R3, SL River Sed Trib

Proposed Changes To 303(D) List

Proposed Listings

The recommended changes to the 1998-303(d) list are shown in Attachment Two. Additions are shown in a highlighted format and deletions are shown in a ~~strikethrough~~ format.

More information about proposed new listings is shown in Attachment Three. Included is staff's rationale for adding a specific condition.

Proposed 303(d) Delistings

Staff is proposing to remove water quality conditions from the 1998-303(d) List. Waters proposed for delisting are summarized below and shown in a ~~strikethrough~~ format in Attachment Two. Attachment Five contains detailed rationale for proposed listing.

Chorro Creek Metals

Staff is proposing to delist Chorro Creek for metals after evaluating data and finding conditions support delisting factor three because sample data showing exceedences was collected from outside of the waterway. Available information also supports delisting factor four based on aquatic habitat data submitted after the listing by the California National Guard. Chorro Creek will remain on the list for Siltation which also supports delisting factor six because sediment reductions required under the Siltation TMDL are expected to also reduce metals loads in Chorro Creek.

Los Osos Creek Priority Organics

Staff is proposing to delist Los Osos Creek for Priority Organics. Water column and sediment data was collected as part of a monitored assessment and no exceedences of standards existed. Therefore delisting factor four is supported. Los Osos Creek will remain on the list for Siltation which also supports delisting factor six because sediment reductions required under the Siltation TMDL are expected to also reduce pesticides loads in Los Osos Creek.

San Lorenzo River Estuary—Siltation

Staff is proposing to delist the San Lorenzo River Lagoon. The original listing appears to have been based on generic data that was not truly indicative of the conditions in the SLR Lagoon. This conclusion supports delisting factor three, use of faulty data. The City of Santa Cruz's 1989 study of the lower San Lorenzo River (Philip Williams & Associates, et al, 1989), which includes the Lagoon Management Plan, has established that problems within the lagoon are associated with the breaching of the sand bar that becomes established between the lagoon and Monterey Bay, and are not due to the delivery of sediment from upstream sources.

Other Changes Proposed

Attachment Two indicates a priority and schedule for each new listing and changes to priority and schedule for some existing listings.

The following general comments provide background and justification for proposed schedules shown on Attachment Two:

While initial assessments started for several listings between 1996 and 1998, TMDL development did not. From 1996 to 2000, TMDL-related efforts focused on updating the 1998 303(d) list and assessing resource needs and priorities for TMDL development, watershed management, and establishment of CCAMP. In July 1999, Region 3 secured dedicated resources (for five staff people) for TMDL development. These resources were augmented in July 2000 (with three additional staff people). Much of the TMDL effort during 1999 focused on recruiting, hiring, and training new staff, establishing the TMDL program and integrating the program into the Watershed Branch. Actual TMDL development work throughout Region 3, as defined by the 1998 303(d) List, began in July 2000 and significantly increased in January

ChannelKeeper, up the TMDL on the south coast, at Mission Creek or the Arroyo Burro Creek.

Citizens for Responsible Forest handed out pictures of timber harvest problems in Kings Creek and requested San Lorenzo River tributaries be listed for sedimentation/siltation. She also requested that San Lorenzo River Lagoon not be delisted for sedimentation/siltation.

Board Member Young asked about virus data submitted by Heal the Ocean for the south coast area. Mr. Briggs said it appeared that all Heal the Ocean sampling sites (those with multiple samples) were already covered in some way by existing and proposed listings, with the exception of Carpinteria Marsh. Mr. Briggs recommended the Board direct staff to add Carpinteria Marsh to the listing conditioned on staff evaluating virus and other data more fully.

Motion: Bruce Daniels moved to approve the recommendation that the State Water Resources Control Board consider changes shown in the Staff Report, Attachment Two, for the statewide update of impaired surface waters (referred to as the 303(d) List). Additionally, (1) add Santa Maria River Estuary for "organochlorine pesticides" to the recommendation, (2) keep the San Lorenzo River Estuary Listing for sedimentation/siltation in the recommendation (do not de-list), 3) re-evaluate San Lorenzo River tributaries sedimentation/siltation data/information to determine if additional tributaries (Zayante Creek, Bean Creek, and Kings Creek, at a minimum) should be added to the 303(d) List recommendation, and (4) re-evaluate available information for Carpinteria Marsh pathogens to determine if Carpinteria Marsh should be added to the 303(d) List recommendation. SECONDED by John Hayashi. CARRIED – Unanimously (5-0)

(Staff Counsel, Jennifer Soloway left the meeting at 3:50 p.m.)

(Chair Shallcross announced a break at 3:55 p.m. The meeting reconvened at 4:05 p.m.)

18. Reports by Regional Board Members..... Status Report

Bruce Daniels shared an article on Scotts Valley Water District and their plans to do inject treated effluent or to irrigate. Mr. Daniels also shared an article about the mercury TMDL in the San Francisco Bay area.

