2015 Annual Self-Monitoring Report
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Prepared for:

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Introduction

The South Bay Salt Pond Restoration Project (Project) 2015 Annual Self-Monitoring Report (Report) has been prepared to provide: 1) an update of the Project's 2015 accomplishments; 2) information on on-going operations of the Alviso and Ravenswood Ponds; 3) results of the 2015 studies conducted at Pond A8, A16 and SF2; 4) results of fisheries monitoring and studies; and 5) an update on Phase 2 planning efforts.

In previous years, this annual report has focused on water quality monitoring results and has been submitted to the California Regional Water Quality Control Board (Water Board) to comply with the Self-Monitoring Program (SMP) as described in the Final Order (No. R2-2008-0078). This is the fifth year the report will also be submitted to NOAA's National Marine Fisheries Service (NMFS) because we have included additional fisheries monitoring conducted as part of the Science Program's Applied Studies, which are intended to fill the most important gaps in our knowledge about South San Francisco Bay (South Bay) ecosystem.

It is anticipated that both water quality and fisheries information will help the Water Board and NMFS: 1) understand the status of the Project; 2) provide feedback and guidance to the Project Management Team on current and future applied studies and monitoring; and 3) assist in identifying emerging key uncertainties and management decisions required to keep the Project on track toward its restoration objectives as we implement Phase 2.

2015 Progress Towards Our 3 Project Goals

Goal 1: Restore & Enhance Habitat

<u>3,040 Acres of Habitat Restored Over the Past Ten Years</u>

To date, we have opened 3,040 acres of former industrial salt ponds to the Bay so nature can recreate tidal wetlands. We are now starting our second phase of restoration work, which could include restoring thousands of additional acres to tidal salt marsh. Our initial goal is to restore half of the Project footprint, 7,500 acres, to tidal marsh, with the other 50% in managed ponds.

<u>Work Completed on 230-Acre Eden Landing Pond Multiplex</u>

Former salt ponds are being restored so they provide optimal habitat for a variety of shorebirds and waterbirds. In 2015, we constructed 230 additional acres in Eden Landing for nesting western snowy plovers.

Goal 2: Provide Public Access

Construction was completed on a boardwalk and kayak launch in Eden Landing.

Goal 3: Provide Flood Risk Management

<u>Draft Plan for Alviso Levees On-Going</u>

A goal of the Project is to maintain or improve existing flood risk management. Managers are committed to ensuring that flood hazards to nearby communities and infrastructure do not increase as a result of the restoration: restoring salt marsh in flood-critical parts of the Project area will not occur until flood protection is established. In 2014, the South San Francisco Bay

Shoreline Study was released by the U.S. Army Corps of Engineers (Corps) and local agencies for 15-foot-high Bay levees near Alviso and the San Jose water pollution plant. On December 18, 2015 the Corps signed a report recommending that Congress authorize the Shoreline Study. http://www.southbayshoreline.org/

2015 Pond Operations

The 2015 Pond Operation Plans are included in Appendix A. In general, the goal for all ponds is to maximize circulation through the ponds while maintaining discharge salinities. A summary of pond management is described below.

Alviso Pond System A1/A2W
The management objectives for Pond System A1/A2W is to maintain full tidal circulation through ponds A1 and A2W while maintaining discharge salinities to the Bay at less than 40 ppt. These ponds are part of the planning process for Phase 2 of the Project, and may be breached in the next 5-10 years to restore the ponds to tidal marsh. The Phase 2 final EIS/EIR was finalized in April 2016.

Alviso Pond System A3W
The Alviso Pond System A3W consists of Ponds AB1, AB2, A3W, A2E, and A3N. The objectives for the Alviso Pond A3W system are to: 1) maintain full tidal circulation through ponds AB1, AB2, A2E, and A3W while maintaining discharge salinities to Guadalupe Slough at less than 40 parts per thousand (ppt); 2) maintain water levels in Pond A3N to cover the pond bottom to limit mercury methylation through the wetting and drying of a seasonal pond; and 3) maintain water surface levels lower in winter to reduce potential overtopping of A3W levee adjacent to Moffett Field. The Pond A3W/Guadalupe Slough water control structure was repaired during the summer and fall of 2015.

Pond System A8
The Pond A8 system consists of Ponds A5, A7, A8N, and A8S. This system is operated to maintain muted tidal circulation through the ponds while maintaining discharge salinities to the Bay at less than 40 ppt. As part of the Phase 1 initial actions, a 40-foot armored notch with multiple bays that can be opened and closed independently at A8 and Alviso Slough was installed. Current operation (October 2014 to present) is that 5 bays were opened, year round to gather data on salmonid tracking with UC Davis. On-going mercury studies continue (see below). Pond A8 is identified as tidal habitat in the long-term programmatic restoration of the Project. In October 2014, the gate on one of the intake culverts at A5 from Guadalupe Slough failed and intakes and discharges water freely with the changing tides (it cannot be fully closed). In the fall of 2016, we plan to open A8 water control structure to 8 bays (fully open) year round.

Pond System A9-A14
The Pond A14 System consists of Ponds A9, A10, A11, A12, A13, A14, and A15. The objectives of the Alviso Pond A14 systems are to: 1) maintain full tidal circulation through ponds A9, A10, A11 and A14, while maintaining discharge salinities to Coyote Creek at less than 40 parts per thousand (ppt); 2) maintain pondsA12, A13 and A15 as higher salinity ponds

and operate at 80 – 120 ppt salinity during summer to favor brine shrimp development, as possible. During the winter of 2015, Ponds A9-14 were operated at lower levels due to levee erosion along the Alviso Slough side. In January and February 2015, The Santa Clara Valley Water District moved some of the internal levee material in this system to A10 and A11, inside the ponds along the Alviso Slough side to prevent further damage. Currently, the Service has a need for more material to rebuild the internal levees, which are planned to be repaired in late summer of 2016.

Pond System A16/17

Alviso Pond A16/A17 was the final Phase 1 action that was completed in 2012. Pond A17 is now tidal with uninhibited hydraulic connection to Coyote Creek. Pond A16 provides 243 acres of managed shallow pond habitat with 16 nesting islands (along with 4 existing islands). The Pond A16 fish screen was repaired on March 4, 2015 and is currently running 3 screens.

Pond System SF2

The objectives of the Pond SF2 System is to manage a 155-acre pond with 30 nesting islands for nesting and roosting shorebirds, and an 85-acre seasonal wetland for western snowy plover nesting. The water level in SF2 is designed to maintain shallow water to provide foraging habitat for shorebirds and waterfowl. Water control structures are used both to manage water levels and flows into and out of Pond SF2 from the Bay, and between cells, for shorebird foraging habitat and to meet water quality objectives. The internal weir boards for maintaining water levels in this pond are currently being replaced as they have broken off or are damaged. Replacement should be finished by fall 2016.

Sustainability of Managed Ponds

Maintaining dissolved oxygen (DO) levels in the Alviso Ponds while meeting water quality objectives and Final Order requirements has been a significant management challenge for the Service during operation of the ponds. Over the last several years, the Service in conjunction with the California Regional Water Quality Control Board (RWQCB) developed and implemented a number of BMPs in an attempt to improve DO levels in the ponds (baffles, solar aerators, timing of discharge, etc.). Some of these BMPs appeared to be temporarily effective in either raising DO levels within ponds or minimizing the impacts of low pond DO to the receiving waters. However, the Service no longer considers these BMP's to be practical or effective on a long-term basis. Based on previous lessons learned, the Service has been operating the ponds as continuous flow-through systems to try and reduce the water resident time as much as possible, while supporting species that use these ponds (e.g., hundreds of thousands of migratory, wintering, and nesting birds).

Pond A16 and Pond SF2 Water Quality Data

In 2014, the Service committed to conducting sampling at Pond A16 and Pond SF2 for Water Board compliance with Continuous Circulation Monitoring (CCM) water quality standards (salinity <44 ppt, 10th percentile DO >3.3 mg/L, pH 6.5-8.5). This effort had delays and datasondes were not deployed until August 20, 2014. In review of the data by a hydrologist in the USFWS Inventory and Monitoring Program, there was significant uncertainty as to the degree of accuracy of all of the DO readings at both sites. As a result of these complications, this sampling effort was not repeated by USFWS in 2015.

In 2015, the San Francisco Bay Bird Observatory (SFBBO) took measurements of Ponds A16 and SF2 concurrent with their bird surveys (Table 1). In general the results show conformance to the standards except for some occurrences of pH above 8.5.

Table 1. Pond A16 and SF2 water quality sampling in 2015, taken during high tide bird surveys at the ponds.

Season	Date	Pond	pH	DO mg/l	Salinity	Temp
Winter	1/16/2015	A16	8.97	21.08	15.28	14.24
Winter	2/17/2015	A16	8.61	13.64	13.24	16.64
Spring	3/20/2015	A16	8.93	16.77	15.49	20.13
Spring	4/28/2015	A16	9.31	13.91	17.14	22.13
Summer	7/16/2015	A16	7.92	6.84	25.3	27.18
Fall	10/12/2015	A16	8.6	14.8	26.69	24.04
Fall	11/12/2015	A16	8.38	12.18	22.96	15.89
Winter	12/7/2015	A16	8.05	9.85	22.73	14.33
Winter	1/30/2015	SF2	9.06	13.12	25.36	19.98
Spring	4/1/2015	SF2	8.1	8.26	26.85	20.4
Spring	4/16/2015	SF2	8.13	9.19	29.45	27.45
Summer	8/4/2015	SF2	8.24	9.52	35.84	26.37
Fall	9/14/2015	SF2	8.42	11.2	35.55	25.2
Fall	11/23/2015	SF2	8.11	10.49	32.25	16.32

Update on Mercury Studies

Summary of Mercury Studies at Pond A8 and Alviso Slough (contributed by L. Valoppi, USGS. May 2016)

Mercury dynamics in Pond A8 and Alviso Slough have been studied in order to adaptively manage Pond A8 gate operations and concerns regarding mercury remobilization and bioaccumulation. On June 1, 2011, Pond was opened to muted tidal flows on a seasonal basis. Gates were closed on December 1 of 2011, and then 3 gates were open on June 1 of 2012. During 2012 and 2013, 3 gates were opened on June 1, and closed again on December 1. In early March of 2014, 3 gates were opened early for that year, and on September 29, 2014, 2 additional gates were opened for a total of 5 out of 8 gates being opened to muted tidal flows into Pond A8. The 5 gates have remained open since then, including for the first time remaining open past December 1. These operational changes were allowed by working with the National Marine

Fisheries Service (NMFS). During 2015 researchers studied what the effects of leaving the gates open during the winter months had on mercury bioaccumulation and water quality.

