

PROJECT DESCRIPTION

Aquatic Park Improvement Program – Phase I and II

[Heather, I've provided preliminary comments on Phase I ... Brian Wines, California State Water Board Aquatic Park EGRET note: Comments by Brian Wines are bracketed with red type]

Site Description and Problem Statement

Aquatic Park, located in West Berkeley, was created in the 1930's as part of the construction of the east shore highway (I-80) and in order to provide a water-based recreation area. The area Aquatic Park occupies was intertidal land prior to development.

The park encompasses about 101.5 acres including:

- 68 acres of open water
- 0.76 acres of salt brackish marsh
- 1.12 acres of freshwater wetlands
- 11.0 acres of grass and uplands
- 7.08 acres of roads and trails

The Main Lagoon (ML) is 58.3 acres and the largest water body in the park. The Model Yacht Basin (MYB) is 5.0 acres. The Radio Tower Pond (RTP) is 4.7 acres, is primarily private property and only partially within the park. The lagoons are connected to the Bay through a series of Tide Tubes and through the Potter Street Storm Drain. The ML is connected to the bay by five 24" culverts under I-80 and to the smaller MYB by two 24" culverts. An additional culvert at the north end of the ML is no longer functional. The MYB receives limited tidal inflows through two 24" connections to the Potter Street storm drain and a single 24" tide tube under I-80. The RTP receives a small amount of tidal inflow from a single 24" tide tube under I-80. This single tide tube is collapsing under the frontage road between I-80 and the Bay.

This system, composed of relatively small 24" culverts, does not supply a large enough volume of tidal water to maintain good water quality in the summer and fall months. At that time of year, the lagoons have persistent large algal mats, strong odors and poor water quality. The SWAMP (Surface Water Ambient Monitoring Program), administered by the Regional Water Quality Control Board (RWQCB), monitored summer and fall water temperatures and dissolved oxygen (DO) levels at three sites in the Main Lagoon with continuous water monitoring instruments (2002; 2004) The monitoring shows summer water temperatures of 20-24° C, significantly higher than the ambient bay water temperatures (15-18° C) just offshore of the lagoon in the shallow subtidal area. The DO levels, measured in the ML, showed eutrophic conditions are present in the lagoon with low dissolved oxygen levels overnight likely limiting fish survival. ***[Have fish survival/fish kills been studied and tracked in the lagoon? It's not yet clear that the existence of sub-optimal conditions in the lagoon is actually resulting in fish kills. Do the fish have refuges in the lagoon that allow them to avoid low DO and high temperatures.]*** Water temperatures often exceed the tolerance of many bay fish species. These poor water quality conditions impair the beneficial uses of the lagoons identified in the RWQCB Basin Plan including water recreation, cold water fish habitat, fish and wildlife, and others. Low DO levels are not in compliance with RWQCB water quality standards. ***[It is more correct to state the low DO levels are not in conformance with the RWQCB water quality***

objectives. In addition, it would be useful to note that the RWQCB's Basin Plan also sets water quality objectives for bacteria, bioaccumulation, sediment, settleable material, suspended material and toxicity. Although increased tidal circulation is likely to raise DO levels and lower temperatures, the associated, potentially significant increase in stormwater inputs associated with the larger openings in the Potter stormdrain lines may have negative impacts on bacteria, bioaccumulation, sediment, settleable material, suspended material and toxicity in the lagoons. The water quality objectives are in Chapter 3 of the Basin Plan:

3.3.1 BACTERIA

HYPERLINK "http://www.waterboards.ca.gov/sanfranciscobay/basinplan/web/tab/tab_3-01.html" Table 3-1 provides a summary of the bacterial water quality objectives and identifies the sources of those objectives. HYPERLINK

"http://www.waterboards.ca.gov/sanfranciscobay/basinplan/web/tab/tab_3-02.pdf" Table 3-2 summarizes U.S. EPA's water quality criteria for water contact recreation based on the frequency of use a particular area receives. These criteria will be used to differentiate between pollution sources or to supplement objectives for water contact recreation.

3.3.2 BIOACCUMULATION

Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.

3.3.12 SEDIMENT

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life.

3.3.13 SETTLEABLE MATERIAL

Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.

3.3.14 SUSPENDED MATERIAL

Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

3.3.18 TOXICITY

All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90 percent survival, or less than 70 percent survival, 10 percent of the time, of test organisms in a 96-hour static or continuous flow test.

There shall be no chronic toxicity in ambient waters. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community.

Chronic toxicity generally results from exposures to pollutants exceeding 96 hours. However, chronic toxicity may also be detected through short-term exposure of critical life stages of organisms.

As a minimum, compliance will be evaluated using the bioassay requirements contained in [HYPERLINK "http://www.waterboards.ca.gov/sanfranciscobay/basinplan/web/BP_CH4b.html"](http://www.waterboards.ca.gov/sanfranciscobay/basinplan/web/BP_CH4b.html) \ "4.5.5.3.1" Chapter 4.

The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors.

3.3.19 TURBIDITY

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 NTU.]

