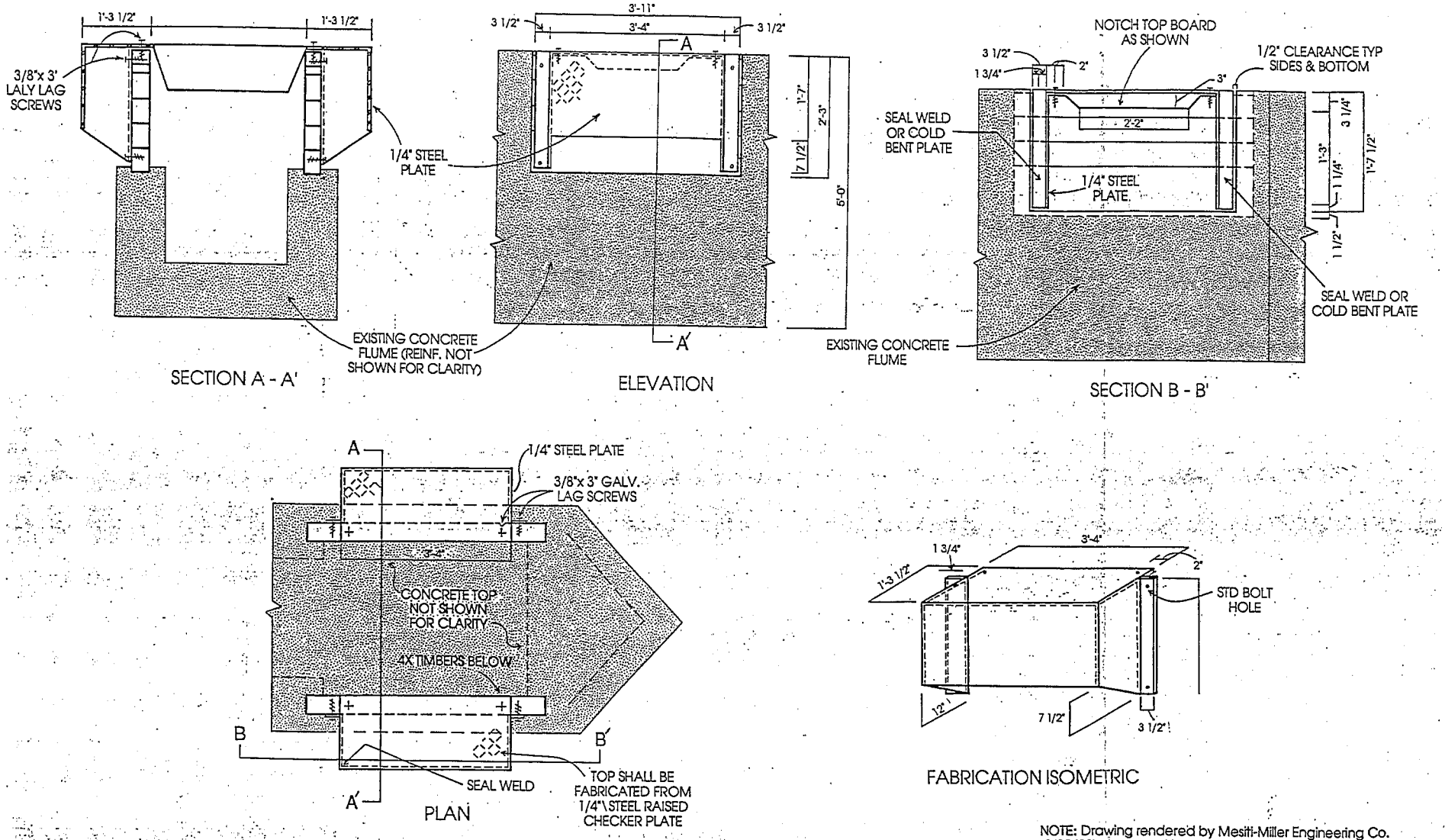
It has been determined that the storm drains emptying directly into Soquel Creek/Lagoon and Noble Gulch in the City of Capitola are not equipped with silt and grease traps. In an effort to assess the cost of installing such traps, the following list of storm drains has been compiled.

Storm drains to be modified that empty into Soquel Creek/Lagoon:

Location	Bank	Diameter (inches)	Type
Downstream of Highway 1	East	27	RCP
Near Grace Street	West	18	RCP
End of Blue Gum Ave.	East	72	CMP
Off Prospect Ave.	West	12	CMP
Upstream of SPRR Trestle	East	24	RCP
Off Cliff Drive	West	12	CMP
Off Cliff Drive	East	8	RCP

Storm drains to be modified that empty into Noble Gulch

NE corner Park & Monterey	East	12	CMP
Monterey and Bay	East	24	CMP
Monterey and Bay	West	?	?
At Carl Lane	West	12	RCP
At Alma Lane	West	12	RCP
Junipero & Monterey	East	18	CMP
400' upstream of previous	West	18	CMP



NOTE: Drawing rendered by Mesiti-Miller Engineering Co. (9/23/88). Approved by Ted Vande Sande (CDFG) 10/4/88.

The Habitat Restoration Group
JOHN STANLEY & ASSOCIATES
6001 Butler Lane, Suite 1 • Scotts Valley, CA 95066 • (408) 439-5500 FAX (408) 438-1142

Figure 6. CULVERT FISH GATE

SCALE: 9/16" = 1'-0"

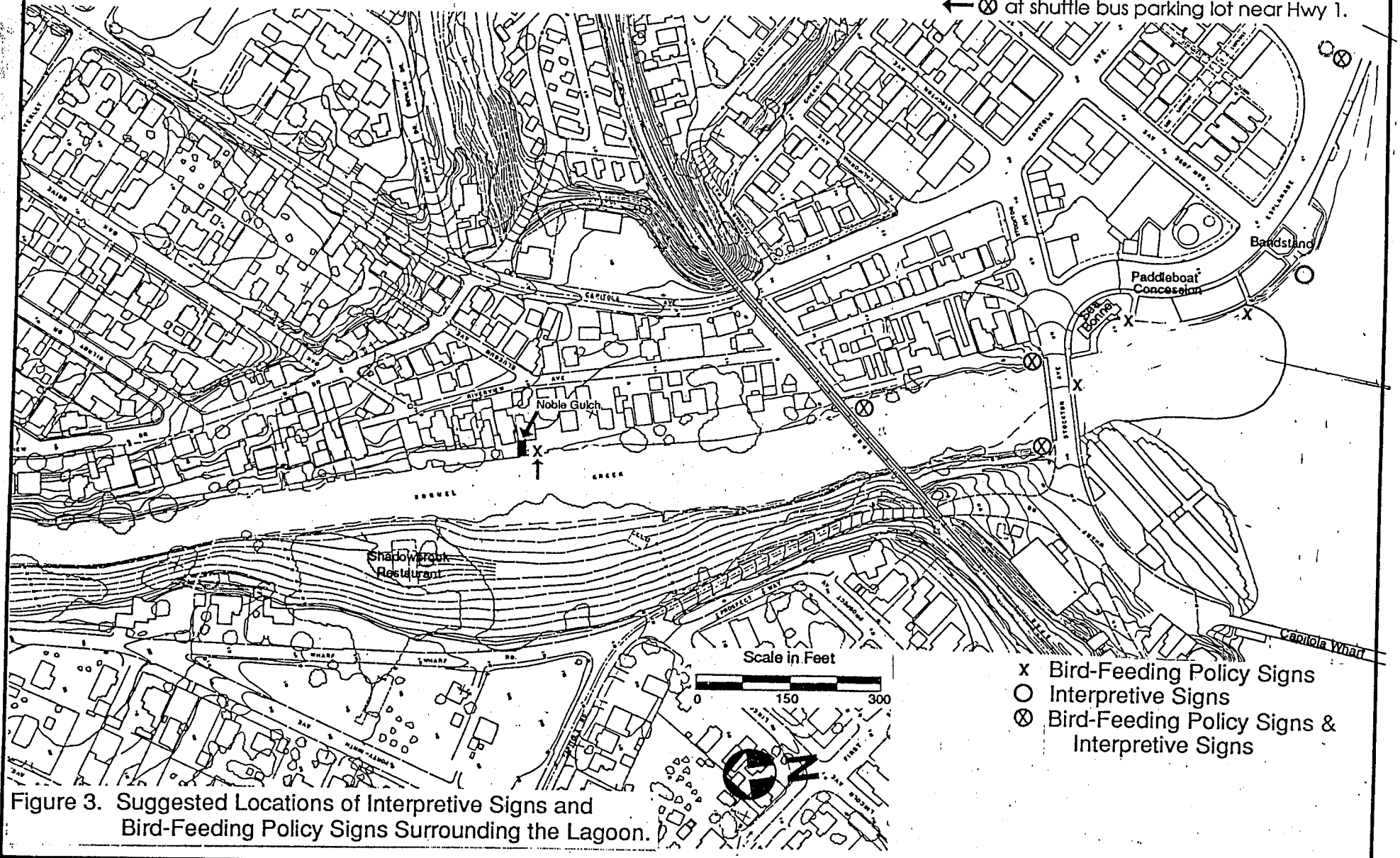


Figure 3. Suggested Locations of Interpretive Signs and Bird-Feeding Policy Signs Surrounding the Lagoon.

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SOQUEL LAGOON
Management & Enhancement Plan

May 1990
424-01

Figure 4. Lagoon management and enhancement questionnaire.

HOW SHOULD WE MANAGE SOQUEL LAGOON

check appropriate boxes:
() lagoon-front home owner
() Capitola Village business owner/manager
() Santa Cruz County resident
() non-local visitor

polled when:
() picnicking
() boating
() shopping
() dining
() bird feeding
() birdwatching
() swimming
() sunning/beach
() other:_____

(Check appropriate responses- multiple choice questions may have more than one appropriate response. Please use answer column on right.)

BACKGROUND

1) Did you know that to form the lagoon, a sandbar is manually constructed in the late spring and opened in the early fall? (Y) (N)

2) Are you aware that many of the ducks and all of the geese that live in the lagoon are domesticated and not wild? (Y) (N)

3) Are you aware that the pigeons and domesticated ducks and geese rely primarily on handouts to survive? (Y) (N)

4) Did you know that the lagoon is posted for no swimming most of the summer due to high bacteria levels? (Y) (N)

5) Are you aware that the waste products of ducks, geese, and other birds is the primary cause of the high bacteria levels in the lagoon? (Y) (N)

6) Are you aware that the endangered tidewater goby, a small bottom dwelling fish, lives in Soquel Creek lagoon, and that the lagoon is one of the most productive lagoons in California for the goby? (Y) (N)

7) Did you know steelhead trout, a fish once abundant to this area but now becoming increasingly scarce, uses Soquel Lagoon for spawning? (Y) (N)

8) Do you know the difference between pondweed and algae, both of which grow in the lagoon? (*Pondweed is the rooted bottom-growing plant, while algae is the stringy surface vegetation.) (Y) (N)

9) Did you know that the algae in the lagoon is a natural occurrence of a freshwater lagoon, and not due to polluted water? (Y) (N)

10) Did you know that the wild ducks that migrate to the lagoon during summer feed on the pondweed, and keep it "mowed" below the surface? (Y) (N)

11) Did you know that pondweed is also food for small organisms that, in turn, are the food for the fish of the lagoon? (Y) (N)

12) Are you aware that pondweed supplies essential shelter to the steelhead trout and other species of fish from predators such as gulls, terns, and cormorants? (Y) (N)

MANAGEMENT CONSIDERATIONS

1) Presently, do you use and/or enjoy the lagoon for:
(A) a place to relax? (B) a place to eat and/or picnic? (A) (B) (C) (D)
(C) a place to feed the birds? (D) a place to birdwatch?
(E) a place to people watch? (F) a place to boat? (E) (F) (G) (H)
(G) swimming? (H) other? _____

2) Visually, do you feel the pondweed and algae
(A) take away from the lagoon's beauty?
(B) add to the lagoon's beauty? (C) make no difference? (A) (B) (C)

3) Does the lagoon attract you to the restaurants around the lagoon? (Y) (N)

4) Do you feel the pedal boats
(A) are a benefit to the lagoon? (B) detract from the lagoon? (A) (B) (C)
(C) make no difference?

5) Do you think algae and pondweed make use of the lagoon less enjoyable? (Y) (N)

6) What future uses of the lagoon would you like to see:
(A) swimming (B) education (C) boating (D) longer walking path (A) (B) (C) (D)
(E) bird feeding (F) bird watching (G) other: _____ (E) (F) (G)

7) Do you think the lagoon should be deepened each year to allow for more boating, even if this were detrimental to the lagoon environment? (Y) (N)

8) What level of algae control would you like to see implemented? (A) (B) (C) (D)
(A) chemical application (herbicide)
(B) chemical application (blue dye to shade out sunlight) (E)
(C) low-impact manual removal (raking from a boat)
(D) high-tech mechanical removal (mechanized harvester)
(E) no control- allow algae to reach its own natural level

9) What level of pondweed control would you like to see implemented?
(A) chemical application (herbicide) (A) (B) (C) (D)
(B) chemical application (blue dye to shade out sunlight)
(C) low-impact manual removal (D) high-tech mechanical removal (E)
(E) no control- allow the pondweed to reach its own level

10) Knowing that birds are probably the leading cause of high bacteria levels in the lagoon, do you feel (A) (B) (C)
(A) steps should be taken to reduce the high numbers of domesticated ducks and geese?
(B) the waterfowl and other birds are a benefit of the lagoon and should be left alone?
(C) other: _____

11) Do you feed the ducks, geese and/or any of the other birds (A) (B) (C)
(A) never? (B) occasionally? (C) regularly?

12) What do you feel would be an appropriate method to reduce the number of waterfowl and other birds in and around the lagoon? (A) (B) (C) (D)
(A) removal of the non-wild ducks and geese
(B) the posting of educational signs around the lagoon to discourage feeding the birds
(C) a city ordinance that would make feeding the birds illegal
(D) other _____

13) Do you feel the sandbar at the mouth of the lagoon should
(A) form naturally in the spring/summer? (A) (B)
(B) continue to be opened and closed artificially?

14) Assuming that the longer the lagoon remains in the autumn, the better it is for the steelhead trout, do you feel the sandbar should (A) (B) (C) (D)
(A) naturally break in the fall from high water run-offs from the first storms?
(B) be mechanically breached when flooding appears likely?
(C) be mechanically breached before the rainy season?
(D) other: _____

15) Do you feel management of the lagoon should focus more on:
(A) preservation of the habitat and species of the lagoon? (A) (B) (C)
(B) human use of the lagoon? (C) other: _____

Figure 5 Results of questionnaire.

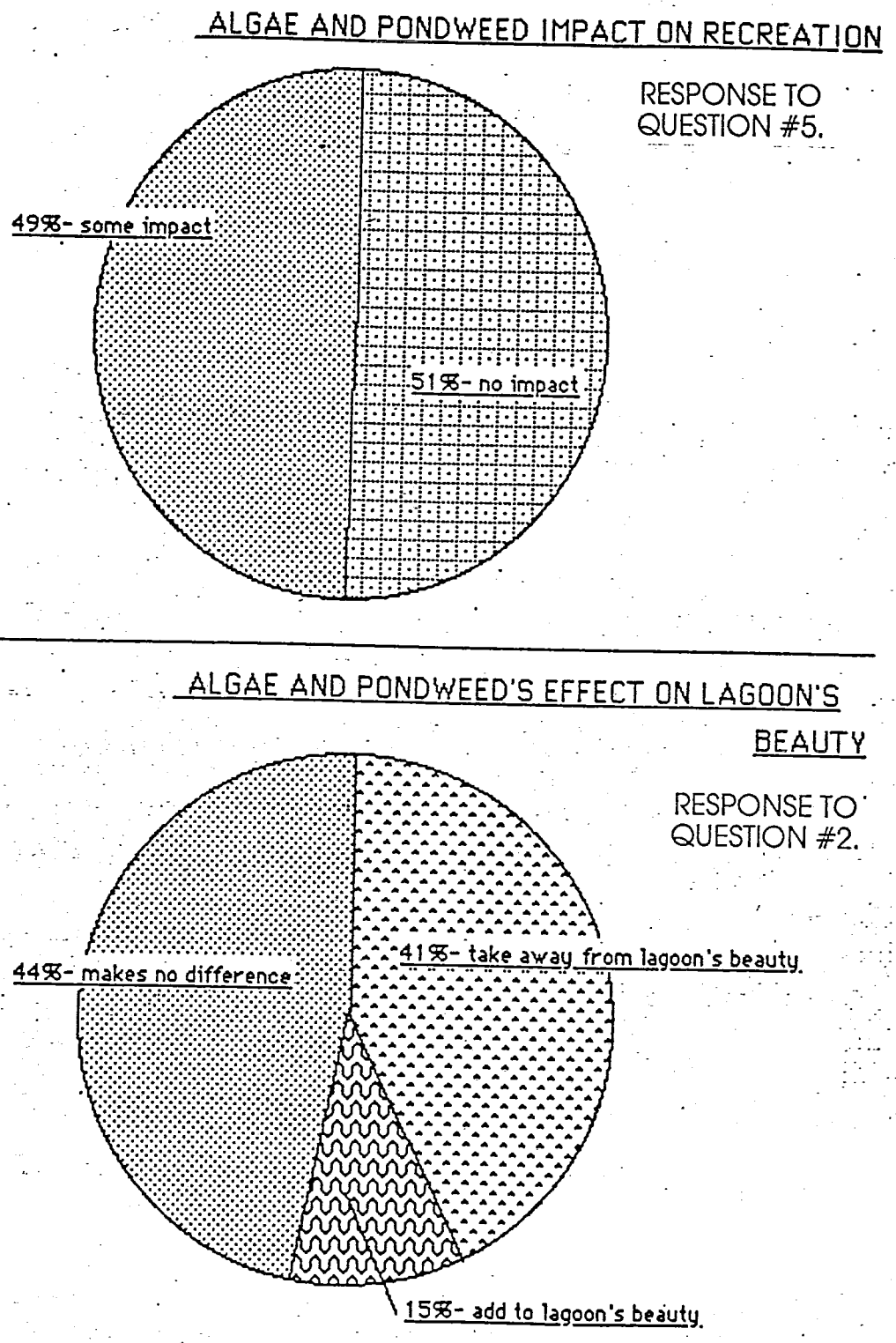
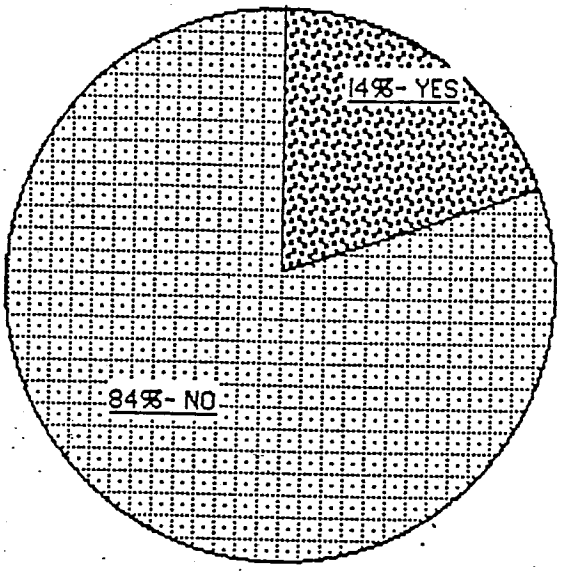


Figure 5 Contd. Results of questionnaire.

SHOULD THE LAGOON BE DEEPENED RESPONSE TO QUESTION #7.



(rep. ques. #6) DESIRED FUTURE USES RESPONSE TO QUESTION #6.

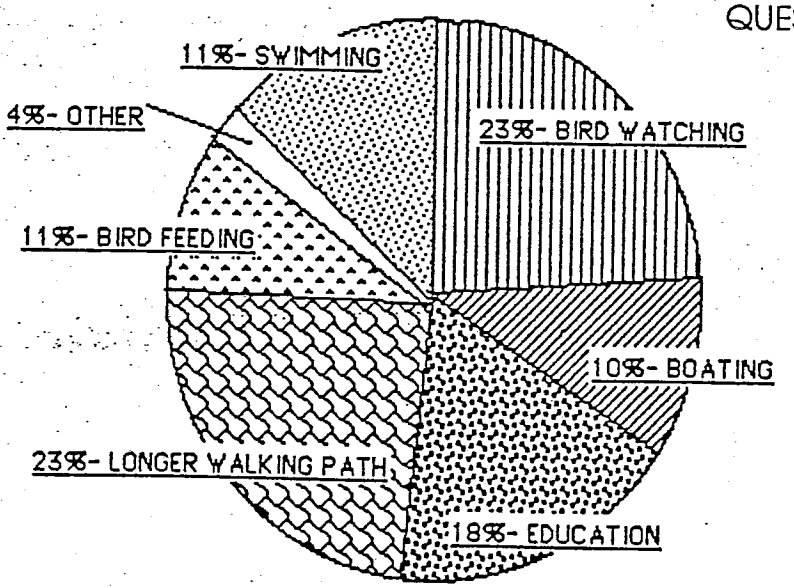
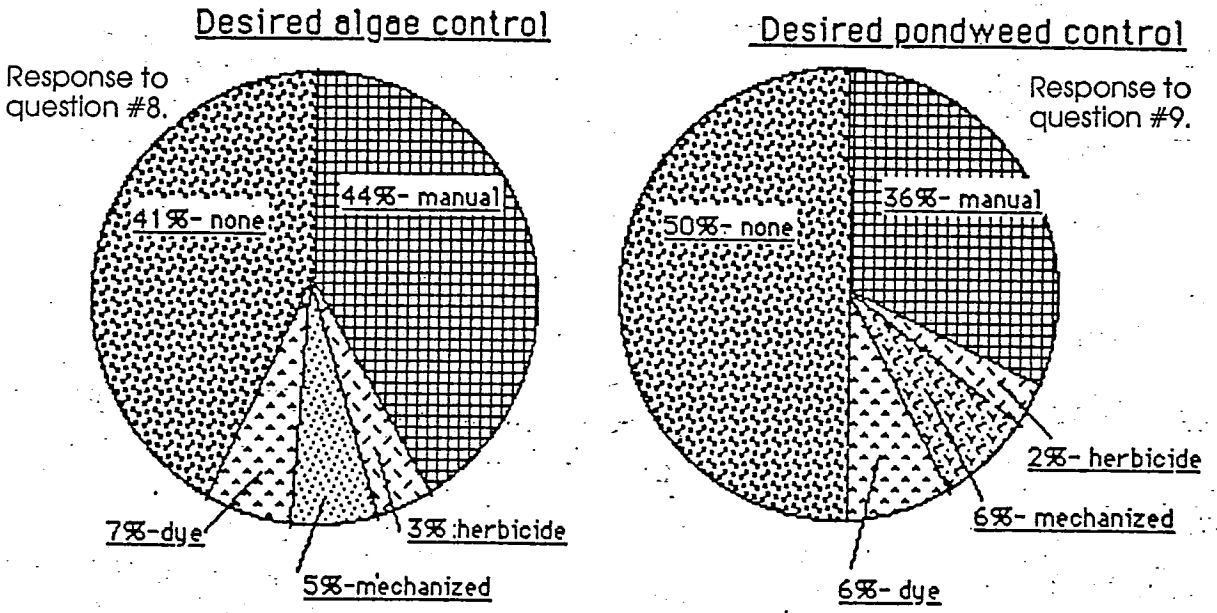


Figure 5. Results of questionnaire. Contd.



(note: Besides the 9% higher value pondweed has in "no control", approx. 12% of all pollees specified focusing control on algae rather than pondweed.)

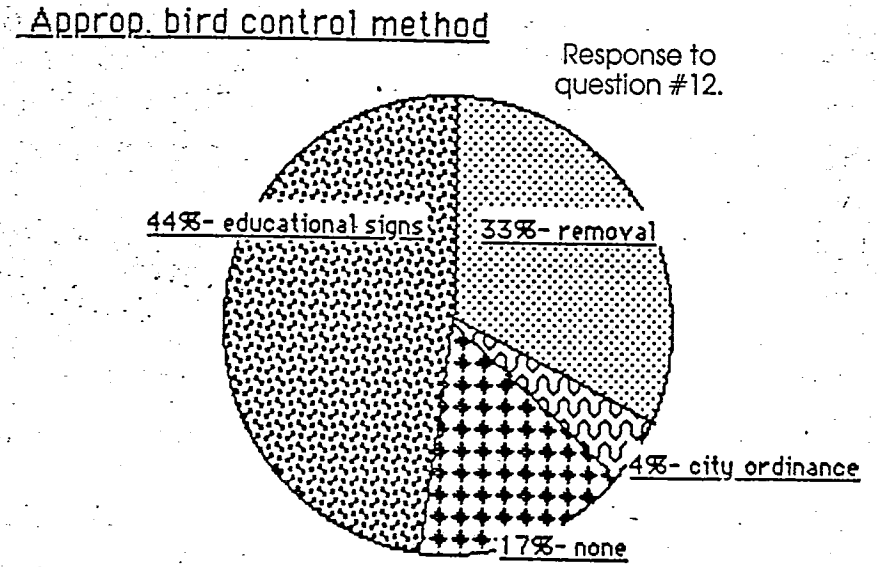
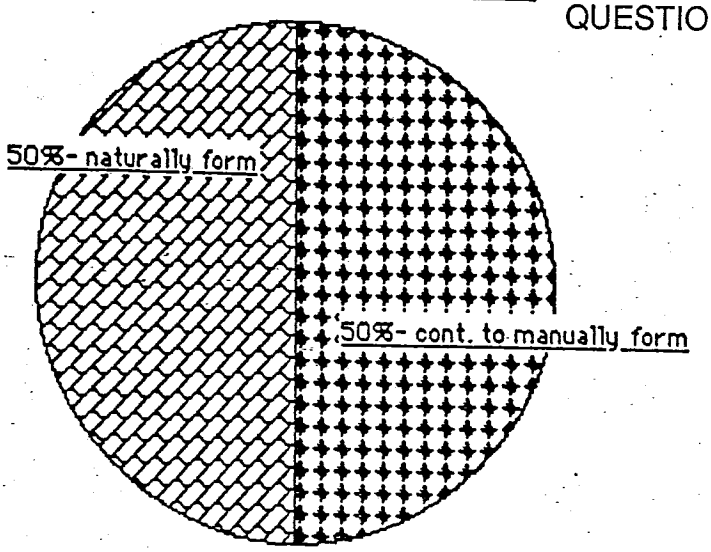


Figure 5 Contd. Results of questionnaire.

SANDBAR FORMATION RESPONSES FROM QUESTION #13.



SANDBAR BREACHING IN FALL RESPONSES FROM QUESTION #14.