The results of the 2015 study found that bird egg mercury concentrations were about the same levels found at reference areas collected during the same time period. Similarly, pond and slough fish mercury levels were at levels consistent with nearby reference areas. Water samples of mercury in the pond and sloughs supported the conclusions from the fish sampling. Alviso Slough scour results show that erosion is still occurring in Alviso Slough, still mostly near the A6 breaches as had been observed previously, though more erosion is now occurring in the rest of the slough. From 2010 to October 2015 about 35kg to 39 kg total Hg remobilized over the entire length of slough – ~64 % is from the zone including the A6 breaches with about one-third of the total is immediately near A6 breaches

Overall, the results show that mercury levels of birds, fish and water have stabilized to what they would be without restoration efforts. Keeping the gates open through the winter months did not affect mercury levels. Leaving the gates open did not appreciably increase erosion in the slough; a result that is supported by scour model results which indicate limited slough erosion would occur in the short term even with all 8 gates open.

Based on the above results, researchers have indicated it would be acceptable to open all 8 gates in mid-August of 2016. Researchers are continuing to study mercury in biota, scour and remobilization of mercury, and water levels at the southern levee, in 2016.

Bird Egg Results

Bird eggs (Forster's Tern and American Avocet) were collected by Josh Ackerman of the U.S. Geological Survey for mercury analysis. The results from the 2015 sampling, which reflect leaving the gates open during the winter months, found that tern and avocet egg mercury levels had increased in mercury by about 59% in restored ponds, and increased about 60% in reference ponds. Since there was a comparable increase in both reference and restored ponds, the increase is likely due to normal fluctuations in mercury levels, and not likely due to Pond A8 operations. For the last few years, the restored ponds and reference ponds have been consistent in their response to mercury. Essentially, bird egg mercury levels are at the levels that would be expected had no restoration actions had occurred, though mercury levels are still above those associated with reproductive impairment.

Slough Fish Results

In 2015 Darell Slotton and James Hobbs of University of California, Davis targeted collection of three-spined stickleback and Mississippi silverside fish from 2 locations in Alviso Slough, at the notch and at a mid-slough location. Fish were also collected from two Reference locations in Artesian Slough (aka Mallard Slough) to the east of Alviso Slough and also on the Guadalupe Slough (GUASL) to the west of Alviso Slough. Fish were collected at 4 different times between February and August. Stickleback fish had an increase in mercury levels about mid-year, but a similar increase was also observed during that time at the reference locations, so the seasonal increase could not be attributed to Pond A8 operations.

Silverside mercury levels in 2015 at the notch were within the same range as the last few years. At the mid-Alviso slough location, there appears to be a bit of an increase in Hg levels, while Mallard Slough stayed the same as in prior year. There does seem to be a divergence about mid-slough starting about mid-2015 with Hg levels going higher, while Mallard Slough seems to be going lower. Mallard slough may not be an ideal reference location due to its influence from A16 outflows as well as outflows from the wastewater treatment plant. However, mercury levels in silverside in Guadalupe Slough also seems very variable over time, and in the same range as Alviso Slough, so the increase mid 2015 at mid-slough location are not likely due to Pond A8.

In summary, the 2015 slough fish mercury data do not appear to show major increases in mercury in relation to keeping the Pond A8 notch open during the winter months.

Water Mercury Results

To coincide with collection of slough and pond fish, Mark Marvin-DiPasquale of the U.S. Geological Survey collected water samples inside Pond A8 and in 2 Reference Ponds, as well as in Alviso Slough at the A8 notch and at 2 Reference Slough locations. Samples were collected in February, May, July and August. Water was analyzed for a suite of analytes including Total Mercury (THg), and methyl-mercury (MeHg). A partitioning coefficient was developed for each sample which describes the tendency for the mercury to be absorbed onto particles, or dissolved in the water. If the particles are organic, for example algae or detritus, the mercury is more likely taken up by living organisms and bioaccumulated. However, if the particle is inorganic, for example sediment, then the mercury is likely not very available to be taken up by living organisms. Data from 2015 were compared to data from the same locations collected in earlier years.

Within the Ponds A5/7/8, there was a decrease in unfiltered (particulate and dissolved) and dissolved THg, MeHg and % MeHg after the A8 notch was opened in June of 2011. There was also a decrease in particulate MeHg and % MeHg. The only fraction within the pond complex that did not show a decrease before and after the 2011 notch opening was particulate THg, which remained unchanged.

For Alviso Slough, the analysis approach differed somewhat due to the apparent strong influence of the Pond A6 levee breach during December 2010 (as opposed to the opening of the Pond A8 notch during June 2011), particularly with respect to the mid- Alviso Slough location, which is downstream of the A8 notch but upstream of the A6 breaches. The temporal comparison was thus mostly before versus after the breaching of Pond A6, and the mid-slough and upper slough sites were tested independently. There was a short lived, but measureable spike in unfiltered (particulate + dissolved) THg at both locations in the period following the breaching of Pond A6, which reversed to pre-breach levels by mid-2011 and have remained so since. There was a short lived (1-2 month) spike in unfiltered MeHg following the opening of the A8 notch during 2011, but concentrations have decreased to pre-opening levels or lower since that event. There was no significant change in unfiltered %MeHg, filtered THg, filtered MeHg, filtered %MeHg, particulate THg, or THg partitioning associated with the Pond A6 breach at either slough location. There was a significant and sustained decrease in MeHg, %MeHg and MeHg partitioning (towards the dissolved pool) only at the mid-slough location after the Pond A6 breach.

Overall, for the sampling years 2014-15, following the initial opening of the A8 Notch (in 2011 to 1 gate), Hg species in surface waters have remained about the same (and generally lower than the pre-notch period) as more gates have been successively opened, opened earlier in the year, and remained open during the winter months. The water sampling results, collected at the same time and location as the fish samples, are overall consistent with the fish mercury results, which indicate that although mercury levels may fluctuate, these fluctuations are not likely due to operation of the Pond A8.

Bathymetry and Mercury Remobilization Results

Bathymetric studies (mapping of the seafloor) of Alviso Slough were conducted from late 2010 to October 2015 by Bruce Jaffe of the U.S. Geological Survey. Deep cores of the sediment, with interval sampling of mercury with depth were previously collected by Mark Marvin Di-Pasquale of the U.S. Geological Survey. The mercury core data were used in conjunction with the bathymetric mapping to estimate the amount of mercury that was released from the slough sediments eroding.

Continued bathymetric studies in October 2015 found that most of the erosion that has occurred since 2010 continues to be near the Pond A6 breach locations. For the first time we had gates open in winter in 2014, and there has been more erosion in the upper part of slough and rest of slough from October 2014 to April 2015. But from April 2015 to Oct 2015, there was deposition in slough in Spring and Summer, even though all 5 gates were open. Near A6 breach, the cross-section over time shows the east bank is eroding and the thalweg (the deep center of the channel), with the west bank staying about the same. At the mid-slough cross-sections, from 2010 to Oct 2015 there is a re-distribution of sediment, with some areas erosional and some depositional. Near the notch, between 2010 and Oct 2015, there is deposition at the thalweg, but widening of banks.

From 2010 to October 2015 about 35kg to 39 kg total Hg was remobilized over the entire length of slough. About 64 % is from the zone about mid-slough down to the mouth of the slough. About one-third of the total is immediately near the A6 breaches. The least Hg remobilization is near the A8 notch (5-10% of total).

Alviso Scour Model Results

An Alviso Slough Scour Model was developed by Carlos Rey of the UNESCO-IHE Institute for Water Education. The model utilized data from U.S. Geological Survey (Bruce Jaffe, Gregg Shellenbarger, and Mark Marvin-DiPasquale) to investigate short-term sediment dynamics in Alviso Slough after opening ponds for restoration.

Five scenarios were evaluated using the model:
1. 2010 conditions with A6 breaches and A8 notch closed, but A7 gate open as intake
2. 2010 conditions with A6 breaches and A8 notch opened

3. 2012 conditions with A6 breaches and A8 notch 15 feet (3 gates open)
4. 2012 conditions with A6 breaches and A8 notch 40 feet (all 8 gates open)
5. 2012 conditions with A6 breaches and A8 notch 40 feet (all 8 gates open), and a hypothetical open breach mid slough (near existing sediment flux stations)

Each scenario was evaluated for a range of conditions to cover spring and neap tides at high and low flow river discharge levels. The model results indicate that opening both A6 to full tidal flows and A8 to muted tidal flows had a dramatic impact on sediment transport in Alviso Slough. However, the impact of opening all Pond A8 notch gates results in only a slight increase in sediment being deposited in the pond, and some increased erosion in the upper part of Alviso Slough. So the width of the notch opening does not play a major role in sediment import into Pond A8. Model results indicate that Pond A6 has the most sediment deposition, followed by A7, A5 and last A8.

The results also show how these models could be used to investigate sediment dynamics of placing one or more additional breaches in Pond A8. Adding a hypothetical breach to Pond A7 results in a dramatic increase in sediment transport and flux during almost all tide and river flow conditions, with about 2 x the amount of sediment moving bayward as in Scenario 4 (all 8 gates at the notch open). The amount of sediment delivery into Pond A8 is much greater with a hypothetical breach in Pond A7 than predicted in the other scenarios. Erosion of the slough also changes, with considerable erosion from the hypothetical breach downstream to the mouth, and deposition in the slough between the hypothetical breach upstream to the A8 notch. This model is being expanded to allow for computations over longer time frames to assess the long term effects on slough sediment dynamics.

Sediment Flux Study Results

In order to characterize the amount of sediment moving between Pond A8 and Alviso Slough, a sediment flux (turbidity and velocity) and water quality (temperature, salinity, and dissolved oxygen) station was installed about midway between the Pond A8 notch and the mouth of Alviso Slough. An additional station has been installed at the confluence of Alviso Slough and Coyote Creek. Dave Schoellhamer and Maureen Downing Kunz of U.S. Geological Survey have studied the sediment movement at this location since WY2011. They continue to find that net sediment movement in the water is generally landward, or upstream, except during rainfall events. Therefore, mercury associated with the sediments would also be expected to have a net movement landward, or upstream, except during rainfall events. There are relatively high suspended-sediment concentrations (SSC) throughout the slough, especially on spring tides, suggesting it is likely that there is deposition at restoration sites. Data suggest Pond A8 is accumulating sediment since on spring tides SSC is much higher for waters entering Pond A8 from the slough and is sourced from further Bayward/seaward, or downstream.

Preliminary water quality data also indicates that opening of the Pond A8 gates through the winter of 2014/15 stabilized and slightly increased the salinity levels in Alviso Slough water. Before the March 2014 gate openings, salinity in Alviso Slough varied between less than 5 ppt to over 20 ppt, indicating watershed discharge and Bay water were alternately transported in the slough. After the gates were opened, the minimum salinity in the slough increased from 0 to 10, indicating the watershed discharge had less influence on slough water quality.

Water levels at Pond A8S landfill liner

In 2015, the Refuge became aware of erosion occurring at the southernmost extent of the Pond A5/A7/A8 complex (Pond A8S berm), adjacent to the closed landfill. Matt Brennan and Michelle Orr of ESA were consulted to do an assessment of the erosion and make recommendations to the managers to prevent further erosion. Dave Schoellhamer and Maureen Downing-Kunz of the U.S. Geological Survey established a station near the Pond A8 levee to record water levels and wave data for use by ESA in their evaluation.