19. Executive Officer's Report [Roger Briggs 805/549-3140]..... Information/Discussion

Executive Officer Briggs noted that the Morro Bay Shellfish Technical Advisory Committee has preliminary information from the DNA work commissioned with Dr. Samadpour at the University of Washington. A report will be provided at the February 2002 Board meeting along with a report on sea otters. The Duke Morro Bay Power Plant will be addressed in a status report at the December Board meeting this year. The Los Osos Wastewater Project had a State Revolving Fund timing problemand the Regional Board sent a letter to the State Board asking them to keep Los Osos on the list. The State Board Executive Director was to contact the Los Osos Community Services District with a status on the requested funding. Mr. Briggs noted that the Clean Beaches Initiative Project represents almost $5.7 million for this region. Mr. Briggs noted that the Regional Board would be focusing on groundwater issues at the Former Casmalia Hazardous Waste Landfill at an upcoming meeting. The State Board has scheduled a workshop for January 2002 to work on the Update of the Enforcement Policy. Board Member Jeffrey Young asked about the total maximum daily load schedule for south coast listed waters and if any could be accelerated. Mr. Briggs explained that there would be tradeoffs, such as delaying previously scheduled TMDLs. After some discussion, the Board directed Mr. Briggs to evaluate the pathogen TMDL schedule for the Pacific Ocean at Arroyo Burro Creek and/or Mission Creek to determine if these can be scheduled and initiated earlier than currently proposed (and indicate what projects may be delayed as a result). Mr. Briggs announced that all the Board members would be attending the WQCC meeting in November. Mr.

From: Mark Angelo
To: Melenee Emanuel
Date: 9/5/02 5:08PM
Subject: Re: Response to Comments for the 303(d) list

Melenee,

No, there is no data that supports sedimentation/siltation is due to a sandbar and not an upstream source. Furthermore, that was not the case that I was trying to make in support of the delisting. I had a 1989 report that indicated there were a host of issues associated with the lagoon that were related to the formation of the sand bar and its subsequent breaching, but none of those issues were related to sediment. Recommendations of the report indicated that if water levels in the lagoon were managed properly that the lagoon could better function as steelhead habitat.

So, there is no data to support the delisting. On the other hand, there was no data to support the listing either.

Some background info. The City of Santa Cruz used to clear the channel and in doing so they would remove riparian vegetation and reshape the channel bottom, thereby destroying much of the instream and riparian habitat value within the lagoon area. Recently, the Army Corps raised the levees on either side of the lagoon, to allow for greater flood protection, and the City has modified its scorched earth policy in favor of more ecologically sensitive channel maintenance practices. Since the city changed its practices, there has been a dramatic recovery of instream and riparian habitat in the channelized area. Some have speculated that the channel design encouraged depostion of sediment within the channelized area.

Sorry for not getting back to you earlier today.

Mark

Mark Angelo, WRCE
Regional Water Quality Control Board
81 S. Higuera Street, Ste. 200
San Luis Obispo, CA 93401

Phone: (805)542-4771
Fax: (805)788-3505
email: mangelo@rb3.swrcb.ca.gov

>>> Melenee Emanuel 09/05/02 03:55PM >>>
Hi Lisa, Is there any data that supports sedimentation/siltation is due to a sandbar and not an upstream source? If there is and we don't have the data at the SB...can someone send it to me? I left a voice message for Mark Angelo, but I have not heard from him.

Thanks much!

Melenee

Melenee Emanuel
State Water Resources Control Board
Division of Water Quality, Monitoring
1001 I Street, P.O. Box 944213
Sacramento, CA 95812
emanm@dwq.swrcb.ca.gov
p (916) 341-5271
F (916) 341-5550

Old Fact Sheet

Region 3

San Lorenzo River Lagoon

Water Body	San Lorenzo River Lagoon
Stressor/Media/Beneficial Use	Sediment/Siltation/water/Aquatic life
Data quality assessment. Extent to which data quality requirements met.	City of Santa Cruz of lower Lorenzo River (Philip Williams and Associates, et al, 1989). ~~Unknown if~~ QAPP ~~used~~.
Linkage between measurement endpoint and benefical use or standard	Siltation is linked to Aquatic Life BU
Utility of measure for judging if standards or uses are not attained	Original listing appears to have been based on generic data that was not indicative of the conditions in the SLR Lagoon. The Lagoon Management Plan has established that problem within the lagoon are associated with the breaching of the sand bar that becomes established between the lagoon and Monterey Bay, and are not due to the delivery of sediment from upstream sources.
Water Body-specific Information	Data 4 years old
Data used to assess water quality	No actual data
Spatial representation	Unknown
Temporal representation	Unknown
Data type	Unknown
Use of standard method	City of Santa Cruz, methods unknown
Potential Source(s) of Pollutant	Due to the establishment of a sandbar and not from sediments upstream.
Alternative Enforceable Program	
RWQCB Recommendation	Delist (list)
SWRCB Staff Recommendation	Delist (Impairment not due to delivery of sediment upstream sources, but due the established of a sandbar.)

list

New Staff Report Factsheet.

Region 3: San Lorenzo River Lagoon Sediment/Siltation

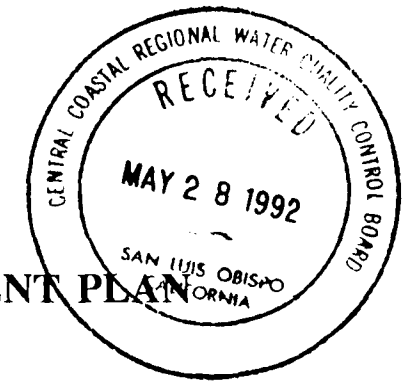
Water Body	San Lorenzo River Lagoon
Stressor/Media/Beneficial Use	Sediment/Siltation/water/Aquatic life
Data quality assessment. Extent to which data quality requirements met.	Unknown
Linkage between measurement endpoint and benefical use or standard	Siltation is linked to Aquatic Life.
Utility of measure for judging if standards or uses are not attained	Unknown
Water Body-specific Information	Unknown
Data used to assess water quality	No actual data
Spatial representation	Unknown
Temporal representation	Unknown
Data type	Unknown
Use of standard method	Unknown
Potential Source(s) of Pollutant	Sources is unknown. There is no supporting evidence for pollutant source.
Alternative Enforceable Program	
RWQCB Recommendation	Maintain Listing
SWRCB Staff Recommendation	After reviewing the available information provided by the RWQCB and the recommendation, SWRCB staff concludes that the water body should be removed from the section 303(d) list because there was originally no information to support listing and currently there is no new information provided to support maintaining on the list.