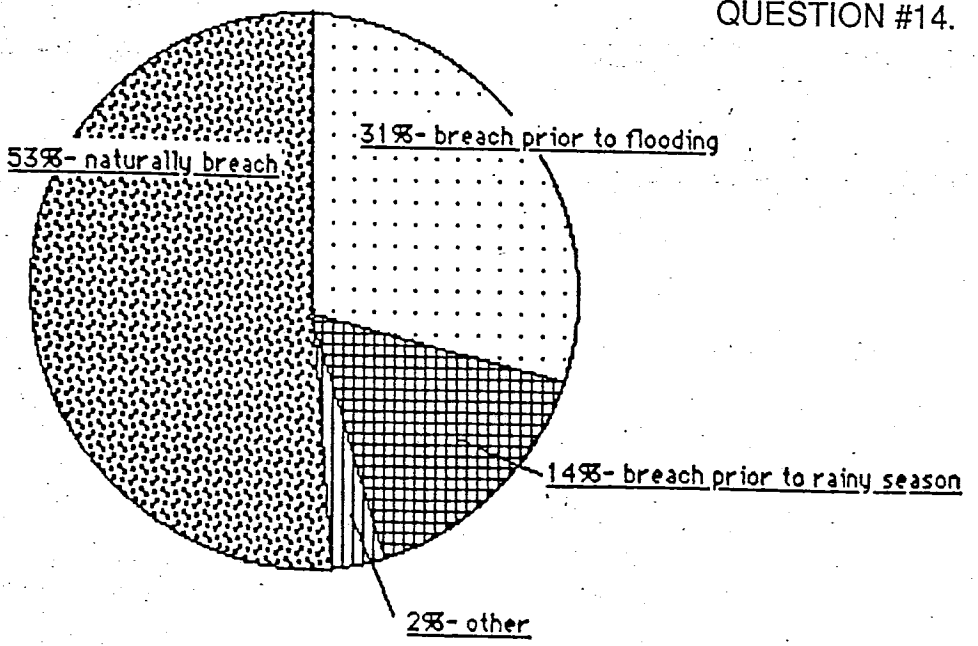
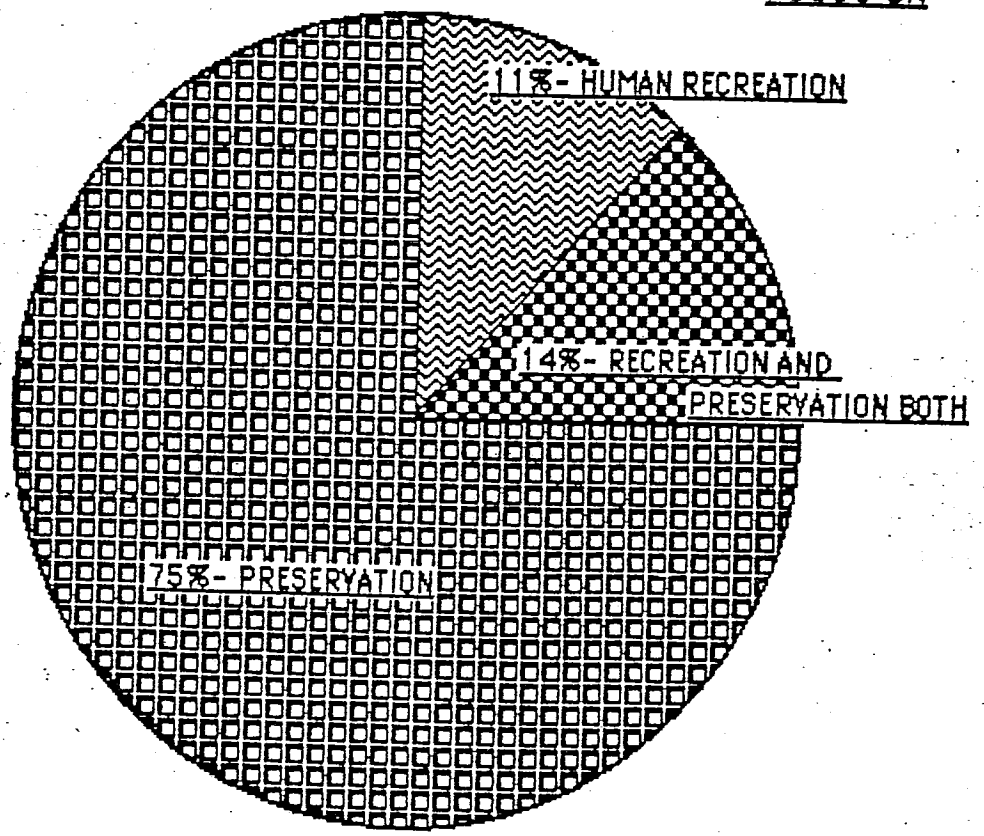


Figure 5 Contd. Results of questionnaire.

RESPONSE TO
QUESTION #15.

ASPECT OF THE LAGOON MANAGEMENT SHOULD FOCUS ON



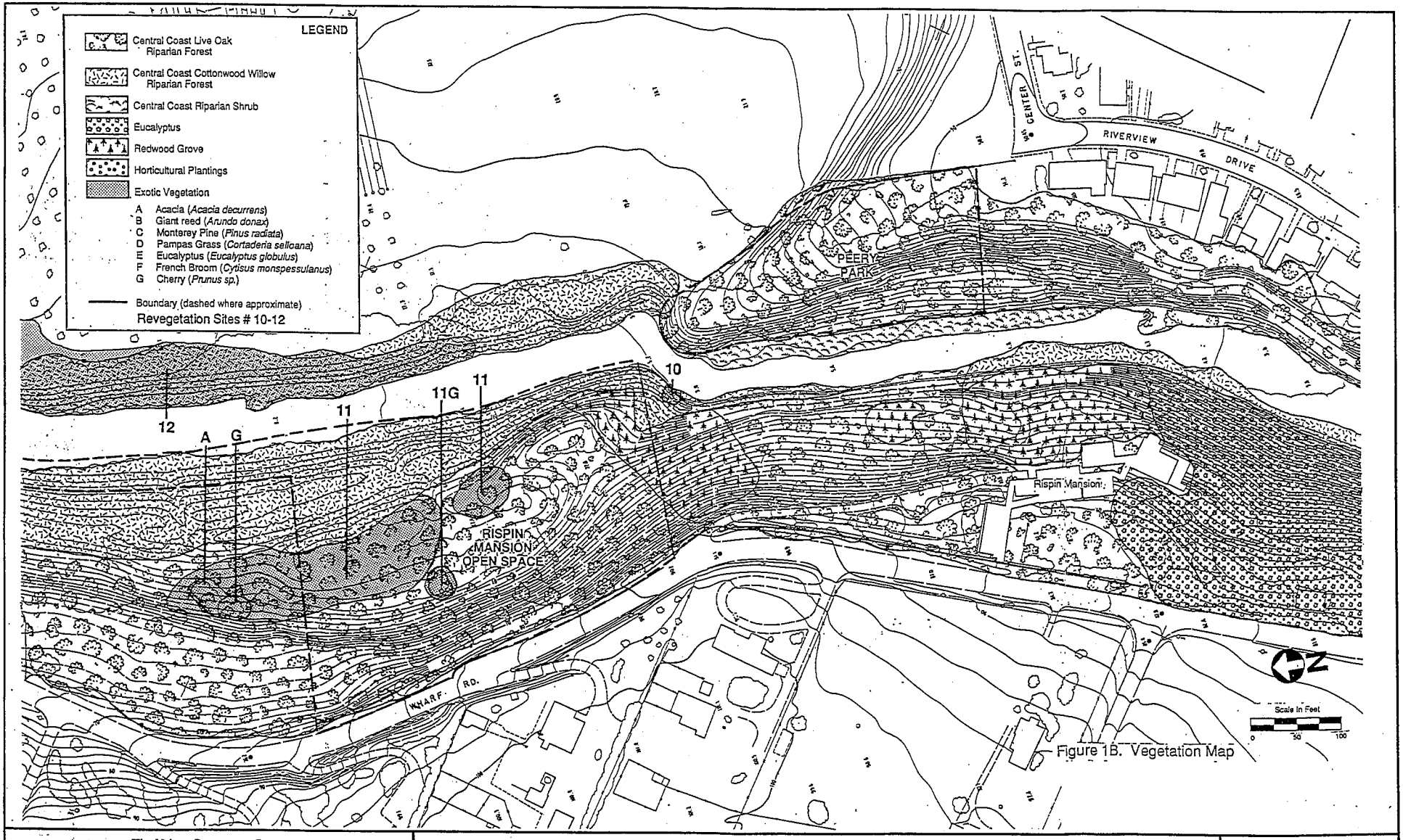


Figure 1B. Vegetation Map

The Habitat Restoration Group
JOHN STANLEY & ASSOCIATES
6001 Butler Lane, Suite 1 • Scotts Valley, CA 95066 • (408) 439-5500 FAX (408) 438-1142

SOQUEL LAGOON
Management & Enhancement Plan

May 1990
424-01

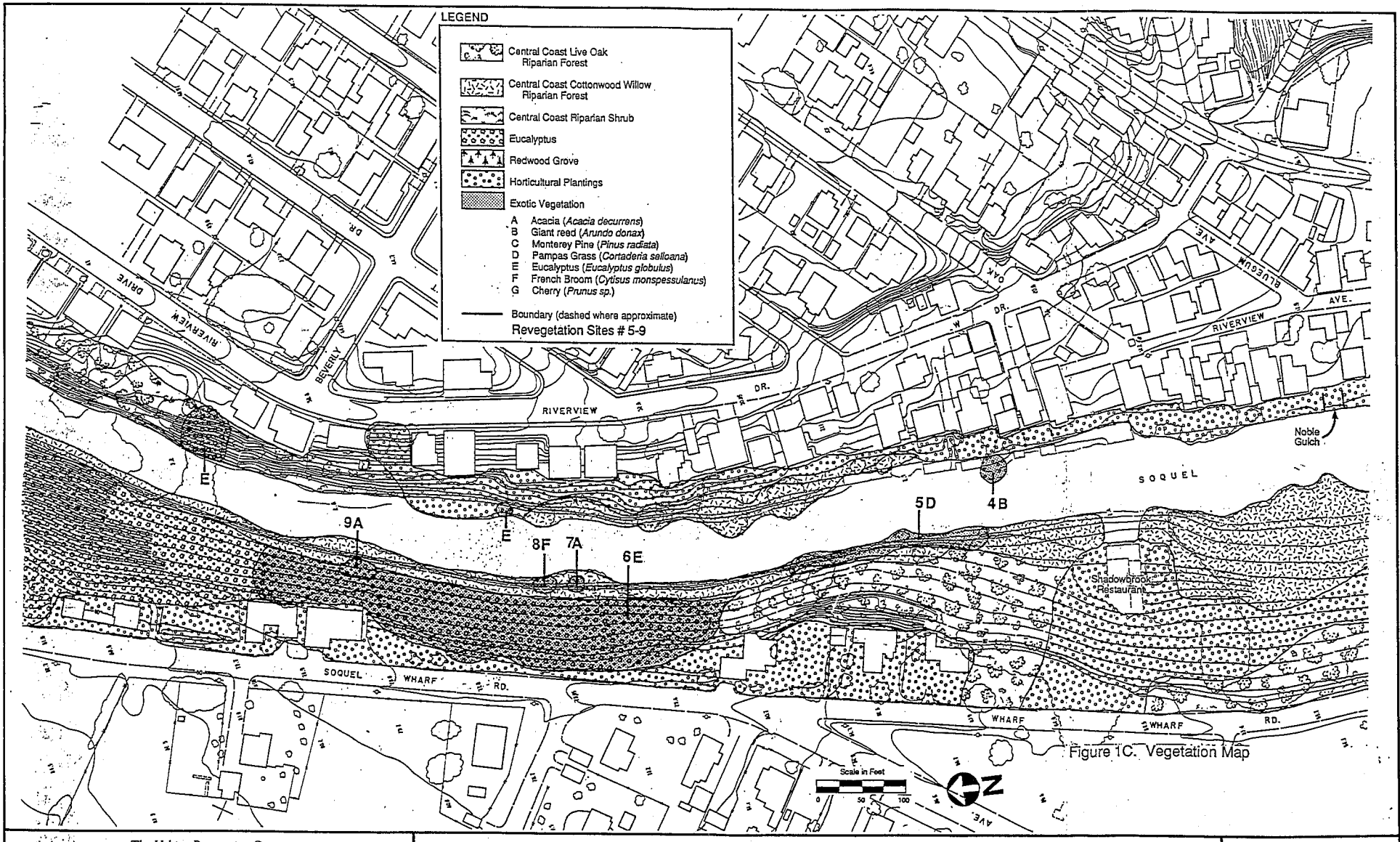


Figure 1C. Vegetation Map

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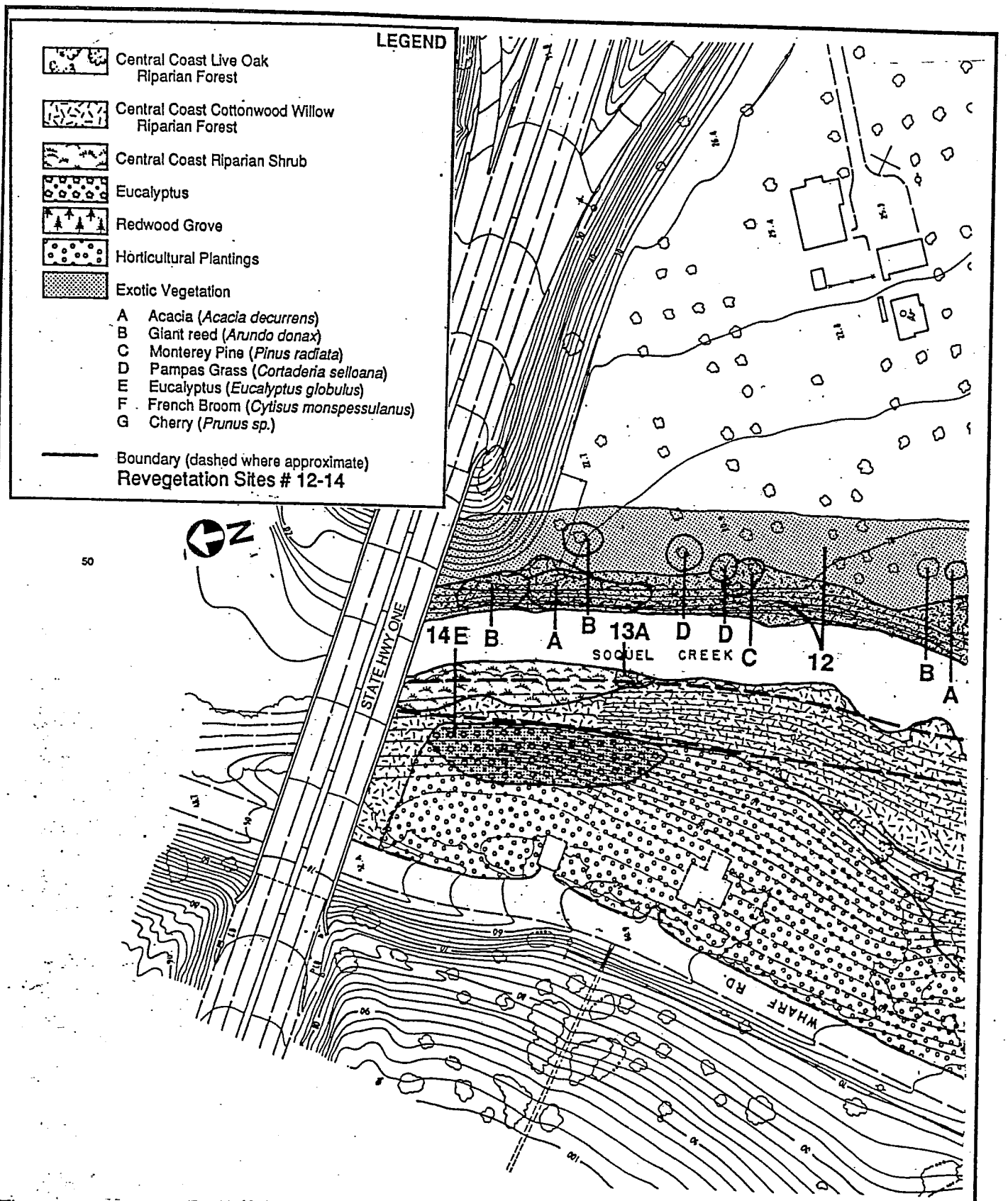

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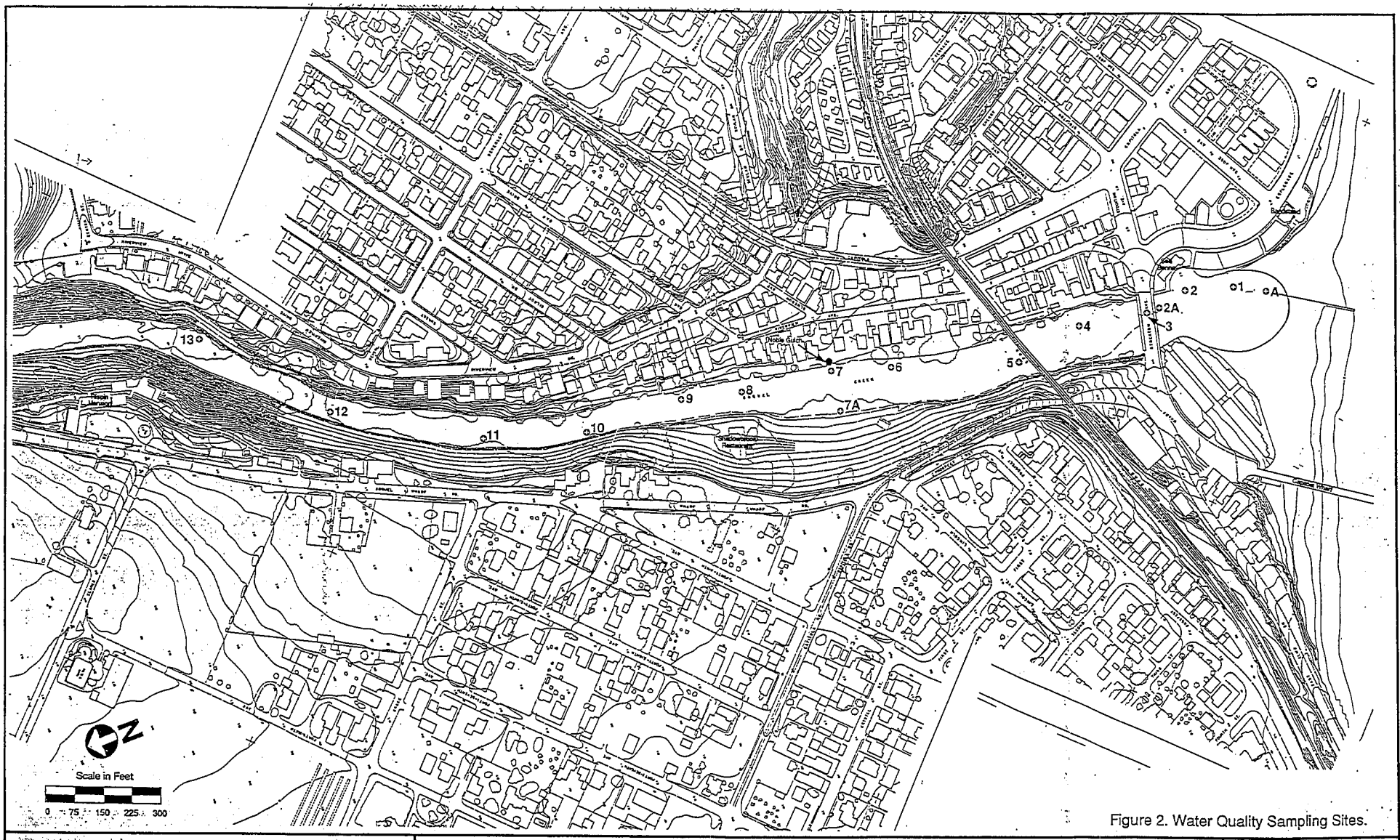

Figure 2. Water Quality Sampling Sites.

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JOHN STANLEY & ASSOCIATES
6001 Butler Lane, Suite 1 • Scotts Valley, CA 95066 • (408) 439-5500 FAX (408) 438-1142

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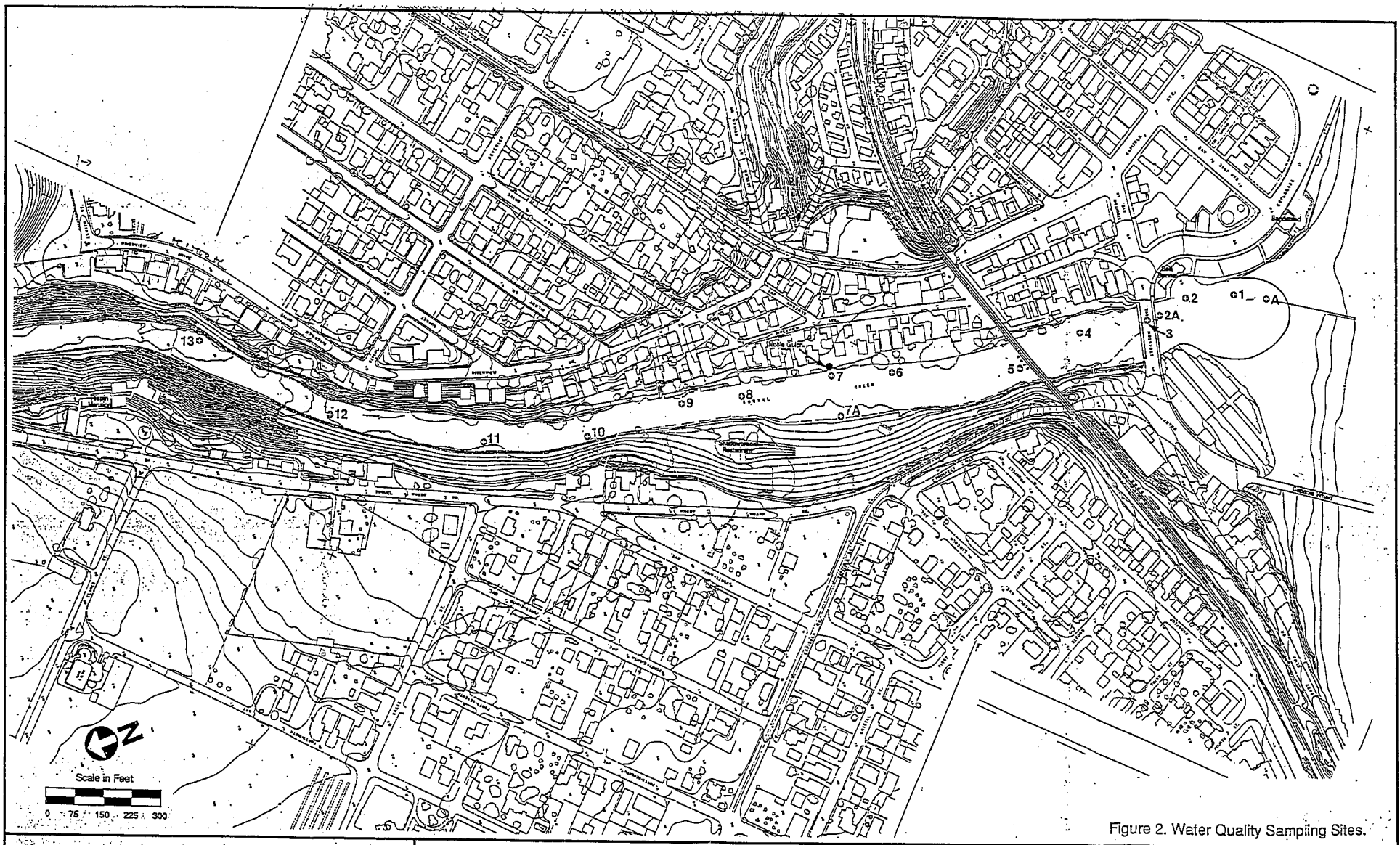

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APPENDIX A. IN-DEPTH DESCRIPTION OF HABITAT USE BY WILDLIFE WITH DESCRIPTION OF RARE, THREATENED, AND ENDANGERED WILDLIFE AND SPECIES OF SPECIAL CONCERN

Aquatic Habitat

The value of the lagoon for **amphibians** is greatest in its upstream portion, where streamside emergent vegetation and riparian habitat provide cover. The value of the lower lagoon for these species is low, due to the lack of cover and the restricted access to adjacent terrestrial habitats created by the walls bordering the lagoon. Two amphibian species, Pacific Treefrog (*Hyla regilla*) and Western Toad (*Bufo boreas*) lay their eggs in the lagoon's quiet waters. The upper reach of the lagoon offers potentially suitable habitat for Red-legged Frog (*Rana aurora*), a candidate species Federal listing as endangered species, and Foothill Yellow-legged Frog (*Rana boylei*), a species of special concern in California. But these species are not known to be present. Movement of amphibians to and from the lagoon is limited by development bordering all but the upper lagoon.

The Western Aquatic Garter Snake (*Thamnophis couchi*) would be the only **reptile species** to use the aquatic habitat on a regular basis, although Common Garter Snake (*T. sirtalis*) and Western Terrestrial Garter Snake (*T. elegans*) may also occur. Movement of reptiles to and from the lagoon is limited by development bordering all but the upper lagoon.

Birds use the lagoon for feeding, bathing, and drinking, although few species are common. The Mallard (*Anas platyrynchos*) is the only species of native waterfowl that occurs regularly at Soquel Lagoon. Most individuals using the lagoon make regular flights to and from other nearby areas, such as further up Soquel Creek, to Corcoran Lagoon, and to Schwan Lake. Mallards use the entire lagoon, feeding on pondweed, filamentous algae, invertebrates living on these aquatic plants, and handouts from people. Mallards are present year-round, but are most common when the sandbar at the beach is closed. These conditions provide favored quiet waters, and in the summer and early fall, promote the growth of aquatic plants used for food. A few Mallard pairs breed at the lagoon from April to July, most likely hiding their nests most likely low vegetation along the shore of the upper lagoon.

A flock of domestic geese (primarily *Anser* spp.) and feral ducks are permanent residents at the lagoon. About 16 geese and 10-20 feral ducks were observed in the fall of 1988. These birds have been released at the lagoon by the public. Many of the geese cannot fly, or do so poorly. A few feral ducks are capable fliers, and may move locally, but most are sedentary. Handouts comprise the bulk of their diet, although pondweed and algae are also consumed. The geese and some of the feral ducks travel around the lagoon in a flock, and tend to concentrate activities around the lower lagoon, downstream of the railroad trestle.

Gulls are numerous, with nine species occurring regularly. Heermann's Gull (*Larus heermanni*), Mew Gull (*L. canus*), Ring-billed Gull (*L. delawarensis*), California Gull (*L. californicus*), Western Gull (*L. occidentalis*), and Glaucous-winged Gull (*L. glaucescens*) are the most common species, with Heermann's, California, and Western Gulls being the most numerous species during the summer months. These species are attracted to the lagoon as a source of freshwater, and many are present primarily to bathe and drink. In addition, they are attracted by the easy food sources provided by human handouts and refuse. Gulls may also take small numbers of fish from the lagoon, but their foraging style limits the availability of this resource. Gulls are abundant all year, but are most common from October to March. Their numbers vary throughout the day, with individuals coming and going continually. Fifty to 1500 gulls may be present at Capitola Beach and Soquel Lagoon at any one time, with the number actually using the lagoon or creek mouth fluctuating between 20 and 200. Gulls use the entire lagoon, but the vast majority of their activities are confined to the lower lagoon, especially the area adjacent to the beach (see Appendix C).

The American Coot (*Fulica americana*) is the only other waterbird species that occurs at Soquel Lagoon in large numbers. The first migrants arrive in late August, with their population peaking at 100 to 150 individuals during October and November. During the late summer and fall, coots feed primarily on pondweed and algae, and the associated invertebrates (see Appendix C). Increased streamflows of late fall and winter carry away most or all of the aquatic vegetation, causing the number of coots using the lagoon to drop to approximately 20 to 50 individuals. During the winter months coots are regularly present wherever handouts are offered. The lagoon's wintering population leaves the area in March and April. No suitable breeding habitat for coots is available due to the lack of emergent vegetation.

Few fish-eating birds forage at the lagoon during the spring and summer months. A few Pied-billed Grebes (*Podilymbus podiceps*) are usually present from August until high stream flows cause them to move elsewhere. A few Western Grebes (*Aechmophorus occidentalis*) and Clark's Grebes (*A. clarkii*) may use the lagoon from November to March, foraging during high streamflow. One or two Belted Kingfishers (*Ceryle alcyon*) fish along lower Soquel Creek and the upper lagoon. Herons and egrets visit the lagoon, but human activity and limited foraging resources reduce their presence. Great Blue Heron (*Ardea herodias*), Great Egret (*Casmerodius alba*), Snowy Egret (*Egretta thula*), Green-backed Heron (*Butorides striatus*), and Black-crowned Night-heron (*Nycticorax nycticorax*) have all been recorded. Terns (*Sterna spp.*) gather on the beach, but forage in the lagoon only occasionally. Human activity makes the lagoon unsuitable for regular foraging by terns.

None of the **mammal species** inhabiting the area are strongly associated with the aquatic habitat of the lagoon, although many may use the lagoon as a water source. The lagoon's value is greatest in its upstream portion, adjacent to the extensive

riparian habitat. Raccoons (*Procyon lotor*) forage along the lagoon's edge. Bats probably forage for insects over the lagoon.

Beach Habitat

Capitola Beach is a resting place for **birds**, such as gulls and terns, and a foraging site for shorebirds. Gulls are a regular year-round feature on the beach, along with terns from April to October. Gulls using the beach are the same species listed as using Soquel Lagoon. Terns which use the beach include Elegant Tern (*Sterna elegans*), Caspian Tern (*S. caspia*), and Forster's Tern (*S. forsteri*). Gulls and terns use the beach as a resting site between periods of foraging in adjacent ocean or littoral habitats, or after bathing in the lagoon. Gulls also obtain food from handouts and refuse left by beach-recreationalists.