Water levels from staff gauges in Pond A5, A7 and A8 (ponds are hydraulically connected via internal levee breaches) all closely tracked each other (except for a period in 2010 when construction was occurring in A8 and water levels were lowered). It appears that water levels increased during periods when the gates were open compared to when they were closed, but opening 3 gates from 1 gate did not seem to appreciably increase water levels as observed at A5/7, and by inference Pond A8. Water levels seemed to be fairly stable at between 4 and 5 feet NAVD after the 5 gates were open, then there was fluctuation during the period when SCVWD was pumping water from A4 into A5. Water levels started to decrease when the A7 gate was changed to outflow only (there are flapper gates to control the direction of flow). Currently, the WCS at A7 is outflow only while that at A5 is outflow only for one gate and 2-way flow for the second gate, which is broken.

So it appears that while opening or closing the gates at the A8 notch influences water levels inside the Pond A5/7/8, the number of gates open does not. Changing the WCS at Ponds A5 & A7 to be outflow only as much as possible seems to have brought water levels down considerably. The most recent data indicates that though water levels have gone down since the summer and fall of 2015, there is considerable fluctuation (X cm) due predominantly to spring/neap tide cycle, not gate operations. Water levels are continuing to be monitored.

Conclusion

Overall, the 2015 results continue to show that mercury levels in birds, fish, and water have decreased since the initial opening of the Pond A8 gates in 2011. Although there have been fluctuations in mercury levels year to year, these yearly fluctuations are similar between restored ponds and reference areas such that the variation cannot be attributed to Pond A8 operations. Specifically, opening all 5 gates throughout the winter of 2014/2015 did not result in any appreciable increase in mercury in Pond A8 or Alviso Slough.

Overall, researcher findings do not indicate cause for concern with opening more gates at Pond A8. However, managers decided to keep 5 gates open through mid-August, and at that time consider opening all 8 gates. Mid-August was chosen as that is when nesting within Pond A8 would be finished, and all the planned sampling for mercury studies in 2016 would also be completed. Further funding is being sought to continue the studies in 2017, which will be used to evaluate the effects of opening all 8 gates and keeping them open year round.

OTHER MERCURY UPDATES

In 2015, one bay-wide study in mercury was published and is summarized here: "**Dietary mercury exposure to endangered California Clapper Rails in San Francisco Bay", by M. Casazza, et al. 2014.** Marine Pollution Bulletin: 254-260. http://www.ncbi.nlm.nih.gov/pubmed/25066452

Authors collected 233 dietary samples (invertebrates and fish) of the Ridgway/Clapper Rail (rail) from four tidal marshes in South San Francisco Bay (South Bay) – Arrowhead, Colma Creek, Cogswell, and Laumeister. Invasive Spartina hybrids dominated Arrowhead, Colma and Cogswell marshes, whereas Laumeister marsh was dominated by native marsh plants (pickleweed, gumplant, Spartina foliosa). Diet items were collected prior to the breeding season in the December to March of 2008/9 and 2009/10. Collected diet items from tidal channels included eastern mudsnail, Baltic clam, soft-shell clam, ribbed horse mussel, polychaete ragworms, mud crab, and staghorn sculpin. Patterns in the concentrations of total mercury (Hg) in the diet items from each marsh was compared to the pattern of mercury in the blood of rails from the same marsh (study by Ackerman, et al. 2012). Hg levels in diet items were also compared to toxicological thresholds for reproduction and behavioral impairment.

Results indicated Hg concentrations differed significantly among marshes for all taxa except soft-shell clams and staghorn sculpin. Hg concentrations were consistently lower in diet items from Colma Creek compared to concentrations from the other three marshes. Cogswell marsh had the second lowest concentrations of Hg in the majority of diet items. Hg concentrations at Arrowhead, Cogswell, and Laumeister were similar for eastern mudsnails, ribbed horse mussels, and mud crabs, and Hg concentrations in soft-shell clams and staghorn sculpin followed a similar spatial pattern, though not statistically significant. In all marshes, Hg concentrations were highest in eastern mudsnail (non-native species). Baltic clam, soft-shell clam, ragworm, ribbed horse mussel, mud crab and staghorn sculpin had lower Hg levels.

The overall pattern of relatively higher Hg in diet items from Arrowhead, Cogswell, and Laumeister compared to lower Hg in diet items from Colma Creek, matched the spatial pattern described previously for Hg in rail blood (Ackerman et al. 2012). This finding is consistent with the rail having high site fidelity to a specific marsh and limited adult dispersal. The author's hypothesis, which was not supported, was that rail Hg blood levels would decrease with geographic distance away from the Guadalupe River (a known point source of Hg discharge into South Bay from an upstream legacy Hg mine). In particular, the relatively lower Hg in diet and rails blood at Colma Creek is of interest. Marsh elevation does not appear to explain the pattern (Arrowhead and Colma Creek marshes are both low elevation marshes).

Colma Creek marsh was a mudflat until mid-1980s, while Cogswell marsh was a former salt production pond that was restored starting in 1980. By contrast, Arrowhead and Laumeister are greater than 100 years old. Thus, marsh age may be a contributing factor to the pattern, such that younger marshes have had less time to accumulate organic matter that enhances Hg methylation and accumulation into rail diet items; while older marshes have had more time to accumulate organic matter. Older tidal marshes may present greater Hg risk to rail than younger marshes if they provide more labile organic matter for the methylating microbes. So marsh-specific biotic and abiotic factors are likely the strongest drivers for mercury risk to rails.

Hg concentrations in eastern mudsnails represent a relatively consistent risk of Hg exposure to rails across tidal marshes, with other diet items having a more variable risk. Hg levels in eastern mudsnails posed a moderate risk for avian reproduction impairment, with Hg levels in the other diet items posing a lower risk for reproduction impairment. Staghorn sculpin Hg levels also posed a moderate to low risk for reproductive impairment (depending on the toxicological threshold used); whereas 25% of the sculpin exceeded the threshold for behavioral impairment. In fish, the majority of total Hg is in the MeHg form, so more confidence is provided in comparing sculpin Hg levels to toxicity thresholds; comparison to toxicity thresholds would infer that 25% rails in the marshes studies are at risk for behavioral effects, but not to reproductive impairment.

There is some uncertainty of Hg risk to rails - levels above toxicological thresholds do not mean that adverse effects are actually occurring since toxicological thresholds are based on a range of species. Also, toxicological thresholds are based on methyl mercury (MeHg), the most toxic form; the various invertebrate diet items may have different percentages of MeHg to total Hg (total Hg is what was measured in the diet items). However, evidence of Hg risk to rails is independently supported by studies showing rail body condition was negatively associated with Hg blood levels, and decreased reproduction in rails was associated with Hg levels.

This study has shown an alternative to measuring Hg risk to rails directly by instead assessing Hg levels in their diet items. Assessment of risk would be improved by measuring MeHg instead of total Hg. This study also demonstrates that biogeochemical processes responsible for methylation of mercury in a marsh environment are complex, and occur at a local rather than a regional scale. The authors recommend that restoration or enhancement of marshes should consider factors that affect methylation such as the removal or addition of organic matter and the wetting and drying frequency of the marsh. Consideration could also be given to reducing the abundance of eastern mudsnails, which have high total Hg levels.

Fisheries Monitoring

The following is a summary of **"Steelhead Smolt Outmigration and Survival Study: Year 2 Stream Surveys", by J. Hobbs**. **July 2015**. 18pp.
http://www.southbayrestoration.org/documents/technical/Final%20Report%202014-15_Guadalupe%20River%20Steelhead%20Smolt%20Outmigration%20Study_July2015.pdf

This is the second year results of a two year study to test the movement of threatened steelhead smolt, Central California Coast (CCC) (*Oncorhynchus mykiss*), in Alviso Slough and potential entrainment and entrapment in Pond A8. Through consultation with the National Marine Fisheries Program, conducting this study for two years has allowed the early opening of Pond A8 gates in March of 2014, and maintaining the gates open between Dec 1, 2014 to May 31, 2015 (when they normally would have to be closed to prevent steelhead entrainment and entrapment). This study employed Passive Integrated Transponder (PIT) tags injected into wild *O. mykiss* collected in the Guadalupe River and Radio Frequency Identification (RFID) remote antenna interrogation systems to detect fish passage from the river and into/out of the pond A8 armored notch, A5 and A7 water control structures. In 2014, a pilot study was conducted with the support of the Santa Clara Valley Water District (SCVWD), to sample a select number of sites within the main stem Guadalupe River to tag Steelhead Trout. Over 5 surveys from December through March 2014, 70 *O. Mykiss* were tagged with PIT tags. Only 6 individuals were detected migrating out of the Guadalupe River, and a single individual was detected at the pond A8 armored notch.

This second year of the study began in the Fall 2014, when four additional stream surveys were conducted and *O. mykiss* were tagged. Beginning October 13th 2014, Dr. Hobbs (operating as an independent contractor for the SCVWD) and CDFW biologist (Michelle Leicester) conducted a survey of 20 existing electrofishing stations previously surveyed by the Santa Clara Valley Water District (SCVWD) between 2004 and 2012. In addition, a series of sites where California Department of Fish and Wildlife (CDFW) had surveyed in the past with Dr. Jerry Smith of San Jose State University were visited to assess sampling feasibility. Of the 12 sites located in the main stem Guadalupe River, only one site (Skyport Blvd) had water with conditions conducive to residence of *O. mykiss*. No *O. mykiss* were encountered in the main stem of the Guadalupe River. An area near Bascome Avenue on Los Gatos Creek had water with appropriate conditions, and two sites in Los Alamitos Creek (Greystone Park) and Vichy Springs were sampled. Guadalupe Creek above Hicks Road had the longest contiguous area of flowing freshwater with appropriate conditions for residence of *O.Mykiss*. A majority of the sampling effort in fall 2014 was focused in this area. Researchers counted and measured 32 *O. mykiss* during the 4 surveys, with 28 fish successfully tagged and released.

Beginning on February 24, 2015, SCVWD staff began operating the 3 RFID antennas on the Pond A8 notch gates; however 1 of the 3 antennas was inoperable during this Year 2 study. In late September 2014, 2 additional gates (total of 5) had been opened. Thus, 2 gates were operated open without RFID antennas until May 18th, by which time SCVWD staff had successfully installed RFID antennas. The antenna for the Pond A5 structure, connecting to Guadalupe Slough, was destroyed and damaged or lost beyond repair as was the upstream antenna located in the Guadalupe River near Trimble Avenue. Similarly, the antenna and housing for the Pond A7 structure, connecting that pond to Alviso Slough were destroyed and the PVC housing was lost. Although the A7 water control structure is intact and still operable, the antenna and housing could not be replaced and re-installed in time for this Year 2 study. Unfortunately, the SCVWD was unable to install a stream antenna upstream of the Pond A8 notch during the 2015 out-migration period In summary, for the Year 2 study, antennas on the A5 and A7 structures were not in place; 2 of the A8 gates had operational antennas turned on starting February 24, 2015, two additional gates at A8 had antennas that were installed and operational by May 18th, one of the bays on A8 did not have an operational antenna during this Year 2 study, and the upstream antenna was not installed. No Steelhead were detected at the pond A8 notch in 2015.