The original system of tide tubes is deteriorating. The tide tube at the RTP has collapsed and this appears to also be true of the northern tide tube in the ML. The bay front side of the five main tide tubes to the ML is collapsing and three of the five tubes are fully or partially blocked.

The lagoons in Aquatic Park support significant numbers of migratory diving ducks when water quality conditions are not impaired during the winter months. There is also a resident population of egrets and herons which roost in the trees at the park. Both the migratory and resident birds are potentially affected negatively by poor water quality. *[Impacts on bird life should be evaluated with respect to all potential impacts on water quality. In addition to the summer-time negative impacts of high temperature and low DO, potential winter-time impacts associated with contaminants in stormwater runoff should be evaluated. Under existing conditions, stormwater is discharged to the lagoons via the bypass lines in the techite pipe on the east side of the park and via the outfalls at Strawberry Creek and Potter Creek,. Therefore, the statement that “water quality conditions are not impaired during the winter months” does not appear to be accurate.]*

There are a variety of wetland and upland habitat and recreation areas in the park. In most natural tidal lagoons salt marsh covers the upper intertidal zone. There is very little (<1 acre) of tidal/brackish march along the lagoon shorelines. Much of the shoreline of the lagoons has ornamental vegetation, invasive non-native plants, turf and some native vegetation. The eastern side of the park hosts the highest levels of recreational use with bicycling, dog walking, hiking, disc golf, bird watching and other activities. The western side of the park has lower use and provides more isolated, less disturbed areas. A series of freshwater wetlands fed by groundwater seeps covers 1.12 acres along the base of the railroad berm. A combination of native cattail, tules and willows, as well as invasive ivy, blackberry and other species covers the soggy soils.

All of the habitat areas suffer from infestations of invasive plants and high levels of disturbance from human activities and unleashed dogs. Poor tidal circulation, steep rock-lined shoreline and wind-driven wave erosion limit the extent and quality of tidal wetland habitats.

The City of Berkeley, which owns and manages the park, contracted with Laurel Marcus and Associates (LMA) and Hydrologic Systems Inc. (HSI) to complete a concept design for two phases of improvements at the park.

Phase I of the Aquatic Park Improvement Program (APIP) addresses hydrologic and hydraulic analyses and an engineering concept design for improving tidal water inflows and circulation and

limiting winter storm water inflows. *[The mechanism for limiting winter storm flows is not yet clear. The reference condition for limiting winter storm flows is also not clear. Is the goal to limit flows in comparison to existing conditions? Or is the goal to limit winter storm flows in conformance with Board Order 70-14? Prohibition 1 of Board Order 70-14 states that, “[T]he discharge of all wastes, including storm drainage which may contain wastes, to the Berkeley Aquatic Park Lagoon is prohibited effective July 1, 1971, pursuant to Section 13243 of the California Water Code.” Since the construction of the techite pipe along the east side of the park, two factors have prevented the full implementation of the Board Order: 1) the overflow lines from the techite pipe to the lagoon were equipped with oil/water separators and trash collectors that have not been maintained for many years; and 2) the weirs between the Potter Creek stormdrain and the lagoons were removed about 10 years ago. These two factors are resulting in the discharge of storm drainage which may contain wastes to the lagoons.* Phase II includes a concept design for a series of wetland and terrestrial habitat improvements. A subcommittee of the City’s Park and Recreation Committee reviewed all the steps in the analyses and the concept designs.

Phase I (Hydrology)Improvements

A hydrologic model of the watershed draining to the park was created to evaluate storm water inflows. A hydraulic model of the lagoon system and its tide tubes was also created. All of the pipes, inlets and outlets were surveyed to assure accuracy in the model and a one foot topographic survey of the entire park was completed. A bathymetric survey from 2002 of the lagoons was also used. Additionally the tidal water levels were monitored for nearly 3 months and this data used to calibrate the model.

These two hydrologic models were then used to evaluate the existing conditions in the system and to determine the effectiveness of a series of 14 different alternatives for improving water quality and aquatic habitat conditions. The alternatives encompass various combinations of changes in which tidal water will enter and exit the lagoon system. There are major storm drains on each end of the park. The Strawberry storm drain is located under University Ave. but has a connection to the Main Lagoon via a 60” to 90” storm pipe under 2nd St. and Addison St. The Strawberry storm drain currently only provides storm water flow to Aquatic Park under certain conditions. The Potter Street storm drain is located under the I-80 on-ramp between the MYB and the RTP and currently provides some tidal inflows and storm flows to the MYB. Both of these storm drains are intertidal and able to provide large volumes of tidal water to the lagoons.

All of the alternatives include repairs to the five tide tubes under I-80 and the construction of a connection channel between the MYB and the ML. The alternatives and the model results were reviewed and discussed extensively at a total of four meetings of the subcommittee.

The model results showed that under the existing conditions in the Main Lagoon, the average tidal range is 0.2 ft. With this very small tidal range, the Main Lagoon has an average of 22.2 acre-ft of new water entering and leaving the lagoon per day. The Main Lagoon holds a total of 404 acre-feet of water, much of which is at subtidal depths. The very low level of tidal circulation in the ML allows the water to heat up and remain stagnant creating perfect conditions for algal blooms and eutrophication. A series of local storm drains add summer urban flows to the Main Lagoon and likely add nutrients to the system.