The wet sand of the bay's littoral zone and the lagoon edge, is frequented by shorebirds. Sanderling (*Calidris alba*), Marbled Godwit (*Limosa fedoa*), Willet (*Catoptrophorus semipalmatus*), and Black-bellied Plover (*Pluvialis squatarola*) are the most numerous species. These species are primarily present at Capitola Beach from August to April.

The flock of domestic geese and some of the feral ducks use the beach adjacent to the lagoon. Flocks of Rock Doves (pigeons) (*Columba livia*) and Brewer's Blackbirds (*Euphagus cyanocephalus*) feed on handouts or food left by beach-goers.

Riparian Habitat

Amphibians using riparian habitat at Soquel Lagoon include California Slender Salamander (*Batrachoseps attenuatus*), Arboreal Salamander (*Aneides lugubris*), Western Toad (*Bufo boreas*), and Pacific Treefrog (*Hyla regilla*). Important habitat components for amphibians include the cover and mesic environment created by the vegetative cover, fallen leaves, and other woodland debris.

Reptiles are more abundant and diverse in riparian habitat at Soquel Lagoon than in any of the other habitats. Western Fence Lizard (*Sceloporus occidentalis*), Southern Alligator Lizard (*Gerrhonotus multicarinatus*), and Common Garter Snake (*Thamnophis sirtalis*) are the most common species. These species find refuge and food among the leaf litter and downed wood. Other reptiles expected to occur include Western Skink (*Eumeces skiltonianus*), Rubber Boa (*Charina bottae*), Gopher Snake (*Pituophis melanoleucus*), and Western Terrestrial Garter Snake.

Birds are diverse and numerous in riparian habitat at Soquel Lagoon, although the overall avian species composition reflects the developed nature of the surrounding area. Riparian habitat along the immediate California coast attracts and concentrates large numbers of migrants landbirds. The willows and other dense vegetation provide productive foraging for insectivorous species.

Flocks of migrant warblers, vireos, and flycatchers feed in this habitat during the spring and fall. Common species during migration include Yellow Warbler (*Dendroica petechia*), Yellow-rumped Warbler (*D. coronata*), Orange-crowned Warbler (*Vermivora celata*), Pacific-slope Flycatcher (*Empidonax difficilis*), Warbling Vireo (*Vireo gilvus*), and Ruby-crowned Kinglet (*Regulus calendula*). Migrant species that are rare in California, such as Blackburnian Warbler (*Dendroica fuscus*), have been found in this habitat at the lagoon. Other species which occur here include Wrentit (*Chamaea fasciata*), Bushtit (*Psaltriparus minimus*), Cedar Waxwing (*Bombycilla cedrorum*), Song Sparrow (*Melospiza melodia*), Scrub Jay (*Aphelocoma coerulescens*), Swainson's Thrush (*Catharus ustulatus*), and Bewick's Wren (*Thyromanes bewickii*). The most noteworthy breeding species in this habitat is the Yellow Warbler. Approximately 2-3 pairs nest along the shores of the lagoon, with more nesting in the riparian habitat upstream of the lagoon. This species' breeding population has declined considerably in California in recent decades, and it is considered a species of special concern in the State.

Mammals observed or predicted to frequent riparian habitat at Soquel Lagoon include Broad-footed Mole (*Scapanus latimanus*), Brush Rabbit (*Sylvilagus bachmani*), Deer Mouse (*Peromyscus maniculatus*), Western Harvest Mouse (*Reithrodontomys megalotis*), California Vole (*Microtus californicus*), Striped Skunk (*Mephitis mephitis*), and Raccoon. Several species of bats may roost in the taller trees. The suburban and urban environment of the local setting renders the the site unsuitable for most medium- to large-sized mammals, although Black-tailed Deer (*Odocoileus hemionus*) may sometimes enter this habitat from further upstream.

Residential and Commercial Development Areas.

The developed areas surrounding Soquel Lagoon support a limited diversity of wildlife, but many of those species present are relatively numerous. The landscaped plantings, and even the buildings, provide shelter and cover for some wildlife. A primary factor attracting some species is the availability of human foods. Gulls, Rock Doves (pigeons), Brewer's Blackbirds, and House Sparrows (*Passer domesticus*) all frequent the area around the restaurants on the Esplanade. Gulls, Rock Doves, and Brewer's Blackbirds regularly take handouts on the restaurant balconies, and on the east shore of the lagoon, adjacent to the Stockton Avenue Bridge. A few species of mammals also frequent the developed habitats, primarily at night. Raccoons, Norway Rats (*Rattus norvegicus*), and House Mice (*Mus musculus*) are numerous.

The railroad trestle is used as a roost site by Rock Doves. The number of doves using the trestle is unpredictable from day to day, as many of the doves using the trestle also roost under the nearby Capitola Wharf, and perhaps elsewhere near the lagoon. In general, smaller numbers of doves are present on the trestle during the day, with more present during the night. There may be extended periods when only a few Rock Doves roost on the trestle.

This species is not known to nest on the trestle, though the structure does provide suitable ledges for nest placement. Rock Doves do nest under the Capitola Wharf.

The landscaped plantings along the lagoon's east shore provide food and cover for birds, but these plantings are less productive for wildlife than the riparian vegetation on the opposite shore. Some of the bird species nesting along the lagoon's east shore include House Finch (*Carpodacus mexicanus*), Anna's Hummingbird (*Calypte anna*), Allen's Hummingbird (*Selasphorus sasin*), Hooded Oriole (*Icterus cucullatus*), and Mourning Dove (*Zenaida macroura*).

Domestic cats (*Felis domestica*) and dogs (*Canis domesticus*) are common inhabitants of the developed areas around Soquel Lagoon. These pets, especially cats, prey upon, or otherwise harass the wildlife using the area. The many cats and dogs living around the lagoon reduce the area's wildlife value. Their excrement probably finds its way into the lagoon, increasing pollution problems.

Sensitive Species

Red-legged Frog (*Rana aurora draytonii*) is a Candidate (List 2) for Federal endangered status, and is a species of special concern in California. This species may reside in Soquel Creek just upstream of the lagoon, possibly using the lagoon during part of the year. The lagoon's aquatic habitat values are reduced for this species by the lack of emergent vegetation and the steep (often vertical) banks.

Foothill Yellow-legged Frog (*Rana boylei*) is a species of special concern in California. This species may reside in Soquel Creek just upstream of the lagoon, possibly using the lagoon during part of the year. This species prefers riffle habitat of streams, which is lacking in the lagoon area. The lagoon's aquatic habitat values are reduced for this species by the lack of emergent vegetation and the steep (often vertical) banks.

Common Loon (*Gavia immer*) is a species of special concern in California. This species is an uncommon to fairly common visitor to inshore ocean waters off Capitola Beach from September to May, and is rare there during the summer months. Individuals may occasionally visit the lagoon, but Common Loons are not expected to occur there regularly.

California Brown Pelican (*Pelecanus occidentalis californicus*) is a Federally and State endangered species. This species may be seen year-round over the ocean adjacent to Capitola Beach, but it is most numerous from May to October. Brown Pelicans often feed close to the shoreline, but are otherwise expected to have little interaction with the study area's habitats. Small numbers may occasionally rest on Capitola Beach when not disturbed, but levels of human use of the beach area are generally far beyond

this species' tolerance levels. Brown Pelicans are not expected to use the lagoon.

Double-crested Cormorant (*Phalacrocorax auritus*) is a species of special concern in California. This species is uncommon to fairly common in inshore ocean waters adjacent to Capitola Beach from August to April, and is rare there during the summer months. Small numbers of Double-crested Cormorant occasionally feed in the lagoon during the winter months, although their use of the lagoon appears to be irregular in nature. Levels of human disturbance in the study area are usually beyond this species' tolerance level.

Osprey (*Pandion halietus*) is a species of special concern in California. This species occurs in the vicinity of the study area primarily as an aerial transient during spring and fall migration. Ospreys may occasionally forage in the inshore ocean waters adjacent to Capitola Beach, but are not expected to use the study area's habitats.

Sharp-shinned Hawk (*Accipiter striatus*) is a species of special concern in California, and is listed as "sensitive" by the U.S. Fish and Wildlife Service. This species is uncommon in the study area from September to April, occurring primarily in the riparian habitat or as an aerial transient. No suitable breeding habitat occurs in the vicinity of the study area.

Cooper's Hawk (*Accipiter cooperii*) is a species of special concern in California. This species is uncommon in the study area from September to April, occurring primarily in the riparian habitat or as an aerial transient. No suitable breeding habitat occurs in the vicinity of the study area.

Merlin (*Falco columbarius*) is a species of special concern in California. This species is a rare visitor to Santa Cruz County, occurring primarily from October to March. A few Merlins are reported from Capitola each year (Santa Cruz Bird Club unpubl. data), and they are expected to occasionally visit the study area. Most Merlins in the vicinity of Soquel Lagoon are expected to be aerial transients, although they may occasionally prey on shorebirds feeding on Capitola Beach.

Peregrine Falcon (*Falco peregrinus*) is a Federally and State endangered species. This species is a rare visitor to Santa Cruz County, occurring primarily during spring and fall migration. Peregrine Falcons are rarely reported from Capitola, with most occurring along the immediate coast (Santa Cruz Bird Club unpubl. data). Individuals are expected to occasionally visit the study area. They are expected to be aerial transients, although they may occasionally prey on shorebirds feeding on Capitola Beach.

Laughing Gull (*Larus atricilla*) is a species of special concern in California. This species has been recorded in Santa Cruz County seven times, and is considered a casual visitor to the central California coast. One has been seen on Capitola Lagoon.

California Gull (*Larus californicus*) is a species of special concern in California. California Gulls are common visitors to the study area from August to April, becoming less numerous from May to July. California Gulls use the beach, lagoon, and developed habitats of the study area, as well as inshore ocean waters adjacent to the beach. Over 500 individuals have been recorded at one time in the gull flocks at Capitola Beach.

Elegant Tern (*Sterna elegans*) is a species of special concern in California. This species is uncommon to fairly common in the vicinity of the study area from May to October, with most present from July to September. Elegant Terns forage in the inshore ocean waters adjacent to Capitola Beach, and flocks gather to rest on the beach when levels of human use are low. Up to 70 have been observed on the beach at one time.

California Least Tern (*Sterna antillarum browni*) is a Federally and State endangered species. This species was probably once a regular visitor to Capitola Beach and the adjacent ocean waters, but is now very rarely encountered in Santa Cruz County (Santa Cruz Bird Club). Migrant individuals are expected to occur occasionally, perhaps pausing to forage in the ocean, but are not expected to use the beach or lagoon habitats.

Marbled Murrelet (*Brachyramphus marmoratus*) is a species of special concern in California, with recent work suggesting threatened status may be appropriate. This species is an uncommon to rare visitor to inshore ocean waters adjacent to Capitola Beach, occurring primarily from April to December. It is not expected to occur in the study area itself.

Willow Flycatcher (*Empidonax traillii*) is a State threatened species. This species is a rare spring and fall migrant in Santa Cruz County, occurring primarily from May to early June and August to October. Very small numbers are expected to visit the lagoon's riparian habitat during these migration periods, and it has been observed along Soquel Creek just upstream of the lagoon.

Yellow Warbler (*Dendroica petechia*) is a species of special concern in California. This species is a fairly common spring migrant and common fall migrant in Santa Cruz County, being uncommon and distributed only in riparian habitat during the breeding season. Yellow Warblers nest along Soquel Creek from the vicinity of Shadowbrook Restaurant to the vicinity of Glen Haven Drive in Soquel. Approximately two to three pairs nest in the riparian habitat of the lagoon area, with more nesting just upstream of the lagoon in the cottonwood - willow forest.

Yellow-breasted Chat (*Icteria virens*) is a species of special concern in California. This species may have once nested along Soquel Creek, and was once an uncommon migrant in Santa Cruz County, but is now a rare spring migrant and an occasional fall migrant. Occasional individuals are expected to visit the study area's riparian habitat during spring migration.

APPENDIX B. THE IMPORTANCE OF RIPARIAN HABITATS FOR WILDLIFE

The riparian habitats of California provide one of the most important and varied environments for wildlife, and are considered to be the most productive habitats for wildlife in the State. Riparian habitat is of special concern in California because of its high wildlife value, and limited distribution.

Riparian ecosystems often contain some special ecological features, or combination of features, that are not found in upland areas. The availability of water, diversity and abundance of plant life, and complex vegetation structure provide a variety of wildlife species with food, cover, breeding, and rest sites. Wildlife species diversity and abundance in riparian habitats are generally greater than in adjacent habitats due to the juxtaposition of aquatic and terrestrial habitats, and the high proportion of habitat edge (habitat edges, where different vegetation types meet, generally receive high levels of wildlife use). Additionally, riparian corridors function as important passages for wildlife movement.

Woody vegetation is a primary structural feature of riparian wildlife communities, increasing humidity and providing shade that is attractive to some species of wildlife. Dead woody vegetation is also an important component of riparian woodlands. Standing dead trees, or "snags", are used extensively by wildlife. Snags provide nest sites for cavity dwelling birds, den trees for small and medium-sized mammals, and feeding and perching sites for many species. Fallen logs and branches function as cover, feeding, and reproduction sites, and create microclimates suitable for amphibians seeking terrestrial refugia (islands of good habitat).

Surface water is a requirement of many wildlife species, and is used for drinking, feeding, reproduction, travel, and escape. Consequently, many species are rarely found far from water. In the absence of surface water, soil moisture may be ultimately responsible for major differences in species composition and productivity between riparian and upland ecosystems. Generally, moister sites are more productive for wildlife, because foods (vegetation, seeds, insects) are presumably more abundant there, and vegetation structure is more favorable to a greater number of species.

Associated with most riparian ecosystems is the substantial development of habitat edge at the interface between the stream channel and riparian vegetation, and in the transition from riparian to upland communities. Edges, especially those between riparian and upland vegetation, are usually richer in wildlife species and resources than adjoining areas, attracting species of both upland and riparian habitats.

APPENDIX C. WILDLIFE SPECIES OBSERVED AND PREDICTED TO OCCUR AT SOQUEL CREEK LAGOON, AND THE ADJACENT SHORELINE, CAPITOLA SANTA CRUZ COUNTY

Key:

O : Species observed at Soquel Lagoon or the adjacent shoreline.
S : Sign of species (e.g., tracks) observed.
P : Species predicted to occur at Soquel Lagoon or the adjacent shoreline.
P?: Species possibly occurs at Soquel Lagoon.
* : Species is of irregular occurrence or rare in Santa Cruz County
**: Species predicted to occur in the area primarily or entirely on the ocean adjacent to the lagoon.
n : Bird species observed or predicted to nest at Soquel Lagoon, or in the immediate area.
a : Species expected to be primarily or entirely aerial in vicinity of the lagoon, having little or no interactions with terrestrial or aquatic habitats.

CLASS: AMPHIBIA	
ORDER: CAUDATA (Salamanders)	
FAMILY: SALAMANDRIDAE (Newts)	
California Newt, (Taricha torosa)	P
FAMILY: PLETHODONITDAE (Lungless Salamanders)	
Ensatina, (Ensatina eschscholtzi)	P
California Slender Salamander, (Batrachoseps attenuatus)	P
Arboreal Salamander, (Aneides lugubris)	P
ORDER: SALIENTIA (Frogs and Toads)	
FAMILY: BUFONIDAE (True Toads)	
Western Toad, (Bufo boreas)	O
FAMILY: HYLIDAE (Treefrogs and Relatives)	
Pacific Treefrog, (Hyla regilla)	O
FAMILY: RANIDAE (True Frogs)	
Red-legged Frog, (Rana aurora)	P?
Foothill Yellow-legged Frog, (Rana boylei)	P?
CLASS: REPTILIA	
ORDER: SQUAMATA (Lizards and Snakes)	
SUBORDER: SAURIA (Lizards)	
FAMILY: IGUANIDAE (Iguanids)	
Western Fence Lizard, (Sceloporus occidentalis)	O
FAMILY: SCINCIDAE (Skinks)	
Western Skink, (Eumeces skiltonianus)	O
FAMILY: ANGUIDAE (Alligator Lizards and Relatives)	
Southern Alligator Lizard, (Gerrhonotus multicarinatus)	O
Northern Alligator Lizard, (Gerrhonotus coeruleus)	P

SUBORDER: SERPENTES (Snakes)

FAMILY: BOIDAE (Boas)

Rubber Boa, (Charina bottae)	P

FAMILY: COLUBRIDAE (Colubrids)

Ringneck Snake, (Diadophis punctatus)	P
Racer, (Coluber constrictor)	P
Gopher Snake, (Pituophis melanoleucus)	P
Common Garter Snake, (Thamnophis sirtalis)	O
Western Terrestrial Garter Snake, (Thamnophis elegens)	O
Western Aquatic Garter Snake, (Thamnophis couchi)	P

CLASS: AVES

ORDER: GAVIIFORMES (Loons)

FAMILY: GAVIIDAE (Loons)

Red-throated Loon, (Gavia stellata)	O**
Common Loon, (Gavia immer)	O**
Pacific Loon, (Gavia pacifica)	O**

ORDER: PODICIPEDIFORMES (Grebes)

FAMILY: PODICIPEDIDAE (Grebes)

Pied-billed Grebe, (Podilymbus podiceps)	O
Horned Grebe, (Podiceps auritus)	P**
Red-necked Grebe, (Podiceps grisegena)	P**
Eared Grebe, (Podiceps nigricollis)	O
Western Grebe, (Aechmophorus occidentalis)	O
Clark's Grebe, (Aechmophorus clarkii)	O

ORDER: PROCELLARIIFORMES (Albatrosses, Shearwaters, Petrels, and Relatives)

FAMILY: PROCELLARIDAE (Shearwaters, Fulmars)

Northern Fulmar, (Fulmarus glacialis)	P**
Sooty Shearwater, (Puffinus griseus)	O**

ORDER: PELECANIFORMES (Tropicbirds, Pelicans, and Relatives)

FAMILY: PELECANIDAE (Pelicans)

Brown Pelican, (Pelecanus occidentalis)	O**

FAMILY: PHALACROCORACIDAE (Cormorants)

Double-crested Cormorant, (Phalacrocorax auritus)	O
Brandt's Cormorant, (Phalacrocorax penicillatus)	O**
Pelagic Cormorant, (Phalacrocorax pelagicus)	O**

ORDER: CICONIIFORMES (Herons, Storks, Ibises, and Relatives)

FAMILY: ARDEIDAE (Herons and Bitterns)

American Bittern, (Botaurus lentiginosus)	P?
Great Blue Heron, (Ardea herodias)	O
Great Egret, (Casmerodius albus)	O

Snowy Egret, (Egretta thula)	O
Green-backed Heron, (Butorides striatus)	O
Black-crowned Night Heron, (Nycticorax nycticorax)	O

ORDER: ANSERIFORMES (Screamers, Ducks, and Relatives)

FAMILY: ANATIDAE (Swans, Geese, and Ducks)

Ross' Goose, (Chen rossii)	O*
Brant, (Branta bernicla)	P
Canada Goose, (Branta canadensis)	O
Wood Duck, (Aix sponsa)	P?
Green-winged Teal, (Anas crecca)	P
Mallard, (Anas platyrhynchos)	O,n
Northern Pintail, (Anas acuta)	P
Cinnamon Teal, (Anas cyanoptera)	P
Northern Shoveler, (Anas clypeata)	P
Gadwall, (Anas strepera)	P
American Wigeon, (Anas americana)	P
Canvasback, (Aythya valisineria)	P
Greater Scaup, (Aythya marila)	P?
Lesser Scaup, (Aythya affinis)	P
Black Scoter, (Melanitta nigra)	O**
Surf Scoter, (Melanitta perspicillata)	O**
White-winged Scoter, (Melanitta fusca)	O**
Common Goldeneye, (Bucephala clangula)	O
Bufflehead, (Bucephala albeola)	P
Red-breasted Merganser, (Mergus serrator)	O**
Ruddy Duck, (Oxyura jamaicensis)	P

ORDER: FALCONIFORMES (Vultures, Hawks, and Falcons)

FAMILY: CATHARTIDAE (American Vultures)

Turkey Vulture, (Cathartes aura)	O,a

FAMILY: ACCIPITRIDAE (Hawks, Old World Vultures, and Harriers)

Osprey, (Pandion haliaetus)	O,a
Sharp-shinned Hawk, (Accipiter striatus)	O
Cooper's Hawk, (Accipiter cooperii)	O
Red-shouldered Hawk, (Buteo lineatus)	O
Red-tailed Hawk, (Buteo jamaicensis)	O,a

FAMILY: FALCONIDAE (Caracaras and Falcons)

American Kestrel, (Falco sparverius)	O,n
Merlin, (Falco columbarius)	P,a
Peregrine Falcon, (Falco peregrinus)	P,a

ORDER: GALLIFORMES (Megapodes, Currassows, Pheasants, and Relatives)

FAMILY: PHASIANIDAE (Quails, Pheasants, and Relatives)

California Quail, (Callipepla californica)	P,n

ORDER: GRUIFORMES (Cranes, Rails, and Relatives)

FAMILY: RALLIDAE (Rails, Gallinules, and Coots)

American Coot, (Fulica americana)	O

ORDER: CHARADRIIFORMES (Shorebirds, Gulls, and Relatives)

FAMILY: CHARADRIIDAE (Plovers and Relatives)	
Black-bellied Plover, (Pluvialis squatarola)	O
Semipalmated Plover, (Charadrius semipalmatus)	P
Killdeer, (Charadrius vociferus)	O
FAMILY: SCOLOPACIDAE (Sandpipers and Relatives)	
Greater Yellowlegs, (Tringa melanoleuca)	P
Willet, (Catoptrophorus semipalmatus)	O
Wandering Tattler, (Heteroscelus incanus)	P
Spotted Sandpiper, (Actitis macularia)	O
Whimbrel, (Numenius phaeopus)	O
Long-billed Curlew, (Numenius americanus)	P
Marbled Godwit, (Limosa fedoa)	O
Ruddy Turnstone, (Arenaria interpres)	O
Black Turnstone, (Arenaria melanocephala)	O
Sanderling, (Calidris alba)	O
Western Sandpiper, (Calidris mauri)	P
Least Sandpiper, (Calidris minutilla)	P
Dunlin, (Calidris alpina)	P
Short-billed Dowitcher, (Limnodromus griseus)	P
Long-billed Dowitcher, (Limnodromus scolopaceus)	P
Common Snipe, (Gallinago gallinago)	O
Wilson's Phalarope, (Phalaropus tricolor)	P
Red-necked Phalarope, (Phalaropus lobatus)	P
Red Phalarope, (Phalaropus fulicaria)	P**
FAMILY: LARIDAE (Gulls and Terns)	
Pomerine Jaeger, (Stercorarius pomarinus)	O**
Parasitic Jaeger, (Stercorarius parasiticus)	O**
Laughing Gull, (Larus atricilla)	O*
Bonaparte's Gull, (Larus philadelphia)	O
Heermann's Gull, (Larus heermanni)	O
Mew Gull, (Larus canus)	O
Ring-billed Gull, (Larus delawarensis)	O
California Gull, (Larus californicus)	O
Herring Gull, (Larus argentatus)	O
Thayer's Gull, (Larus thayeri)	O
Western Gull, (Larus occidentalis)	O
Glaucous-winged Gull, (Larus glaucescens)	O
Glaucous Gull, (Larus hyperboreus)	O
Black-legged Kittiwake, (Rissa tridactyla)	O**
Caspian Tern, (Sterna caspia)	O
Elegant Tern, (Sterna elegans)	O
Common Tern, (Sterna hirundo)	P**
Forster's Tern, (Sterna forsteri)	O
Least Tern, (Sterna antillarum)	P*,**
FAMILY: ALCIDAE (Auks, Murres, and Puffins)	
Common Murre, (Uria aalge)	O**
Pigeon Guillemot, (Cepphus columba)	O**
Marbled Murrelet, (Brachyramphus marmoratus)	O**
Ancient Murrelet, (Synthliboramphus antiquus)	O**

ORDER: COLUMBIFORMES (Pigeons and Doves)

FAMILY: COLUMBIDAE (Pigeons and Doves)	
Rock Dove, (Columba livia)	O,n
Band-tailed Pigeon, (Columba fasciata)	O
Mourning Dove, (Zenaida macroura)	O,n
ORDER: STRIGIFORMES (Owls)	
FAMILY: TYTONIDAE (Barn Owls)	
Barn-Owl, (Tyto alba)	P
FAMILY: STRIGIDAE (Typical Owls)	
Great Horned Owl, (Bubo virginianus)	P
ORDER: APODIFORMES (Swifts and Hummingbirds)	
FAMILY: APODIDAE (Swifts)	
Vaux's Swift, (Chaetura vauxi)	P,a
FAMILY: TROCHILIDAE (Hummingbirds)	
Anna's Hummingbird, (Calypte anna)	O,n
Rufous Hummingbird, (Selasphorus rufus)	P
Allen's Hummingbird, (Selasphorus sasin)	O,n
ORDER: CORACIIFORMES (Kingfishers and Relatives)	
FAMILY: ALCEDINIDAE (Kingfishers)	
Belted Kingfisher, (Ceryle alcyon)	O
ORDER: PICIFORMES (Woodpeckers and Relatives)	
FAMILY: PICIDAE (Woodpeckers and Wrynecks)	
Acorn Woodpecker, (Melanerpes formicivorous)	P
Red-breasted Sapsucker, (Sphyrapicus ruber)	P
Downy Woodpecker, (Picoides pubescens)	O,n
Hairy Woodpecker, (Picoides villosus)	P
Northern Flicker, (Colaptes auratus)	O
ORDER: PASSERIFORMES (Perching Birds)	
FAMILY: TYRANNIDAE (Tyrant Flycatchers)	
Olive-sided Flycatcher, (Contopus borealis)	O
Western Wood-Pewee, (Contopus sordidulus)	O,n
Willow Flycatcher, (Empidonax traillii)	P
Pacific-slope Flycatcher, (Empidonax difficilis)	O,n
Black Phoebe, (Sayornis nigricans)	O,n
Ash-throated Flycatcher, (Myiarchus cinerascens)	P
FAMILY: HIRUNDINIDAE (Swallows)	
Tree Swallow, (Tachycineta bicolor)	O
Violet-green Swallow, (Tachycineta thalassina)	O,n
Northern Rough-winged Swallow, (Stelgidopteryx serripennis)	O,n
Cliff Swallow, (Hirundo pyrrhonota)	O,n
Barn Swallow, (Hirundo rustica)	O,n
FAMILY: CORVIDAE (Jays, Magpies, and Crows)	
Steller's Jay, (Cyanocitta stelleri)	O,n
Scrub Jay, (Aphelocoma coerulescens)	O,n
American Crow, (Corvus brachyrhynchos)	O

FAMILY: PARIDAE (Titmice)	
Chestnut-backed Chickadee, (Parus rufescens)	O,n
Plain Titmouse, (Parus inornatus)	O,n
FAMILY: AEGITHALIDAE (Bushtit)	
Bushtit, (Psaltriparus minimus)	O,n
FAMILY: SITTIDAE (Nuthatches)	
Red-breasted Nuthatch, (Sitta canadensis)	P
Pygmy Nuthatch, (Sitta pygmaea)	O,n
FAMILY: CERTHIIDAE (Creepers)	
Brown Creeper, (Certhia americana)	P
FAMILY: TROGLODYTIDAE (Wrens)	
Bewick's Wren, (Thryomanes bewickii)	O,n
House Wren, (Troglodytes aedon)	P
Winter Wren, (Troglodytes troglodytes)	O
FAMILY: MUSCICAPIDAE (Old World Warblers, Gnatcatchers, Kinglets, Thrushes, Bluebirds, and Wrentit)	
Golden-crowned Kinglet, (Regulus satrapa)	P
Ruby-crowned Kinglet, (Regulus calendula)	O
Blue-gray Gnatcatcher, (Polioptila caerulea)	O
Swainson's Thrush, (Catharus ustulatus)	O,n
Hermit Thrush, (Catharus guttatus)	O
American Robin, (Turdus migratorius)	O,n
Varied Thrush, (Ixoreus naevius)	P
Wrentit, (Chamaea fasciata)	O,n
FAMILY: MIMIDAE (Mockingbirds and Thrashers)	
Northern Mockingbird, (Mimus polyglottos)	O,n
FAMILY MONTACILLADAE (Wagtails and Pipits)	
American Pipit (Anthus rubrascens)	O
FAMILY: BOMBYCILLIDAE (Waxwings)	
Cedar Waxwing, (Bombycilla cedrorum)	O
FAMILY: STURNIDAE (Starlings)	
European Starling, (Sturnus vulgaris)	O,n
FAMILY: VIREONIDAE (Typical Vireos)	
Solitary Vireo, (Vireo solitarius)	P
Hutton's Vireo, (Vireo huttoni)	O,n
Warbling Vireo, (Vireo gilvus)	O,n
FAMILY: EMBERIZIDAE (Wood Warblers, Sparrows, Blackbirds, and Relatives)	
Orange-crowned Warbler, (Vermivora celata)	O,n
Nashville Warbler, (Vermivora ruficapilla)	P
Yellow Warbler, (Dendroica petechia)	O,n
Yellow-rumped Warbler, (Dendroica coronata)	O
Black-throated Gray Warbler, (Dendroica nigrescens)	O
Townsend's Warbler, (Dendroica townsendi)	O
Hermit Warbler, (Dendroica occidentalis)	P
Blackburnian Warbler, (Dendroica fusca)	O*
Palm Warbler, (Dendroica palmarum)	O
Northern Waterthrush, (Seiurus noveboracensis)	O
MacGillivray's Warbler, (Oporornis tolmiei)	P
Yellow-breasted Chat, (Icteria virens)	P
Common Yellowthroat, (Geothlypis trichas)	P
Wilson's Warbler, (Wilsonia pusilla)	O,n
Summer Tanager, (Piranga rubra)	O*
Western Tanager, (Piranga ludoviciana)	O