In 2014, California was experiencing the third year of an unprecedented drought. A majority of stations were either completely dry or only a few inches deep, when surveyed in early October. Sites above Woz Park to Almaden Lake were dry, as was the majority of Colero-Alamitos Creek and the lower reach of Los Gatos Creek. In addition, sites along the main stem of the Guadalupe River downstream of Woz Park experienced low dissolved oxygen. Storm flows were infrequent in water year 2015, and short in duration, and would have led to very short windows of opportunity for fish to migrate downstream. An additional survey with the RFID back-pack wand was conducted by Stephen Andersen of the SCVWD in Spring 2015 and several tags were again detected, however only the tags were recovered, thus the fish had either shed the tag or died and decomposed. The extreme drought conditions, warm winter temperatures and general condition of the watershed likely resulted in a loss of a majority of the fish tagged in fall 2014. Given the effects of a 3rd year of extreme drought and the resulting low water flows and poor water quality, along with the presence of predators throughout the watershed, it was unlikely a significant out-migration occurred in 2015.

Reported Fish Kills

No fish kills were observed during 2015 that were associated with pond operations or Phase 1 restoration ponds.

Appendix A: Pond Operations Plan

DON EDWARDS SF BAY NWR

POND OPERATION PLANS

Updated 2/24/15

Monitoring
The system monitoring will require weekly site visits to record pond and intake readings. The monitoring parameters are listed below.

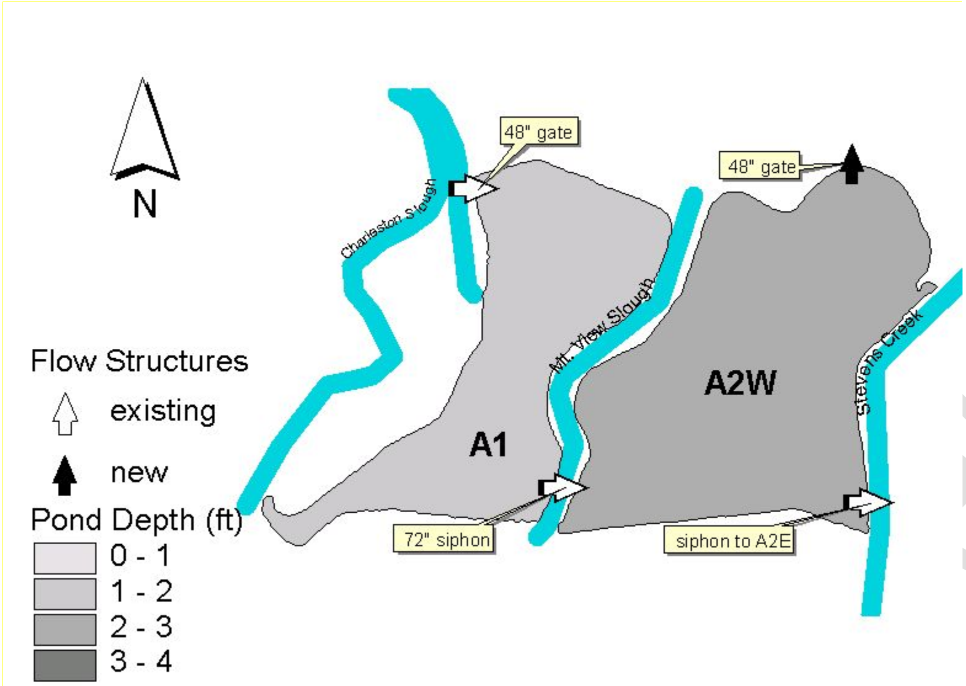
Weekly Monitoring Program

Location	Parameter
Intakes	Salinity
In-pond	Depth, Salinity, Observations
Discharges	Depth, Salinity, Observations

The weekly monitoring program will include visual pond observations to locate potential algae buildup or signs of avian botulism, as well as visual inspections of water control structures, siphons and levees.

Contents

A1 AND A2W



Objectives
Maintain full tidal circulation through ponds A1 and A2W while maintaining discharge salinities to the Bay at less than 40 ppt. These ponds are part of the planning process for SBSPRP Phase 2, and may be breached in the next 5-10 years.

Structures
The A2W system includes the following structures needed for water circulation in the ponds:

- 48" gate intake at A1 from lower Charleston Slough
- NGVD gauge at A1
- 72" siphon under Mountain View Slough between A1 and A2W
- staff gauge (no datum) at A1
- 48" gate outlet structure with 24' weir box at A2W to the Bay
- NGVD gauge at A2W
- Note that siphon to A2E is present, but closed

The system will discharge when the tide is below 3.6 ft. MLLW.

Summer Operation: May through October

Summer Pond Water Levels

Pond	Area (Acres)	Bottom Elev. (ft, NGVD)	Water Level (ft, NGVD)	Water Level (ft, Staff Gauge)
A1	277	-1.8	-0.4	2.0
A2W	429	-2.4	-0.5	NA

Water Level Control
The water level in A2W is the primary control for the pond system. The outlet at A2W includes both a control gate and control weir. Either may be used to limit flow through the system.

The A1 intake gate can be adjusted to control the overall flow though the system.

Design Water Level Ranges

Pond	Design Water Level Elev. (ft, NGVD)	Maximum Water Elev. (ft, NGVD)	Maximum Water Level (ft, Staff Gauge)	Minimum Water Elev. (ft, NGVD)	Minimum Water Level (ft, Staff Gauge)
A1	-0.4	1.2	3.6	-0.6	1.8
A2W	-0.5	1.1	NA	-0.7	NA

Based on system hydraulics, pond A2W would typically be about 0.1 feet below pond A1.

Winter Operation: November through April

Winter Pond Water Levels

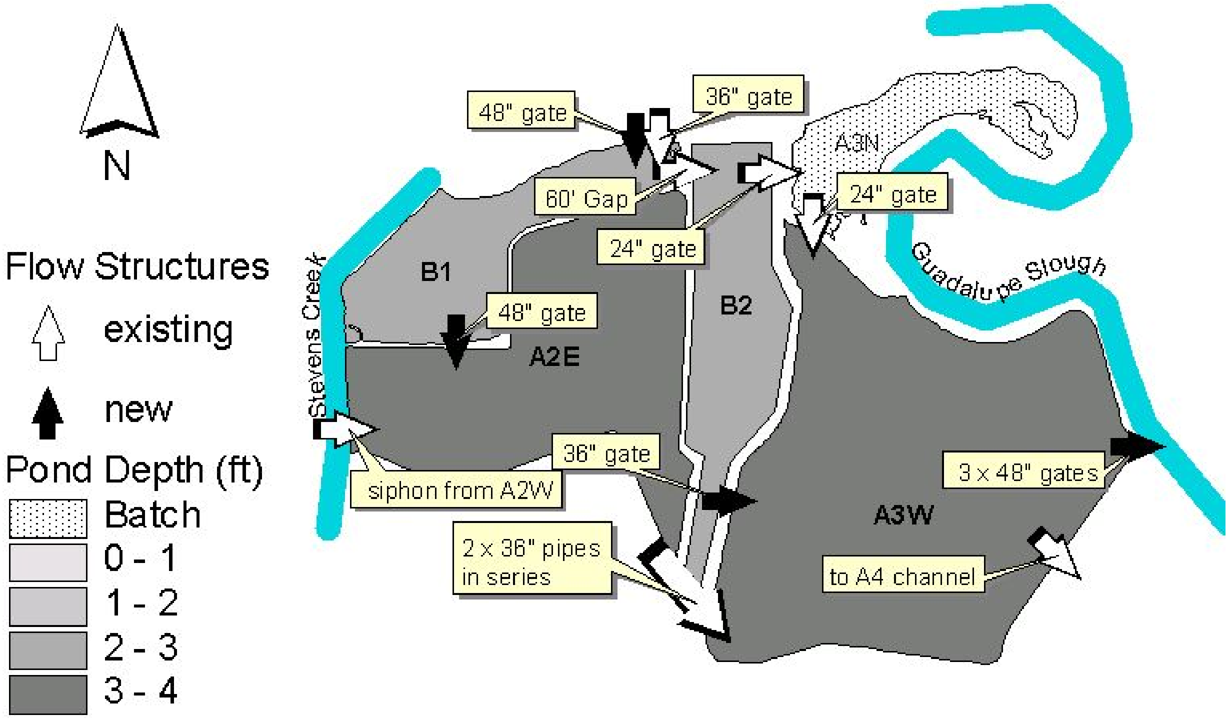
Pond	Area (Acres)	Bottom Elev. (ft, NGVD)	Water Level (ft, NGVD)	Water Level (ft, Staff Gauge)
A1	277	-1.8	-0.6	1.8
A2W	429	-2.4	-0.6	NA

Water Level Control
Normal winter operation would have the intake gate partially open to reduce inflow during extreme storm tides. The pond water level may vary by 0.2 ft due to the influence of weak and strong tides, and over 0.5 ft due to storms

During winter operations, the water levels should not fall below the outlet weir elevation. If the elevation does decrease in April, it may be necessary to begin summer operation in April instead of May.

During winter operations, if the water levels exceed approximately 1.2 ft NGVD, the A1 intake should be closed to allow the excess water to drain. Note that without rainfall or inflow, it will take approximately 3 weeks to drain 1.0 ft from the ponds.

B1, B2, A2E, AND A3W



Objectives

1. Maintain full tidal circulation through ponds B1, B2, A2E, and A3W while maintaining discharge salinities to Guadalupe Slough at less than 40 parts per thousand (ppt).
2. Due to mercury hotspots in Pond A3N, maintain water levels to cover the pond bottom. This can be done by leaving the A3N / A3W gate fully open, year round.
3. Maintain water surface levels lower in winter to reduce potential overtopping of A3W levee adjacent to Moffett Field.
4. CURRENT CONDITIONS, October 2014 include a broken tide gate at A3W/Guadalupe Slough. Thus the entire system is being held at a lower water level as only a third of the gate is open for discharge. Repairs are expected in spring/summer 2015.