Melenee,

Here are the pertinent pages for the San Lorenzo Lagoon. Let me know if you need anything else. I still think no action on your part is the prudent approach.

Mark

SAN LORENZO RIVER ENHANCEMENT PLAN



THE SAN LORENZO RIVER ENHANCEMENT PLAN

A Plan for Biological Enhancement on the Lower San Lorenzo River

Prepared for the City of Santa Cruz

with funding from

The California State Coastal Conservancy

by

Philip Williams & Associates
Consultants in Hydrology

Mitchell L. Swanson
Project Manager
Associated Consultant

N. Elizabeth Bradley, P.E.
Associate

John Stanley and Associates
Ecological Consultants

John Stanley
Principal

Kathleen Lyons
Botanist & Project Manager

Williams Lapaz
Horticulturalist

David Suddjian
Wildlife Biologist

Jerry Smith
Fisheries Ecologist

VI. LAGOON MANAGEMENT PLAN

ıtroduction

an Lorenzo River Lagoon (Figure 6.1) is an important biological resource in the Lower San zo River. Its proper management is key to realizing the full potential of the restoration effort e Enhancement Plan. Enhancement of the lagoon offers an opportunity to restore a greater ead population, improve habitat for other fish, provide more extensive and diverse habitats for owl and other wildlife, increase vegetation, and improve the river's aesthetic and natural rance.

same time the lagoon presents serious problems to the surrounding urban developments as agoon levels cause seepage and flooding in basements, erosion in the flood control levees, decline in the safety and quality of beaches and picnic areas along the parking lot at the Cruz Boardwalk. In the past, the river mouth has been breached several times each summer er the lagoon water surface elevation and relieve the flooding problems, but this proves ul to the steelhead fishery. In the past the lagoon was used for bathing, but the present led summer water quality makes human contact hazardous.

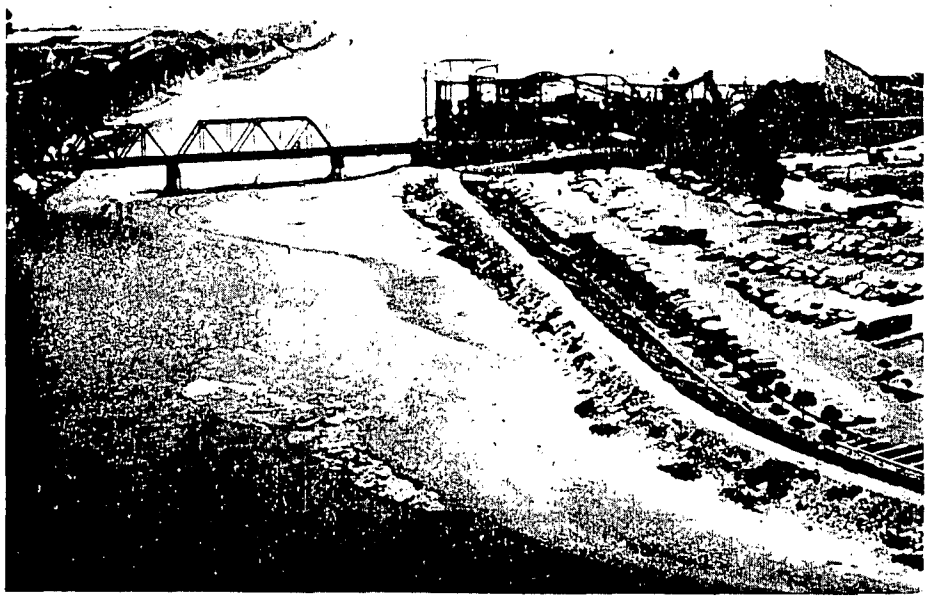
an Lorenzo River Lagoon has experienced a history similar to other wetland areas in the rn United States and coastal California. In the earlier part this century, lagoons, marshes and ies were viewed as waste land areas of little value and even a source of disease. equently, many were filled or drained and their ecosystems destroyed. The importance of these nd environments in the health of declining wildlife populations was not recognized until the and not protected from damage by regulation until the late-1970s. Much of the San Lorenzo Lagoon and Estuary was destroyed by urbanization and ultimately by channelization for control in 1958. It has recently been recognized through fish and water quality studies, that an Lorenzo River Lagoon is an important aquatic resource, especially as a rearing area for the omous steelhead population.

purpose of the Lagoon Management Plan is to strike a reasonable balance between responsible effective biological management, while minimizing the summer flooding problems in the surrounding urban areas caused by high summer lagoon levels.

B. Lagoon Setting

The San Lorenzo River Lagoon comprises the reach from Monterey Bay at the Santa Cruz Boardwalk amusement park to north of Water Street. Predominantly freshwater conditions occur upstream of Water Street while brackish water dominates the environment downstream of the Pedestrian bridge. This estuarine zonation is reflected by the distribution of vegetation species on the channel bed and the lower levee and embankment slopes. In 1988, tule and cattail thrived in the brackish water conditions downstream of the Pedestrian Bridge, while freshwater species such as willow and alder were excluded and absent. Upstream of the brackish water zone above Water Street, willow and alder grow on the channel bed.