Recommended Hydrologic Alternative

The Recommended Hydrologic Alternative (4b) would maximize tidal flushing to improve summer water quality and aquatic habitat conditions through the creation of new, enlarged connections while limiting any change in winter storm inflow by installing adjustable gates at the new connections *[As I discuss four paragraphs below, it is not yet certain that the proposed Alternative 4b can limit any change in winter storm inflow. In addition, it appears that existing winter flow conditions are not in conformance with Board Order 70-14. Therefore, existing winter storm inflow may not be the appropriate baseline condition.]* The Recommended Alternative would create a new larger connection between the ML and the Strawberry storm drain at the north end of the ML. This would entail removal of an existing weir between the Strawberry storm drain and the 60” connecting pipe and replacement with an adjustable slide gate system. Daily tidal inflows and outflows would move through the new 60” connection. A new connection would also be constructed at the Potter Street storm drain to allow increased tidal inflows and outflows with the MYB. Two enlarged connections, five feet in width and three feet in height, would be constructed. The MYB would be connected to the Main Lagoon through a 25 foot wide by five foot deep channel excavated from the existing road. The side slopes of the channel will be cut to 3:1 to support tidal marsh and transition zone vegetation. A bridge (possibly a rail car bridge) would be placed over the new channel to allow vehicle and pedestrian access. This new channel would allow tidal inflow and outflow from the new Potter Street storm drain connection to refresh both the MYB and the ML.

[The analyses of the various alternatives was limited entirely to flow enhancements. While this analysis is useful for improving summer-time temperature and DO levels, it does not address the increased introduction of polluted stormwater into the lagoon. I recommend that several additional alternatives be analyzed that take into account the negative impact of allowing more stormwater into the lagoon. For example, analyze two-way flow through the five tide tubes in combination with one way flow out of the lagoon at Strawberry and Potter Creeks. This would probably get less tidal exchange, but would reduce the amount of stormwater getting into the lagoons. This would reduce the influx of pollutants into the lagoon and improve compliance with Board Order 70-14. In some high flow and high tide situations, water still might back up into the Potter Creek system and flow into the lagoons via the bypass lines in the techite pipe. However, this is still likely to be an improvement over the existing conditions.

It would be very valuable to run the analysis to try to find the best trade off between tidal exchange and limiting stormwater input to the lagoon. In any case, we would probably require such an analysis before issuing any permits for the project.]

The five tide tubes in the ML would be repaired and a protective structure installed on the bayside of the tubes. The five tide tubes would also allow tidal inflow and outflow. At the location of each new connection and the new channel native plants will be installed following construction.

The total amount of tidal water which will enter and exit the MYB and ML through these new connections is 115 acre-feet daily compared to 22 acre-feet under existing conditions. This level of improvement is expected to greatly improve water quality by reducing water temperatures and stagnant conditions. The improved aquatic habitat would support marine fish species common in the bay just outside the lagoon including northern anchovy, topsmelt, jacksmelt, Pacific herring,

surfperch, staghorn sculpin and others. The improved aquatic habitat may also support eelgrass and native oyster beds if water clarity and quality is high.

As part of the two new connections, large slide gates will be installed to control winter storm water inflows. A detailed operations manual will be developed which specifies the elevations that each gate would be set at during the fall/winter/spring to limit storm water inflows to the current existing volumes. If storm water is not allowed into Aquatic Park, residences and businesses in West Berkeley will flood during some storm events. The gates will be closed prior to the first several storms each fall/winter to restrict first flush storm water from entering the lagoon system. First flush storm flows have the greatest concentrations of urban contaminants, often representing 80% of the total annual contaminant load. *[It's not clear what happens if the first storm of the year is a major storm. Would such a storm be routed directly to the lagoons to prevent flooding? Given the intermittent nature of rainfall in the Bay Area, there are effectively many "first flush" events, since, even in the wet season, there are often weeks of dry weather between major storm systems. The preceding paragraph also implies that there will be a flood control aspect to the project, beyond the habitat improvement goals. Until we have a better handle on the impact of stormwater on the health of the lagoon, I'm less than comfortable with the preceding paragraph. I'm also not sure that allowing stormwater into the lagoon is consistent with Board Order 70-14.]*

The slide gates could be fitted with automated controls to assure they are not raised to add additional storm water to the lagoons and that they are shut to avoid first flush. Water level sensors could be installed upstream in the Strawberry and Potter Street storm drains to trigger the gates to close in the early part of the rainy season. They could also be set to open if the water level of the first storms increases to a larger storm flow. Additionally, water and gate level sensors can be installed with real-time internet display of the sensor information. This would allow for local citizens to actively monitor lagoon water management. *[This proposed operating protocol may be problematic. It sounds like a very sophisticated operating system would be required. Has the City identified a system that could perform in these circumstances? The proposal to allow larger storms into the lagoon may also impact trash levels in the lagoon. Although the first flush may have the most dissolved and suspended contaminants, larger flows are more likely to mobilize coarse debris (i.e., trash). Also, large flows of stormwater will impact the salinity in the lagoon. In the winter, sudden drops in lagoon salinity may be as detrimental to habitat values and aquatic life as the high temperatures and low DO levels in the summer. Has the City evaluated the sensitivity of aquatic life in the lagoon to sudden drops in salinity?]*