Structures

The A3W system includes the following structures needed for water circulation in the ponds:

- 36” gate intake structure from the bay at B1
- 48” gate intake from the bay at B1
- 48” gate between B1 and A2E
- 2x36” pipes in series between A2E and A3W (no gates)
- 36” gate between B2 and A3W

- gap between B1 and B2
- 24” gate between B2 and A3N
- 24” gate between A3N and A3W
- 3x48” gate outlet at A3W to Guadalupe Slough. Two are outlet only, and one allows both inflow and outflow, no weir
- staff gauges at all ponds and NGVD gauges at all ponds
- siphon from A2W is closed, but available if needed
- siphon to A4 is available (via pump) for emergency purposes in conjunction with SCVWD

Summer Operation: May through October

Summer Pond Water Levels

Pond	Area (Acres)	Bottom Elev. (ft, NGVD)	Water Level (ft, NGVD)	Water Level (ft, Staff Gauge)
B1	142	-0.8	0.4	1.3
B2	170	-0.6	0.4	1.3
A2E	310	-3.1	-0.5	3.0
A3W	560	-3.2	-1.4	2.1
A3N	163	-1.4	NA	NA

* Pond B1 and B2 will be operated at lower water levels on an experimental basis in an attempt to improve shorebird nesting and foraging habitat. If water quality or operations are jeopardized from lower water levels in Ponds B1 or B2, the system will be reverted back to normal operating levels, during non-hunting season.

Water Level Control

The flow through B2 to A3W is only required to maintain circulation through B2. This circulation prevents local stagnant areas which may create areas of higher salinity or algal blooms.

The flow through A2E is controlled by the gates from B1 to A2E. The partial gate opening is to maintain the water level differences between A2E and B1. There are no gates on the culverts between A2E and A3W, therefore the water levels in those two ponds should be similar.

The B1 intake gates should be adjusted to control the overall flow through the system. The water levels in B1 (and therefore B2) will change due to the change in inflow.

Water levels in Pond AB1 and Pond AB2 of Pond A3W system will be lowered during the summer to improve shorebird nesting and foraging habitat

Design Water Level Ranges

Pond	Design Water Level Elev. (ft, NGVD)	Maximum Water Elev. (ft, NGVD)	Maximum Water Level (ft, Staff Gauge)	Minimum Water Elev. (ft, NGVD)	Minimum Water Level (ft, Staff Gauge)
B1	0.4	1.6	2.5	-0.2	0.7
B2	0.4	1.6	2.5	-0.2	0.7
A2E	-0.5	-0.2	3.3	-2.0	1.5
A3W	-1.4	-0.2	3.3	-2.0	1.5
A3N	NA	NA	2.6	NA	NA

Salinity Control
The summer salinity in the system will increase from the intake at B1 to the outlet at A3W, due to evaporation within the system. The intake flow at B1 should be increased when the salinity in A3W is close to 35 ppt. Increased flow will increase the water level in A3W. Water levels in pond A3W above elevation -0.2 ft NGVD (3.3 ft gauge) should be avoided as they may increase wave erosion of the levees.

Winter Operation: November through April

Winter Pond Water Levels

Pond	Area (Acres)	Bottom Elev. (ft, NGVD)	Water Level (ft, NGVD)	Water Level (ft, Staff Gauge)
B1	142	-0.8	0.9	1.8
B2	170	-0.6	0.9	1.8
A2E	310	-3.1	-1.8	1.7
A3W	560	-3.2	-1.8	1.7
A3N	163	-1.4	NA	NA

Water Level Control
The water levels in A3W are important to prevent levee overtopping. The south levee separates the pond from the Moffet Field drainage ditch. The levee is low, and subject to erosion with high water levels.

Whenever possible, the system intake at B1 should be closed in anticipation of heavy winter rains and high tides. When the system intake gates are closed, the internal gates from B1 to A2E and from B2 to A3W should also be closed to keep water in the upper ponds (B1 and B2).

There is no gate between A2E and A3W. During winter operations with reduced flows through the system, the A2E water level will be similar to the A3W water level. During the summer, the higher flows will establish approximately 0.9 ft difference due to the head loss through the two pipes in series which connect the ponds.

A5, A7, AND A8

Objectives
The Pond A8 system is operated to maintain muted tidal circulation through ponds A5, A7, A8N and A8S while maintaining discharge salinities to the Bay at less than 40 ppt.
Note that SCVWD is currently placing fill along the southern portion of A8S as part of their beneficial reuse program. This will continue for at least the next 5 years during the dry season.

Structures
The A8 system includes the following structures needed for water circulation in the ponds:

- 2x48” gate intake at A5 from Guadalupe Slough. CURRENT LY (Oct 2014) this tide gate is broken and intakes water a high tide (cannot be fully closed)
- 2x48” gate in/outlet with two 24’ weir boxes at A7 from Alviso Slough; this functions as the outlet for the system when needed
- NGVD gauges at A5 and A7 structures
- notches in the levees between A5/A7/A8/A8S; these ponds effectively function as one
- siphon between A4 to A5 will generally be closed; this siphon is pump driven rather than gravity fed.

- 40-foot armored notch with multiple bays that can be opened and closed independently at A8 and Alviso Slough. Current operation (October 2014) is 5 bays open, year round to gather data on salmonid tracking with UC Davis.

Weir Structure: A portion of the levee adjacent to Pond A8 was reconfigured as part of the Lower Guadalupe River Flood Protection Project to act as an overflow. The 1,000-ft long overflow weir at Pond A8 would allow high flood flows to exit Alviso Slough when water levels reach approximately 10.5 ft NAVD88. The water levels have never overtopped the weir since 2004, but it remains in place in case of a flood event.

A4 Siphon: It is possible to pump water from Pond A4 into Pond A5 or vice versa, if necessary, in accordance with the SCVWD Pond A4 Water Management Operations Plan (December 2005).

System Description
Water exchange through the notch connection is limited and the tidal range within the ponds is muted. All gravity intake flow occurs at high tide, and all outflow occurs when the tide is below 8.12 ft. MLLW. Previous seasonal water levels no longer apply here.

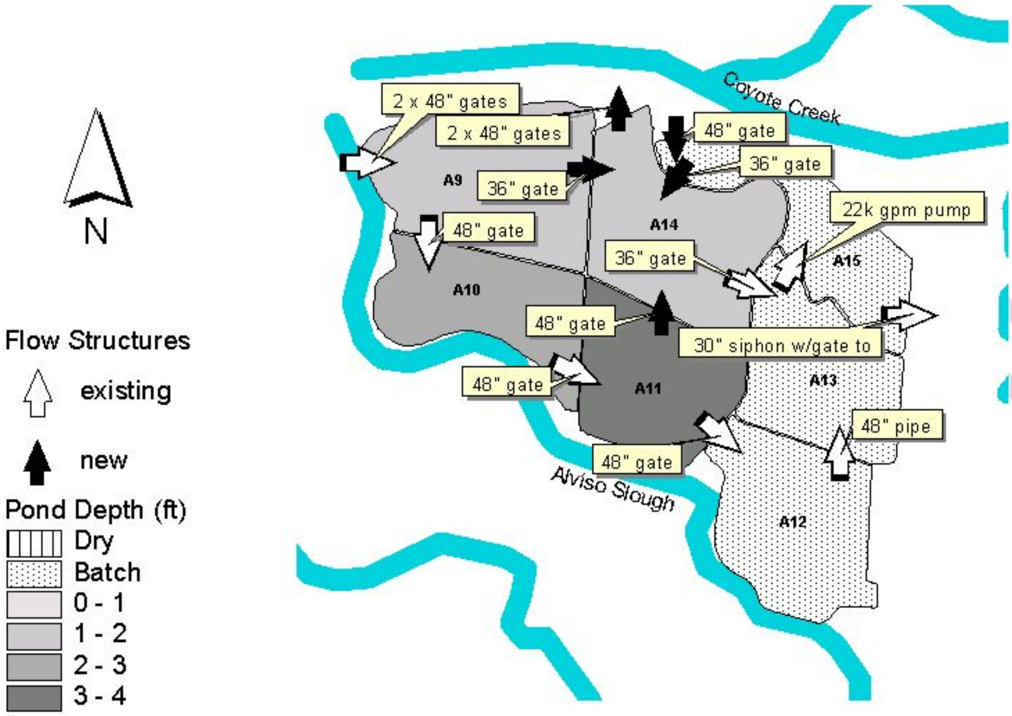
Water Level Control
The A5 and A7 intake gates can be adjusted to control the overall flow through the system. After the installation of the “notch”, water levels are much higher here due to a muted tidal system into A8.

Winter Operation

Previous operation of this system included the notch is being closed during winter months (December – May) to prevent entrapment of migrating salmonids. During these winter months, Pond A8 system was operated by intaking water at A5 and releasing water at A7. Five bays of the notch are left open year round as of 9/29/14 in conjunction with salmonid research by UC Davis.

Note that without pumping, rainfall or inflow, it will take approximately 3 weeks to drain 1.0 ft from the ponds.

A9, A10, A11, A14 AND A12, A13, A15



Objectives

1. Maintain full tidal circulation through ponds A9, A10, A11 and A14, while maintaining discharge salinities to Coyote Creek at less than 40 parts per thousand (ppt).
2. Maintain pond A15 as a higher salinity pond and operate at 80 – 120 ppt salinity during summer to favor brine shrimp development, as possible.
3. CURRENT CONDITIONS (Oct 2014): A9-A14 are currently being operated at lower levels due to levee erosion along Alviso Slough. During the winter of 2014 SCVWD is proposed to come in and move some of the internal levee material in this system to A10 and A11, inside the ponds along the Alviso Slough side.

Structures

The A14 system includes the following structures needed for water circulation in the ponds:

- 2 x 48” gate intake at A9 from Alviso Slough
- 48” gate between A9 and A10; 48” gate between A9 and A14- left open always
- 48” gate between A10 and A11; 48” gate between A11 and A14- - left open always
- 48” gate between A11 and A12; 48” gate between A12 and A13
- 36” gate between A14 and A13
- 36” gate between A15 and A14; 22,000 gpm pump from A13 to A15 (no power, would need a generator to operate)
- 48” gate intake at A15 from Coyote Creek
- 2 x 48” gate outlet at A14 into Coyote Creek
- staff gages at all ponds and NGVD gages at all pond
- internal breaches in levees between A9/A10/A11/A14 were put in place in 2008 to

improve water flow

System Description
The normal flow through the system proceeds from the intake at A9, then flow through A10-A11- to the outlet at A14. All gravity intake flow would occur at high tide, and all outflows would occur when the tide is below 6.2 ft. MLLW.

Pond	Area (Acres)	Bottom Elev. (ft, NGVD)	Water Level (ft, NGVD)	Water Level (ft, Staff Gauge)
A9	385	-0.2	2.0	3.3
A10	249	-0.8	1.8	3.0
A11	263	-1.8	1.3	2.5
A14	341	-0.0	0.9	2.3
A12	309	-2.0	1.2	2.5
A13	269	-1.1	1.1	2.6
A15	249	0.7	2.8	4.1

Summer Operation: May through October

Summer Pond Water Levels

Water Level Control
The water level in A14 is the primary control for the pond system. The system flow is limited by the inlet capacity at A9. Normal operation would have the outlet gates fully open. Water levels are controlled by the weir elevation at A14. The A14 weir should be at approximately 0.0 ft NGVD to maintain the summer water level in A14 at 0.9 ft NGVD (2.3ft gauge).