During winter months, the river mouth is opened by winter floods and the lower river is subject to tidal exchange to a high tide elevation of up to about 4.0 feet above mean sea level (msl). In the summer months, the combined effect of declining river flows and a build up of sand on the beach by summer wave conditions closes the river mouth with a sand bar. With the river mouth blocked, the lagoon fills up to elevations of 5.0 to 6.0, and occasionally up to 8.0 feet above mean sea level with freshwater supplied by inflows on the San Lorenzo River and Branciforte Creek. Because high lagoon levels have created flooding problems for the surrounding urban areas, the lagoon has often been artificially drained by breaching the sand bar with a bulldozer, or by hand if the sand bar is narrow.



The San Lorenzo River Lagoon in 1985. River water level approximately 2.5-3.0 feet NGVD.

C. Biological Resources and the Impact of Sand Bar Breaching

The San Lorenzo River Lagoon provides important habitats for anadromous, marine and freshwater fish species and waterfowl. The lagoon, mudflats and the fringe vegetation offer habitat for a variety of bird species. But the lagoon is especially important and productive for young steelhead trout, a focus of concern to the City of Santa Cruz River Restoration Committee. A productive lagoon allows young steelhead to feed and grow to a greater size and increase their chances for survival in the ocean and for returning to breed. Recent research on California central coast lagoons indicates that healthy and rapid growth of steelhead depends upon maintenance of proper lagoon water quality conditions (proper temperature range, dissolved oxygen levels and salinities) and providing conditions favorable to the invertibrate animals on which the steelhead feed.

The lagoon is most productive when it is either entirely freshwater, as in the summer after the mouth has closed and freshwater inflows have displaced residual salt water, or when the water column is a well-mixed combination of salt and fresh water, typically in the winter months when the river mouth is open to tidal circulation (Figure 6.2). The lagoon habitat is not productive if it is static and stratified with a denser layer of salt water underlying a less-dense layer of freshwater. Stratification occurs either in the early summer months shortly after closure of the river mouth prior to conversion to freshwater, or when the lagoon has been artificially opened by breaching. When the lagoon is stratified and static, the bottom salt water layer acts as a solar collector which traps heat, raising water temperatures above levels where steelhead and their food (mostly aquatic species dependent on the environment of the lagoon bottom) can survive. In a prolonged stratified condition, steelhead are forced to the cool surface water where little food exists and where they become highly visible and easy prey for birds. Stratified conditions can also result in poor dissolved oxygen levels in bottom waters which degrade or destroy habitat for steelhead and their food.

Breaching the sand bar to drain the lagoon in the summer months prolongs the stratified condition and damages the important steelhead habitat by introducing salt water and releasing freshwater. Breaching in the late summer months can be particularly severe because freshwater inflows to the lagoon decline, offering little chance to convert the lagoon to freshwater.

During the summers of 1987 and 1988, a preliminary investigation of habitat changes was conducted. During this period, sand bar breaching was limited, and at times, the lagoon was allowed to fill up to 6.5 feet above msl. Without breaching, the summer lagoon converted to purely freshwater and provided good quality habitat. It extended upstream of Water Street with higher quality aquatic habitats from Water Street to the Ocean: adult steelhead were found in pools along San Lorenzo Park, juvenile steelhead found improved habitat throughout, and more vegetation along the lagoon fringes brought greater food productivity drawing greater numbers of waterfowl. When breaching was conducted several times in the summer of 1988, the water quality conditions declined and the fish population in the lagoon declined dramatically.

D. Flooding and other Management Problems with the Summer Lagoon

While the environmental quality of the lagoon improved with higher water levels in the summers of 1987 and 1988, this led to numerous flooding and other problems in the urban areas. A hydrological investigation of the urban problems found a direct relationship between water levels and urban flooding. Preliminary results indicated that a summer lagoon level may be found which maintains sufficient environmental quality in the lagoon and reduces flooding problems in the urban areas to an acceptable level.

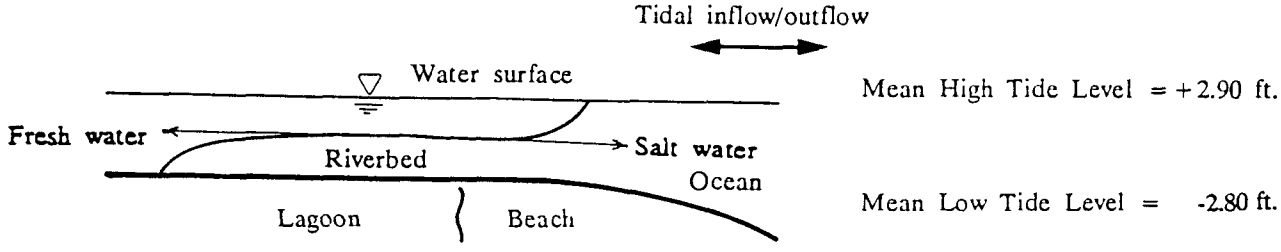
Figure 6.3 shows the extent of the problems identified in 1987 and 1988:

a. Flooding of basements and lands behind levees in downtown Santa Cruz and at the Santa

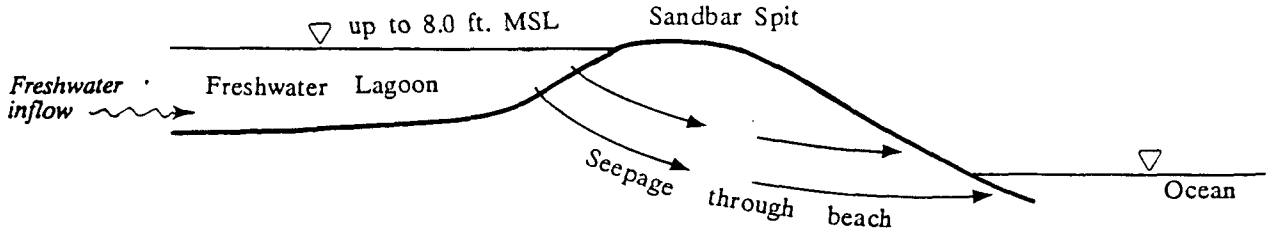
Water Quality Conditions in the San Lorenzo River Lagoon