Black-headed Grosbeak, (Pheucticus melanocephalus)	O,n
Rufous-sided Towhee, (Pipilo erythropthalmus)	O,n
California Towhee, (Pipilo crissalis)	O,n
Savannah Sparrow, (Passerculus sandwichensis)	P
Fox Sparrow, (Passerella iliaca)	O
Song Sparrow, (Melospiza melodia)	O,n
Lincoln's Sparrow (Melospiza lincolnii)	O
Swamp Sparrow, (Melospiza georgiana)	P
White-throated Sparrow, (Zonotrichia albicollis)	P
Golden-crowned Sparrow, (Zonotrichia atricapilla)	O
White-crowned Sparrow, (Zonotrichia leucophrys)	O
Dark-eyed Junco, (Junco hyemalis)	O
Red-winged Blackbird, (Agelaius phoeniceus)	O
Brewer's Blackbird, (Euphagus cyanocephalus)	O,n
Brown-headed Cowbird, (Molothrus ater)	O,n
Hooded Oriole, (Icterus cucullatus)	O,n
Northern Oriole, (Icterus galbula)	P,n
FAMILY: FRINGILLIDAE (Finches)	
Purple Finch, (Carpodacus purpureus)	O,n
House Finch, (Carpodacus mexicanus)	O,n
Red Crossbill, (Loxia curvirostra)	P,a
Pine Siskin, (Carduelis pinus)	O
Lesser Goldfinch, (Carduelis psaltria)	O,n
American Goldfinch, (Carduelis tristis)	P
Evening Grosbeak, (Coccothraustes vespertinus)	P
FAMILY: PASSERIDAE (Weaver Finches)	
House Sparrow, (Passer domesticus)	O,n

CLASS: MAMMALIA

ORDER: MARSUPIALIA (Opossums, Kangaroos, and Relatives)

FAMILY: DIDELPHIDAE (Opossums)	
Virginia Opossum, (Didelphis virginiana)	P

ORDER: INSECTIVORA (Shrews and Moles)

FAMILY: SORICIDAE (Shrews)	
Ornate Shrew, (Sorex ornatus)	P
Trowbridge's Shrew, (Sorex trowbridgii)	P
FAMILY: TALPIDAE (Moles)	
Broad-footed Mole, (Scapanus latimanus)	S

ORDER: CHIROPTERA (Bats)

FAMILY: VESPERTILIONIDAE (Vespertilionid Bats)	
Little Brown Myotis, (Myotis lucifugus)	P
Yuma Myotis, (Myotis yumanensis)	P
Long-eared Myotis, (Myotis evotis)	P
Fringed Myotis, (Myotis thysanodes)	P
Long-legged Myotis, (Myotis volans)	P
Western Pipistrelle, (Pipistrellus hesperus)	P
Big Brown Bat, (Eptesicus fuscus)	P
Red Bat, (Lasiurus borealis)	O

Hoary Bat, (Lasiurus cinereus)	P
Pallid Bat, (Antrozous pallidus)	P
FAMILY: MOLOSSIDAE (Free-tailed Bat)	
Brazilian Free-tailed Bat, (Tadarida brasiliensis)	P
ORDER: LAGOMORPHA (Rabbits, Hares, and Pikas)	
FAMILY: LEPORTIDAE (Rabbits and Hares)	
Brush Rabbit, (Sylvilagus bachmani)	P
ORDER: RODENTIA (Squirrels, Rats, Mice, and Relatives)	
FAMILY: SCIURIDAE (Squirrels, Chipmunks, and Marmots)	
Merriam's Chipmunk, (Tamias merriami)	O
Western Gray Squirrel, (Sciurus griseus)	O
Fox Squirrel, (Sciurus niger)	O
FAMILY: GEOMYIDAE (Pocket Gophers)	
Botta's Pocket Gopher, (Thomomys bottae)	O
FAMILY: CRICETIDAE (Deer Mice, Voles, and Relatives)	
Western Harvest Mouse, (Reithrodontomys megalotis)	P
Deer Mouse, (Peromyscus maniculatus)	P
Dusky-footed Woodrat, (Neotoma fuscipes)	P?
California Vole, (Microtus californicus)	P
FAMILY: MURIDAE (Old World Rats and Mice)	
Norway Rat, (Rattus norvegicus)	O
House Mouse, (Mus musculus)	P
ORDER: CARNIVORA (Carnivores)	
FAMILY: PROCYONIDAE (Raccoons and Relatives)	
Raccoon, (Procyon lotor)	S
FAMILY: MUSTELIDAE (Weasels, Badgers, and Relatives)	
Long-tailed Weasel, (Mustela frenata)	P
Striped Skunk, (mephitis mephitis)	P
ORDER: ARTIODACTYLA	
FAMILY: CERVIDAE (Deer, Elk, and Relatives)	
Black-tailed Deer (Odocoileus hemionus)	P

APPENDIX H. DETAILED DISCUSSION OF WILDLIFE MANAGEMENT AND ENHANCEMENT ISSUES

Introduction

The water samples taken at Soquel Lagoon by the Santa Cruz County Environmental Health Department and the City of Capitola in the summer of 1988 suggest excrement left by birds using the lagoon may have contributed significantly to the high fecal coliform/ fecal streptococcus ratios recorded (see Appendix E). The water quality recorded in the lagoon during the summer of 1988 probably had no negative impact on the wildlife using the site, although it did impact the site's recreational uses, forcing closure of the lagoon to swimming. In addition to contributing to poor water quality in the lagoon, bird excrement is high in nutrients, indicating birds may also contribute to the growth of aquatic plants in the lagoon. However, birds also consume large quantities of aquatic plant growth, perhaps creating a somewhat balanced system of plant growth and plant consumption.

Improving water quality for human use may be a management goal, but some of the measures necessary to achieve this goal, such as disruption of bird patterns and bird harassment, conflict with the goal of enhancing the lagoon's wildlife value. It is assumed that a relatively natural lagoon system is desired, adding an attractive accent to the City of Capitola.

Five types of birds potentially contribute significantly to the poor water quality at Soquel Lagoon, by virtue of their numbers and patterns of habitat use. These are (1) gulls (various species), (2) wild Mallards, (3) domestic geese and feral ducks, (4) American Coots, and (5) Rock Doves ("pigeons").

The geese, being permanent residents, and the largest birds at the lagoon, probably contribute significantly to the total amount of bird excrement entering the lagoon. Mallards, continually present on the lagoon and its immediate shoreline, are probably also a major source contributing to the total amount of excrement in the lagoon. Gulls and Rock Doves using the lagoon spend a large percentage of their time away from the water, so their excrement enters the lagoon when they are flying over, bathing (gulls), waiting for handouts from people (gulls), or perching on the railroad trestle (primarily Rock Doves). American Coots, like Mallards, are continually present on the lagoon, but they do not arrive at the site until late August.

Reducing the number of birds at Soquel Lagoon and/or limiting their use of the site, may improve the lagoon's water quality, and may decrease nutrient levels in the water. The available options for controlling bird use of the lagoon are described and discussed below. These options, their suitability for the study area, and their potential effectiveness are summarized in Table 1 of the main report.

RECOMMENDATIONS FOR MANAGING SOQUEL CREEK LAGOON'S BIRD POPULATIONS AND FOR ENHANCING WILDLIFE WITHOUT SWIMMING AS A PRIMARY GOAL.

It is desirable to strike a balance between the goals of improving Soquel Lagoon's water quality, enhancing its wildlife habitat, and managing the lagoon as a relatively natural ecosystem. It would be very impractical, and perhaps impossible, to exclude all waterbirds and Rock Doves from the lagoon and its environs, and would directly conflict with some of the goals of this management plan. It would be possible to greatly reduce waterbird and Rock Dove use of the site, but this would require transforming the lagoon into a hostile environment for wildlife, removing feeding opportunities (both natural and unnatural), and severely limiting the distribution of birds at the lagoon. The intense program of bird management required to greatly reduce the number of birds using the lagoon would negatively impact the site's aesthetic qualities, and would be in direct conflict with the goals of enhancing wildlife habitat, and managing a relatively natural lagoon system.

We recommend a more restrained approach to bird management at Soquel Lagoon, employing a few measures to selectively reduce the numbers of certain species or types of birds, managing their use of the lagoon, and managing the behavior of people at the lagoon. A "low key" management plan would be in keeping with the goals of enhancing wildlife habitat, managing the lagoon as a relatively natural system, and may contribute, through a reduction in the number of waterbirds and Rock Doves present, to improving the lagoon's water quality. It may be possible to reduce the bird populations sufficiently to improve water quality, while still allowing the lagoon to support a moderate population of waterbirds. Birds are integral parts of the natural community of coastal lagoons, and are of great aesthetic value both to residents and tourists.

Remove Domestic Waterbirds and Reduce Bird-Feeding

This would involve removal of Soquel Lagoon's existing population of domestic geese and ducks, prohibiting future releases of additional birds, and prohibiting feeding of the birds by the public. This alternative would not be expected to have any significant detrimental effects on the lagoon's wild animal populations and would probably reduce diseases among the wild birds. It may reduce bird numbers sufficiently to result in a measurable improvement in the lagoon's water quality.

Cull Individuals or Populations. Only the population of domestic geese and ducks could be effectively reduced at the lagoon by the a program of culling or relocation. These birds, being non-native, and strongly dependent on food from humans, are not a natural part of the area's avifauna. The same could be said of the lagoon's Rock Dove population, but, for reasons discussed above, it may not be practical or effective to attempt to remove

that species from Soquel Lagoon. The domestic geese and ducks undoubtedly contribute measurably to the lagoon's water quality problems, and could be culled or relocated.

The CDFG does not encourage the coexistence of non-native, domestic or feral populations with populations of native and wild species. Domestic birds may carry pathogens that could affect the health of the wild community, and their coexistence with wild birds allows the for the possibility of interbreeding between populations and weakening of genetic stocks.

We recommend removal of Soquel Lagoon's population of domestic geese and ducks. The CDFG will not allow relocation of these types of birds to other public lagoons, ponds, or lakes. While they do not encourage relocation of such birds to private lands, where they might be "adopted" by members of the public, they permit it. There is no assurance, however, that adopted birds will not be returned to the lagoon, or another nearby site, at some time in the future. While an attempt could be made to find members of the public who are willing to adopt a domestic goose or duck, it would probably not be possible to relocate all of these birds. It may be necessary to eliminate some of them.

Education of the public regarding the problem and the recommended solution should be performed before any management actions are carried out. A series of public meetings should be held to inform the public of the plan, discuss their concerns, and discuss the possibility of alternate solutions. The public should be notified, through newspaper announcements or other forms of publicity, that the domestic geese and ducks at Soquel Lagoon are available for adoption. Organizations, such as the Humane Society, Native Animal Rescue, the SPCA, the Boy Scouts, Girl Scouts and other youth organizations, as well as businesses which may have ponds on their property, such as farms, ranches and/or quarries, should be contacted to help find new homes for these birds. It would not be wise to allow the birds to be relocated to other sites in the vicinity of the lagoon, as this would increase the likelihood of their being returned to the site. An adoption period should be established and announced, after which other methods of removing the domestic geese and ducks from the lagoon would be employed.

After the adoption period, the remaining domestic geese and ducks should be trapped and destroyed. This should be carried out by a City or County animal control agency, and should be done in cooperation with the California Health Department. A variety of capture techniques are possible. A qualified biologist should be present to insure that no wild ducks are taken. The possibility of using some or all of the geese and ducks as food for endangered raptors (peregrin falcons) at U.C. Santa Cruz's Predatory Bird Research Center should be explored.

Prohibit the Abandoning of Animals at Soquel Lagoon. The lagoon's population of domestic geese and ducks were all released at the site. Additional domestic individuals are released each season at

the lagoon and other similar sites. Such releases are especially frequent in the spring, when ducks purchased for Easter are abandoned at likely sites. We recommend that the City establish and enforce an ordinance prohibiting the public from abandoning their domestic geese and ducks at the lagoon. The City should consider an ordinance which prohibits the sale of ducks in pet stores.

Stop Bird-Feeding At Soquel Lagoon. Bird-feeding attracts and concentrates birds at the lagoon. It significantly affects the distribution of gulls and Rock Doves, increasing their numbers, the amount of time they spend at the lagoon, and the amount of excrement they contribute to the lagoon. Most of the foods offered to the birds are nutritionally poor and unhealthy. In addition, uneaten foods sink to the bottom of the lagoon, decay, and contribute further to the lagoon's high nutrient levels. Feeding also encourages the site's rodent population. Rodents, particularly Norway Rats, take what food might be overlooked or otherwise uneaten.

Bird feeding also has a positive aspect. It allows people to interact with animals, providing a connection to wild communities, and a learning experience for all ages. At Soquel Lagoon, however, management concerns are in conflict with bird feeding. It may be possible to provide people with other educational opportunities instead of bird feeding.

We recommend that the City establish a program to stop bird-feeding at Soquel Creek Lagoon. This program would not apply to seed or sugar-water feeders maintained by local residents, but would be directed at stopping the practice of offering food to the waterbirds and Rock Doves. Because of the number of people feeding birds at the lagoon, and the relative frequency of feeding, it will probably be necessary for the City to establish and enforce an ordinance that prohibits bird-feeding in the lagoon area.

The program would not effectively contribute to improving water quality unless all, or nearly all, bird-feeding was stopped. Infrequent, but regular, offerings of food will cause many individuals to spend extra time at the lagoon, waiting for feeding opportunities, and will not lead to a significant reduction in the number of birds using the lagoon. It is important to involve the restaurant proprietors in the program. They should be encouraged to include a no bird-feeding policy on their menus. Restaurant employees are presently a primary source of handouts to geese, based on repeated observations. They must be educated, as well.

Programs administered by the Parks and Recreation Department of the City of Santa Cruz to curtail bird-feeding at Neary's Lagoon, Westlake, and San Lorenzo Park have met with limited success (George Lundquist pers. comm.). This program has not been backed by an enforced ordinance, and although bird-feeding has been reduced at these sites, it still occurs relatively frequently.

The program has been least successful at Westlake, a situation similar to Soquel Lagoon, where homes exist immediately adjacent to the site of bird-feeding.

Establishing a program to stop bird-feeding would not be detrimental to the wild birds using the lagoon. The majority of the foods given to the wild birds are detrimental to their health, and natural foods are available at the lagoon. It is not necessary to supplement the diet of wild birds using the lagoon. A "don't feed the birds program" would probably affect the survival of the domestic geese and ducks currently using the site, but we recommend that these birds be removed from the lagoon area.

Public Education. We recommend that public education be included within the management program. The first phase of the program should be to inform the public of the inter-relationship among water quality problems, bird-feeding, recreational uses, and the health of wild bird populations. Public awareness of the rationale behind the the recommended program to stop bird feeding could be achieved with public meetings, media announcements and newspaper articles, posted notices, and prepared educational programs for local schools. It would be necessary to obtain cooperation from the restaurants bordering the lagoon, as their staff and patrons have been identified as a major source of handouts. Cooperation should also be obtained from the proprietor of the paddleboat concession to stop feeding the birds, and to prohibit feeding of the birds by customers.

Following the initial period of public education, signs should be installed at the places where bird-feeding occurs most regularly. These locations include the walkway between restaurants to the lagoon, Venetian Courts, the Stockton Avenue Bridge, the park-like areas on both shores immediately upstream from the Stockton Avenue bridge, the beach near the flume, the restaurants bordering the lagoon, the trestle area, the confluence with Noble Gulch, and the Shadowbrook Inn (see Figure 2). These signs should not only inform people about the program or ordinance to stop bird-feeding, but should also provide educational material about the relationship between bird-feeding and the lagoon's water quality problem, and the detrimental effects of bird-feeding to the lagoon's wild bird populations.

Although water quality is only a concern during the late spring, summer, and early fall, the recommended program should be in effect year-round. The program will be most effective in altering people's behavior at the lagoon if it is in effect during all seasons. Special efforts could be made to stress the program during the warmer months, when recreational use of the lagoon is at a maximum. The City of Capitola should issue a series of press releases each spring and summer, reminding the public of the bird feeding policy or ordinance.

Limit Aquatic Plant Growth. Aquatic plant growth provides natural food sources for the waterbirds using Soquel Lagoon. Removing all

or most of the vegetation would conflict with the management goals of wildlife habitat enhancement, and maintaining a relatively natural lagoon system. However, removal of 30-50% of the vegetation would limit the food resources, and probably reduce the number of Mallards and and American Coots at the lagoon, while still allowing smaller populations to use the site.

We recommend removal of surface growths of filamentous algae only. Removal of root aquatic vegetation (pond weed) could have a deleterious effect on fish habitat within the lagoon.

Monitoring Program of Bird-Feeding, Bird Use of the Lagoon, and Bird Numbers. We recommend that the City begin a monitoring program to document changes in the frequency of bird-feeding, the number of birds using the lagoon, and the distribution of birds at the lagoon following the implementation of the management plan. The bird monitoring program would be concurrent with water quality monitoring. To obtain baseline data on the frequency of bird-feeding and the number of birds present, the bird monitoring program should begin before any management actions are implemented.

Removal of Exotic Plant Species and Revegetation with Native Riparian Species

The riparian habitats adjacent to Soquel Lagoon contain numerous exotic plants (Appendix C). Exotic plant species generally provide less productive resources for wildlife than native riparian species, and reduce the value of the native habitats in which they occur. The wildlife value of the lagoon area would be enhanced by removal of as many of the existing exotic plants as possible, and replacing them with native riparian species. Suitable species for planting are detailed in Appendix C.

Preserve Tree Snags

Tree snags (standing dead trees) are used extensively by wildlife. Snags provide nest-sites for cavity dwelling birds, den trees for small and medium sized mammals, and feeding and perch sites for many species. Snags are currently rare in the habitat bordering the lagoon. All existing and future snags in the habitats adjacent to the lagoon should be left standing, unless they pose an immediate threat to buildings or other structures.

Install Nest Boxes

Tree cavities are usually a limited commodity in most habitats, and they have been observed to be rare adjacent to the lagoon. Nest boxes and nest shelves should be installed to provide nest sites for cavity-nesting birds, and den-sites for small mammals. The holes in nest boxes should not be larger than 1 1/2 inches, to prevent their use by European Starlings (*Sturnus vulgaris*). Bird species that might use nest boxes in the Soquel Lagoon area include Downy Woodpecker (*Picoides pubescens*), Violet-green

Swallow (*Tachycineta bicolor*), Chestnut-backed Chickadee (*Parus rufescens*), Plain Titmouse (*P. inornatus*), and Bewick's Wren (*Thryomanes bewickii*). Mammals using nest-boxes would include various mice, and possibly bats. Nest shelves would be used by Western Flycatcher, Black Phoebe (*Sayornis nigricans*), Barn Swallow (*Hirundo rustica*), and American Robin (*Turdus migratorius*). Construction and installation of boxes should be supervised by a qualified biologist.

Allow Moderate Growth of Aquatic Vegetation

Pondweed, filamentous algae, and the associated invertebrate populations provide an important food source for Soquel Lagoon's wild waterbirds. Removal of all the aquatic vegetation, in an effort to improve the site's aesthetic quality, conflicts with the interests of the site's wildlife and fishery. We recommend removal of surface algae. This would still allow for feeding by waterbirds, while improving the lagoon's aesthetic quality.

Restrict Night Lighting

Night lighting is generally disruptive to the behavior patterns of nocturnal species. We recommend night lighting in the Soquel lagoon area be directed toward buildings, not the lagoon or riparian habitat along the lagoon's west shore.

Restrict Boating To The Lower Lagoon Area

Boating and other activities in the waters of the lagoon are disruptive to the wildlife using the lagoon. We recommend that the City establish a policy to restrict boating to the area downstream from Shadowbrook Restaurant. This would allow the upper lagoon to remain as a less disturbed area, maximizing its value for wildlife. An exception to this restriction could be made during the Begonia Festival because of its short duration.

Install Interpretive Signs

It is desirable to increase the public's awareness of wildlife. Interpretive educational material could enhance recreational uses of the lagoon, allowing people to connect themselves, through knowledge, to the lagoon's wildlife community. Interpretive material could be presented on signs. These signs could be placed along the walkway bordering the east edge of the lagoon, in the vicinity of the Stockton Avenue bridge, and on the beach, adjacent to the lagoon.

The interpretive material could discuss interesting aspects of the local wildlife, fish, and vegetation. Some topics that might be addressed include Brown Pelican and cormorant feeding behavior, use of the beach and lagoon by gulls, shorebirds of the sandy beach, Mallard behavior, fall landbird migration, nesting birds of the lagoon area, steelhead migration and spawning behavior, the Tidewater goby, riparian habitat and and its wildlife value.

RECOMMENDED BIRD CONTROL MEASURES WITH SWIMMING AS A PRIMARY MANAGEMENT GOAL

The number of birds using the lagoon may be reduced or limited in three ways. First, populations of a given species may be directly limited by removing some or all of the individuals from the site. Second, the lagoon's habitats or food resources may be altered, indirectly affecting bird populations. Third, the activity patterns of individuals of a given species may be disrupted or disturbed, causing them to go elsewhere or limiting their use of the lagoon. Several methods may be employed in an attempt to limit bird numbers or bird use at the lagoon, but the effectiveness or practicality of each method varies, depending on the type of bird considered. Some methods are unsuitable for the site, regardless of the type of bird considered.

Limitation of Bird Numbers By Direct Removal

Culling Individuals or Populations. Bird numbers may be directly limited by culling and destroying individuals or entire populations using the site. This would not be legally possible for the lagoon's populations of gulls or wild Mallards. It might be possible to obtain a permit to cull American Coots, but it is not likely a permit would be granted for Soquel Lagoon. Rock Doves may be culled from the site, but this would probably not lead to a significant reduction in the number of doves using the site. The large population of Rock Doves residing in the surrounding area would be expected to serve as a population reservoir, with individuals continually moving into to the lagoon area to consume the handouts left by birds that had been removed. A permit could be obtained from the California Department of Fish and Game (CDFG) to cull the entire population of domestic geese and feral ducks.

Relocation of Individuals. The number of birds using the lagoon may also be reduced by capturing individuals and relocating them elsewhere. It would difficult to capture the gulls, and as they are abundant in the local area and highly mobile, their relocation would not be expected to result in a net reduction in their numbers at the site. Wild Mallards, American Coots, and Rock Doves could be captured in small numbers and relocated, but they would be expected to return to the site, or be replaced by other individuals. There would probably be no net reduction in the numbers of these species at the site. The entire population of domestic geese and feral ducks could be captured with relative ease, but an acceptable relocation site would have to be found. The CDFG will not permit relocation of domestic geese and feral ducks to other ponds, lagoons, or lakes. If permission could be obtained, these birds could be relocated to privately owned farm ponds or quarry ponds in the County. They could potentially be "adopted" as pets by members of the public, and kept on private property. Hopefully, these birds would not be returned to the lagoon later.

Limit Reproduction. Bird reproduction at the lagoon could be limited, but this would not be expected to result in a net reduction of individuals of any of these species groups. Gulls, American Coots, and Rock Doves do not currently nest at the lagoon, although Rock Doves may do so at some point in the future. A few pairs of wild Mallards reproduce at Soquel Lagoon, but these birds are contributing in only a small way to the local population, as they have been observed to suffer heavy predation from the local population of cats. It is illegal to destroy the nests or remove the eggs from nests of wild Mallards (Migratory Bird Treaty Act, as amended, 16 U.S.C. 703-711). Some of the domestic geese and feral ducks are able to reproduce at the lagoon (primarily the ducks), although their reproductive rate is unknown, and is probably rather low. Eggs could be removed from their nests, hard-boiled and returned to nests, limiting reproduction by these birds. But such action would probably have only a small effect on their numbers at the site.

Rock Doves nest near the lagoon under the Capitola Wharf. The nests of these birds could be removed, or the small ledges used for nest placement could be made inaccessible to the doves. However, because of the large population resident in the Capitola area, it is unlikely such actions would significantly reduce the number of doves visiting the lagoon. If Rock Doves should begin to nest on the railroad trestle, their nests could be removed, or the trestle could be made inaccessible to the birds (see below in the section titled Disturb or Disrupt Bird Activity).

Remove Domestic Waterbirds From Noble Gulch. Domestic ducks reside in a mobile home park along Noble Gulch. In addition, a small number of wild Mallards, including some of the birds using Soquel Lagoon, frequent the waters of Noble Gulch. Excrement from the domestic waterfowl and wild Mallards which enters Noble Gulch is eventually added to the waters of Soquel Lagoon. These birds may be the source of the high fecal coliform/ fecal streptococcus ratios recorded at the confluence of Noble Gulch and Soquel Lagoon. We recommend that the City look into removal of the domestic waterfowl present at this mobile home park. In addition, we recommend that the City should attempt to gain cooperation from the proprietor and residents of the mobile home park to stop feeding waterbirds.

Lowering of Bird Numbers by Altering Habitat or Food Resources

Stop The Offering Of Handouts. The offering of handouts to birds concentrates their activities at the lagoon, and attracts additional individuals to the site. Establishing a program to curtail or abolish the feeding of birds would affect the number and distribution of birds at the lagoon. Such a program would affect the populations of gulls, wild Mallards, domestic geese and ducks, Rock Doves and, to a lesser degree, American Coots.

If feeding were stopped, gulls would be less likely to congregate away from the beach edge of the lagoon. Many gulls would still be present, but their distribution at the lagoon would be altered, and numbers of gulls actually on the lagoon would probably be reduced. The domestic geese and ducks depend heavily on handouts from people, so a policy to stop feeding of the birds (if effective) would be expected to greatly reduce the site's suitability for these birds. Wild Mallards take advantage of the easily available food offered by handouts, but as they also feed extensively on natural foods, a policy to stop bird feeding would not be expected to have a major effect on the number of Mallards using the site. Rock Doves congregate around the lagoon primarily to take advantage of handouts. A policy to stop bird feeding would probably significantly affect the number and distribution of doves visiting the lagoon. American Coots, present at the lagoon from late summer to mid-spring, were not observed to take handouts in the fall of 1988 (see Appendix D), although they were observed taking handouts during the winter, and commonly do so elsewhere (personal observation). A policy to stop bird feeding would probably have a limited effect on the number of American Coots using the lagoon. Overall, curtailing or abolishing bird feeding at the lagoon would be beneficial to the health of the wildlife using the site. Most of the foods that are offered are unhealthy for the birds, and, if natural foods are available, it is not necessary to supplement their diet with handouts.

A program to stop bird-feeding at Soquel Lagoon could be carried out by posting signs, and perhaps passing a City ordinance against feeding the birds. It would probably be necessary to attempt to entirely abolish the offering of handouts to have a measurable effect on the number and distribution of birds at the lagoon. A policy to control bird feeding at Soquel Lagoon is expected to be in conflict with the opinion of some parts of the public, so it would be appropriate to establish a program of public education to enlighten the public on the relationship and conflicts between water quality, feeding and attracting birds, and the health of the lagoon's wildlife populations.

Depress aquatic growth. It is our opinion that significant (more than 50%) of the aquatic plant biomass would need to be removed before an effect on bird populations would occur. Such removal would negatively impact fish and would violate conditions of the permit.

Lowering of Bird Numbers by Disruption or Disturbance of Activity Patterns

It is our opinion that techniques involving sound devices are either ineffective or inappropriate. The use of chemicals on roosting sites is not recommended because of the danger to aquatic organisms.

