Pond A18
2015 Annual Self Monitoring Report

Reporting Period:
June 1- October 31, 2015

San José-Santa Clara Regional Wastewater Facility
2015 Pond A18 Annual Report

Order No. R2-2005-0003

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I. Introduction

This report summarizes 2015 water quality monitoring for Pond A18. Monitoring began June 1st and ended October 31st as required by the Waste Discharge Requirement (WDR) Order No. R2-2005-0003 (Order) and subsequent modifications to the Order as approved by the Executive Officer of the San Francisco Bay Regional Water Quality Control Board (Water Board).

This was the eleventh year of continuous discharge monitoring for Pond A18. The City of San José (City) shares weekly data and management strategies with the Water Board. Figure 1 indicates the location of Pond A18 hydraulic control structures and sampling sites in the receiving waters (Artesian Slough).

A. Waste Discharge Requirements

Pond A18 circulates San Francisco Bay (Bay) water by means of two hydraulic control structures located at the northern and southern ends of the levee bounding the western edge of the pond. Discharge of pond water back into the Bay via Artesian Slough is regulated by the WDR and the water quality of the pond must meet specific general water quality limits (Table 1).

Table 1. Pond A18 discharge requirements for salinity, dissolved oxygen (DO) and pH

Constituent	Instantaneous Maximum	Instantaneous Minimum	Units
Salinity	44		ppt
Dissolved Oxygen		5.0	mg/L
pH	8.5	6.5	

Pond A18 must meet the following water quality requirements:

1. Discharge temperature into Artesian Slough shall not exceed the receiving water temperature by 20°F.
2. If pond dissolved oxygen (DO) levels at station A-A18-D fall below 1.0 mg/L, the discharger shall monitor, report, and take corrective actions required by Provision D.2.

B. Monitoring Requirements

Monitoring in 2015 was conducted in compliance with the A18 WDR monitoring requirements on page 9, Table 2 of the Self-Monitoring Program of Order No. R2-2005-0003, and subsequent revisions to the WDR. The City continuously monitored (15-min intervals) Pond A18 discharge from 1 June to 31 October, 2015 for DO, pH, temperature, and salinity. Additionally, chlorophyll-*a*, DO, pH, temperature, and salinity were measured between 0800 and 1000 once per month in the pond. Further, City staff recorded both surface and bottom DO, pH, temperature, salinity, and turbidity measurements by discrete grab sampling on a monthly interval at four monitoring stations in the receiving waters (Artesian Slough).
Following the 2012 annual report, the continuous monitoring requirement for receiving water was modified with approval from the Water Board Executive Officer Bruce Wolfe via a letter

dated 9 April, 2013. In 2015, the receiving water was monitored with weekly discrete water column measurements in response to the pond's weekly 10th percentile DO concentration falling below the 3.3 mg/L trigger threshold. Per a modification to the WDR in 2010, the previous requirement for annual sampling of pond sediment mercury and methyl mercury was modified to require receiving water mercury and methyl mercury monitoring in August or September every other year. This monitoring was last conducted in September 2013 and was conducted again in September 2015.

C. Northern Structure Rebuild and Altered Operations in 2015

Pond operations were substantially different for the first two and a half months of the 2015 monitoring season compared to all previous years. From May 28 through August 18, 2015 exchange of water between the pond and the slough was accomplished using a single water control structure. This was necessary due to significant deterioration of the northern hydraulic control structure (the intake point under standard continuous circulation operations) requiring a complete rebuild of the structure to avoid levee failure and breach. A more detailed description of the construction of a new northern hydraulic control structure is later in this report (IV. Discussion and Interpretation of 2015 Results). While the northern structure was demolished and rebuilt under an emergency permit from the Army Corps of Engineers, the southern structure was operated as either an intake point (with no discharges from the pond) or a discharge point (with no water flowing into the pond) for several days at a time during the construction period. The altered operations and the conditions that required the altered operations were communicated to the Water Board in advance and approved by the Water Board via letter dated June 12, 2015.

Because water exchange is governed by gravity flow, water can only flow into the pond or out of the pond at any given moment. The volume and rate of flow that can be achieved at any given time is governed by the water surface elevation difference between the pond water and the slough water and the amount the 1-way flap gates on the ends of the two 48" pipes are open. An objective of standard pond operations is to maintain a consistent pond water depth over time. Since this was not possible with a single exchange point operated by alternating between intake and discharge, the City used the following approved criteria to determine when to change the direction of flow through the southern structure with the goal of maintaining as consistent a range of pond water depths as possible, and maximizing flushing of water from the pond:

- Intake until the pond water elevation reaches a depth of 3.3 feet as measured by the staff gauge located on the southern structure. At that point, the City will reverse the valve setting for the southern structure so it will cease to intake Artesian Slough water and will be set to discharge pond water.
- Discharge until the pond water elevation reaches a depth of 2.8 feet as measured by the staff gauge located on the southern structure. At that point, the City will reverse the valve setting for the southern structure so it will cease to discharge pond water and will be set to again intake Artesian Slough water.

The pond was operated in this fashion until August 18, 2015 when standard operations were resumed. During the modified operations, pond water quality was monitored at the southern structure, and 10th percentile weekly DO values calculated on discharge water only.