Monitoring Program

Prior to implementing the Phase I improvements, a water and sediment quality characterization study will be done. This study will establish the baseline conditions in the system and allow comparison with post project conditions. *[This is a very good idea. Baseline data is very important to evaluating the success of the project. How many years of baseline monitoring will be performed before the project is implemented?]* Sediment quality characterization involves collecting sediment samples from a variety of locations in each lagoon. The samples would be analyzed for sediment size (sand vs. mud), bulk chemistry (presence and concentrations of contaminants) and bioassays (acute toxicity of sediment and/or elutriate to typical marine invertebrate test organisms). Because most persistent urban contaminants such as heavy metals, PCBs, DDT, oil and gas (PAHs) are transported into tidal areas on clay particles, nearshore estuarine areas have greater contaminant

levels in sediments rather than the water column. The sediment characterization study would provide the baseline for comparison with future tests and a determination of the suitability of placing oyster beds in the Main Lagoon.

Water quality monitoring would use continuous monitoring devices to track basic indicators – temperature, dissolved oxygen, salinity, and pH. In addition, a number of other parameters should be measured including nutrients – nitrate, ammonia, total phosphorus; organophosphate pesticides and potentially organochloride pesticides, total dissolved solids (TDS) and total suspended sediment (TSS), a range of polycyclic aromatic hydrocarbons (PAHs), PCBs, metals and trace elements, coliform and chlorophyll to evaluate algal growth. Water quality monitoring would occur year round to characterize summer/fall conditions, first flush contaminants under the current system and winter season conditions. Sampling would likely need to be done in all three lagoons as well as the large and small storm drains. *[The monitoring proposed in this paragraph would be very helpful to evaluating the project.]*

Another part of the baseline and ongoing monitoring would be characterization of the benthic invertebrates which inhabit various areas of the lagoons. Worms, mollusks and crustaceans would be expected to live in the intertidal and subtidal mud layers. The diversity abundance and distribution of these animals would be characterized as a baseline condition and then at quarterly to annual intervals as part of the lagoon monitoring program. It will be especially important to review any significant changes to the benthic invertebrates after a major storm and freshwater inflow. *[Monitoring of benthic invertebrates is also a good idea.]*

The baseline monitoring will be analyzed and used to devise a post-project monitoring program. It is likely that water levels, water clarity, basic indicators (temperature, dissolved oxygen, salinity, and pH) and many of the persistent and storm water based contaminants would need to be monitored.

Storm Water Filtering and Treatment

A major concern voiced by members of the subcommittee is the potential for adverse environmental effects from urban storm water entering the Aquatic Park lagoons. Urban storm water washes a variety of materials from city streets and sidewalks, parking lots, urban gardens, buildings and roofs into storm drains and into the lagoons. Under existing conditions storm water that enters the lagoons is retained for a long time as the water circulation volumes are very low. This longer residence time may allow sediment, the primary transport mechanism for persistent contaminants, to deposit and remain in the lagoon potentially becoming bioavailable. Revising the circulation volumes will allow the storm water that comes into the lagoons to move out much more quickly and avoid the deposition of sediment which may carry contaminants. *[While increased tidal exchange will dilute stormwater, the modifications to the stormwater outlets are also likely to result in increased discharges of stormwater to the lagoons. The sudden change in velocity as the water leaves the confined culvert and enters the relatively unconfined lagoons is likely to promote sedimentation near the outlets. This material may not be effectively washed from the lagoon by tidal exchange. Although the project will attempt to maintain inflows of stormwater to the lagoon at pre-project levels, I am concerned that it may be difficult to achieve this goal in actual practice. It appears that a significant commitment of staff time would be necessary to effectively operate the new weir system.]*

Currently there is a weir in the Strawberry storm drain that restricts storm water from entering the lagoon except at higher flows. The existing size and elevation of the Potter Street connection also restricts a portion of the storm flows. These existing restrictions will be replaced in the new system through the use of slide gates and further restrictions will be implemented to limit first flush inflows. There are a number of smaller storm drains and runoff areas that contribute storm water directly into the lagoons. Watershed flow modeling showed that 38-40% of storm water entering the lagoons originated not from the Potter and Strawberry stormdrains, but from stormdrains and urban runoff along the east side of the park. Addison and Bancroft Streets have runoff that flows directly into the Main Lagoon. This runoff would be directed into a bioswale constructed parallel to the ML along the grass/road on the northeastern shoreline. Storm drains run along Channing, Dwight, Parker, Carleton, Grayson and Heinz Streets through the railroad berm and into the Main Lagoon. The Parker, Carleton, Grayson and Heinz Streets storm drains are each fitted with an oil/water separator and a high and low flow pipe system. [Oil/water separators are not effective for the treatment of urban runoff. These storm drains should be retrofitted with state-of-the art treatment systems.] Depending on tidal levels, storm water from these four drains may flow into the Potter Street drain via the transite pipe or directly into the Main Lagoon *[Flow directly into the Main Lagoon does not appear to be consistent with Board Order 70-14.]*