Productive Lagoon Water Quality

1. Winter Condition, Mixed Seawater/Freshwater

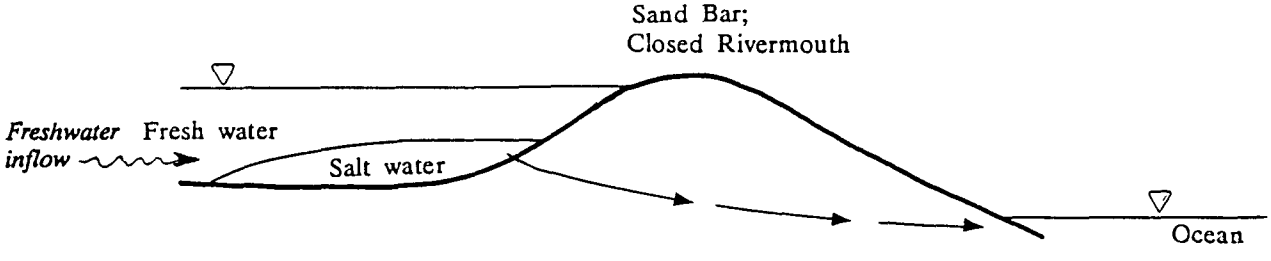


2. Summer Freshwater Lagoon (after conversion)



Unproductive Water Quality

1. Transition from Stratified to Freshwater Lagoon



2. Prolonged Stratification Due to Summer Breaching

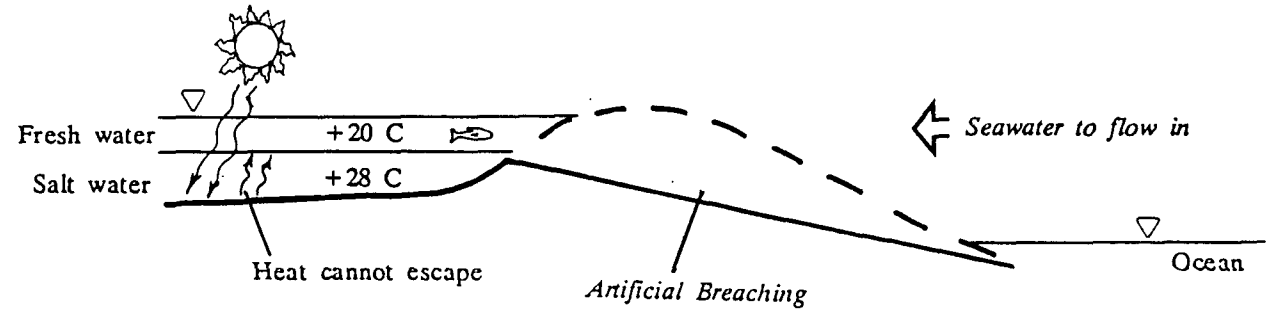


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FIGURE 6.2

an elevation below 3.0 feet. Little is known about the extent of seepage with sustained water levels between 3.0 and 5.0 feet.

3. Excessive Pumping behind Levees

When the lagoon exceeds 5.0 feet msl, seepage water is collected behind the levees by the internal drainage system of ditches and pumps. Behind the levees at the Boardwalk's parking lot and behind the levee along San Lorenzo Blvd., two electric pumps are overworked when the gravity drains do not work or clog and force the pumps to run the water back into the lagoon. There is concern that these pumps may wear prematurely and that the expense of pumping may be excessive.

The electric pump system was designed to work only as a winter storm drainage system, to drain storm runoff from the low areas behind the levees when the river level is high during winter floods. For the periods when the lagoon level is low, in the summer and the winter periods without flooding, the gravity drainage system was designed with a positive flow gradient towards the gravity outlets. During floods, some gravity outlets are closed manually with a slide gate, or other outlets have flap gates which are designed to open to allow drainage to flow out and close during floods or high levels in the lagoon and not allow flow in. With a higher river bed caused by sedimentation, the gravity outlets are often blocked. With lagoon levels above 5.0 feet msl, there is not a positive flow gradient from the drainage ditches behind the levees to the outlets. The flap gates are easily clogged and allow water from the lagoon to flow into the outlet and into the toe ditch behind the levee. Then seepage fills the toe ditch and switches on the pumps.

4. Conflicts between Summer Lagoon and Beach Use

When the lagoon water level exceeds 5.0 feet msl, purposeful or inadvertent breaching of the sand bar and draining of the lagoon brings deep and rapid water flowing across the beach, which is often crowded with recreational users. This flow can easily sweep an adult or child out to sea, creating a hazardous condition for beach users. Usually the lagoon forms directly behind the beach foreshore with only a narrow berm of sand separating the lagoon from the ocean. With the lagoon water level several feet higher, a small channel dug by hand at low tide can expand quickly and lower the lagoon several feet in a few hours. As flow concentrates and erodes a larger channel, it is difficult to control. This hazard occurs primarily immediately after sand bar formation when the bar is narrow. Later in the summer, the bar widens and inflows to the lagoon diminish and natural breaching is unlikely.