Use of Physical Devices to Restrict Roosting and Nesting. The two main areas where physical devices could be implemented are

the Southern Pacific railroad trestle and the rooftops of the restaurants on the Esplanade. The rooftops are used irregularly, and to a small degree, by gulls, and to a greater degree by Rock Doves. No regularly occurring, sizable roost of either species has been noted. The trestle is used off and on as a roost site and resting place by variable numbers of Rock Doves, and as a temporary perch site by small number of gulls.

It is unlikely that use of the rooftops by gulls or Rock Doves contributes to the lagoon's water quality problems. However, these areas are used for roosting, and we recommend that gull use of the Esplanade rooftops be discouraged by installing a series of closely-spaced, fine wires over the rooftop surfaces.

Bird use of the trestle directly contributes to the lagoon's poor water quality, although the number of birds present on the trestle is variable. Rock Doves would be the primary source of excrement. Excrement on the trestle is not an aesthetic problem, as most of it falls directly into the lagoon. Chemical repellents, as discussed above, could be applied to the trestle structure, but such treatments are environmentally unsuitable.

To limit bird use of the railroad trestle, the trestle structure could be made inaccessible to birds by attaching a wire fence to the sides and bottom, preventing access to perch sites. Such a fence would significantly alter the trestle's appearance.

Harassment. The activities of bird populations at the lagoon could be disrupted by harassment. However, it is our opinion that this approach will not reduce bird use or fecal pollution. Harassment already occurs regularly at the lagoon, such as when children run towards the flock of gulls at the lagoon edge, forcing them to take flight. The birds have become accustomed to this form of disturbance, and it does not appear to reduce the number of birds at the site. In addition, birds have the tendency to evacuate their waste when taking flight. So, this method could even increase the amount of excrement entering the lagoon.

APPENDIX I. AVIAN USE OF SOQUEL CREEK LAGOON, OCTOBER 24-31, 1988.

Abstract

Avian use of Soquel Lagoon was monitored during October 24-31 1988 to obtain quantitative data on the distribution of waterbirds using the lagoon. Censuses were conducted, assigning each individual bird to one of 16 pre-defined sections of the lagoon. Birds were concentrated in the lower reaches of the lagoon, with 51% occurring between Stockton Avenue and the beach, and 32% between Stockton Avenue and the railroad trestle. Each species exhibited a slightly different distribution on the lagoon. Feeding behavior and interactions with humans were also recorded. Comparisons were made between the results obtained on this study, and the observed distribution of waterbirds at the lagoon during the summer months.

The Study Area

Soquel Lagoon, at the mouth of Soquel Creek in Capitola, was defined as the length of creek from the beach to approximately 1200' upstream (see Figure 1). The lagoon is traversed by Stockton Avenue, near the beach, and the Southern Pacific Railroad trestle upstream from there. The lagoon was cut off from the ocean by a berm at the beach. Sandy beach bordered about half the lagoon downstream from Stockton Avenue, with the remainder of this portion being bordered by restaurants and residential development. The west shore of the lagoon, above Stockton Avenue, is mostly vegetated. The Shadowbrook Inn is located about 400 feet upstream from the railroad trestle. The east shore of the lagoon is bordered by residential development, with landscaped vegetation, lawns, and boat docks.

The lagoon is impacted by humans and domestic pets. Stockton Avenue is busy at all times of the day, and human activity occurs all around the lagoon. The west shore of the lagoon above Stockton Avenue is the least impacted. Numerous cats and dogs reside along the east shore of the lagoon. People regularly offer food to the birds that use the lagoon.

During the time of observations, significant amounts of pondweed and algae were noted in the lagoon. There was almost no flow of water into the lagoon from Soquel Creek. Only wind action on the surface might have had much effect on currents or mixing in the lagoon, but during this study the winds were consistently calm. Weather varied from 100 percent fog cover to clear skies.

Methods

Bird use of Soquel Lagoon was monitored on six days from 24-31 October 1988. The lagoon was divided into 16 sections to quantify bird use in different parts, as shown on Figure 1. Fifteen censuses were made.

Four types of birds were censused: Mallards, American Coots, Gulls (two species present: Western Gull and California Gull), and domestic geese. Two Pied-billed Grebes were also present on each census, but they were not included in this analysis. Rock Doves and Brewer's Blackbirds were commonly observed around the edge of the lagoon, especially near the beach, but these birds were not included in this summary, as they had little interaction with the lagoon itself. Rock Doves were not roosting on the railroad trestle at the time of this study, though they did during the summer months.

Vantage points allowed the entire lagoon to be censused. Each census consisted of the biologist viewing the lagoon from the south side of Stockton Avenue, the north side of Stockton Avenue, the east side of the railroad trestle, and two spots further upstream from the trestle. The bank of the lower lagoon, downstream from Stockton Avenue, was frequented by many birds, especially gulls. In this portion of the lagoon, only those individuals within one foot of the lagoon were included in the census. This method included birds that were interacting with the lagoon, but excluded those that were simply present near the lagoon. Upstream from Stockton Avenue, only Mallards were noted on the banks of the lagoon. These individuals were recorded separately from the Mallards that were in the lagoon itself. Census duration ranged from 8-21 minutes (average = 13.3 minutes). Censuses were conducted at various times between 8:45 am and 4:38 p.m.

Feeding of bread or other handouts was recorded when observed, along with the location of the feeding, the type of food, and the number of birds that were responding.

During analysis of the results, the 16 quadrats were lumped into three reaches, as shown on Figure 1. Reach 1 was defined as the area from the beach to Stockton Avenue, Reach 2 was defined as the area from Stockton Avenue to the railroad trestle, and Reach 3 was defined as the area from the railroad trestle to the upper end of the study site.

Results

All species that were present in the summer months were observed in this study. The total number of individuals of the species of interest ranged from 137 to 233 on each census. The ranges for wild Mallards, domestic geese and ducks, American Coots, and gulls were 33-102, 5-16, 64-106, and 24-54, respectively. The general patterns of bird use of the lagoon did not vary significantly from day-to-day. Instead, the locations of concentrations of birds were fairly predictable. In addition, there appeared to be no significant differences in the distribution of the birds at various times of the day.

Distribution of Birds at the Lagoon. As shown on Figure 2, birds used the entire lagoon, but they were not evenly distributed

throughout the lagoon. Figure 3A shows that 51% of all the individuals tallied were concentrated in Reach 1, and 32% were concentrated in Reach 2. The quadrat labeled "E4" (see Figures 1 and 2) had the greatest overall concentration of birds (17.7% of the total number of individuals recorded). Quadrats "W1" and "W2" also had high concentrations of birds (12.8% and 15.4% of the total, respectively).

The distribution of all the species combined, excluding American Coot, was examined to better approximate the distribution of birds at the lagoon during May to August, prior to the arrival of coots (see Figure 3B). The very small differences in distribution illustrated in Figures 3A and 3B suggest the results obtained on this study closely approximate the distribution of birds during the summer months. In addition, casual observation of the distribution of waterbirds on the lagoon during July and August 1988 found their distribution to be quite similar to the results obtained on this study.

Each species had a different distribution in the lagoon. Mallards used the entire lagoon, but 49 percent were concentrated in Reach 2, (see Figure 4A). Thirty-eight percent were in quadrats "W4" and "E4". The 26 percent observed in Reach 1 was similar to the 25 percent observed in Reach 3. Mallards roosting on the banks of the lagoon were limited to favored spots, with over 98% along Reach 2 (see Figure 4B). These birds were observed regularly at the west edge of quadrat "W4", at the east edge of "E4", at the east edge of "E5", and under the railroad trestle, on the west side of the lagoon. Fifty-eight percent of the roosting Mallards were at the west edge of quadrat "W4" alone. These birds probably chose these sites for their structural qualities and to avoid disturbance, rather than proximity to any activity on the lagoon.

Domestic geese and ducks, forming a rather unified group, were strongly tied to the lower lagoon area (see Figure 5A). Ninety-five percent of those seen were in Reach 1, with 79.7% being in quadrat "W2".

American Coots were evenly distributed over much of the lagoon, although they tended to concentrate in downstream from the railroad trestle (see Figure 5B). Thirty-five percent were observed in Reach 2, with 48% observed in Reach 1.

Gulls were strongly associated with the lower lagoon, at Reach 1, with 94.4% being in this area (see Figure 6). They were especially regular in quadrat "W1", where 56.1% were concentrated. Upstream from Stockton Avenue, gulls were somewhat irregular in occurrence, and when observed were present in very small numbers.

Observations of Feeding Behavior. The species examined in this study had at least five obvious sources of food to exploit at the lagoon: aquatic plants, invertebrates, fish, handouts offered by humans, and carrion. During this study all of these sources were

readily available except carrion, which was scarce or lacking. Humans were observed to offer handouts 16 times on nine of the 15 surveys (60% of the surveys). Handouts were offered an average of 4.8 times per hour. It was not unusual to observe handouts being offered simultaneously at more than one location around the lagoon. The most frequently observed source of handouts was the customers at Margaritaville, in quadrat "E3". Customers of this restaurant that feed tortilla chips to the birds accounted for 44% of all the observations of human feeding of the birds. Quadrat "W2", adjacent to Venetian Courts, was the next most frequently observed site of handout-feeding, accounting for 38% of the observations. Handout-feeding was observed once in three other quadrats: "W4","E4", and "E7".

Mallards fed extensively on natural food sources, taking both the algae on the lagoon's surface and the pondweed below the surface. They also took invertebrate life associated with these plants, and their concentration at quadrat "E4" correlated with high concentrations of this prey (D. Alley pers. comm.). Mallards also regularly took handouts from humans. Mallards were present on all occasions when handouts were offered, though only 29% of the Mallards tallied were taking advantage of this food source. On one occasion when food was being offered at three spots simultaneously, all but one of the Mallards present were in attendance, indicating this food source can be frequently used by this species in Soquel Lagoon.

Domestic geese and ducks were strongly associated with human offerings. They were present on every occasion that handouts were offered, with an average of 95% of them taking advantage of this food source during this study. The geese were not observed using natural food sources during this study, though a small proportion of the domestic ducks regularly took pondweed and algae.

American Coots fed exclusively on plants and their associated invertebrates. Coots took algae from the surface, and dove or dabbled to obtain pondweed below the surface. Although coots frequently accept handouts from humans at other lagoons and ponds, they were not observed to do so in this study.

Gulls took handouts from humans, but were not noted taking natural foods available in the lagoon. They were present on all occasions when handouts were offered, with an average of 41% of the gulls taking advantage of this source. Based on our observations of feeding behavior and the habitat requirements of these species, it is assumed that the majority of the gulls were attracted to the lagoon as a freshwater source, and not as a place to find food.

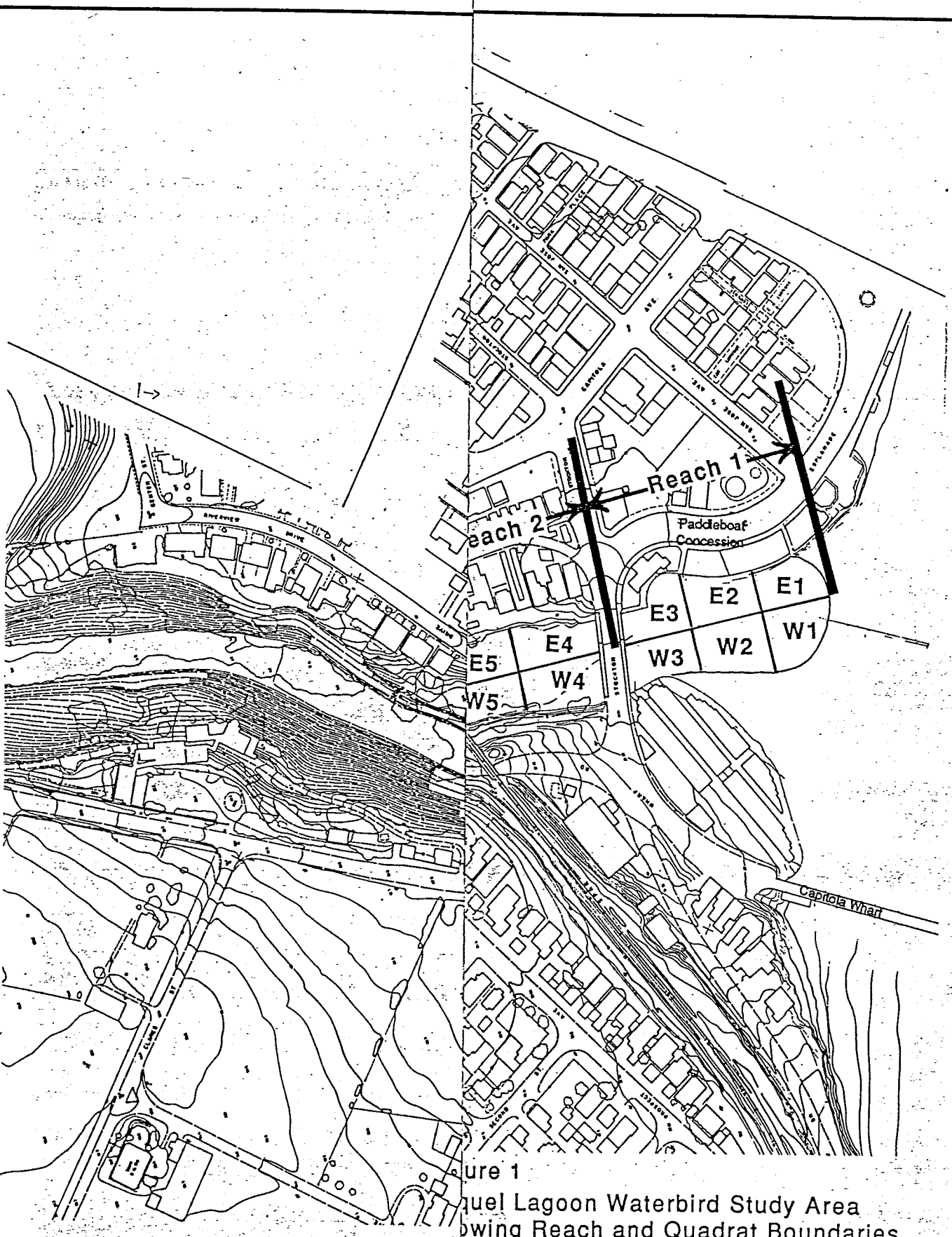
Discussion

The observed distributions of bird species on this study closely paralleled the distributions of these species noted during casual observation from May to September. One exception was the

American Coot. This species was not present on the lagoon prior to the end of August, when the first migrants appeared. Their numbers increased steadily through the fall.

The offering of handouts seemed to have a significant effect on the overall distribution of the birds, though other factors were obviously involved. Handout-feeding was most frequent downstream from Stockton Avenue, and this area had the most birds, overall. But this area also had the deepest water, supported good growths of algae, and was adjacent to the beach, all of which are factors which these species of birds might find attractive.

If the City of Capitola were to adopt a policy to discourage the feeding of birds, the overall number of birds present during the summer months would probably decline, but their distributions would probably not change significantly. Such a policy would probably significantly affect the domestic geese and ducks, and, to a lesser extent, the Mallards and gulls. Similarly, discouraging the growth of aquatic vegetation would be expected to result in decreases in the number of Mallards and American Coots present, though this would not be expected to significantly change the distribution of birds on the lagoon.



ure 1
uel Lagoon Waterbird Study Area
owing Reach and Quadrat Boundaries.

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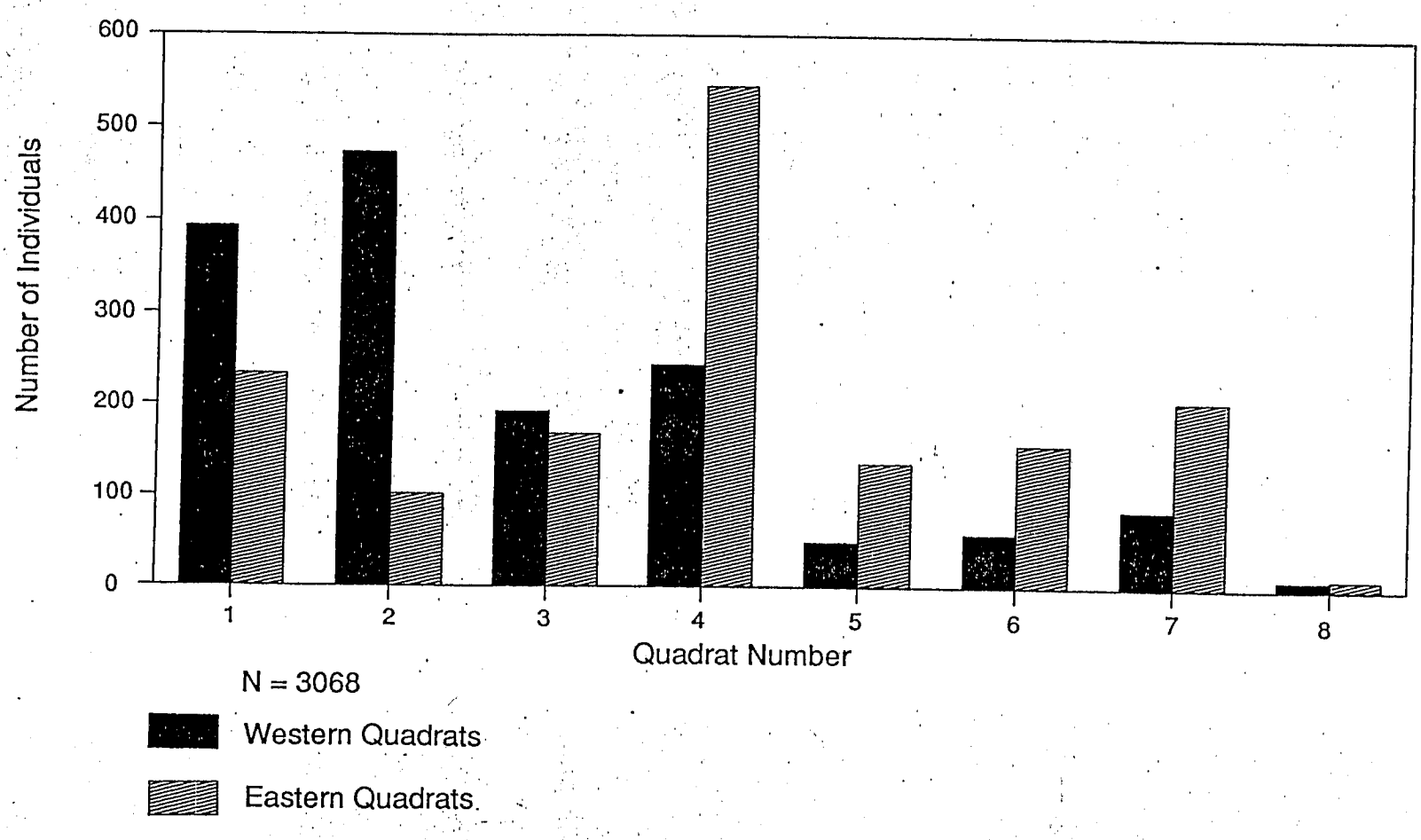

Figure 2. CUMULATIVE NUMBER OF INDIVIDUALS OBSERVED IN EACH QUADRAT. (all species combined)

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JOHN STANLEY & ASSOCIATES
6001 Butler Lane, Suite 1 • Scotts Valley, CA 95066 • (408) 439-5500 FAX (408) 438-1142

CUMULATIVE NUMBER OF INDIVIDUALS OBSERVED IN EACH QUADRAT. (all species combined)

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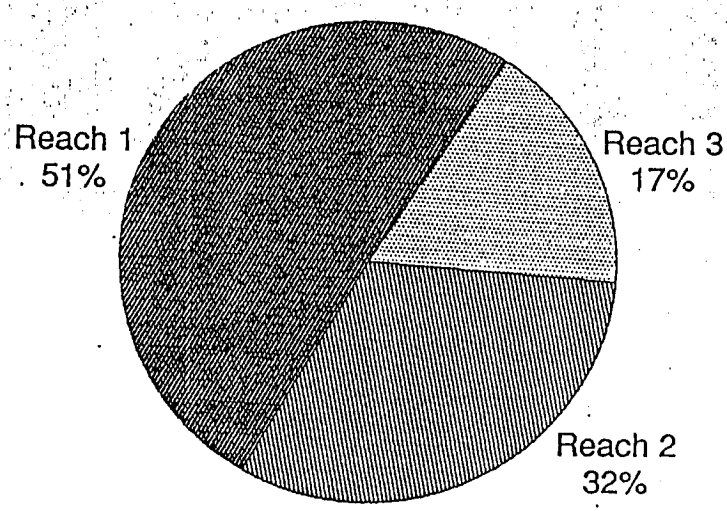
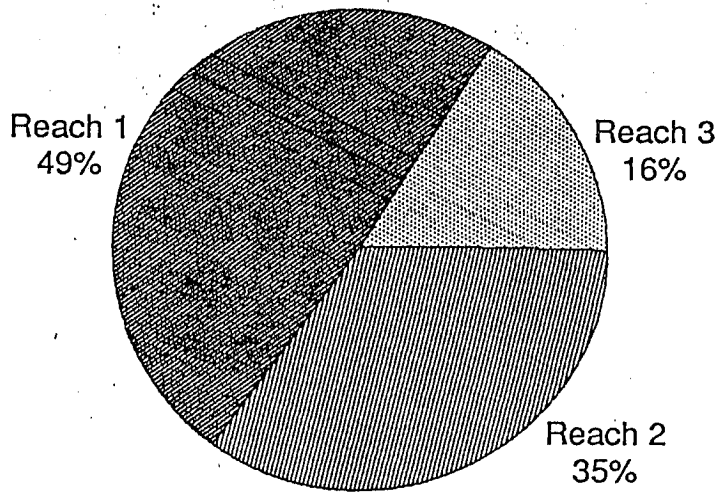


N = 3045

Figure 3A. PERCENT OF OBSERVATIONS IN EACH REACH.; ALL SPECIES COMBINED. (all species combined)



N = 1834

Figure 3B. PERCENT OF OBSERVATIONS OF ALL SPECIES, EXCLUDING AMERICAN COOT, IN EACH REACH.

NOTE: This distribution closely approximates the distribution of waterbirds during the months of May to August, prior to the late summer of American Coots

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Percent of Observations in Each Reach

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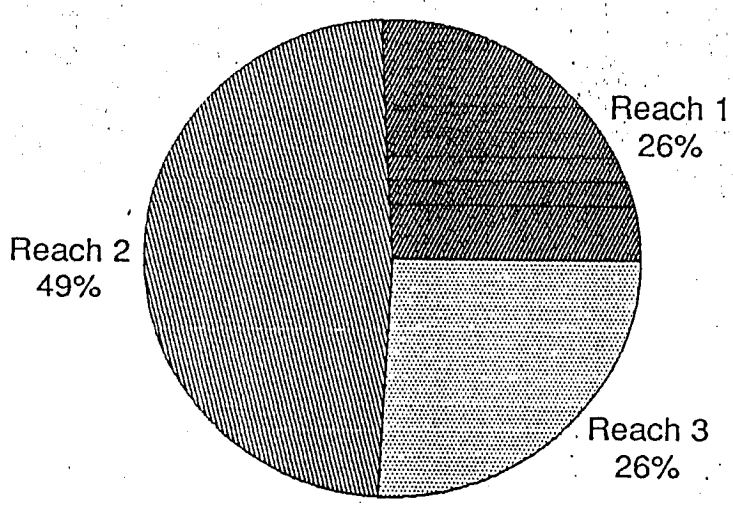
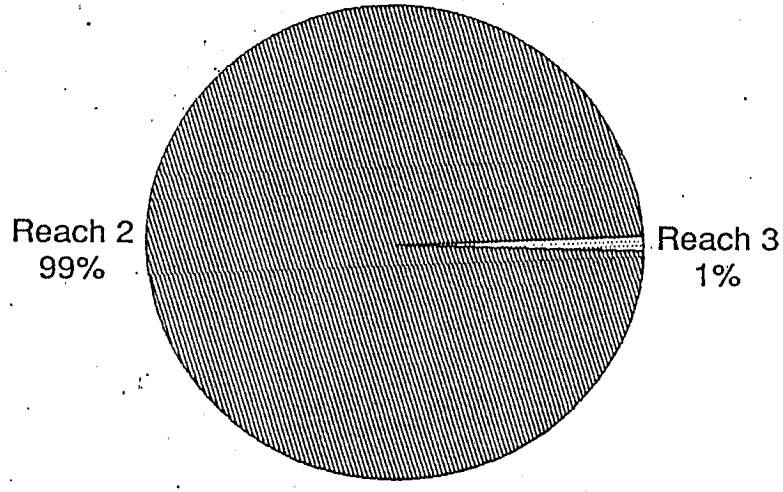


N = 1101

Figure 4A. PERCENT OF OBSERVATIONS OF MALLARD IN EACH REACH.



N = 620

Figure 4B. PERCENT OF OBSERVATIONS OF ROOSTING MALLARDS IN EACH REACH.

Note: Roosting Mallards were standing or sitting out of the water, within five feet of the bank.

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Percent of Observations In Each Reach

May 1990

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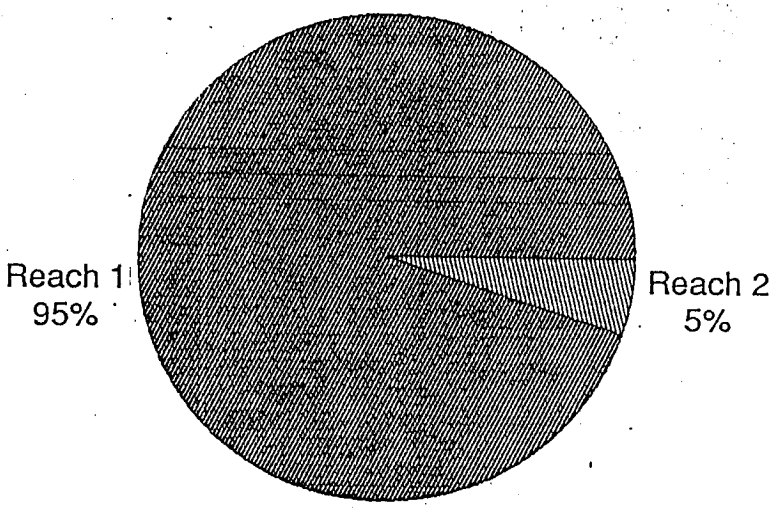
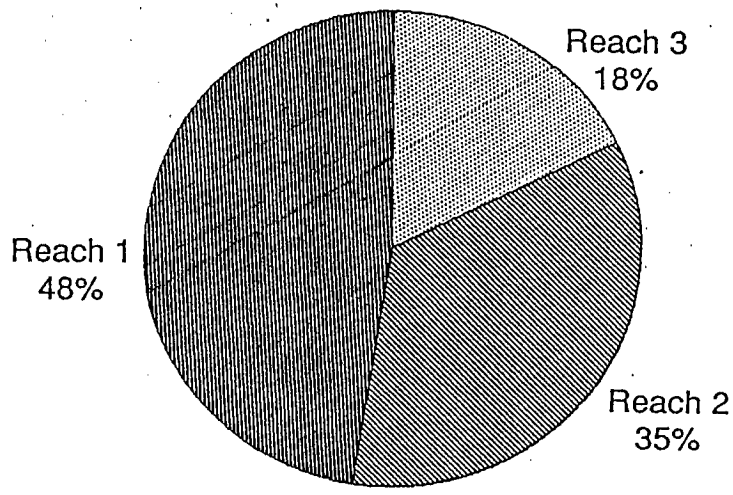


N = 188

Figure 5A. PERCENT OF OBSERVATIONS OF DOMESTIC GEESE AND FERAL DUCKS IN EACH REACH.



N = 1211

Figure 5B. PERCENT OF OBSERVATIONS OF AMERICAN COOTS IN EACH REACH.