Several of these drains could be fitted with a filter system on the upslope/east side of the railroad berm. These filters remove trash, large particulates and oil and grease. *[The permitting process would be easier if these devices were implemented as part of Phase I of the project.]*

In addition to these filters, the urban streets, parking lots and buildings of the area drained by these six drains could be redeveloped with storm water bioretention facilities. These facilities can be installed along sidewalks, in parking lots and along street edges to catch and filter out trash and contaminants while also providing tree and planting areas. *The permitting process would be easier if these devices were implemented as part of Phase I of the project.]*

Freshwater Wetlands

An additional method to filter and sequester contaminants from urban flows can be accomplished by changing the freshwater wetlands at the base of the railroad berm in the park. There are a series of linear wetlands, running north to south, created by seeping groundwater and characterized by shallow water and saturated soils with dense cattails and invasive plants. The 1.12 acres of wetlands are relatively degraded due to constant human disturbance and unleashed dogs.

Improvements to the wetlands for habitat purposes would be to deepen and revegetate them to produce a shoreline ring and islands of native vegetation within an open water pond system. This type of change could make use of summer flows from several of the local storm drains. Freshwater wetlands have been documented to filter out and treat particulates, nutrients, bacteria and other pollutants. It will be important to design the wetlands to create isolated areas for ducks and other marsh birds, protect several existing willow areas used by songbirds, provide for nearby recreational uses and provide for filtering functions. *[The conversion of existing wetlands into wetlands for the treatment of summer flows is not consistent with Regional Board Resolution No. 94-102. Since RWQCB staff have already provided this information to City staff, this proposal should probably not be present in the current project summary. Although the creation of treatment wetlands is encouraged, existing wetlands should not be converted into treatment wetlands.]*

The subcommittee has suggested a pilot freshwater wetland be designed. The pilot will take summer flows from the Dwight St storm drain and would be 1.02 acres in size and located in the northern-most area of the freshwater wetlands. The eastern edge of the pilot wetland will be stabilized with rock at 1:1 and the western edge will have a gentle 3:1 slope with native rushes, sedges and islands of vegetation. Water depth will be 7 ft to limit the growth of tules and cattails to edges and islands. A small sediment/trash basin would be created where the storm drain outlet reaches the park edge. Two small creeklets would carry the flows from the ponds into the Main Lagoon and be planted with *Juncus* sp. and other rush species and be stabilized with rock in various locations. It is also likely there will be a log weir in the creeklet channels to control water levels in the pond.

Water quality monitoring would be done for water flows into and out of the pond to test the effectiveness of the system.

Recommended Phase I (Hydrology) Improvements

Implement the Recommended Hydrologic Alternative for water circulation improvements (Alternative 4b) including new, larger connections to the Potter Street and Strawberry storm drains, repairs to the five tide tubes and a 25 x5 foot channel between the MYB and the ML.

Install automated slide gates with water level and gate level sensors on the new connections at each storm drain and sensors upstream to measure flows. Sensors would be set up to display real-time data on an internet site to allow citizen review of operations. Gate operations will not increase storm water volumes over existing conditions and will block first flush flows. *[This is a good goal, but may be hard to achieve in practice.]*

Complete a detailed pre-project characterization of the lagoons including sediment quality, water quality and benthic invertebrate communities. Devise a detailed monitoring program for assessing post project water quality and aquatic habitat conditions based on the baseline evaluation. Carry out the monitoring program once the project is constructed.

Replace or repair the oil/water separators on the Parker, Carleton, Grayson and Heinz streets storm drains *[Repair of the oil/water separators should not be considered. Oil/water separators do not provide effective treatment for urban runoff.]*

Install a bioswale on the northeastern side of the Main Lagoon to capture and filter direct runoff from Addison and Bancroft Streets

Begin design for installation of bioretention and biofiltering systems as well as storm water detention facilities in the ultra urban area bounded by Addison St, 7thSt., Ashby Ave. and Aquatic Park. If the area is planned as a demonstration program that is integrated with improvements to water quality in the lagoons there may be grant funds available from the Regional Board or other clean water funds. In addition Redevelopment and other City funds or private funding may be needed. As part of this design process the quantity of storm water that would be treated and the contaminant loads that could be filtered/treated should be calculated. *[These devices should be constructed concurrently with the changes to the Potter and Strawberry outfalls in order to mitigate potential negative*

impacts associated with stormwater entering the lagoon, and to improve compliance with Board Order 70-14.]