Due to the internal levee cuts, water flows freely between ponds A9 to A10 to A11 to A14.

Operating the ponds at or near minimum depths will interfere with circulation through the ponds and may cause significant increases in pond salinity during the summer evaporation season. Exposing the pond bottom at A9 also brings in western snowy plovers to nest, further reducing our capacity to manage water here.

Salinity Control
Increased flow may increase the water level in A14. The inflow at A9 is constrained by the tide level in Alviso Slough since the intake gates would be fully open. Water levels in pond A14 above elevation 2.0 ft NGVD (3.4 ft gauge) should be avoided as they may increase wave erosion of the levees.

Batch ponds A12, A13, and A15 summer salinity levels should be between 80 and 120 ppt, to provide habitat for brine shrimp and wildlife which feeds on brine shrimp. However, due to limited flow through here (ultimately from the intake at A9) this batch system does not usually function this way. Further, we have reduced water levels in A12 and A13 in recent years to promote nesting by terns and shorebirds. These two ponds are often mostly dry during the summer with only high salinity water in the borrow ditches and some standing water.

Ponds A12 and A13 operate as a single unit, with inflow from pond A11 and outflows to either A14 or A15. The water levels in A12 and A13 would generally be between the elevations in A11 (higher than A12) and A14 (lower than A13); inflows from A11 and outflows to A14 would be by gravity. Pond A15 operates as a separate batch pond to some extent with inflow from A14 or by gravity from Coyote Creek.

If the salinity levels are high in A14, it may be necessary to reduce or suspend outflows from the batch ponds and allow the batch pond salinity to increase until later in the season. The salinity in a batch pond will increase by ~ 10 ppt per month during the peak evaporation months.

Winter Operation
During the winter season, the A9 intake will be closed to prevent entrainment of migrating salmonids; December through May 31. Excess water from rainfall would be drained from the system after larger storms and will require additional active management to adjust the interior control gates. In years with low rainfall and because there is no inflow to this entire system during the winter, water levels in A9 are often very low by spring. This can lead to western snowy plovers nesting on the exposed pond bottom, which further limits our ability to take in water as of June 1.

Winter Pond Water Levels

Pond	Area (Acres)	Bottom Elev. (ft, NGVD)	Water Level (ft, NGVD)	Water Level (ft, Staff Gauge)
A9	385	-0.2	1.5	2.8
A10	249	-0.8	1.5	2.7
A11	263	-1.8	1.4	2.6
A14	341	-0.0	1.3	2.7
A12	309	-2.0	1.4	2.7
A13	269	-1.1	1.2	2.7
A15	249	0.7	2.8	4.1

A16

Objectives

Provide 243 acres of managed pond habitat in Pond A16, with 16 new nesting islands (along with 4 existing islands).

Structures

- 63” culvert intake at A16 near the southwest corner of A17 (200 cfs capacity)
- outlet structure into Artesian Slough (180 cfs capacity) with 140-ft outlet pilot channel
- siphon into New Chicago Marsh

System Description

Flows into and out of Pond A16 can changed by adjusting slide gates.

Pond A16 is managed for shallow water habitat. A large majority of the pond bed has elevations ranging from 2.2 to 3.1 feet NAVD. In addition to the 20 islands, you can often see parts of the pond standing above the water line. The intake culvert has a tide gate to prevent water from flowing back into A17.

CURRENT CONDITIONS (Oct 2014): the fish screen is currently under repair and should be back in place and functional by Feb. 2015.

The Refuge and the USACE finished a project to place toppings on two islands for use by nesting Caspian terns (islands 11 and 12) and one for nesting western snowy plovers (island 3) in winter 2015. Decoys and sound systems will be placed here in 2015.

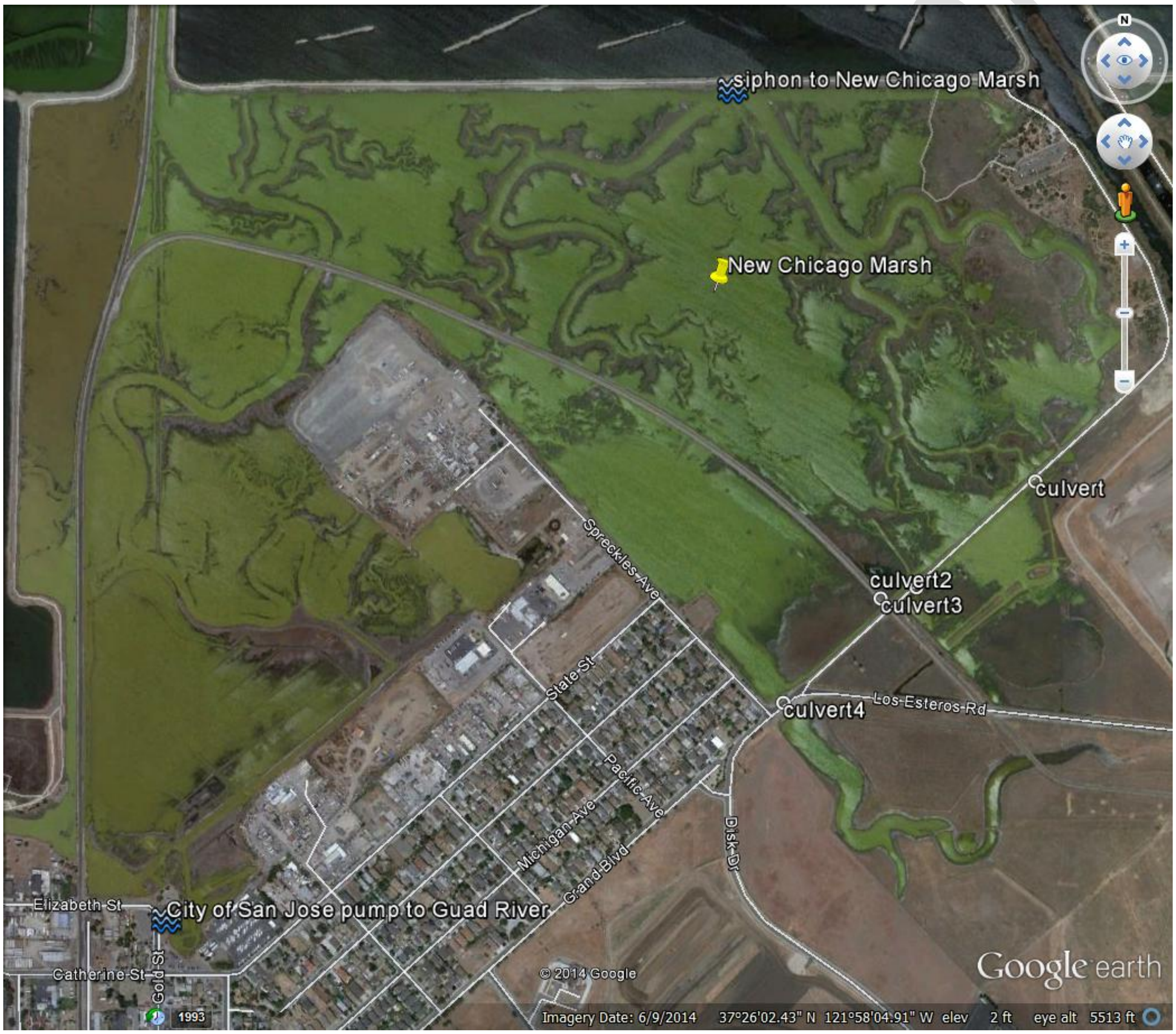
Outlet structure:

- Discharge a maximum capacity of 180 cfs to Artesian Slough during low tide events.
- Prevent water from flowing back into A16 through the outlet structure.

NEW CHICAGO MARSH

The siphon from A16 into NCM is closed in the wi unless water levels drop significantly due to low rain fall. In spring and summer the siphon is open ~3 inches to keep up with evaporation and not flood out nesting birds. Recommendations are to keep water levels between -2.5 to -2.7.

There is no outlet, although a small pump is available in the case of emergency. The pump is located in the southeast corner, along the entrance road into the EEC and releases water into Artesian Slough. Water in NCM drops ~1/10 or one inch every two days with the pump running full time. City of San Jose has a pump in the SW corner of NCM that is used to prevent flooding in Alviso.



A22 AND A23

There is one 48" gate located on Mud Slough at the cross levee between the two ponds. It takes a very high tide to get water to flow through the gate. There is no outlet for this system and these ponds currently function as seasonal ponds. Currently, the internal "donut" levee is cut to allow water to flow into A23 but not A22. The Refuge, in conjunction with LAM, has plans to add a cut into A22 to allow water flow into both ponds in winter 2014. As of December 2014, this breach is not yet low enough to allow water into A22 without first filling A23. We are working to get this lowered even more.

These two ponds are used for snowy plover habitat and need to remain dry during nesting season. Some water can be brought in during summer to allow for foraging habitat within channels and the borrow ditch. In 2014, this usually meant opening the water control structure for 3-5 days every 2-3 weeks.

SF2

Objectives

Manage 155-acre pond with 30 nesting islands for nesting and roosting shorebirds, and an 85-acre seasonal wetland for western snowy plover nesting. The water level in SF2 is designed to maintain shallow water to provide foraging habitat for shorebirds and waterfowl. The Refuge and the USACE finished a project to place toppings on three islands for use by nesting Caspian terns (islands 17, 21, 12) and one for nesting western snowy plovers (island 10) in winter 2015. . Decoys and sound systems will be placed here in 2015. Decoys only for Forster's terns will be placed on island 22.

Islands that need to be plowed (as of February 2015) to reduce cracks include: 13, 16, 20.

Structures

- intake structure consisting of 5: 4-foot intake culverts with combination slide/flap gates on each end of the culvert
- outlet structure consisting of 6: 4-foot outlet culverts, with combination slide/flap gates on both ends of each culvert
- there is one staff gauge at the outlet channel

System Description

Water flows into and out of pond SF2 through water control structures at the northern (cell 1) and southern ends (cell 4) of the bayfront levee. Weirs with adjustable flashboard risers are used to control flow in and out of cells 2 and 3. Water flows out of SF2 during low tides through the structures located along the bayfront levee. Within SF2, flashboard riser weirs are installed to convey flow into and out of cells.