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Percent of Observations In Each Reach

May 1990

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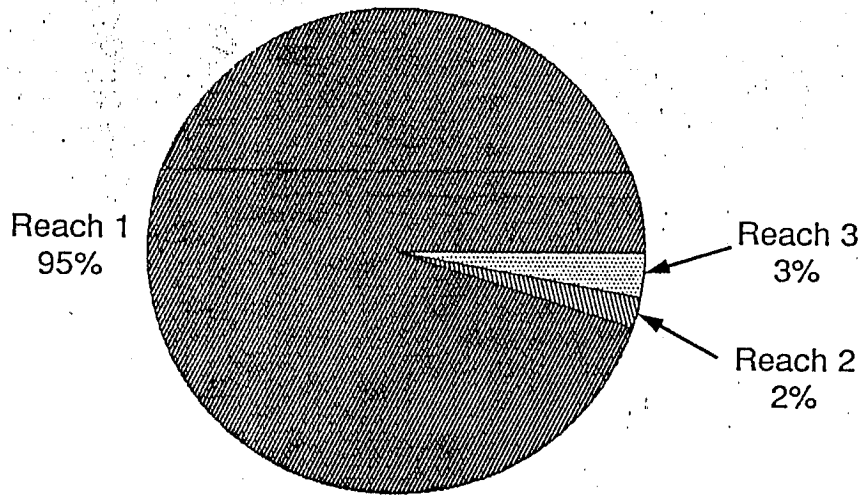

N = 545

PERCENT OF OBSERVATIONS OF GULLS IN EACH REACH.

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Figure 6.
Percent of Observations of Gulls In Each Reach

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APPENDIX D. IN-DEPTH DESCRIPTION OF PLANT COMMUNITIES AND THEIR DOMINANT SPECIES COMPOSITION

Central Coast Cottonwood-Willow Riparian Forest.

The central coast cottonwood-willow riparian forest borders Soquel Creek throughout the study area, primarily in the lower elevations of the creek channel. The upper portion of the creek, directly south of Highway 1, contains wide areas of riparian vegetation on both banks. On the east bank, the density of the riparian vegetation approaches a full canopy of deciduous trees, and is intermixed with numerous species of invasive non-native vegetation.

The west bank has a grove of mature black cottonwoods (*Populus trichocarpa*) on the middle slope of the bank, in addition to young red alder (*Alnus oregano*)and willow (*Salix* spp.) trees at the toe of the slope.

The natural diversity of native vegetation has been affected by the introduction of horticultural plant species. In addition, much of the native riparian vegetation has been removed where homes and businesses border the creek. On the south end of Soquel Creek, the east bank is nearly devoid of natural riparian vegetation where domestic gardens have replaced native vegetation.

The dominant tree species in the central coast cottonwood-willow riparian forest community are arroyo willow (*Salix lasiolepsis*), red willow (*Salix laevigata*), black cottonwood, and red alder. The understory consists of rushes (*Juncus spp.*), sedges (*Carex spp.*), blackberry (*Rubus ursinus*), nettle (*Urtica holosericea*), horsetail (*Equisetum arvense*), pigweed (*Chenopodium sp.*), and smartweed (*Polygonum hydropiperoides*). The invasive non-native plants include pampas grass (*Cortaderia selloana*), giant reed (*Arundo donax*) and French broom (*Cytisus monspessulanus*).

Central Coast Live Oak Riparian Forest.

This community predominately occupies the upper slopes and top of bank areas adjacent to the central coast cottonwood willow riparian forest. It represents one of the least disturbed riparian communities in Santa Cruz County (City of Capitola Local Coastal Plan, 1988). The proximity of this community to Soquel Creek is related to elevation and slope. The creek banks with the greatest slope gradient contained only narrow strips of central coast cottonwood willow riparian forest vegetation on the toe and lower slopes of the bank, bordered by large sections of central coast live oak riparian forest on the middle and upper slopes of the bank. This community intermixes with the horticultural planting areas on the west bank. Peery Park is comprised of a central coast live oak riparian forest.

The dominant tree species include coast live oak (*Quercus agrifolia*), California buckeye (*Aesculus californica*), California

bay (*Umbellularia californica*), and Douglas fir (*Pseudotsuga menziesii*). The horticultural species found scattered throughout this community are Monterey pine (*Pinus radiata*) and pittosporum (*Pittosporum sp.*). The invasive non-native tree, green wattle (*Acacia decurrens*), is also common.

The understory contains coyote brush (*Baccharis pilularis* ssp. *consanguinea*), blackberry, nettle, hedge nettle (*Stachys sp.*), foxtail (*Hordeum sp.*), current (*Ribes sanguineum*), poison oak (*Toxicodendron diversilobum*), cleavers (*Galium sp.*), periwinkle (*Vinca major*), and English ivy (*Hedera helix*).

Associated species that are found scattered throughout the community include: sword fern (*Polystichum minitum*), figwort (*Scrophularia californica*), rose (*Rosa sp.*), elderberry (*Sambucus mexicana*), snowberry (*Symphoricarpos albus* var. *laevigatus*), mugwort (*Artemesia douglasiana*), and wild cucumber (*Marah sp.*). Invasive non-natives species include pampas grass, French broom, green wattle, periwinkle, English ivy and Monterey pine.

Central Coast Riparian Scrub.

The central coast riparian scrub community occupies the lower slopes of the bank in two locations along Soquel Creek. One area is on a gravel bar adjacent to the west bank, south of Highway 1. The second area is adjacent to the existing creek channel on the east bank, extending from the north end of Peery Park to the eucalyptus/monarch grove. The dominant plants are willow and alder saplings (the establishment of riparian scrub vegetation in these areas is a result of the absence of scouring creek flows over the last 3-4 years that would normally occur).

Introduced Groves, Invasives and Horticultural Plantings

Eucalyptus Grove. A eucalyptus grove exists on the west bank adjacent to (and south of) the Rispin Mansion. This particular grove is a resting place for monarch butterflies in the winter. Additional eucalyptus trees are located on the west bank adjacent to Highway 1, and in homeowner's gardens on the east bank. The leaf litter of eucalyptus trees inhibits the growth of understory vegetation. The dominant tree species are blue gum (*Eucalyptus globulus*) and green wattle. The understory is comprised of blackberry and periwinkle.

Redwood Grove. Redwood groves are located in three areas on the west bank in the vicinity of the Rispin Mansion and open space. The dominant plant species is coast redwood (*Sequoia sempervirens*), with an understory of hazel (*Corylus californica*), coffeeberry (*Rhamnus californica*), snowberry and thimbleberry (*Rubus parviflorus*).

Horticultural Plantings. The east bank of Soquel Creek, from the Stockton St. bridge to Peery Park, contain houses with landscaped yards. Only very small patches of riparian vegetation remain, many of which have been incorporated into domestic gardens. The

west bank is comprised of large sections of horticulture vegetation that intermix with the adjacent central coast cottonwood willow riparian forest and the central coast live oak riparian forest. Soquel Creekway Park, located at the intersection of Stockton and Wharf Roads, includes plants native to California, but not necessarily native to this area. Horticultural plantings surround two homes that are north of the trestle and other areas surrounding homes throughout the study area.

The common horticultural species include pittosporum, fuschia (*Fuschia sp.*), cotoneaster (*Cotoneaster sp.*), firethorn (*Pyracantha sp.*), honeysuckle (*Lonicera japonica*), peppermint, Monterey pine, cherry (*Prunus sp.*), jasmine (*Jasminum officinale*), escallonia (*Escallonia sp.*), nasturtium (*Tropeolum major*), and bottlebrush (*Callistemon citrinus*).

Invasive Non-natives. The following non-native plants can be found along the entire course of Soquel Creek. The largest infestations are on the east and west banks, south of Highway 1.

GREEN WATTLE (*Acacia decurrens*). This tree was observed in each of the plant communities as well as in many gardens, predominately on the west bank. There is a grove of acacia adjacent to the Rispin Mansion in association with the eucalyptus and redwood grove communities.

GIANT REED (*Arundo donax*). Giant reed forms large patches in the riparian community. A clump is located on the creek, behind the homes that are on Riverside Drive located directly across from Gilroy Drive. There are numerous large clumps of giant reed found along the east bank between Highway 1 and Nob Hill.

PAMPAS GRASS (*Cortaderia selloana*). This species is found in scattered locations throughout each plant community. Four areas are noteworthy. On the west bank, they are found near the trestle and just south of the two houses which occupy the flood plain. Another patch extends along the west bank, north of the Shadowbrook Restaurant. The third and fourth areas contain many scattered plants of pampas grass distributed throughout the west bank south of the Highway 1 bridge and adjacent to the redwood grove, as well as on the east bank between Highway 1 and Nob Hill.

MONTEREY PINE (*Pinus radiata*) Individual Monterey pine trees are scattered throughout the study area. A majority of the trees are located between Highway 1 and the Rispin Mansion, and in horticultural planting areas.

PERIWINKLE (*Vinca major*). This common plant is a dominant ground cover throughout the entire study area.

GERMAN IVY (*Senecio mikanioides*). This invasive vine grows within the central coast cottonwood willow riparian forest area located between Highway 1 and Nob Hill on the east bank. This

vine is also found is the central coast live oak riparian near the Shadowbrook Restaurant along Wharf Road on the west bank.

ENGLISH IVY (*Hedera helix*). Ivy is found is all plant communities in the study area.

FRENCH BROOM (*Cytisus monspessulanus*). Reproducing freely by seed, French broom is scattered throughout the study area in all plant communities.

Rare, Threatened or Endangered Plant Species.

There are no rare, threatened or endangered plant species in the riparian corridor of Soquel Creek.

APPENDIX E. LIST OF VASCULAR PLANTS SPECIES OBSERVED AT SOQUEL CREEK LAGOON

The following list, arranged by family according to A California Flora (Munz and Keck, 1968), contains all plant species observed on Soquel Creek during a survey conducted in March, 1989. Most of the plants have been identified to species, but a few could only be identified to genus.

SCIENTIFIC NAME	COMMON NAME
ACERACEAE	
Acer negundo	Box Elder
Acer macrophyllum	Big Leaf Maple
AIZOAZEAE	
Carpobrotus edule *	Ice Plant
Drosanthemum sp. *	Ice Plant
ANACARDIACEAE	
Toxicodendron diversilobum	Poison Oak
APIACEAE	
Anthriscus scandicina *	Bur Chervil
Conium maculatum *	Poison Hemlock
Heracleum lanatum	Cow Parsnip
Osmorhiza chilensis	Sweet Cecily
Sanicula crassicaulis	Pacific Sanicle
Sanicula bipinnafitida	Purple Sanicle
APOCYNACEAE	
Vinca major *	Periwinkle
AMARYLLIDACEAE	
Dichelostemma pulchellum	Blue Dicks
Narcissus sp. *	Narcissus
AMYGDALACEAE	
Prunus ilicifolia	Holly-leaved Cherry
Prunus cesaifera *	Cherry Plum
Prunus sp. *	Cherry
AQUIFOLIACEAE	
Ilex aquifolium *	English Holly
ARACEAE	
Philodendron sp. *	Philodendron
Zantedeschia sp. *	Calla Lilly
ARALIACEAE	
Hedera helix *	English Ivy
ASTERACEAE	
Agoseris sp. *	Mountain Dandilion
Arctotis sp. *	African Daisy

Artemisia douglasiana	California Mugwort
Artemisia phycocephala	Beach Sagewort
Baccharis dougalsii	Douglas' Baccharis
Baccharis pilularis ssp. consanguinea	Coyote Brush
Baccharis gloriosus var. exaltatus *	Coyote Brush
Calendula officinalis *	Marigold
Chrysanthemum frutescens *	Daisy
Conyza canadensis	Horseweed
Cotula australis *	Australian cotula
Cirsium sp. *	Thistle
Eupatorium adenophorum *	Sticky Eupatorium
Gnathalium sp.	Life Everlasting
Lactuca serriola *	Prickly Lettuce
Lactuca virosa *	Wild Lettuce
Petasites frigidus var. palmatus	Western Coltsfoot
Picris echioides *	Bristly Ox-tongue
Senicio mikanioides *	German Ivy
Sonchus oleraceus *	Common Sow Thistle
Silybum marianum *	Milk Thistle
Taraxacum officinale *	Commom Dandelion
BETULACEAE	
Alnus oregona	Red Alder
Populus trichocarpa	Black Cottonwood
BIGNONIACEAE	
Tecomaria capensis *	Cape-honeysuckle
BORAGINACEAE	
Cynoglossum grande	Hounds Tongue
Myosotis sylvatica *	Forget-me-not
BRASSICACEAE	
Brassica campestris *	Field Mustard
Brassica nigra *	Black Mustard
Capsella bursa-pastoris *	Shepherd's Purse
Cardamine oligosperma	Bitter Cress
Lepidium strictum	Peppergrass
Lobularia maritima *	Sweet Alyssum
Nasturtium officinale *	Watercress
Raphanus sativus *	Radish
CANNACEAE	
Cana sp. *	Cana
CAPRIFOLIACEAE	
Symphoricarpos albus var. laevigatus	Snowberry
Lonicera hispidula	Hairy Honeysuckle
Lonicera japonica *	Japaneese Honeysuckle
Sambucus mexicana	Blue Elderberry

CARYOPHYLLACEAE	
Sagina sp.	Pearlwort
Silene gallica *	Catchfly
Spergularia sp. *	Spergularia
Stellaria media *	Chickweed
CHENOPODIACEAE	
Chenopodium sp.	Pigweed
CONVALLARIACEAE	
Trillium ovatum	Wake Robin
CORNACEAE	
Cornus californica	Creek Dogwood
CORYLACEAE	
Corylus californica	Hazelnut
CUCURBITACEAE	
Marah fabaceus	Wild Cucumber
CUPRESSACEAE	
Cypress macrocarpa *	Monterey Cypress
Libocedrus decurrens *	Incense Cedar
Thuja sp. *	Arborvitae
CYPERACEAE	
Cyperus esculentus	Nut Grass
ERICACEAE	
Arbutus menziesii	Madrone
Rhododendron sp. *	Azalea
EQUISETACEAE	
Equisetum arvense	Horsetail
Equisetum laevigatum	Scouring Rush
EUPHORBIACEAE	
Euphorbia lathyris *	Gopher Spurge
Euphorbia peplus *	Petty Spurge
FABACEAE	
Astragalus sp.	Locoweed
Cymbalaria muralis *	Kennelworth Ivy
Cytisus monspessilanus *	French Broom
Lathyrus sp. *	Sweet Pea
Lotus sp. *	Bird's Foot Trefoil
Lupinus sp.	Lupine
Medicago polymorpha *	Bur Clover
Melilotis albus *	Sweet Clover
Trifolium sp.	Clover
Vicia sp.	Vetch
FAGACEAE	
Quercus agrifolia	Coast Live Oak

Quercus lobata	Valley Oak
FUMARIACEAE	
Fumaria parviflora *	Small-flowered Fumitory
GERANIACEAE	
Erodium cicutarium *	Red-stemmed Filaree
Geranium dissectum *	Cut-leave Geranium
Pelargonium sp. *	Geranium
GRAMINEAE	
Arundo donax *	Giant Cane
Avena sp. *	Oat
Cortaderia selloana *	Pampas Grass
Cynodon dactylon *	Crab Grass
Hordeum leporinum *	Foxtail
Stenoaphrum secundatum *	Saint Augustine Grass
GROSSULARIACEAE	
Grossularia californicum	Hillside Gooseberry
Ribes sanguineum	Current
HIPPOCASTANACEAE	
Aesculus californica	California Buckeye
IRIDACEAE	
Dietes iridioides *	African Iris
Gladiolus sp. *	Gladiolus
Iris sp. *	Bearded Iris
JUNCACEAE	
Juncus effusus	Bog Rush
Juncus patens	Common Rush
Juncus sp.	Rush
Juncus xiphioides	Iris-leaved rush
LAMINACEAE	
Satureja douglasii	Yerba Buena
Mentha arvensis var. lanatum	Field Mint
Mentha piperita *	Peppermint
Monarda crispa *	Horsemint
Monardella sp.	Coyote Mint
Stachys rigida	Hedge Nettle
Lamiun amplexicaule *	Henbit
Lepechinia calycina	Pitcher sage
Salvia columbariae	Chia
Salvia leucantha *	Mexican Sage
LARDIZABALACEAE	
Akebia quinata *	Akebia
LAURACEAE	
Umbellularia californica	California Bay Laurel
Persea americana *	Avacado

Plantago lanceolata *	English Plantain
Plantago major *	Broadleaf Plantain
PLUMBAGINACEAE	
Armreia maritima *	Sea Thrift
POLYGONACEAE	
Rumex acetosella *	Sheep Sorrel
Rumex crispus *	Curly Dock
Rumex hymenosepalus *	Canaigre
Eriogonum nudum	Buckwheat
Polygonum hydropiperoides	Smartweed
PORTULACACEAE	
Calendrinia ciliata	Red Maids
Montia perfoliata	Miner's Lettuce
PRIMULACEAE	
Anagallis arvensis *	Scarlet Pimpernel
Dodecatheon sp.	Shooting Star
Primula sp. *	Primrose
PTERIDACEAE	
Dicksonia antarctica *	Tree Fern
Pitrogramma triangularis	Gold Back Fern
Polypogon californicum	California Polypody
Dryopteris arguta	Wood Fern
Pteridium aquilinum	Bracken Fern
Polystichum munitum	Sword Fern
Woodwardia fimbriata	Weatern Chain Fern
RANUNCULACEAE	
Ranunculus californicus	California Buttercup
Delphinium sp. *	Larkspur
Aquilegia sp. *	Columbine
Clematis ligusticifolia	Clematis
RHAMNACEAE	
Rhamnus californica	Coffee Berry
Ceanothus thyrsiflorus	Blue Blossom
Ceanothus griseus var. horizontalis *	Carmel Creeper
ROSACEAE	
Cotoneaster sp. *	Cotoneaster
Eriobotrya japonica *	Loquat
Rosa sp. *	Garden Rose
Photinia sp. *	Photinia
Pyracantha sp. *	Firethorn
Rubus parviflorus	Thimbleberry
Rubus ursinus	Blackberry
RUBIACEAE	
Galium aparine *	Bedstraw

RUTACEAE	
Citrus limonia *	Lemon
Fortunella sp. *	Kumquat
SALICACEAE	
Salix babylonica *	Weeping Willow
Salix coulteri	Coulter's Willow
Salix lasiolepsis	Arroyo Willow
Salix laevigata	Red Willow
Salix tortuosa *	Corkscrew Willow
SAXIFRIGACEAE	
Escallonia sp. *	Escallonia
SCROPHULARIACEAE	
Diplacus aurantiacus	Sticky Monkey Flower
Scrophularia californica	California Bee Plant
Pedicularis densiflora	Indian Warrior
SOLANACEAE	
Solanum rantonnetii *	Blue Witch
Solanum sp.	Nightshade
TAXODIACEAE	
Sequoia sempervirens	Coast Redwood
TERNSTROEMIACEAE	
Camellia sp. *	Camellia
TROPAEOLACEAE	
Tropeolum major *	Nasturtium
TYPHACEAE	
Typha sp.	Cattail
URTICACEAE	
Helxine soleirolli *	Baby Tears
Urtica holosericea	Nettles
VALERIANACEAE	
Centranthus ruber *	Red Valerian
VIOLACEAE	
Viola odorata *	English Violet

* indicates non-native plant species

APPENDIX J. RECOMMENDATIONS FOR MANAGEMENT AND ENHANCEMENT OF VEGETATION

I. VEGETATION MAINTENANCE

Maintenance of Natural Riparian Habitat. The riparian plant community that grows along Soquel Creek (in parks, backyards, and behind businesses) must be maintained in accordance with Policies 10, 11, and 16 of the Local Coastal Plan (City of Capitola General Plan, 1989), and the Local Coastal Program Land Use Plan (City of Capitola, 1988) Policies VI-2 and VI-3. Preservation of vegetation includes allowing tree branches to overhang the creek and discouraging pruning of plants that border the creek. The creek bank should not be excavated or have structures installed that impede the growth of riparian vegetation, unless deemed necessary for flood control. Dumping of garden debris onto the streambank destroys vegetation and prevents new growth; this activity should be prohibited and monitored. The residents who own property along the creek/lagoon should be educated on the measures that each citizen can choose to implement to preserve the natural resources of Soquel Creek.

The riparian corridor encompasses the area from top of one streambank to top of the other streambank. The design or expansion of any park facilities along the creek should not encroach into the riparian corridor. The construction of trails and foot bridges into open space areas within the riparian corridor should be discouraged under the Local Coastal Program Policy 35 (City of Capitola General Plan, 1989) and the Local Coastal Program Land Use Plan Policy II-18 (City of Capitola, 1981). Existing parks should retain as much native vegetation as possible. Any landscape maintenance program undertaken by the City should exclusively use native plant species that naturally occur on Soquel Creek.

The riparian corridor is a sensitive habitat dependent on the presence of water for health and vigor. The absence of water may cause die-off of riparian vegetation. In accordance with Policies VI-3 and VI-7 of the Local Coastal Program Land Use Plan (1981), Policies 11 and 15 of the Local Coastal Program, City of Capitola General Plan (1989), the natural flow of water in Soquel Creek should be maintained, and a minimum stream flow (a level that will sustain vegetation and wildlife) should be established. A water master should be installed to regulate the water level on Soquel Creek in accordance with the California Department of Fish and Game and the State Water Resources Control Board.

Regulations that retain or enhance the biological productivity of the riparian corridor should be implemented, including the enforcement of required buffer zones adjacent to any development, Policy 16 of the Local Coastal Program (City of Capitola General Plan, 1989), and Policy VI-2 of the Local Coastal Program Land Use Plan (City of Capitola, 1981). The 35-foot setback from the top of bank required by the City of Capitola should be enforced.

The integrity of the vegetation in the riparian corridor of Soquel Creek should be maintained.

The aforementioned recommendations for the protection of the environmentally sensitive riparian habitat of Soquel Creek are in accordance with the California Coastal Act, Sections 30240 and 30231 (Local Coastal Land Use Program, 1981), and the City of Capitola General Plan, Chapter 6 (City of Capitola, 1989).

Control of herbicide application. Aquazine is the least toxic herbicide that can be used to control algae growth in the lagoon. In low concentrations it is effective in controlling the seasonal algae growth. The following guidelines for the use of Aquazine should be implemented to protect natural vegetation.

* Aquazine should only be applied once a year.

* Aquazine should only be used below the Stockton Avenue Bridge. Aquazine may impact plants that have roots extending into the lagoon, including trees within 50 feet from the bank.

Five pounds of Aquazine was applied during the month of September, 1989 below the Stockton Avenue bridge. The aquazine from this application was detected as far upstream as the railroad trestle, although no injury to vegetation was observed. If additional applications or stronger concentrations of Aquazine are to be applied, vegetation along the creek north of the Stockton Avenue bridge may be injured or destroyed. A monitoring program should be implemented to document the effects of further Aquazine applications.

* Aquazine should be applied in the lowest concentrations possible. The concentration of 1.7 pounds per acre-foot is recommended.

* Aquazine should not be allowed to contact creekside vegetation such as grasses and herbs.

* Aquazine should never be sprayed directly onto riparian vegetation.

II. VEGETATION ENHANCEMENT RECOMMENDATIONS

A. Public education and interpretation of the biotic resources should be enhanced at Soquel Lagoon.

We recommend that interpretive signs be designed that educate the public about the native flora of Soquel Creek, and outline ways in which the public could help to preserve these natural resources. We recommend that signs be placed along the existing trails that border the creek and in Peery and Soquel Creekway Parks (Figure 2).

Seasonal educational panels could be established in City buildings, along the lagoon, and/or in the Rispin mansion that exhibit displays which feature the flora and fauna of Soquel Creek. Examples of seasonal displays include exhibits of the varieties of fish species found in the area, gulls that frequent the lagoon, identification of bird tracks found on the beach, and wildlife uses of riparian vegetation.

We recommend that existing trails be converted into informative nature trails (new trails in the riparian habitat are not recommended). Nature trails could feature native vegetation and include notations on the value of that plant species for wildlife and fish. In addition, a description of the riparian habitat, with reasons and recommendations for preserving this habitat could be provided.

We recommend development of a nature trail in the Rispin Mansion area, it being concentrated in the upper bank area, adjacent to the eucalyptus/monarch grove, and through the redwood grove, thus limiting the impact to the riparian vegetation. If non-native vegetation eradication and native plant revegetation occurs in the area north (upstream) of the Rispin mansion, the nature trail could flank this site. The educational references along the nature trail could include the natural history of the monarch butterfly, redwood ecology, riparian ecology, and native plant revegetation.

B. Vegetation should be enhanced along Soquel Lagoon and along the creek upstream.

The enhancement of the riparian corridor on Soquel Creek is recommended in Local Coastal Program (City of Capitola General Plan, 1989) Policy 16, and the Local Coastal Program Land Use Plan (City of Capitola, 1981) Policy VI-8. This can be accomplished through landscaping and revegetation with native plant species, and the removal of invasive non-native vegetation (with the exception of the eucalyptus grove near the Rispin Mansion). Details of vegetation enhancement follows:

Preservation of the eucalyptus grove near the Rispin Mansion. The grove of eucalyptus that borders the Rispin Mansion is an important habitat for the monarch butterflies that overwinter in the trees. Due to the value of this grove, its preservation is recommended in Local Coastal Program Policy 18 (City of Capitola General Plan, 1989) and the Local Coastal Program Land Use Plan (City of Capitola, 1981) Policy VI-10. The guidelines for the management of the grove should include recommendations for the control of non-native vegetation (other than the eucalyptus) to prevent their spread into the riparian corridor. Eucalyptus seedlings should be removed from the toe of the bank to control the spread of eucalyptus into the riparian corridor. The toe of the bank should be revegetated with native riparian plant species representative of the central coast cottonwood willow riparian forest.

Removal of non-native, invasive vegetation. Non-native, invasive vegetation should be eradicated from the riparian zone adjacent to the lagoon as well as upstream along creek banks. Non-native vegetation successfully competes with the native vegetation, thus limiting the quantity and value of the vegetation in the riparian corridor. The invasive non-native vegetation reproduces rapidly, either vegetatively or by seed, thus choking out the native riparian vegetation by forming dense stands. Homeowners and businesses along Soquel Creek should be encouraged to remove non-native, invasive vegetation from their property.

Produce an informative pamphlet on non-native vegetation. A pamphlet that visually and verbally describes common non-native vegetation along the creek/lagoon, reasons for removal, methods for eradication, and recommendations for revegetation could be distributed by the City. The invasive, non-native plant species on Soquel Creek that should be removed and the areas where they can be found are as follows:

* Giant Reed (*Arundo donax*)

Giant reed grows in large clumps that spread rapidly, and reach a height of approximately 20 feet. It has a bamboo-like appearance with wide leaf blades. Clumps of giant reed are located immediately downstream of Highway 1, behind Nob Hill supermarket, and behind homes which are across the creek from the Shadowbrook Restaurant (on the east bank).

* Green Wattle (*Acacia decurrens*)

Acacia is a tree that is known for its sprays of bright yellow flowers. It can grow to a height of 15 feet, and has light green leaves that are divided into tiny leaflets. Acacia is located on the east bank in the area between Highway 1 and Nob Hill supermarket. The large flat area north of the Rispin Mansion and the eucalyptus/monarch grove south of the mansion contain acacia. Individual acacia trees are also scattered along the toe of the west bank.

* Pampas Grass (*Cortaderia selloana*)

Pampas grass grows in large clumps that spread aggressively. The long leaves are narrow, with sharp edges. The flowers grow on tall spikes that are attractive when dried. It reproduces readily by seed, and the clumps spread rapidly. The field between Highway 1 and Nob Hill supermarket on the east bank contains a large quantity of pampas grass. On the west bank, pampas grass was observed in the flat area north of the Rispin Mansion, along the lower slopes of the bank between the eucalyptus/monarch grove and the Shadowbrook Restaurant, near the trestle, and by the home site south of the Shadowbrook.

* Eucalyptus (*Eucalyptus globulus*)

Eucalyptus is a tree that grows 120 feet tall and has light colored bark that sloughs off. The long leaves are distinctively fragrant; the flowers are white. The aromatic oils in the leaves prohibit native vegetation from growing under these trees. A large eucalyptus grove which serves as a resting place for monarch butterflies is located south of the Rispin Mansion on the west bank; this grove of eucalyptus should be managed for continued use by the monarch butterflies. The remainder of the eucalyptus on Soquel Creek should be removed and includes eucalyptus trees which are located adjacent to Highway 1 and south of the monarch grove on the west bank and eucalyptus trees that grow on the east bank in horticultural areas.

* French broom *(Cytisus monspessulanus)*

French broom is a small shrub with abundant foliage. The leaves are divided into three leaflets; the small flowers are yellow. French broom reseeds freely, forming dense stands. French broom is distributed throughout the area between Highway 1 and Nob Hill supermarket on the east bank. On the west bank, the eucalyptus/monarch grove, and the area directly behind the Rispin Mansion contain French broom. Individuals are scattered throughout the study area.