Begin design for installing stormwater filter units on the dead-end streets along the eastern side of the railroad at Channing, Dwight, Parker, Carleton, Grayson and Heinz Street storm drains. These locations allow enough elevation drop to filter large volumes of storm water in a short time. The City will need to consider a variety of grant, Redevelopment and private funding sources. *[These devices should be constructed concurrently with the changes to the Potter and Strawberry outfalls in order to mitigate potential negative impacts associated with stormwater entering the lagoon, and to improve compliance with Board Order 70-14.]*

Complete additional site specific studies on summer flows, soils, groundwater flows and seek permits for the pilot freshwater wetland. This project may also be eligible for grant funds. Once constructed the water quality into and out of the wetland should be monitored to determine the effectiveness of the filtering process. Wildlife use should also be evaluated. Based on these evaluations determine concept design for additional freshwater wetland improvements.

Implement a new connection between the RTP and the Potter Street storm drain to replace the failing RTP tide tube and then close off the tide tube. Use excavated dirt from the created tidal wetland to build a 4 foot high berm around the radio building to assure that an adequate tidal prism can be created in the RTP while protecting the building from flooding. *[Repair of the tide tube is preferable to a new connection between RTP and the Potter Street storm drain. Since the RTP does not presently receive stormwater from Potter Street, it seems that maintaining current stormwater inputs to the RTP would mean that no new connection to the stormdrain system should be installed to the RTP.]*

Phase II (Habitat) Improvements

The Phase II Improvements address the various habitat types in the park: tidal/brackish marsh, shoreline, Bird Island, freshwater wetlands and uplands.

Tidal/Brackish Marsh Creation

The extent of tidal/brackish wetland was digitized in the field in Spring 2007 using vegetation type, hydrology and saturated soils to define wetlands and totals 0.76 acres. Tidal wetland plants such as pickleweed (*Salicornia pacifica*), gumplant (*Grindelia stricta* var. *stricta*) and salt grass (*Distichlis spicata*) occur in a narrow 6- 10 inch band in a few locations around the edges of the lagoons. Small areas of brackish wetland (*Schoenoplectus robustus* formerly *Scirpus robustus*) occur at the storm drain outlets on the east shore of the Main Lagoon. Most of the shoreline of the ML and MYB has rock riprap, constructed terraces or steep banks limiting wetlands. The RTP has the largest tidal wetland.

There are three locations on the western shoreline of the main lagoon where additional tidal/brackish marshes can be created. The western shoreline of the ML is not eroded by wind-driven waves as the eastern shoreline is. Each of the three areas was evaluated and the southern Rowing Club site is recommended as the wetland restoration site.

The Rowing Club wetland creation site is 1.48 acres in size and ranges in elevation from +4.0 to -1.0 ft Berkeley Datum. The Berkeley Datum at 0.0 ft is equal to +3.17 ft NGVD. A buffer area adjacent to the Rowing Club building would define the southern edge of the site. Much of the site is weedy with ruderal species such as wild radish (*Raphanus raphanistrum*), black mustard (*Brassica nigra*) and annual grasses along with a few Monterey cypress trees (*Cupressus macrocarpa*).

The wetland would be created by excavating out upland and lowering the site to create two zones of -1.1 ft and -1.5 ft Berkeley Datum each. These elevations include the mean tide elevation (-1.5 ft) and slightly below the mean tide elevation (-1.1 ft). These elevations should allow for tidal inundation periods which will support tidal wetland species such as pickleweed (*Salicornia pacifica*), salt grass (*Distichlis spicata*), Jaumea (*Jaumea carnosa*), Alkali heath (*Frankenia grandifolia*) and other plants typical of the high marsh zone. The lower elevation area will support intertidal mudflat and provide feeding habitat for shorebirds along the eastern edge of the site. A berm would be constructed for transition zone plants such as gumplant (*Grindelia stricta* var. *stricta*), salt marsh rosemary (*Limonium californicum*), buckwheat (*Erigeron* sp.), native bunchgrasses and coyote bush (*Baccharis pilularis*). The Monterey cypress on the site may be removed to limit predator perches adjacent to the intertidal mudflat and shorebird habitat.

The creation of tidal marsh in the ML requires the Phase I improvements be implemented. Under the existing conditions of little water circulation and high water temperatures, creating more shallow water/intertidal areas would contribute to water quality problems by promoting algal mat growth. Under the Phase I Improvements increased tidal circulation allows for the creation of intertidal areas without water quality problems.

The Rowing Club Tidal Wetland Creation Site would be excavated and the estimated 7,460 yds³ would be reused in the park for the following: Bird Island, berm around radio building in RTP, restoration in former parking areas P1, P2 and P3 and along the westside road. The soil on the wetland creation site would be tested for contaminants prior to any excavation or reuse.

Shoreline Areas

As part of creating new tidal wetland areas and improving intertidal areas, invasive and non-native plants should be removed from the lagoon shorelines. With the increase in tidal range in the MYB and ML there may be new areas along the lagoon shorelines where tidal wetland plants can establish. Along the north eastern shoreline the trails will be relocated to the road, leaving a shoreline area which could be revegetated. There are areas where native plants can be installed. However, for any of these wetland restoration and native plant revegetation to be successful, the invasive plants need to be eradicated.

The locations of thirteen different species of invasive plants in the park were digitized in the field in Spring 2007. The following species were mapped in the park. The list also indicated if the species occurs in the shoreline zone of the three lagoons.