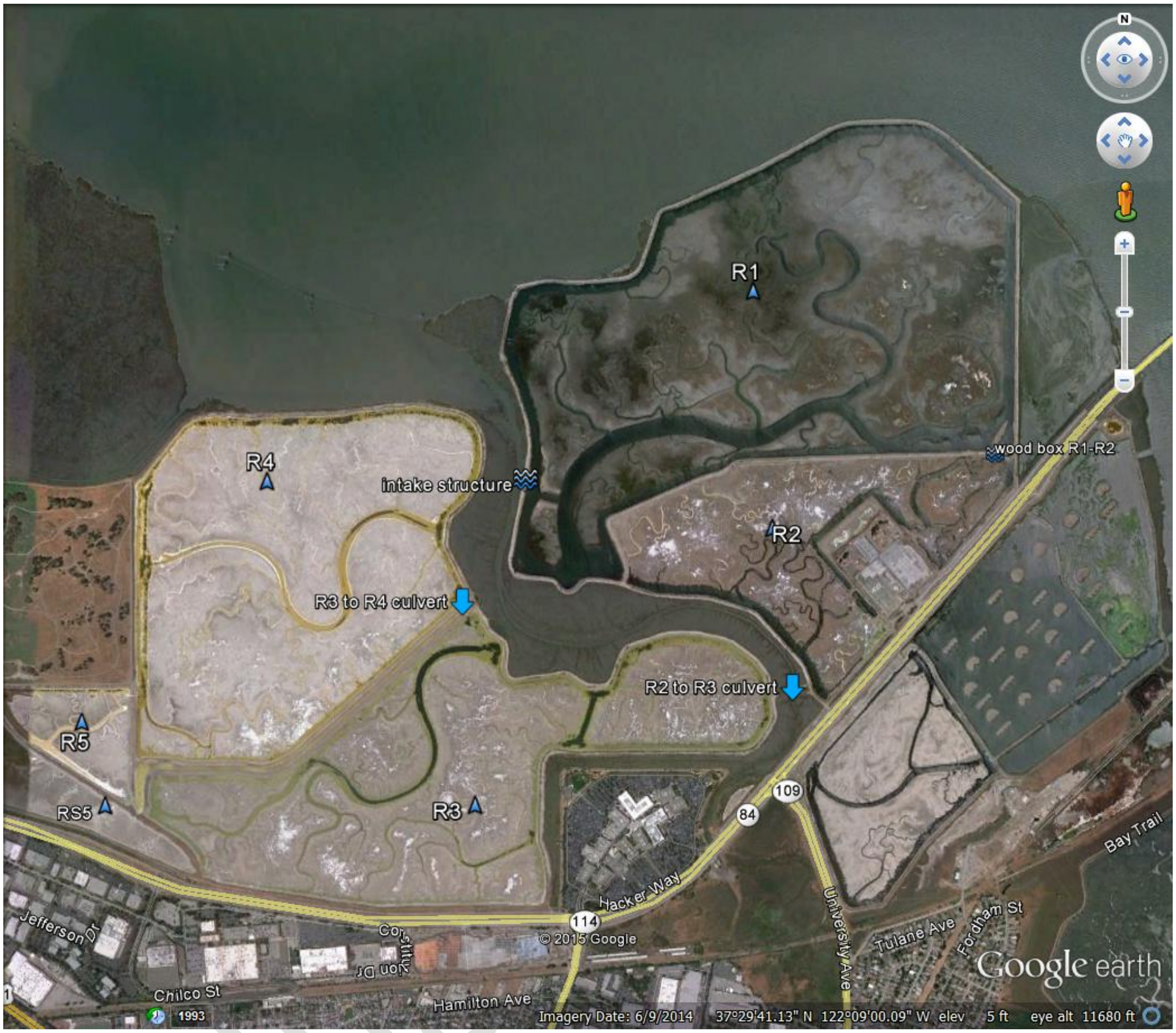
The seasonal wetland area has 1 intake and 1 outlet structure. In addition, 4 cell outlet culvert structures are located where the berms cross deeper, historic channels and borrow ditches to drain deeper water from these channels for periodic maintenance and as a water quality management approach.

Summer Operation
June 1-January 31, the southern water control structure is operated as a one-way outlet and the northern water control structure is operated as a one-way intake. However, during the peak shorebird months, we may manipulate the water levels in cell 1 by operating the intake as a two-way flow. With this option, cells 2 and 4 would continue to operate as a one-way continuous flow, but cell 1 would drain through the intakes at low tide and provide mud flat areas for foraging habitat (until the rising tides refill cell 1). The 2 way flow also helps remove built up sediment in the intake channel on Bay side.

Water Level Control
Water levels are controlled by the outlet weirs located on cell 4.

Winter/Spring Operations
During the winter/spring season, both water control structures will be operated as 2-way flow to create muted tidal conditions, February through May. These measures also help protect juvenile salmon and steelhead entrainment.

R1, R2, R3, R4, R5 AND RS5



There are two 72” gates located at R1 which feed this entire pond system, there are no discharge points for the system. Water moves from R1-R2-R3-R4, and in general the previous pond must be filled before beginning to fill the subsequent pond. The All American Canal can be used to get water to R5 and RS5. All of the water control structure sin this system are old, and may not be totally operational. In particular the culverts R2-R3 and R3-R4 appear to not open and/or close properly.

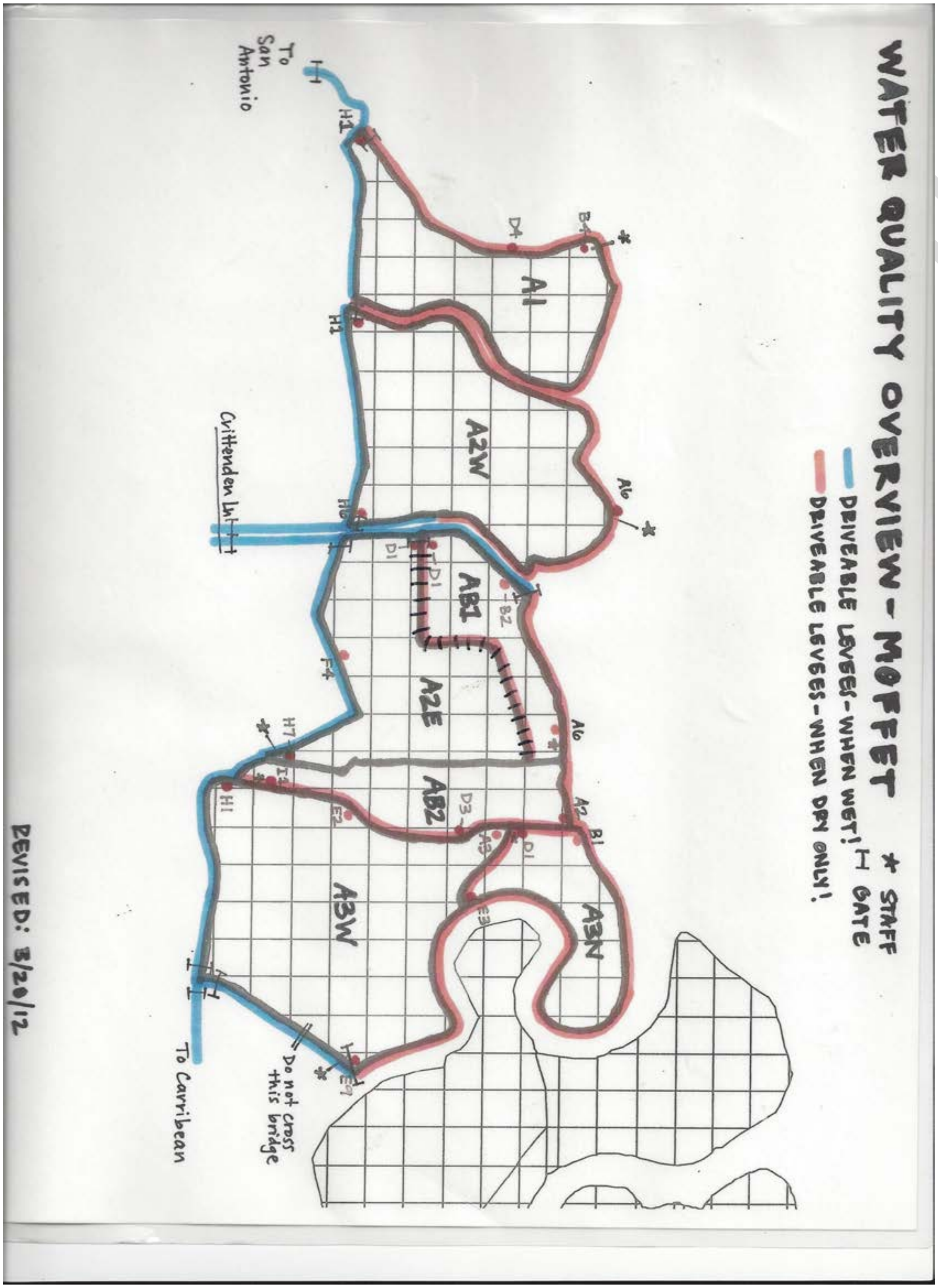
R3, R4, R5, and RS5 currently function as seasonal ponds and receive only rainwater.

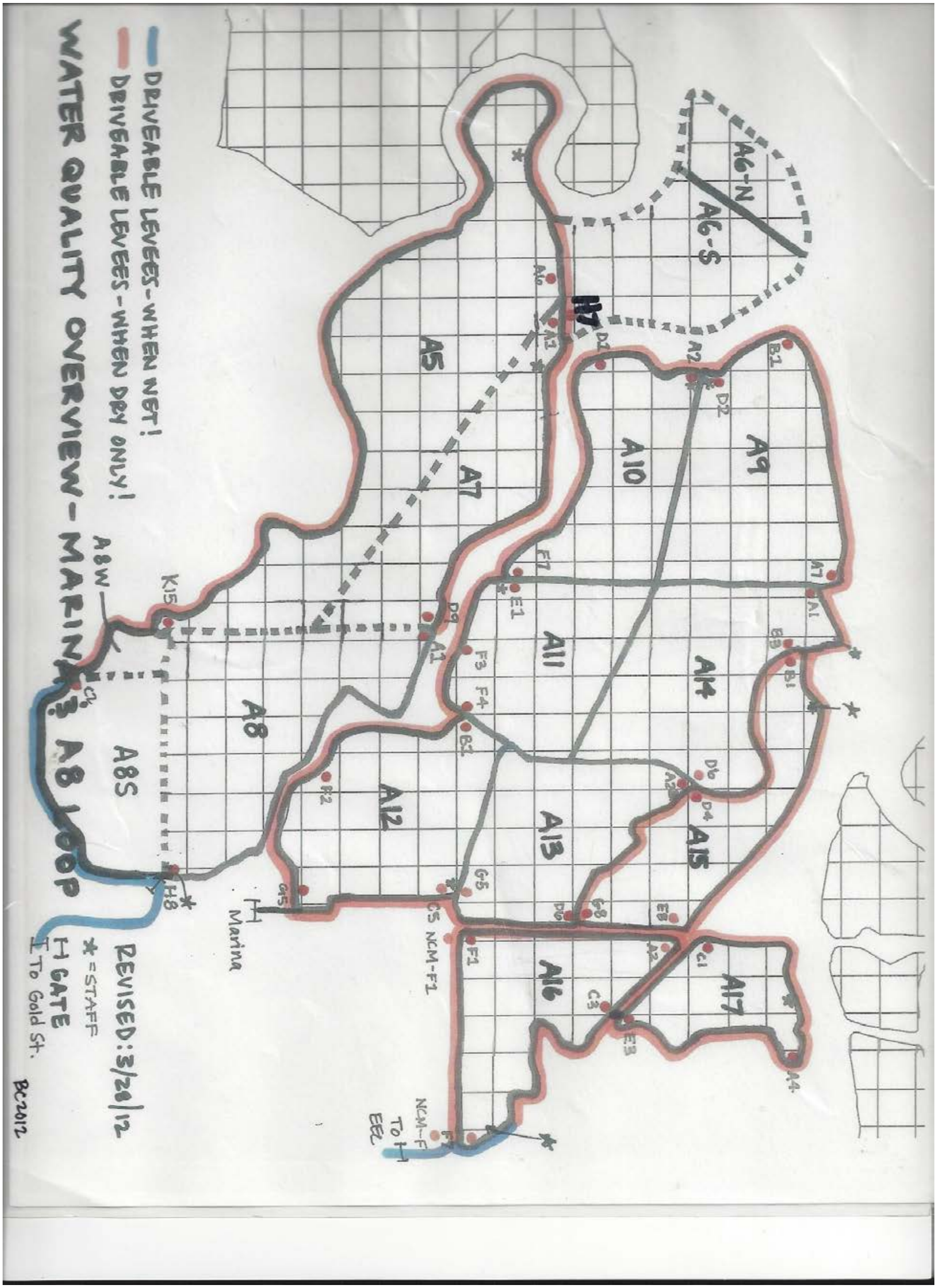
For R1 and R2, during summer operations, these ponds remain dry for snowy plover nesting habitat. During winter operations, one of the intakes approximately is opened ~ 20”, and left open for several weeks to cover the pond bottom in R1 and R2 for the waterfowl hunting season, Oct–Jan.