* English Ivy (*Hedera helix*)

English ivy is a vine with large triangular shaped leaves with deep lobes. The greenish flowers are found in clusters; the berries are blue. Ivy will spread and climb freely, choking out all native vegetation. English ivy has a scattered distribution throughout the study area, although it is predominately located in horticultural landscape areas.

* Algerian Ivy (*Hedera canariensis*)

Algerian ivy looks similar to English ivy, but has a sparse distribution of leaves on the stem. It spreads and climbs aggressively, choking out native vegetation. Algerian ivy has the same distribution as English ivy.

* Periwinkle (*Vinca major* and *V. minor)*

Periwinkle is an erect, evergreen groundcover. It has oval, opposite leaves, and large purple flowers. The trailing stems spread prolifically and choke out native vegetation. Periwinkle is scattered throughout the study area. The locations of the greatest quantity include the area behind the condominiums adjacent to Highway 1, the eucalyptus/monarch grove on the west bank, and the east bank, between Highway 1 and Nob Hill supermarket.

* German Ivy (*Senecio mikanioides*)

German ivy is a climbing vine with thick, light green, nearly round leaves. The clusters of flowers are bright yellow. It will trail and climb persistently, choking out native vegetation. German ivy is found in the area between Highway 1 and Nob Hill.

Revegetate with native riparian vegetation where non-natives are removed. Residents and businesses that flank the creek should be encouraged to landscape with native riparian vegetation. It would be beneficial for the City to distribute a pamphlet that lists the native plant species that are appropriate to plant on Soquel Creek, as well as a short description of planting procedures and long-term maintenance.

We recommend that the City begin a native plant revegetation program in the park area north of the Rispin Mansion.

As part of the renovation of the Rispin Mansion, we recommend that the City of Capitola restore the natural vegetation along the creek surrounding the mansion (except for the eucalyptus/monarch grove), and create a nature trail and other natural history facilities within the mansion.

The following native plant species are recommended for use in revegetation projects along Soquel Creek:

Plants for use on the upper bank

TREES

Coast live oak (*Quercus agrifolia*), Douglas fir (*Pseudotsuga menziesii*), sycamore (*Platanus racemosa*), and elderberry (*Sambucus mexicana*)

SHRUBS

snowberry (*Symphoricarpos albus*), California wild lilac, (*Ceanothus thyrsiflorus* and *Ceanothus* sp.), coyote brush, (*Baccharis* sp.), coffeeberry, (*Rhamnus californica*), and sticky monkey flower (*Diplacus aurantiacus*)

HERBS

yarrow (*Achillea millefolium*), farewell-to-spring (*Clarkia* sp.), lupine (*Lupinus* sp.), California poppy (*Eschscholzia californica*), owl's clover (*Orthocarpus purpurascens*), and yerba buena (*Satureja douglasii*)

Plants to be used on the lower banks of the lagoon/creek

TREES

willow (*Salix* sp.), alder (*Alnus* sp.), California bay (*Umbellularia californica*), and big leaf maple (*Acer macrophyllum*)

SHRUBS

creek dogwood (*Cornus californica*), California wild rose (*Rosa californica*), current (*Ribes* sp.), and gooseberry (*Grossularia* sp.)

HERBS and FERNS

columbine (*Aquilegia formosa*), monkey flower (*Mimulus* sp.), chain fern (*Woodwardia fimbriata*), coastal wood fern (*Dryopteris arguta*), and sword fern (*Polystichum munitum*)

APPENDIX F. HYDROLOGIC ANALYSIS OF FLOW REQUIREMENTS FOR SOQUEL CREEK AND LAGOON SYSTEM

Introduction

During the summer and fall, diminished flows in Soquel Creek and wave action along the shoreline of the Pacific Ocean result in the development of a barrier beach across the outlet of the Creek. The barrier beach causes ponding to occur immediately upstream of the barrier beach, forming Soquel Lagoon. The objective of the the investigation was to determine the minimum Creek inflow required to sustain Soquel Lagoon at an elevation that will meet water quality goals and minimize odor and aesthetic impacts.

A concrete box outfall founded on piers is the surface water connection between the Lagoon and the Ocean while the barrier beach is in place. Summer/fall outflow from the Lagoon occurs when the elevation of the Lagoon water surface exceeds that of the inlet to the box culvert. The culvert inlet is two-sided, with inflow potentially entering via two rectangular notches on the north and south faces of the structure. These notches are fitted with flashboards which enable Lagoon managers with the City of Capitola to regulate surface water discharge from the Lagoon.

Prior to its breaching by mechanical means or by the natural eroding action of early winter flood flows, the Lagoon initially maintains a level sufficient to trigger discharge over the flashboard weir inlet and into the box culvert en route to the Ocean shoreline. Later in the fall, Creek inflow to the Lagoon decreases due to upstream diversion for agricultural and residential irrigation uses. Eventually, losses to evaporation from the Lagoon water surface and to subsurface seepage through the barrier beach can exceed Soquel Creek inflow. From here on, the Lagoon water level will decrease and surface outflow will be restricted to the minute seepage that occurs through the cracks between the flashboards.

During dry years, groundwater levels in the tributary aquifers decrease and Creekflow is correspondingly reduced. Thus, the process of Lagoon recession is accelerated. This is what has happened during the current drought.

Investigative Approach

To determine the minimum required Lagoon inflow, three tasks were undertaken:

1) Install a Parshall flume in Soquel Creek just upstream of the Lagoon and monitor Creek discharge at a time when the Lagoon level is near its transition point from a state of overflow to a state of recession.

2) Repeat the installation and monitoring procedure on Noble Gulch immediately after the gaging of Soquel Creek flows.

3) Compute a water balance for the Lagoon based on cumulative inflows and outflows and monitored Lagoon levels.

The gaged streamflow in Soquel Creek was considered the sole source of Lagoon inflow, while evaporation, seepage through the flashboards, and subsurface seepage through the barrier beach comprised the outflow from the Lagoon. Noble Gulch contributes some water to the Lagoon during the dry season, however, the magnitude of its contribution is minor relative to that of Soquel Creek and can fluctuate dramatically due to small upstream storage impoundments and runoff due to car washing, excessive lawn irrigation and other discrete events. Therefore, Noble Gulch inflow was not included in the water balance computations.

A 2-inch Parshall flume with an attached stilling well was purchased by the City and was installed in Soquel Creek just upstream of the range of Lagoon backwater influence on October 26, 1988. A Stevens Type F chart recorder was also installed at this time. The trace of the chart pen during the approximately 43-hour gaging period is attached in the Technical Appendix. The gaged discharge during this period was nearly constant at a rate of 0.036 cubic feet per second (cfs), or 16 gallons per minute (gpm).

A similar procedure, albeit over a smaller time period, was followed in the gaging of stream discharge on Noble Gulch. The gaging point chosen was located approximately 60 feet upstream of the culvert entrance at Bay Avenue. During the gaging period of roughly 4.5 hours, a significant decline in the recorded flow occurred, which persisted for about 3.0 hours. At the time the flume was removed from the channel, the flow stage registered on the flume's staff gage had returned to the initial position that was registered just after the installation, or 0.075 ft. NGVD. If the dip in the flow is ignored, the measured discharge is 0.012 cfs.

To establish a reference Lagoon elevation for the computation of the hydraulic head that drives seepage through the flashboards and the barrier beach, a field survey was conducted by Harvey and Stanley Associates on October 28, 1988. The elevation of the top of the staff gage, which is secured to the concrete wall on the south side of the channel at the upstream edge of the Stockton Avenue Bridge, was determined relative to known elevations for the bridge deck and walkways.

Applying the information derived from the field survey, the elevation of the Lagoon water surface on both October 28 and 29 was unchanged at +4.77 ft. NGVD (1.865 ft. on staff gage). Note that no overflow was occurring over the flashboards at the inlet to the box culvert. Therefore, the Lagoon was already into its recession stage (i.e., inflow< outflow).

Water Balance for Soquel Lagoon

A simple water balance was computed for the Lagoon with the gaged Soquel Creek inflow as the sole hydrologic input and evaporation, surface seepage (through flashboards above and below the sand-water interface) and seepage through the barrier beach as the outputs. Since the gaged Creek inflow was constant and the Lagoon level was stable during the two day monitoring period, the computed component outflows of the model reflected a short-term equilibrium condition of the Lagoon system. Moreover, given the absence of a recent bathymetric survey of the Lagoon and the very small flow magnitudes involved, the change in storage computed by the model for the selected time period could not be verified by field monitoring of Lagoon water surface changes. Technical computations for the model components are presented in a later section of this appendix.

Evaporation data from the Spreckles Lake pan gage, located at the southern end of Monterey Bay, was assumed to represent the loss potential at Soquel Lagoon (DWR 1979). This was the closest gaging station measuring open water evaporation. The average monthly dry season evaporation (May - Oct.) was 1.2 acre-feet, or 0.020 cfs. Since the Lagoon water surface at the time of the monitoring was approximately 0.5 ft. below the top of the flashboards, it was apparent that inflow had been unable to keep up with outflow for some time prior to the observations. Thus, the evaporation loss rate for the model was conservatively assumed to equal the greatest monthly rate of 1.4 ac-ft., or 0.024 cfs.

On Sunday, October 29, 1988, staff measured inflow from the Lagoon to the box culvert at the Lagoon's western edge. Two methods were attempted. First, an attempt was made to dam the flow in the culvert with a notched sheet metal weir with a rubber edged fitting to seal the bottom and sides against seepage. This method was unsuccessful due to an imperfect seal along the wetted perimeter of the culvert and the extremely low rates of inflow to the culvert.

Upon inspection of the leakage occurring through the flashboards at the culvert inlet, it was noted that the bulk of the inflow through the south portal was entering as a single spout in a locally expanded gap in the flashboards. A graduated cylinder was used to measure the discharge of this leak. The resulting quantity, 0.0006 cfs was multiplied by 4.0 to account for similar inflow at the northern portal and for an equal amount of sheet-like seepage that was also evident over the inside of the flashboards at both portals. Thus, the total discharge (loss) for this outflow component was 0.0024 cfs.

Subsurface seepage through the flashboards from beneath the sand bottom of the Lagoon was computed using Darcy's Law for steady-state groundwater flow. The hydraulic conductivity of the sand was assumed to be 1000 gallons per day per square foot,

(gpd/ft2) and the measured hydraulic gradient (the difference in water surface elevations between the outside and inside of the culvert divided by the distance of separation) was 6.4 ft/ft. The effective cross-sectional area of flow was computed as the cumulative area of spacing between the flashboards below the measured sand surface on the outside of the culvert. The resulting seepage discharge was computed to be 0.003 cfs.

The final outflow component evaluated was the groundwater seepage through the barrier beach. Assuming the same hydraulic conductivity of 1000 gpd/ft2 and a steady Lagoon elevation of +4.77 ft. NGVD, the remaining parameters requiring estimation were the flow cross-sectional area and the hydraulic gradient. At the Ocean boundary, the mean tide level (MTL) was determined to be -0.15 ft. NGVD, based on the MTL of +2.8 ft. MLLW and a reference datum of 0.0 ft. NGVD= +2.95 ft. MLLW (mean lower low water) at Santa Cruz, CA. (NOAA 1987). The resulting hydraulic gradient for groundwater flow through the barrier beach was 0.049 ft/ft.

Assuming an effective beach thickness of 2.0 feet and a cross-sectional width of 250 feet, the computed seepage discharge through the barrier beach was 0.038 cfs. Summing the inflows and outflows computed for the Lagoon for the modeled dry season condition, the net loss in flow totaled 0.031 cfs. Roughly assuming a total Lagoon storage of 2.8 ac.x 4 ft.= 11.2 ac-ft, this loss translates into a reduction in the Lagoon level of 0.26 inches per day.

Conclusions and Recommendations

To maintain a stable water surface in Soquel Lagoon, inflow from Soquel Creek and the less dependable Noble Gulch would have to equal the maximum outflow computed via the water balance model, or 0.067 cfs. Since this is a very small quantity, the existence of small uncertainties in the estimation of the rates of component outflow could influence the range of potential outflow during the dry season. To be safe, it is recommended that the instream flow monitored just upstream of the Lagoon be maintained at rates of 0.15 cfs to 0.20 cfs.

The City of Capitola now owns the Parshall flume used to gage streamflow for this investigation. This flume will enable City field personnel to monitor dry season flows in future years and to make decisions on the extent of allowable diversions upstream of the Lagoon. Since the small contribution of inflow from Noble Gulch was excluded, the inflow it adds will provide a margin of safety for the Lagoon.

WATER BALANCE COMPUTATIONS: SOQUEL LAGOON

Inflow components: Soquel Creek inflow

Outflow components: Evaporation, Lagoon weir/culvert discharge (overflow), subsurface seepage to culvert inlet, and seepage through barrier beach

Evaporation: Spreckles gaging station Lat. 36/37/14
Station#D20 844601 Long. 121/39/27
Elev.= 55 ft. NGVD
(Source: DWR-Evaporation from Water Surfaces in CA.)

For dry season evaporation:

Month	Monthly Evaporation (mm)
May	205
June	217
July	222
Aug.	208
Sept.	168
Oct.	111

Season Ave. = 188.5 mm= 7.4 in.
Max = 222 mm = 8.75 in.

Evaporation rate at the time of the field monitoring in October was at the level expected for the receding Lagoon period. However, for purposes of computing a target inflow, assume the maximum evaporation rate applies.

Thus, $222 \frac{mm}{mo.} = 0.72 \frac{ft.}{mo.} \times 2.8 \text{ ac.} \times 0.7 = 1.42 \frac{af}{mo.}$

$$1.42 \frac{af}{mo.} \times 43560 \frac{cu\text{-}ft.}{af} \times \frac{mo.}{(3600 \times 24 \times 30) sec} =$$

Q= 0.024 cfs (outflow)

Seepage through the culvert flasboard weir:

1) surface seepage/leakage through cracks between flashboards

principal crack (measured)= $700 \frac{ml}{sec} = 0.7 \frac{lit.}{sec} \times \frac{cu\text{-}ft.}{28.32 lit.}$

= 0.0006 cfs

Assume this is matched by the similar leaks through the north portal of the inlet, and by sheet-type leakage down the inside of the boards (impractical to attempt gaging of this). Therefore, the total computed loss due to surface seepage =

Q= 0.0006x 4= .0024 cfs (outflow)

2) subsurface seepage through sand and flashboard cracks into culvert: Apply Darcy's Law

K=hydr.cond.= 1000 gpd/ft2
i= hydr. grad.= h2-h1/L
L= length between reference pts
i= 3.87'-1.77'/0.33'= 6.36 ft/ft
A = flow cross-sec. area
= 14.95 ft2 x % effect. open
7 boards x 6"/bd= 42 in.
assuming 0.1" spacings,
total opening= 0.7 "
Thus, % open= 0.7/42= 0.017 and
effective flow area =
14.95x 0.017= 0.25 ft2

Q= KiA= 1000 gpd/ft2(6.36 ft/ft)(0.25 ft)= 1617 gal/day
= 0.003 cfs (outflow)

Groundwater outflow through the barrier beach:

Applying Darcy's Law: Q= KiA

K= 1000 gpd/ft2
i= Lagoon w.s elev- mean tide level/ distance
Lagoon water level= +4.77 ft. NGVD (field survey)
Mean tide level @ Santa Cruz, CA.= +2.88 MLLW
0.00 ft. NGVD= +2.95 ft. MLLW (NOAA Tide Tables)
Thus, $i = \frac{4.77' - (-0.15')}{100'} = 0.049$ ft/ft

Since groundwater inflow to the Lagoon is neglected, the average effective seepage thickness through the beach sands is assumed to be equal to the average thickness of the barrier beach sediments.

Thus, for an approximate width of 250 ft and a beach thickness of 2.0 ft., the flow cross-sectional area = 500 ft2

Q= 1000(0.049)(500)= 24,500 gal/day
= 0.038 cfs (outflow)

Total outflow= 0.067 cfs vs. total inflow= 0.036 cfs

Net outflow from Soquel Lagoon= 0.31 cfs

APPENDIX L. COST ESTIMATES FOR RECOMMENDED ENHANCEMENT PROJECTS

1. **Construction of baffles within the outlet culvert.**
   Cost: $1150.00

   Budget details:

   4 days Concrete Contractor **$1000.00**, Materials **$150.00**

2. **Design and production of 250 pamphlets describing non-native and native vegetation, care of plants, and wildlife enhancement. Cost: $7560.00**

   Budget details:

   a. Writing text of descriptions of non-native plants and native plants (propagation and maintenance). 5 days Botanist **$1800.00**

   b Writing text for enhancement of wildlife values. 3 days Wildlife Biologist **$1080.00**

   c. Design and layout of pamphlet. 9 days Graphic artist **$2880.00**, 2 days Botanist **$720.00**

   d. Printing and binding of 250 copies. 2 days labor **480.00.** Copying **$200.00.** Covers **$100.00**

   e. Materials and Supplies **$300.00**

3. **Purchasing and placement of 30 nest boxes. Cost: $4410.00**

   a. Purchase of 10 boxes @$12.00 each, 15 boxes @$20.00 each and 5 boxes @ 28.00 each plus shipping. **$680.00**

   b. Locating places to install boxes and communication with City, residents and installers. 3 days Wildlife Biologist **$1080.00**

   c. Installation of boxes. 5 days for 2 laborers **$2400.00**

   d. Travel, communication and materials **$250.00**

4. **Collection of domestic geese and feral ducks. Cost: $1370.00**

   2 days Wildlife Biologist **$720.00**
   2 days Sheep Herders with Border Collies **$500.00**
   Travel and Communication **$150.00**

5. **Design and production of 3 different lesson plans devoted to natural lagoon resources. Cost: $7800.00**

   Refer to recommendation 47 for the 3 topics.

APPENDIX G. ENVIRONMENTAL CONDITIONS, AQUATIC VEGETATION, INVERTEBRATES, FISH AND ENCLOSURE VEGETATION STUDY DATA FOR SOQUEL CREEK LAGOON.

Appendix G is quite lengthy and consists of raw data that were used to develop recommendations for management of fishery resources, algae and pondweed. Appendix G is available upon request from the City of Capitola.

a. Development of content, illustrations, visual aides, station descriptions at the lagoon, laboratory activities, field data collection and data analysis. 12 days Aquatic Ecologist with teaching experience **$5760.00**

b. Design of illustrations. 3 days Graphic Artist **1440.00**

c. Printing. **$600.00**

6. Design, construction and installation of 8 interpretive signs, 1 natural history display for the City's Museum, and 9 no bird-feeding signs. Cost: $32,750.00

Description of interpretive signs around the lagoon:

Tidewater goby using the lagoon.
Located just downstream of the Stockton Ave. Bridge, on the west bank. ~3-4 illustrations and ~150-200 words. Text to discuss importance of lagoon habitat to tidewater goby, how loss of this type of habitat is threatening this fish.

Steelhead using the lagoon.
Located just upstream of the Stockton Ave. bridge on the east bank. ~4-6 illustrations and ~200-250 words. Text to discuss the life cycle of the steelhead, with emphasis on the importance of the lagoon habitat for rearing of juveniles steelhead and the necessity to maintain good water quality for their survival.

Fish using Soquel Creek Lagoon in summer.
Located just downstream of SPRR trestle on the east bank. ~4-6 illustrations and ~100-150 words. Text to briefly list and describe the fish which utilize the lagoon during summer months.

Fish using Soquel Creek Lagoon in winter.
Located just downstream of SPRR trestle on the east bank. ~4-6 illustrations and ~100-150 words. Text to briefly list and describe the fish which utilize the lagoon during winter months.

Gulls using the beach area and lagoon.
Located on the beach near Bandstand and Esplanade. ~4-5 illustrations and ~250 words. Rotational, February to May. Text would discuss the ecological role of gulls and seasonal patterns of species diversity and abundance. Illustrations would show several of the more common species, such as Western, California, Ring-billed, Glaucous-winged and Mew Gull.

Shearwaters, Pelicans, and Terns using the beach and offshore.
Located on the beach near the bandstand and Esplanade. ~5 illustrations and ~200 words. Rotational, June to October. Illustrations would show: (1) Sooty Shearwaters and a map portraying their trans-Pacific migration patterns, (2) Brown Pelicans and a map portraying their migration from their southern breeding sites to the central California coast, and (3) terns and

their feeding behavior. Text would discuss migratory seabirds that journey to the central coast to take advantage of productive foraging produced by upwelling currents.

Shorebirds that use the beach.
Located on the beach near the bandstand and Esplanade. ~5 illustrations and ~200 words. Rotational, November to January. Text would discuss the species which are likely to be seen at Capitola Beach, and would discuss different foraging styles and the resultant resource partitioning. Illustrations would show several species, such as Sanderling, Black-bellied Plover, Willet, Marbled Godwit, and Black Turnstone.

Birds of Soquel Creek Lagoon
Located along the lagoon just upstream of Stockton Avenue Bridge, on west bank. ~4 illustrations and ~200 words. Text would discuss the few species of waterbirds which occur regularly at the lagoon, focusing on feeding behavior. Illustrations would show several species, such as Mallard, American Coot, and Pied-billed Grebe.

Description of Natural History Display in the Museum:

It will be the featured display in the museum. It will be a diorama consisting of a painted mural on canvas with partial and three-dimensional figures, depicting a natural setting at the beach and around the lagoon. There will be a written and graphical representation of vegetation and wildlife, including 6 mounted bird specimens and actual branches and leaves from riparian vegetation.

Budget details:

a1. Design of interpretive signs around the lagoon. 24 days Graphic Artist **$7680.00**, 5 days Senior Biologists **$2400.00**, photography **$400.00**

a2. Construction of eight 3'x 4' signs (3 color enamel, weather resistant aluminum signs. 2"x 2" iron tubing, welded into one solid, 2 posted frame with metal back and plexi-glass front. Sign dimensions 18" x 18". **$9,300.00**

b1. Design of Natural History Display at the City's Museum. 15 days Graphic Artist **$4800.00**, 3 days Senior Biologists **$1440.00**, Travel, materials and expendibles **$1200.00**

c1. Design of "No Bird-feeding" signs. 3 days Graphic artist **$960.00**, photography **$50.00**, 4 hours Senior Biologist **$240.00**

c2. Construction of nine 18" x 18" "No Bird-feeding" signs. (Similar to interpretive signs except in 2 colors.) **$2600.00**

c3. Coordination with City and Sign Maker. 2 days Project Manager **$960.00**, 2 day Graphic Artist **$640.00**, Travel **80.00**

*** Total estimate of Enhancement Projects: $55,040.00**

7. **Monitoring of successful implementation of the Management and Enhancement Plan and preparation of annual report with recommended changes to the Plan. Cost: $12,800.00 first year, $11,420.00 the second year and an escalator factor of 5% for the remaining 3 years. Total: $62,020.00**

Budget details:

a. Monitoring of water quality for aquatic habitat and the health of riparian vegetation near the area of Aquazine application (6 sampling times; after sandbar closure and monthly until Begonia Festival and after the Begonia Festival). Analysis of fecal bacterial counts provided by the County Health Department. 5.5 days Fishery Biologist $2640.00, 24 hours Water Quality Technician $960.00, Equipment fees, travel, expendibles $500.00

b. Monitoring of sandbar construction and breaching. 2 days Fishery Biologist $960.00

c. Questionnaire development with City to evaluate public satisfaction and analysis of responses. 4 days Senior Biologist $1920.00

d. Monitoring of waterbird use of the lagoon and success of the anti-bird feeding campaign. 7 days Wildlife Biologist $2520.00, Travel and expenses $200.00

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e. Annual report preparation. 4 days Project Manager $1920.00 2 days Wildlife Biologist $720.00, 1 day Graphic Artist $360.00. Travel and expendibles $100.00

***Estimate for Monitoring of Plan Implementation: $62,020.00**

***Total Estimate for Enhancement and Monitoring: $118,340.00**

BUDGETARY DETAILS FOR RECOMMENDED EXOTIC VEGETATION REMOVAL AND NATIVE REVEGETATION

Program to eradicate non-native vegetation and revegetation with native vegetation. (Includes 3 years of watering.) Cost: $6,049.00 (City land) and $5,191.00 (private land) with CCC/NREP labor or $16,977.00 (City land) and $14,423.00 (private land) with private firm's labor.

Budget details: See Table 1.

The time allotted for labor and the material costs are estimates. The cost of labor for non-native plant removal will depend on whether City employees, non-profit groups or private companies perform the work. The National Resource Employment Program or the California Conservation Corps could be contracted to perform most of the specified work, and labor cost would be approximately $10 per hour. Labor charges for private companies would be approximately $30 per hour. Removal of large trees may require the services of a qualified arborist. Plant costs are based on wholesale prices.

Maintenance and monitoring of the revegetation sites should be conducted for 3 years after installation. Truck watering would be the easiest and most cost effective method. The vegetation should be maintained from April through October, unless the spring and fall seasons are particularly wet. The plants should be watered once per week for the first year, once every 2 weeks the second year, and once every three weeks the final year.

APPENDIX K. REDUCTION OF FECAL BACTERIAL COUNTS FOR PURPOSES OF ALLOWING BODY-CONTACT RECREATION IN THE LAGOON

Since the use of copper sulfate ceased after 1987 in the lagoon, consistently high fecal coliform bacterial counts have forced the County Environmental Health Department to close the lagoon to swimming during the summer season. A management goal may be to reduce fecal coliform counts below the 200/100 ml level which is deemed a hazard to health by the Environmental Protection Agency, so that the lagoon may once again be used for swimming.

There are several sources of these bacteria and several types of dead material that they decompose and, therefore, multiply from. Both the sources of bacteria and the material that they decompose need to be reduced before the proper health standards can be met to allow swimming.

The major sources of coliform and streptococcus bacteria normally include human and nonhuman excrement. These bacteria also naturally occur in the environment, particularly under anaerobic (without oxygen) conditions on the lagoon bottom. So called fecal bacteria decompose not only excrement, but also dead plant and animal material. Any food that enters the lagoon is decomposed if not eaten by animals. Coliform bacteria are not considered a health hazard in themselves, but are used as an indicator of pathogens in the water.

In locations where the bottom ooze becomes stirred up into the water column, water samples taken for fecal bacterial counts may not be good indicators of pathogenic agents in the water. In these locations, the bacteria that are directly associated with feces may only be a fraction of the bacteria detected in the water samples. Therefore, in an effort to permit swimming, the amount of material that settles into the bottom ooze must be reduced, whether it is animal feces or other decomposing material.

When water samples are analyzed for fecal coliform bacteria, the coliform bacteria that are unassociated with feces are also counted along with the fecal bacteria and contribute to the high counts. Therefore, to reduce the counts, not only the amount of feces entering the lagoon must be reduced, but also the amount of decomposing vegetable and animal matter. For example, <u>Streptococcus faecalis liquefaciens</u> is found in human and animal feces, but is also associated with vegetation, insects and certain soil types.

It is believed that coliform bacteria, more than streptococcus bacteria, live in large numbers in the anaerobic ooze on the lagoon bottom and decompose vegetative matter such as brown kelp, dead algae and dead pondweed. The assumed original source of these bacteria is probably excrement (John Ricker, County Environ. Health Dept., personal communication). Flower blossoms from the Begonia Festival and any uneaten vegetable matter that is either fed to the waterbirds or washed into the lagoon from

restaurant decks also contribute to the decomposing material that supports bacterial growth.

The smaller the quantity of dead plant material present in the lagoon, the lower will be the number of coliform bacteria in the water quality samples.

Another important way to reduce coliform counts is to reduce the feces input to the lagoon. The feces contains the bacteria and provides substrate for bacterial decomposition. In Soquel Creek Lagoon, water quality analysis indicated that the source of fecal coliform bacteria is nonhuman in origin and probably from the bird-life, primarily. The evidence and reasoning for these conclusions are found in the ensuing paragraphs.

The results obtained during three weeks of intensive water sampling in August, 1988, did not show any obvious sewage leaks or groundwater inputs of human waste. The County's data showed sporadically high (above 1000/ 100 ml.) fecal coliform counts from January to October, but no consistently high ratios (fecal coliform bacteria/ fecal streptococcus bacteria), thus failing to conclusively detect pollution from human waste.

It is believed by water pollution experts that nonhuman excrement from waterbirds contains higher relative concentrations of streptococcus bacteria than coliform bacteria compared to human sources. The accepted interpretation as to the source of fecal bacteria, according to Standard Methods, 1985, is as follows (although the conclusions drawn are very tentative due to the aforementioned variables): A fecal coliform/fecal streptococcus ratio of greater than 4.1 indicates that the pollution is derived from human wastes, a ratio between 0.7 and 4.1 is from a mixture of human and nonhuman wastes, and a ratio of less than 0.7 indicates the source is nonhuman. Ratios are also affected by other variables, including the environment sampled, the time and distance from the source of excrement and the sampling methods.