Invasive plants

Wattle (*Acacia* sp.), 1.75 acres total, in shoreline areas
Giant reed (*Arundo donax*), <0.01 acres
Himalayan blackberry (*Rubus discolor*), 0.46 acres
Cotoneaster (*Cotoneaster* sp.), 0.02 acres, in shoreline areas

Blue gum (*Eucalyptus globulus*), 1.9 acres, in shoreline areas
Fennel (*Foeniculum vulgare*), 0.02 acres, in shoreline areas
Broom (*Cytisus scoparius*, *Genista monspessulana*, *Genista juncea*). 0.03 acres, in shoreline areas
Iceplant (*Carpobrotus edulis*), 0.26 acres, in shoreline areas
English ivy (*Hedera helix*), 1.28 acres, in RTP shoreline area
Pampass grass (*Cortaderia selloana*), <0.01 acres
Pepperweed (*Lepidium latifolium*), <0.01 acres, in shoreline areas
Firethorn (*Pyracantha sp.*), 0.02 acres, in shoreline areas
Salt cedar (*Tamarix sp.*), 0.01 acres, in shoreline areas

In addition to removal of the invasive plants along the shoreline, seed producing invasives in other areas of the park would also be removed. Removal of these plants will assure that no secondary infestations occur in the wetland or shoreline revegetation areas. These invasive species include: wattle seedlings, blue gum seedlings, Himalayan blackberry, giant reed, broom, pampass grass, firethorn and cotoneaster.

The native plants installed along the eastern shoreline would include wetland transition species in areas upslope of the rock riprap such as: gumplant (*Grindelia stricta var. stricta*), salt marsh rosemary (*Limonium californicum*), buckwheat (*Erigeron sp.*), native bunchgrasses and coyote bush (*Baccharis pilularis*). In areas with drier conditions there are a variety of plant species including: beach aster, sand strawberry, Douglas iris, monkey flower, yarrow, bunchgrasses and others that could be planted.

The native revegetation along the western shoreline would be integrated with re-use of the excavated fill from the wetland creation site. Currently the western shoreline of the main lagoon has a combination of turf, ornamental plants, Monterey cypress, live oak and invasive non-native species. The excavated material could be placed at parking areas P1, P2, P3, the northern-most bulb-out and the middle bulb-out to cover the bulb-outs, the adjacent parking areas and portions of the roadway. The first twenty to thirty feet of the shoreline area of the bulb-out would not be filled so that tidal wetlands could be created at a future time.

From this shoreline zone to the western road, the fill could be placed to create a hummocky landscape, which could support a variety of native plants. Larger native trees on the site would be retained. This side of the lagoon experiences strong winds so erosion blankets will be needed to stabilize the fill until native plants can become rooted. Some of the potential plant species that could be installed are: coyote bush, silk tassel, ceanothus, manzanita, ocean spray, redbud, toyon, Douglas iris, yarrow, monkey flower, native bunchgrasses, potentially native sand dune species and others.

Bird Island

Bird Island is the only island and truly isolated area in the park. The island has great potential as a roosting area and potentially as a nesting area. Currently Bird Island is at 0.0 to -2.0 ft Berkeley Datum and is too close to the tidal zone to assure that terrestrial vegetation will establish. Fill will be added to the island once the existing building is removed and an existing freshwater line is located and developed for future irrigation. The rock riprap edges of the island may also need to be increased in extent to contain the new fill. The island will be filled to the +2.0 ft Berkeley Datum elevation. Fill will be trucked to the Island by temporarily placing the railcar bridge that will be placed over the

new channel between the ML and MYB between the western shore and the island. Erosion blankets will be put on the fill to stabilize it until native plants establish. The fill will be placed in mounds and trees would be planted in the higher areas to allow a greater rooting zone higher above tidal water. Monterey cypress, Monterey pine or potentially ornamental tree species could be planted as it may be difficult to establish trees on the island. The trees are needed to provide roosting areas for birds. In addition to the trees, low growing shrubs and grasses could also be planted and might attract nesting dabbling ducks such as Mallards.

Freshwater Wetlands

The recommended improvements to the freshwater wetlands are described in the Phase I Improvements. Depending on the success of the pilot project additional changes would be made to the other freshwater wetlands. Removal of the English ivy and other invasive plants should be completed as part of the Phase II improvements.

Upland Areas

Upland areas include the turf, ornamental plantings, pavement, roads, trails and buildings in the park. These areas have the lowest value as habitat and support a variety of recreational activities. However, there are some improvements needed in the upland area including:

Review the condition and potential use of empty buildings and determine what buildings should be removed and how to landscape the site

Reduce asphalt roads and parking areas on the western side of the Main Lagoon where they are no longer used and could be removed or reduced in width and revegetated. Construction of tidal wetlands could generate fill which could be used to revegetate a portion of the road and parking areas

As part of an overall park access and recreational use review, consider relocating northern portions of the shoreline trail along with repair of rock walls and shoreline revegetation

Complete an integrated circulation/recreation plan for the park in concert with the interpretive facilities plan and address the future condition of the on ramp once it is closed.