If the lagoon is allowed to form and rise above 5.0 feet msl, it can cover an extensive area of beach with shallow water from San Lorenzo Point westward. In the view of some, this shallow water is not desirable for beach users considering limited space, particularly during the high use holiday weekends in summer. In addition, lifeguards complain that the best location for their observation tower is flooded, that access for emergency or patrol vehicles is limited, and that sheet water is harder to patrol because of glare.

5. Water Pollution Problems

The lagoon can be a public health hazard when sewage leaks into the lagoon raise fecal coliform counts beyond healthful limits. There is greater concern when an extensive lagoon forms over the beach and allows greater public access as the lagoon draws swimmers less inclined to venture into the waves and colder water of the ocean. The lagoon is often posted with signs stating no body contact is allowed and that fecal coliform counts exceed public health standards. While the lagoon is closed to body contact, particularly when fecal

coliform counts have been excessive, enforcement is difficult and not very effective. A recent study of sewage inflows has not identified a specific source of sewage into the lagoon, although suspected sources include:

1. Leaks from sewer lines into older portions of the City's storm drain system (these are being replaced in piecemeal fashion).

2. Bird feces introduced directly into the lagoon and river;

3. Domestic animal feces;

4. Illegal dumping of recreation vehicle holding tanks into the storm drain system;

5. Non-point source bacterial contamination often found in urban rivers including ponded water in storm drains. In 1986 and 1987, summer storm drainage was pumped into trucks and transported to the sewage treatment plant.

Urban runoff pollutants are also a concern because of their contributions to pollution of the lagoon. Grease, oil, detergents and other toxic fluids are washed from street surfaces, and they could be illegally dumped into the river or storm drains. No specific studies of these pollutants has been conducted.

E. Recommendations for Lagoon Management (Figure 6.4)

1. Regulate summer water levels in the lagoon at 4.5 feet above msl by instituting a water level control program. The program consists of raising the natural sand bar at the river mouth after it has formed naturally in late spring or early summer, and installing a pump and culvert system on San Lorenzo Point to drain water from the lagoon bottom to the ocean (Figures 6.5 and 6.6). Specific design studies and permit applications should be undertaken to install the system by the summer of 1990. Monitoring studies of basement flooding, levees seepage and other problems should continue to test the effect of prolonged lagoon levels. The 4.5 feet limit was determined to be the best compromise between fisheries resource management and the existing knowledge of flooding problems. Isolating the lagoon behind the beach area will best limit public access and reduce the possibility of breaching during crowded periods. The augmented sand bar should be lowered to natural levels by the beginning of each winter flood season (about October 15th).

2. Monitoring flood problems in 1989 and 1990 should help determine if certain basement pump systems are deficient. If so, property owners should be encouraged to upgrade or repair them to a reasonable level. Lower lagoon water levels should be considered if basement flooding is too severe to be controlled by flooding at the 4.5 foot level.

3. Discontinue draining the lagoon by breaching the sand bar. There is sufficient evidence that this practice is harmful to the aquatic life of the lagoon, particularly steelhead trout. Partial breaching should be considered only as a last resort in emergency cases with the consultation of fisheries biologists.

4. Allow vegetation to colonize the levee banks to improve habitat conditions for waterfowl and aquatic species, but not significantly reduce flood capacity. Re-vegetate the fringes of the lagoon as specified in the Vegetation Restoration Plan (Chapter 5).

5. Modify the internal drainage system as follows:

a. At the Boardwalk parking lot, replace the toe ditch with a buried drainage pipe