According to data from weekly sampling conducted by County Environmental Health at stations extending from the flume upstream to Noble Gulch from January through October 1988, 10% of the samples yielded ratios equal to or greater than 4.0, 44% yielded ratios between 0.7 and 4.0, and 46% yielded ratios equal to or less than 0.7. Soil Control Lab data from samples collected at 9 stations by City personnel over a 3-week period in August at locations from the flume upstream to the trestle, yielded 93% of the samples with ratios equal to or less than 0.7 and 7% with ratios between 0.7 and 1.22. It should be noted that there was considerable variation in actual bacterial counts between stations on the same day (Figure 1), and at the same stations on different days. For locations that were sampled by both Santa Cruz County and The City of Capitola in August, 1988, the ratios were lower from the County's bacterial counts, with the two labs reporting different counts. The differences might be partially explained by differences in sampling times. The

County's sample was taken two hours later in the morning than the City's. In addition, the lag time between sampling and analysis for City samples was one hour, while the lag time for County samples was up to 3 hours. Wind conditions may have changed during the day, redistributing the bacteria, and the bird activity at the lagoon may have become concentrated at different locations between the two sample times.

Factors that influence the bacterial counts from water samples include the time between sampling and processing and the survival time of the various bacteria after exposure to the environment as excrement. Survivability of fecal bacteria depends on the source of the excrement, the length of time the bacteria is exposed to the aerobic environment, salinity, water circulation, water temperature, the time of sampling and the location of sampling. Some of these variables are not yet fully understood.

It is believed that human fecal streptococcus survive longer in the environment than human fecal coliform and that nonhuman fecal streptococcus survive for a shorter time than nonhuman fecal coliform. Therefore, the coliform/streptococcus ratio would decrease with time if the source was human excrement and increase if the source was nonhuman excrement (J. Ricker, personal communication, Fechem, 1975). Because of the large number of variables that can affect the ratio of bacterial types, the samples should be analyzed as quickly as possible. However, bacterial counts may fluctuate through the day, depending on the activity of the birds. A sample taken at 0800 hr may contain a much different bacterial concentration than one taken at 1000 hr or 1300 hr, etc.

It appears likely from analysis of bacterial ratios of samples taken weekly from the several stations in the lagoon that most of the fecal bacterial pollution was from bird excrement because almost half of the ratios from County samples were 0.7 or less, because more than 90% of the ratios from the City's samples were 0.7 or less and because the lagoon was heavily used by waterbirds. The excrement could come from the waterbirds that use the lagoon and pigeons that roost on the railroad trestle or fly over the lagoon from the trestle or wharf to areas where humans feed birds, though dog and cat excrement is also a contributing factor. Hundreds of gulls seen at one time on the lower lagoon in summer of 1989. Many would defecate as they left the water surface, particularly if startled.

Additionally, a review of the bacterial counts and ratios from samples taken by the County at the upstream end of the Noble Gulch tunnel near Bay Street in August through October, indicated that large concentrations of fecal bacteria were entering the lagoon from Noble Gulch, with the source being nonhuman. The high concentrations of fecal bacteria were presumably from waterbirds living in artificial ponds on Noble Gulch and pets in the suburban area. Also, high concentrations of bacteria are typical of very low streamflow conditions, as occurred during summer, 1988.

Certain patterns of streptococcus bacteria distribution and abundance in Soquel lagoon were apparent from water samples and were correlated with bird distribution, further implicating the birds as the primary source of fecal bacteria. The occurrence of Streptococcus counts between 1000-5000/100 ml increased from mid-August to the end of October in the area from Noble Gulch down to the railroad trestle. Streptococcus counts were sporadically above 1000/100 ml as early as March through July, especially at the flume (Figure 2). From August through October, streptococcus counts were consistently in the 1000-16000/100 ml range under and downstream of the trestle with the highest being under the trestle and at the flume. Pigeons commonly roost on the trestle during summer months and 83 % of the water birds observed on the lagoon during 8 days of observation were downstream of the trestle.

Within the lagoon, fecal coliform counts appeared to be generally higher below Noble Gulch than above, and much higher downstream of the Stockton Avenue Bridge than upstream. These findings correlated with bird distribution. The highest fecal bacterial counts detected during the period January to October, 1988, were near Venetian Courts the day after the lagoon had been drained, excavated and stirred up in late May.

Monitoring of bird use of the lagoon in late October indicated that 51% of the waterbird sightings occurred between the Stockton Avenue bridge and the beach (Reach 1) and 32% occurred between the bridge and the railroad trestle (Reach 2). The remainder occurred between the trestle and a point upstream of Shadowbrook Restaurant (Reach 3) (Appendix D.).

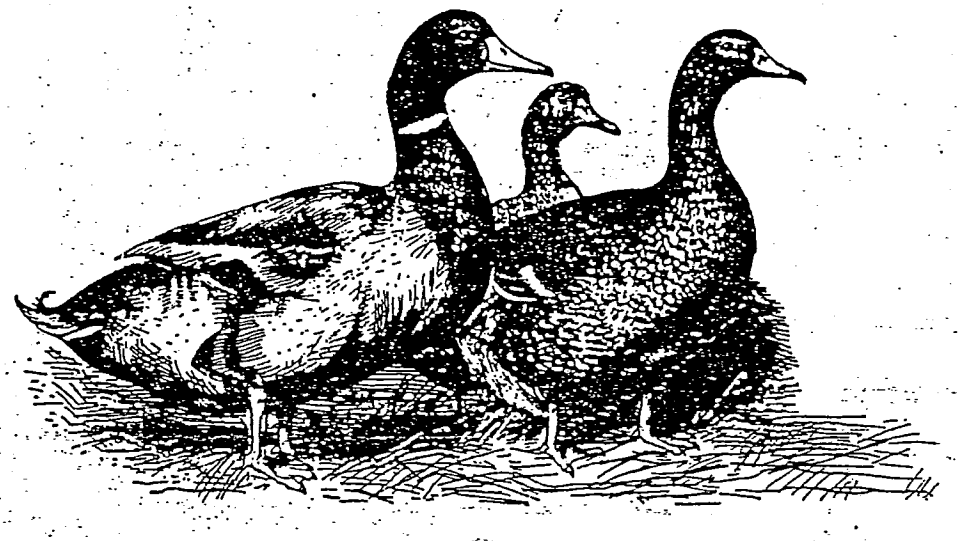
During the 8 days of censusing, the total number of waterbirds using the lagoon ranged from 137 to 233. Ranges for wild Mallards, feral (domesticated birds that have escaped or have been been released into the wild and their offspring) ducks and geese, American Coots, and gulls were 33-102, 5-28, 64-106 and 24-54, respectively. Mallards were most concentrated just upstream of the Stockton Avenue bridge on the east and west sides with 38% of the lagoon sightings from the bridge to half way between the bridge and the trestle. Ninety-eight percent of the mallards roosted on the banks of Reach 2, particularly on the west side.

Domestic geese and feral ducks formed a rather unified group and were strongly associated with Reach 1 with 95% of the sightings there. Though American Coots did not appear on the lagoon until fall, 35% of the sightings were in Reach 2 and 48 % were in Reach 1. Filamentous algae grew mainly in Reach 1, and American Coots fed heavily on it. Ninety-four percent of the gulls were sighted in Reach 1. Though pigeons did not land on the water, they were observed on the trestle throughout the summer and at the popular feeding areas just upstream of the Stockton Avenue bridge and on the beach. Their droppings probably added significant amounts of fecal bacteria to the lagoon under the trestle.

Human feeding of waterbirds was observed during 60% of the censuses and seemed to significantly influence the overall distribution of birds. Domestic geese and feral ducks were present on every occasion that handouts were offered, with an average of 95% of them taking advantage of handouts during such events. Geese were not observed using natural food during. Gulls were present on all occasions of food handouts, with an average of 41% of the gulls taking advantage of this food source.

The most frequently observed source of handouts, accounting for 44% of the observed feedings, was customers at Margaritaville in Reach 1. Tortilla chips were the common food item. Thirty-eight percent of the sightings of human handouts occurred near Venetian Courts on the west side of Reach 1.

Other observations during the summer indicated considerable bird feeding on the west and east side of the lagoon just upstream of the Stockton Avenue Bridge, and by the paddleboat proprietor at the boat ramp and as he canoed up the lagoon. He has since discontinued that practice.



PLEASE DON'T FEED WATERFOWL

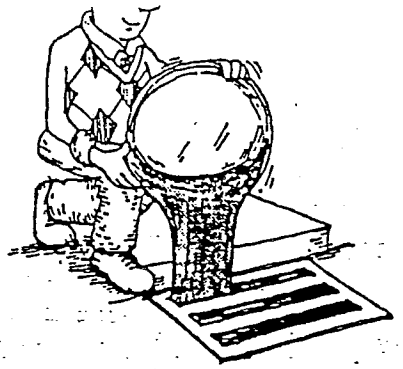
The Park District is dedicated to protecting native wild animals in their natural environment. WE NEED YOUR HELP.

Unfortunately Park lakes have become a favorite place to release unwanted domestic ducks. The ducks quickly multiply and exceed the lake's natural carrying capacity when people regularly feed them.

Water tests often reveal coliform bacteria counts exceeding public health standards and human contact cannot be permitted. The bacteria comes from fecal matter deposited by these birds.

Domestic ducks can carry diseases easily transmitted to wild ducks. Wild ducks can become accustomed to being fed and will not return to the wild.

To help us protect people and wildlife, please don't feed the waterfowl.



WHY STORM DRAIN STENCILS?

Why storm drain stencils? Because poisons are damaging our water quality! Every year people pour hazardous chemicals, pesticides, paints, antifreeze and used motor oil down storm drains.

How much is dumped? The Seattle Aquarium estimates that more than two million gallons of used motor oil ends up in Puget Sound each year. That's enough to fill a medium-sized tanker!

Some people believe that the storm drain will carry the waste to a sewage treatment for cleanup. Not true! (Even if it did, chemical wastes would not belong there.) In fact, storm drains simply carry rainwater into the nearest stream, lake or Puget Sound--directly into fish habitats or sometimes drinking water.

Some Washington communities draw drinking water from surface waters, such as large lakes. Toxic chemicals don't belong there!

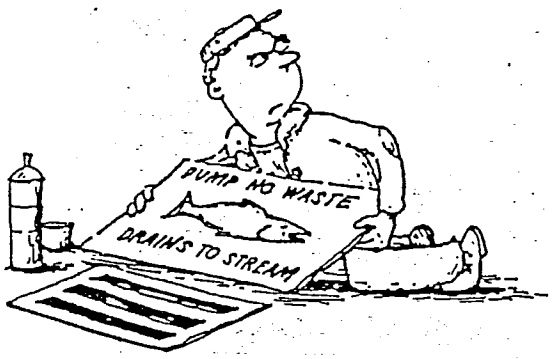
As to marine life, even small amounts of toxic chemicals--like antifreeze, pesticides and household cleaners--can weaken fish and make them susceptible to fatal diseases.

One pint of oil can cause a slick about the size of two football fields on calm water! The surface of the water is a vital biological habitat, and serves as a nursery for developing eggs and larvae of eggs and shellfish. It doesn't take much oil to smother or poison these surface organisms.

What can you do? Apply the enclosed stencil next to the storm drain grates in your community. The next time someone gets ready to pour waste down the drain, they'll get the message!

FOR INFORMATION:

- On where to recycle used oil, call the Department of Ecology's toll-free Recycling Hotline, 1-800-RECYCLE.
- On safe disposal of hazardous substances, call Ecology's Hazardous Substance Information Office Hotline, 1-800-633-7585.



HERE'S HOW TO USE STORM DRAIN STENCILS

FIRST, CALL FOR PERMISSION

For city and county streets, call the city or county Public Works Department, either the storm drain utility or road maintenance division. Public Works will probably issue a permit or letter of approval. They may even provide assistance with storm drain maps, street cleaning and traffic safety.

Storm drains on private property (i.e., business parking lots) require permission of the property owner. If children will be helping to apply the stencil, special care needs to be given to site selection for traffic safety reasons.

WHERE TO PUT THE STENCIL

One option is to lay the stencil on the street side of the drain grate, out of the way of flowing dirt and leaves. Another option is to carefully cut the stencil into three equal sections and stencil the curb above the storm drain. (Additional backing may be required to prevent overspray with this method.) Stenciling the sidewalk itself may be discouraged by Public Works due to the slick nature of a painted surface and possible falls by pedestrians.

WHEN TO APPLY THE STENCIL

Not during a rainstorm! Wait for dry weather and dry pavement with air temperatures in accordance with instructions on the paint can (probably at least 50 degrees). It defeats the purpose to have wet paint rinsed down the storm drain to the creek.

HOW TO APPLY THE STENCIL

Use white, flat latex paint or traffic zone latex. It is probably the least toxic and most visible. It's been used successfully by road crews who report up to a two-year life span on pavement. The paint may be applied with a stencil brush, a small roller (3" with 1/2" nap), or by spray can. The rough surface of the roadway or curb may dictate the best method. (Very new asphalt may taint the color of the paint.) It may even be an advantage to block out a dark background of black and let that dry, then stencil the message in white for better contrast. Recycle unused paint by giving it to someone who can use it.

Scrub the area briskly with a wire brush so the surface is free of dirt. Lay down a background color if desired and let dry. Lay stencil flat and apply paint carefully so it doesn't run under the stencil.

* IF YOU NEED MORE STENCILS or information on local stencil projects, call Rhonda Hunter at the Department of Ecology (206) 459-6356.

Thank you for helping to improve Washington State's water quality!

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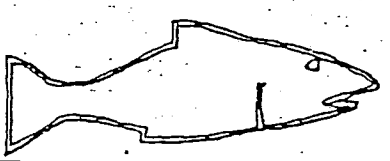
2/88



The Habitat Restoration Group

ORDINANCE 38

BE IT ORDAINED by the Board of Directors of the East Bay Regional Park District:

CHAPTER I - DEFINITIONS

SECTION 100. Unless the context otherwise requires, the definition hereinafter set forth shall govern the construction of this Ordinance.

SECTION 101. DISTRICT DEFINED. "District" means the East Bay Regional Park District, and includes all lands and waters owned, controlled, or managed by the East Bay Regional Park District, which shall hereinafter be referred to as "parklands."

SECTION 102. PERSON DEFINED. "Person" means any natural person, firm, corporation, club, municipality, district or public agency, and all associations or combinations of persons whenever acting for themselves or by any agent, servant, or employee.

SECTION 103. PERMISSION DEFINED. Unless otherwise expressly provided, "permission" means written permission, granted by the General Manager of the East Bay Regional Park District or the General Manager's designee.

SECTION 104. BOARD DEFINED. "Board " means the Board of Directors of the East Bay Regional Park District.

SECTION 105. HEADINGS AND DIVISIONS. Headings and divisions are for convenience only and shall not be considered in the interpretation of this Ordinance and shall not in any way affect the conduct or activities covered by other sections of this Ordinance.

CHAPTER II - REGULATIONS

SECTION 200. GENERAL REGULATIONS.

200.1 All persons entering upon District parklands shall abide by the rules and regulations of the District, the laws of the State of California, and all applicable county and/or municipal ordinances.

200.2 The provisions of this Ordinance shall not apply to employees of the District or to its concessionaires or their employees engaged in and acting within the scope of their authorized duties and concession activities. However, District employees and concessionaires and their employees shall abide by the laws of the State of

California and all applicable county and/or municipal ordinances.

SECTION 201. SPECIAL REGULATIONS. Special regulations enacted for an area or a subject do not preclude the application of general regulations unless expressly so indicated.

CHAPTER III - GENERAL RULES

SECTION 300. AUTHORITY. All section of this Ordinance are adopted pursuant to Section 5541, 5558, 5559, and 5560 of the Public Resources Code of the State of California, and apply to all District parklands. A title, where used, does not limit the language of a section.

SECTION 301. VIOLATIONS OF ORDINANCE AN INFRACTION OR MISDEMEANOR. Any violations of Paragraph 503.6(b) of Section 503, Section 901, or the provision of Section 903 which reads "... in no event shall a vehicle be driven at a speed greater than the posted speed limit for that area," or Section 904 of this Ordinance is punishable as an infraction.

Any other violation of this Ordinance is punishable as a misdemeanor or an infraction, as indicated in the Table of Contents, pages (i), (ii), and (iii).

Any judge of a justice court within any judicial district lying wholly or in part within the District, or any municipal court which may be established within the District, shall have jurisdiction of all prosecutions under this article for violations of any ordinance, rule, or regulations adopted by the Board of Directors.

SECTION 302. SEVERABILITY. If any chapter, section, subsection, paragraph, sub-paragraph, sentence, or clause of this Ordinance is for any reason held to be invalid or unconstitutional, such invalidity or unconstitutionality shall not affect the validity or constitutionality of the remaining portions of this Ordinance; and the Board of Directors declares that this Ordinance, and each chapter, section, subsection, paragraph, sentence, and clause thereof would have been adopted irrespective of such possible finding of invalidity or unconstitutionality and, to that end, the provisions of this Ordinance are hereby declared to be severable.

SECTION 303. AMENDMENT OR REPEAL. Where a section herein or rule or regulation adopted pursuant thereto is amended or repealed, acts and commissions prior thereto may be prosecuted as though such section, rule or regulation had not been so amended or repealed.

801.10 Removal or Clean-Up of Dog Feces in Developed Park and Urban Trail Areas. Any person bringing a dog onto park property shall immediately remove the excrement deposited by such animal on any paved public trail, turf area, developed park area, picnic area or any other area so posted. Animal wastes may be placed in garbage cans, other containers, or placed in an adjacent undeveloped, natural area of the park or trail.

SECTION 802. ABANDONED ANIMALS. No person shall abandon a dog, cat, fish, fowl, or other animal within the District parklands. Any abandoned animals will be live-trapped and relocated, or turned over to Animal Control, or otherwise be removed in compliance with adopted Board policy.

SECTION 803. FEEDING RESTRICTIONS FOR FERAL (DOMESTIC OR NON-NATIVE ANIMAL), WILD ANIMALS, AND FARM ANIMALS. No person shall feed farm animals when so posted, or feral or wild animals at any time on District parklands.

SECTION 804. PLANTS. No person shall damage, injure, collect, or remove any plant or tree or portion thereof, whether living or dead, including but not limited to flowers, mushrooms, bushes, vines, grass, turf, cones and dead wood located on District parklands. In addition, any person who willfully or negligently cuts, destroys or mutilates vegetation shall be arrested or issued a citation pursuant to Penal Code Section 384a.

SECTION 805. GEOLOGICAL FEATURES. No person shall damage, injure, collect or remove earth, rocks, sand, gravel, fossils, minerals, features of caves, or any article or artifact of geological interest or value located on District parklands.

SECTION 806. ARCHAEOLOGICAL FEATURES. No person shall damage, injure, collect or remove, any object of paleontological, archaeological or historical interest or value located on District parklands. In addition, any person who willfully injures an object of archaeological or historical interest or value or enters a fenced and posted archeological site shall be arrested or issued a citation pursuant to Penal Code Section 622-1/2.

SECTION 807. SPECIAL PERMISSION. Special permission (Section 103) may be granted to remove, treat, disturb, or otherwise affect plants or animals or geological, historical, archaeological, or paleontological materials for research, interpretive, educational, or park operational purposes.

SECTION 808. PROPERTY. No person shall cut, carve, paint, mark, paste, or fasten on any tree, fence, wall, building, monument, or other property in the District, any bill, advertisement, directional or informational signs, or inscription whatsoever.

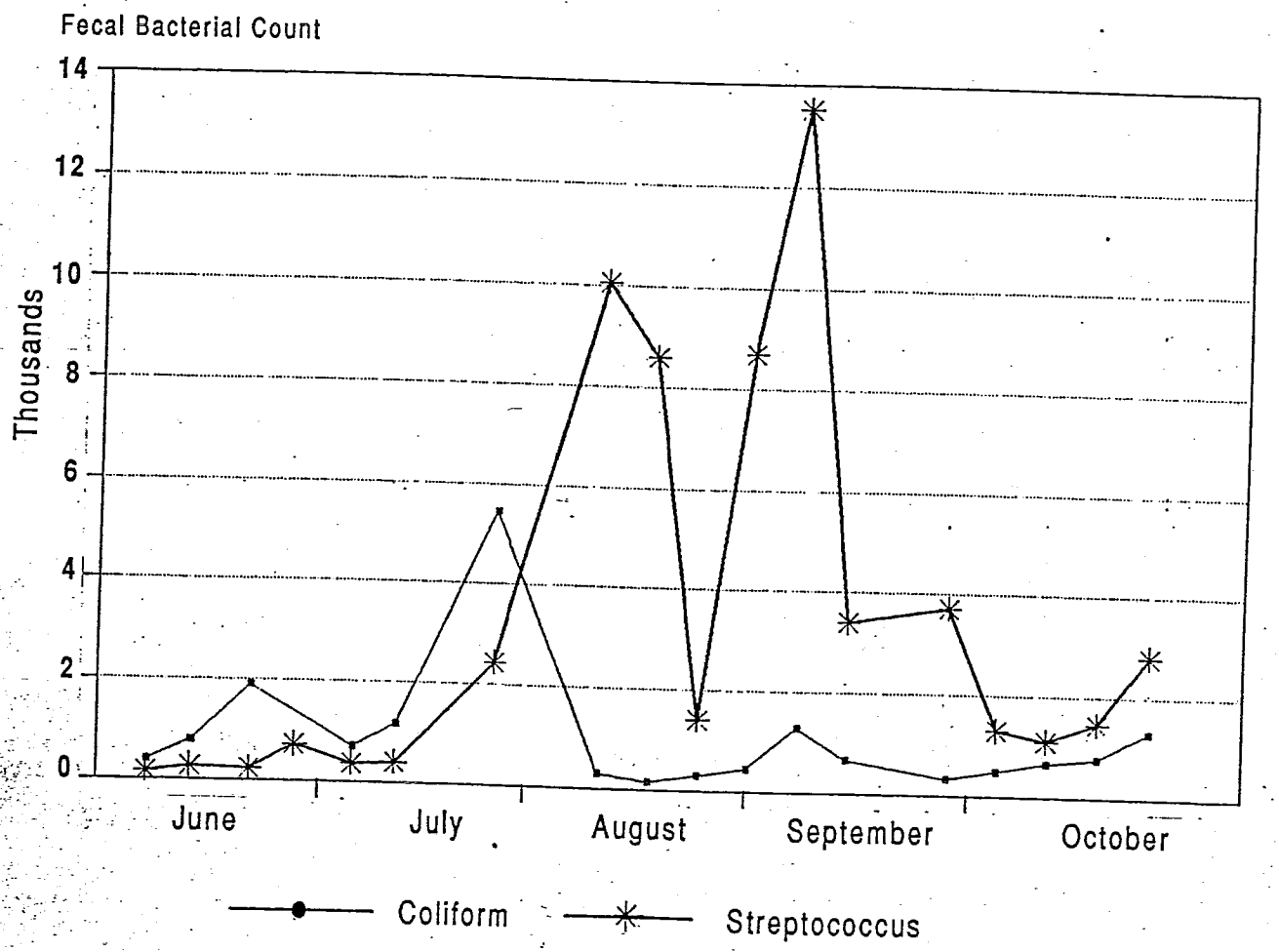
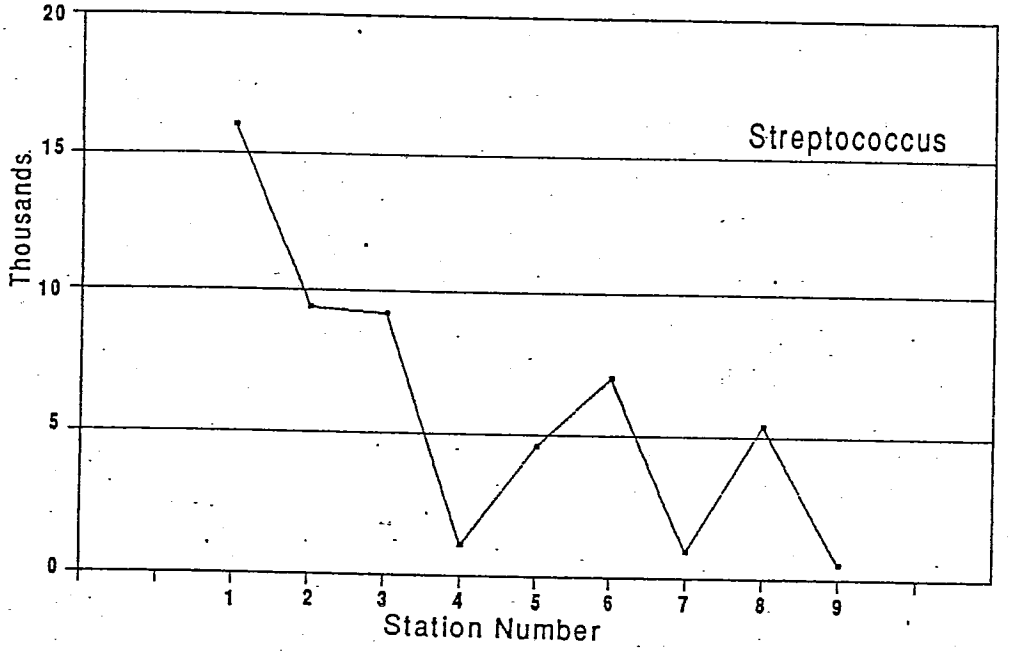


Figure 2.

Coliform and Streptococcus Bacterial Counts at Soquel Lagoon - Near Flume; 1988 (County Samples).

Fecal Streptococcus Bacterial Counts



Fecal Coliform Bacterial Counts

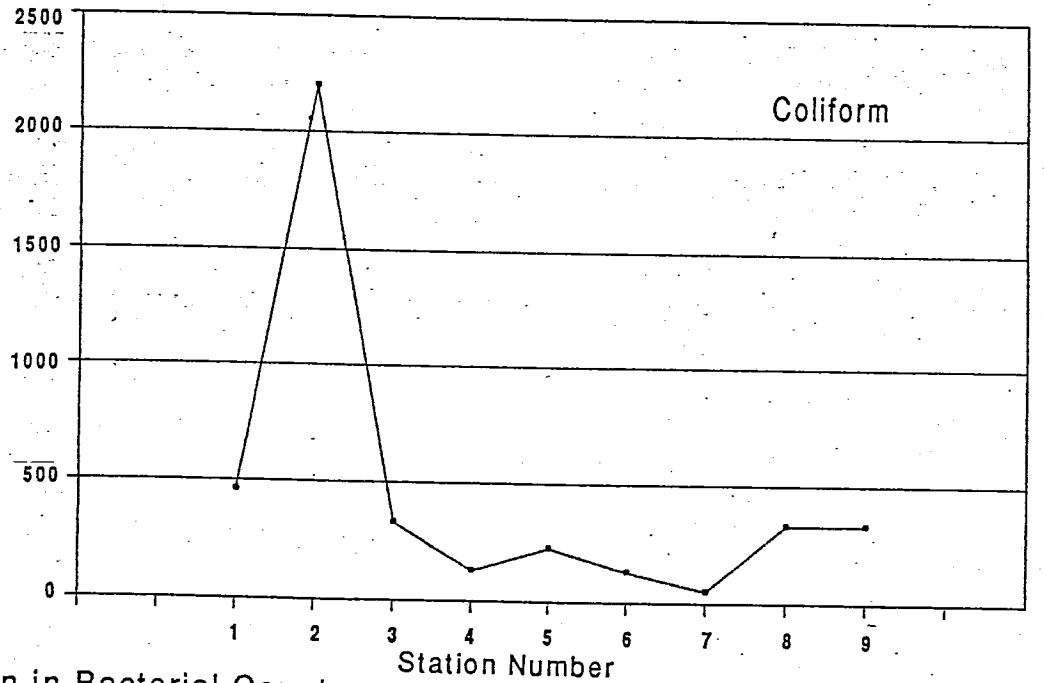


Figure 1.
Spatial Variation in Bacterial Counts in Soquel Lagoon, August 30, 1988 (City Samples).

The Habitat Restoration Group
JOHN STANLEY & ASSOCIATES
6001 Butler Lane, Suite I • Scotts Valley, CA 95066
(408) 439-5500 FAX (408) 438-1142

SOQUEL LAGOON
Management & Enhancement Plan

May 1990

424-01