If there is a build-up of vegetation on R3 and R4, then flood up the ponds to cover the pond bottom after nesting season by bringing in water: R1-R2-R3-R4. Let the water evaporate to expose pond bottom in time for nesting season. Drying time is at least a few months depending on rain. This was last done in ~2009.

LEVEE DRIVING AND STAFF GAUGE MAPS

Updated May 2012, by Stacy Moskal USGS




DRIVEABLE LEVEES - WHEN WET!
DRIVEABLE LEVEES - WHEN DRY ONLY!
WATER QUALITY OVERVIEW - MARINA 3 A8 LOOP
REVISED: 3/20/12
* = STAFF
H GATE
To Gold St.
Marina
A5
A6-N
A6-S
A7
A8
A8S
A9
A10
A11
A12
A13
A14
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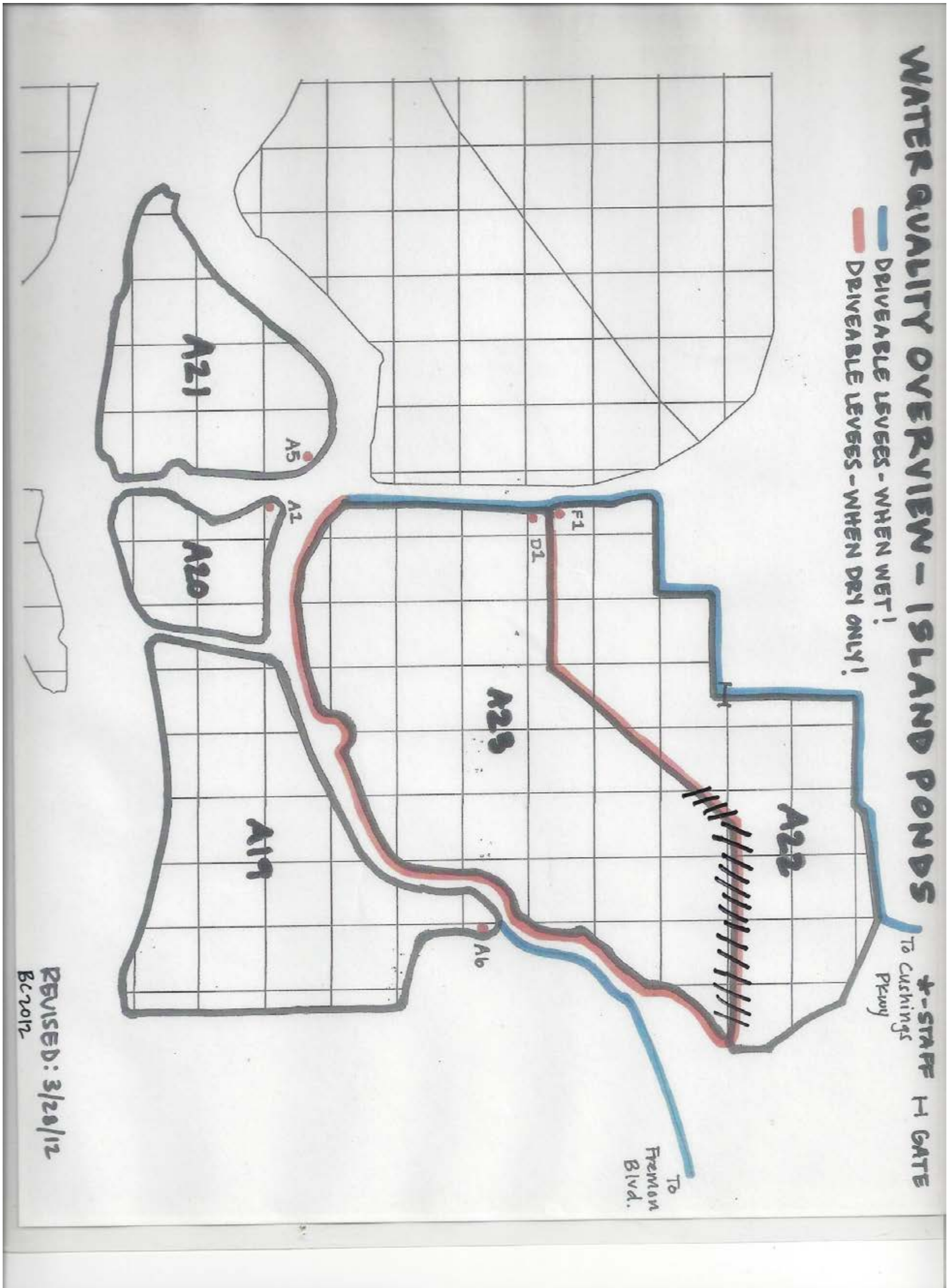
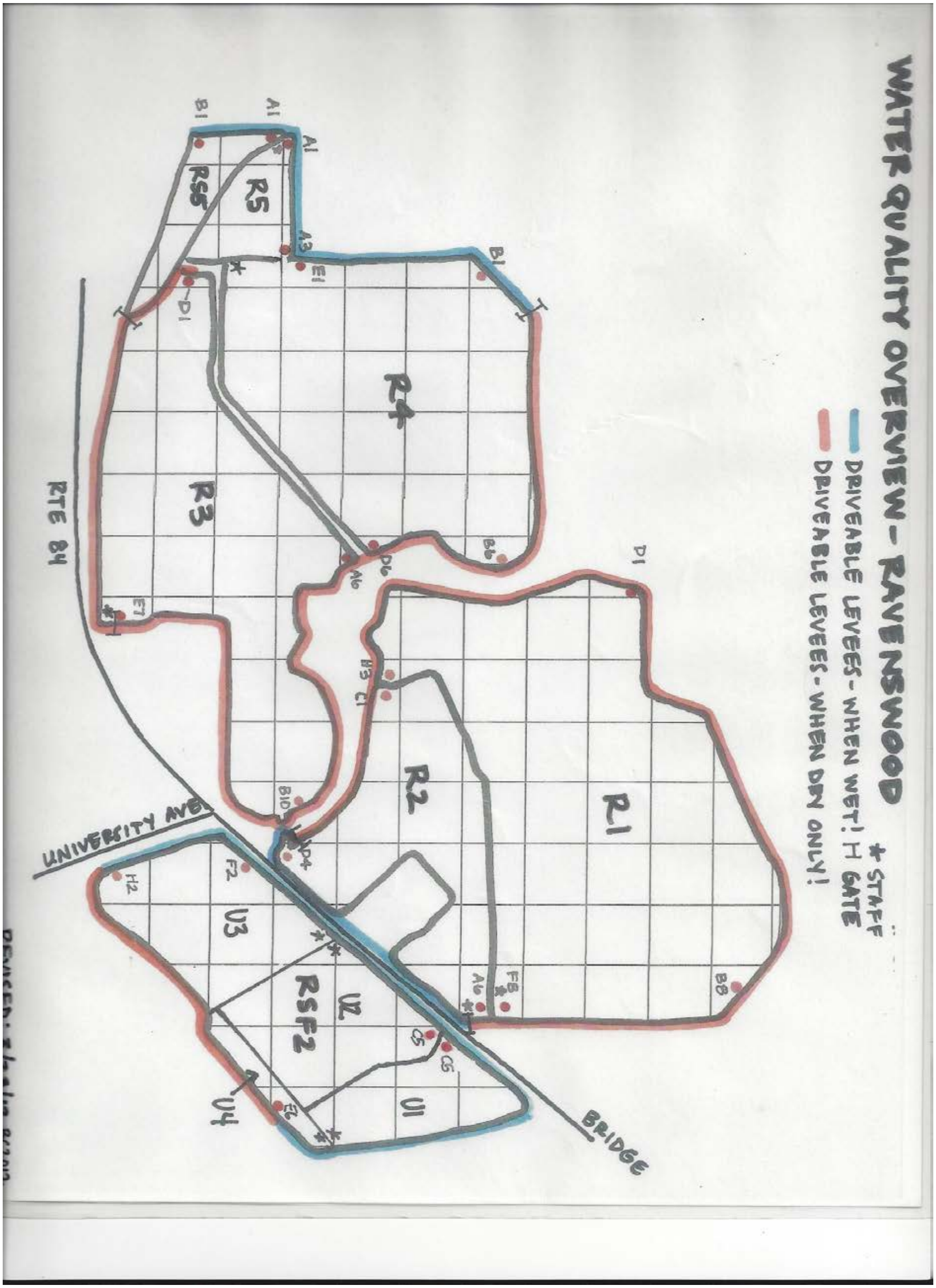
A16
A17
BC2012


WATER QUALITY OVERVIEW – ISLAND PONDS
DRIVEABLE LEVEES - WHEN WET!
DRIVEABLE LEVEES - WHEN DRY ONLY!
*-STAFF
GATE
To Cushings Pkwy
To Fremont Blvd.
A21
A20
A19
A23
A22
A5
A1
F1
D1
A6
REVISED: 3/20/12
BC2012


WATER QUALITY OVERVIEW - RAVENSWOOD
* STAFF
DRIVEABLE LEVEES - WHEN WET! H GATE
DRIVEABLE LEVEES - WHEN DRY ONLY!
R1
R2
R3
R4
R5
RSF2
U1
U2
U3
U4
RTE 84
UNIVERSITY AVE
BRIDGE