Remove invasive and dead plants and install native plants and, in some cases, noninvasive ornamentals.

The removal/reuse of the asphalt parking and road areas will be integrated with the reuse of dirt excavated from the tidal wetland restoration and revegetation of a transitional wetland/shoreline habitat.

Reducing Disturbance in Habitat Areas

The greatest challenge to creating viable wildlife habitats at Aquatic Park is buffering habitat areas from the high level of human activity and unleashed dogs in the park. The eastern side of the park has the highest level of human activity but both the east and west sides of the park suffer from unleashed dogs disturbing birds and wildlife and sometimes chasing them into the lagoons. The west side is the primary focus for habitat improvements to take advantage of the lower level of disturbance.

The following recommendations should be implemented to assure that restored habitats can support wildlife:

Restrict off-leash dogs and people from the restoration areas through the use of signs, leash-law

enforcement and fencing.

Restrict homeless encampments and trash dumping through focused enforcement and signage.

Adaptive Management

Adaptive management is a term often applied to ecological restoration projects and involves changing management strategies as ecosystem monitoring and performance is evaluated. There are several types of management strategies at Aquatic Park that should use this approach.

The water circulation improvements and their predicted outcomes are based on a detailed computer model of the watershed and lagoon system. The model has field data to describe the system and simulated the complex of fresh and tidal water flows into and out of the system. The choice of a particular improvement, Alternative 4b, is based on the model's analysis and on professional judgment. However, no model perfectly simulated real world conditions. Therefore, once the project is built, monitoring of water levels and water quality is recommended to determine if further changes are needed.

One potential change is to place flap gates on the various inlet/outlet connections to change tidal flow direction or level. All of the new connections will be fitted with frames for flap gates and two way gates will be purchased and stored.

The detailed pre- and post-project monitoring can be used in evaluating the effects on the aquatic habitat of various volumes of stormwater entering the lagoons. Salinity at surface and at depth, water quality parameters including suspected stormwater-borne contaminants, and the extent and abundance of the invertebrate communities in the lagoons would be monitored regularly and after major flood events. This data should be evaluated by an independent Technical Advisory Committee, composed of concerned scientists and agencies, to determine if the water gate settings for the lagoons should be changed.

For the habitat areas, adaptive management practices could be used in revising revegetation and replanting practices and /or species. Monitoring of planting success and growth/density measurements along with location, irrigation volumes, use protective hardware and/or weed mat, wind exposure and sun/shade conditions. This information can be used to guide replanting efforts and choice of species as the revegetation project progresses.

A final level of adaptive management should review the success of first step efforts to control human and unleashed dog disturbance to habitat areas. The habitat areas should be photographed regularly and inspected for dog tracks. If signs and periodic enforcement do not decrease disturbance from unleashed dogs, the next step of fencing the areas may need to be implemented. The success of efforts to reduce homeless encampments and any other activities that are used to reduce habitat disturbance should be reviewed no less frequently than yearly and revised as needed to increase effectiveness.

Recommended Phase II (Habitat) Improvements

Implement a tidal wetland creation project on the 1.48 acre Rowing Club wetland site. Excavate the site to -1.5 ft and -1.1 ft Berkeley Datum to create intertidal conditions similar to those in natural salt

marshes and mudflats. Allow pickleweed and other native salt marsh species to invade and plant the western edge with marsh transition zone plants.

Eradicate invasive non-native plants from the entire shoreline of the lagoons and replant with native upper marsh transition zone plant species and upland native plant species. Coordinate revegetation efforts with reuse of excavated dirt placed at P1, P2, P3, the northern and middle bulb-out areas and the western road.

Eradicate invasive plants from non-shoreline areas of the park that pose an infestation threat due to the distribution of seed by wind or animals.

Reuse the excavated dirt from the wetland project to fill Bird Island to the +2.0 ft Berkeley Datum elevation and implement a revegetation project with trees and shrubs to create roosting and duck nesting areas.

Revegetate the shoreline area and upland areas as part of the reuse of the excavated soil and creation of a west side revegetation project incorporating P1, P2, P3 the northern and middle bulb-out areas and the western road. Remove or reuse asphalt from these areas prior to placement of the excavated dirt.

Reuse excavated dirt to build a 4 ft. tall berm around the radio building in the RTP to protect against flooding and to allow an increase in tidal prism to reduce water quality problems in the RTP.

Review the condition and potential use of empty buildings and determine what buildings should be removed and how to landscape the site.

As part of an overall park access and recreational use review evaluate and relocate northern portions of the shoreline trail along the ML with repair of rock walls and shoreline revegetation.

Restrict off-leash dogs and people from the restoration areas through the use of signs, leash-law enforcement and fencing.

Restrict homeless encampments and trash dumping through focused enforcement and signage.

As part of the park monitoring program use the data from water quality, water level and benthic invertebrates studies to implement an adaptive management program for adjusting lagoon operations. Also monitor the success of revegetation projects and disturbance control efforts to allow for improvements in these efforts.

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AQUATIC PARK IMPROVEMENT PROGRAM - PROJECT DESCRIPTION