Elements of Lagoon Management Plan

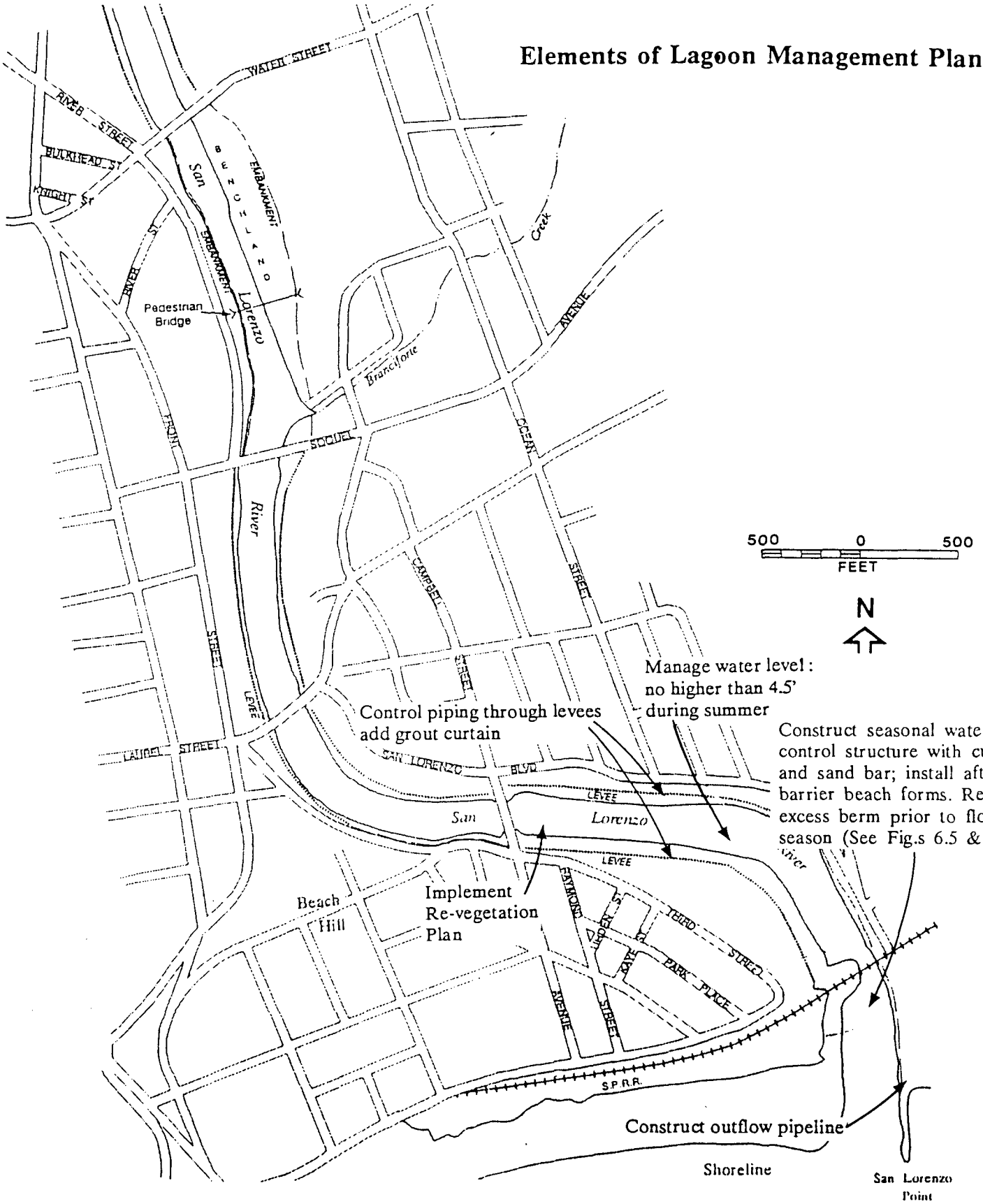

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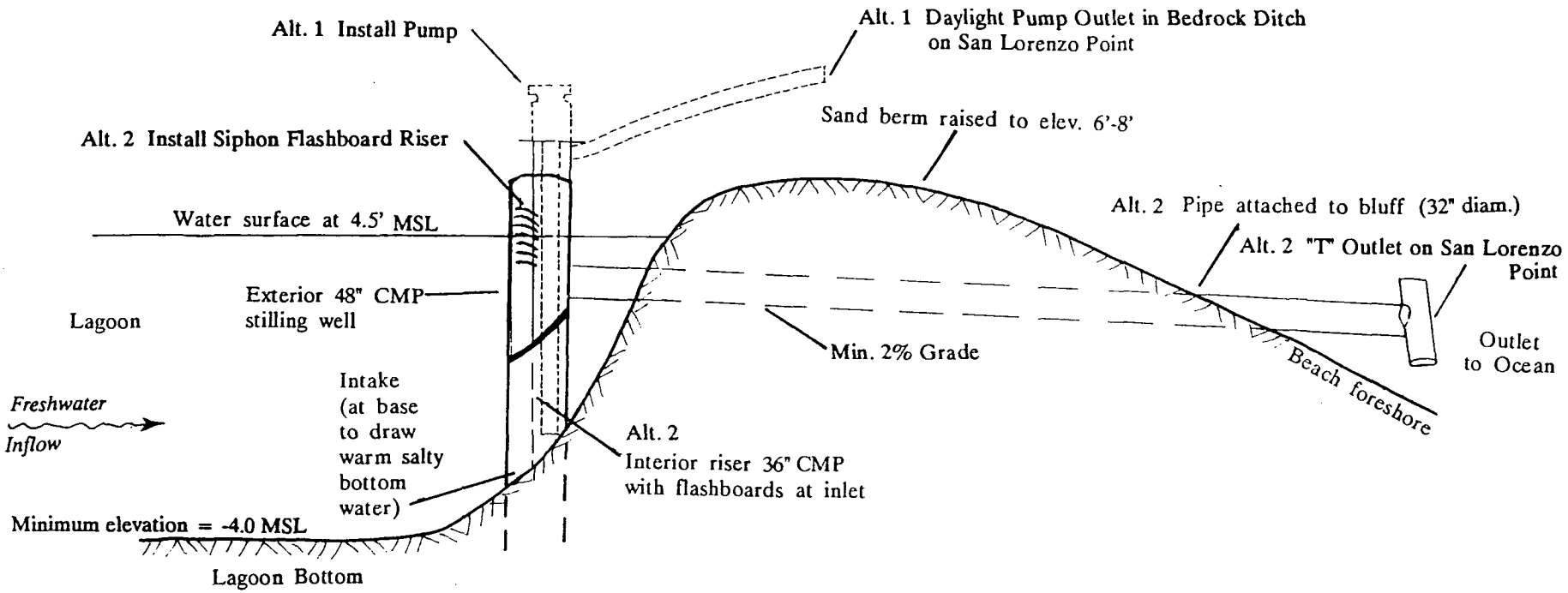
FIGURE
6.4



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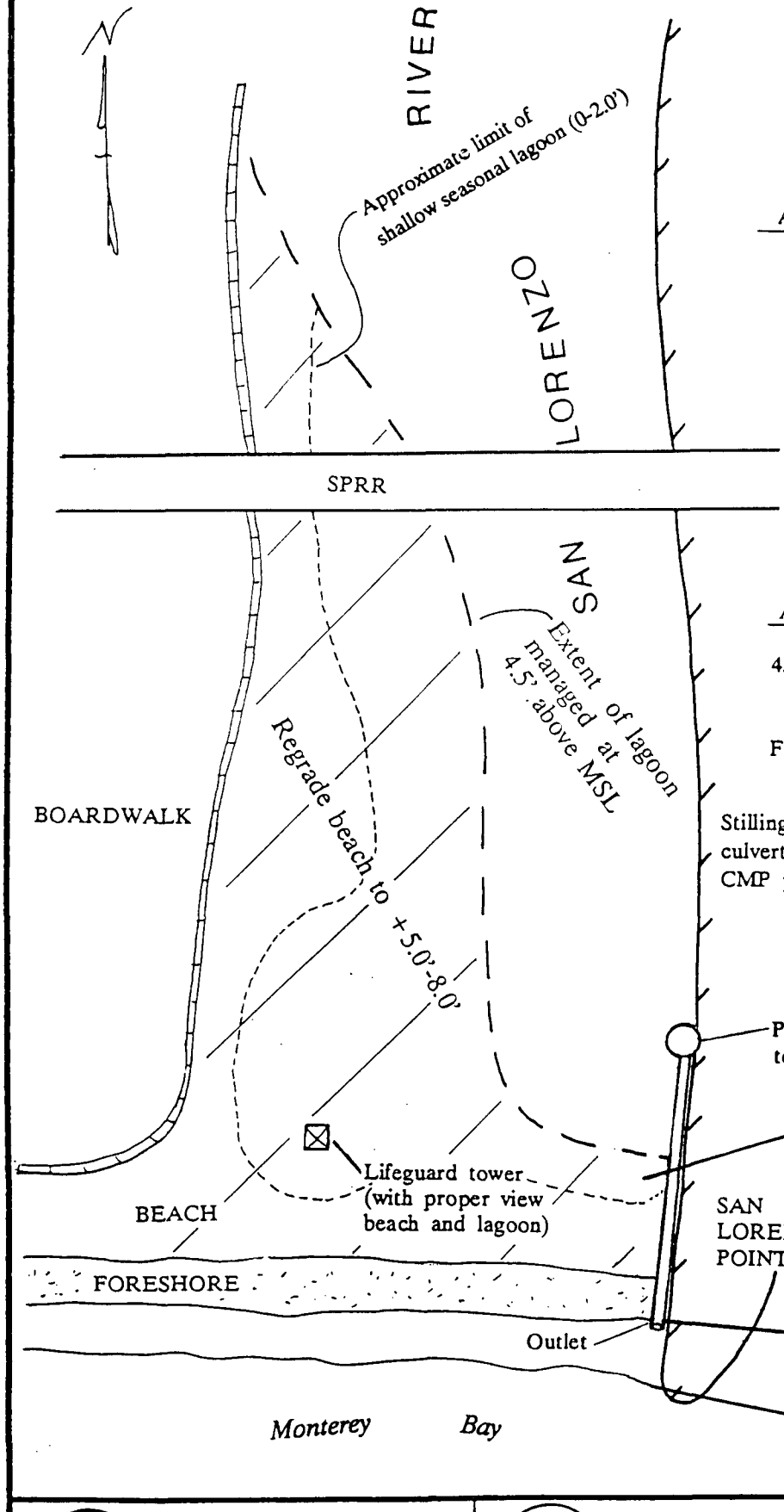
Water Level Control System
Preliminary Design

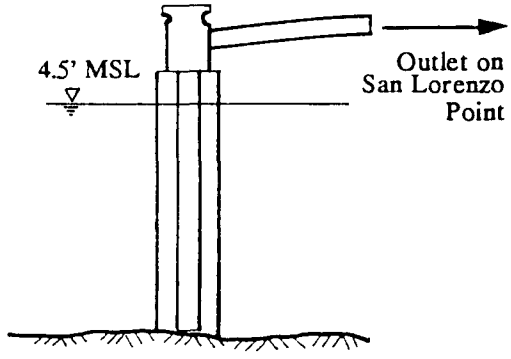
FIGURE
6.5

Schematic Plan View of Water Level Control System

(For Planning Purposes Only)



Alt. 1 Detail of Pump



Alt. 2 Detail of Siphon Structure

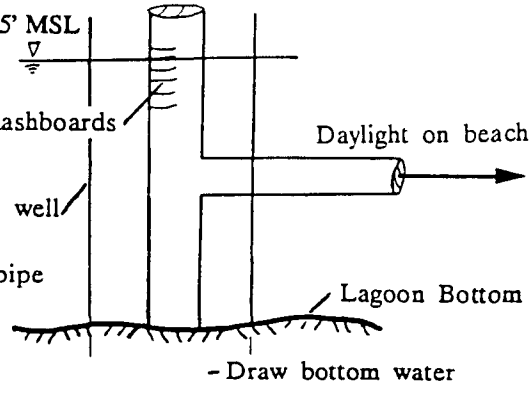


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FIGURE
6.6

and place the picnic tables on fill. Plant riparian tree species that are more tolerant of the high water.

b. Repair the slide gate on the gravity drainage outlet at Jessie Street Marsh (See Chapter XI for additional recommendations on improvements at Jessie Street Marsh). This would reduce inflows from the summer lagoon to the pump at the end of Ocean Street and reduce excessive pump cycling. A functioning slide gate would help arrest freshwater inflows from the lagoon into Jessie Street Marsh. Seepage problems should ease with the lagoon at elevation 4.5 feet, therefore the amount of water to pump over the levee will decrease. Seepage should be monitored in the summer of 1989 to check and modify the recommendations if needed.

5. Determine whether levee seepage problems are acceptable with summer lagoon water levels at 4.5 feet msl. Conduct a geotechnical investigation to determine if seepage presents a hazard to levee stability and whether additional measures are warranted.