II. Monitoring Methods and Results

San José-Santa Clara Regional Wastewater Facility (Facility) biologists used water quality monitoring sondes manufactured by YSI, Inc. for general water quality monitoring (DO, pH, temperature, salinity). The 6600 model sonde was deployed for continuous monitoring, while the 600 XLM sonde was used for discrete monitoring. All sondes were outfitted with an optical DO probe, a conductivity/temperature probe, and a pH probe.

A. Quality Assurance/Quality Control

Facility biologists calibrated and maintained sondes to ensure accuracy before deploying. After each use, staff checked sondes for their accuracy against known standards for conductivity, pH and DO. An unattended 6600 sonde was deployed for 1 or 2 weeks and then replaced with another cleaned and calibrated sonde.

Data Validation

Staff followed established acceptance criteria for sonde data with post-deployment readings within 5% of the theoretical level accepted. Data between 5 -10% were accepted or rejected based on best professional judgment. Staff rejected data with post deployment readings exceeding 10% of theoretical and investigated the cause of such failures.

Facility biologists used the following standards for calibrations and post-deployment accuracy checks:

- DO – percent saturation in water-saturated air (theoretical of 100% saturation).
- pH - a 2-point calibration (pH 7 and pH 10) to establish a pH slope.
- Conductivity - 50,000 microSiemens standard.

Two post-deployment QA/QC failures for pH occurred in 2015. These failures, for the weeks of June 9 through June 16 and October 20 through October 27, were due to water intrusion resulting in sonde malfunction. Based on best professional evaluation of the corresponding data, only the pH data was subsequently invalidated and rejected while the other water quality monitoring data for these periods was accepted.

Figure 1. Artesian Slough and A18 Monitoring Stations and Hydraulic Control Structures
Arrows indicate the current directional flow of water through the water control structures.

B. Continuous Monitoring

Staff monitored Pond A18 discharge (Station A18-D) for temperature, salinity, pH, and DO from June 1, 2015 to October 31, 2015 (Figure 1).

Sondes recorded water quality data every 15 minutes. Following deployment, staff uploaded these data to a computer where they were validated, summarized, and evaluated with respect to discharge requirements and action triggers. Weekly 10th percentile DO readings for pond discharge indicated the need for any adaptive management responses during the upcoming week. Examples of such responses included additional receiving water monitoring or strategic timing of pond discharges to limit low DO discharge. Water Board was frequently updated following evaluation of monitoring datasets.

Temperature

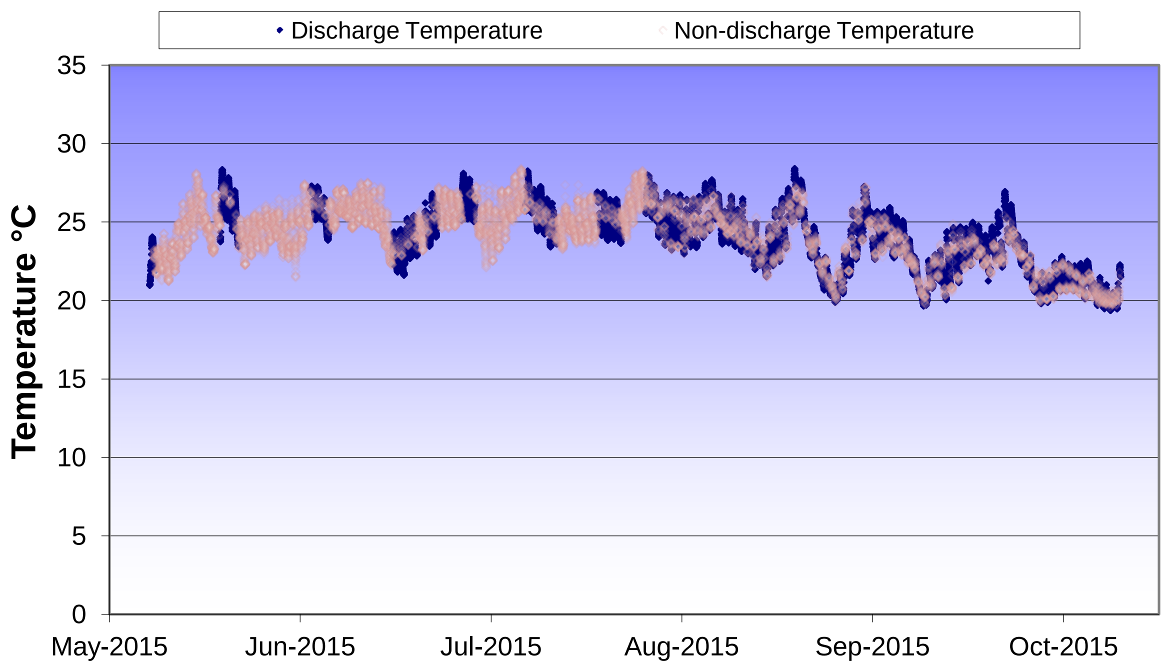
Water temperature for Pond A18 discharge is presented in Table 2.

Table 2. Temperature results – 2015 continuous monitoring (°C)

Site/Condition	Minimum	Maximum	Mean	Median	# of Measurements (n)
A18 Discharge	19.4	28.4	23.8	23.9	6,667
A18 Non-Discharge	19.6	28.4	24.5	24.7	7,972

Pond temperature varied little between discharge and non-discharge periods (Table2; Figure 2).

Figure 2. Temperature Profile – Pond A18 2015 Dry Season



Salinity

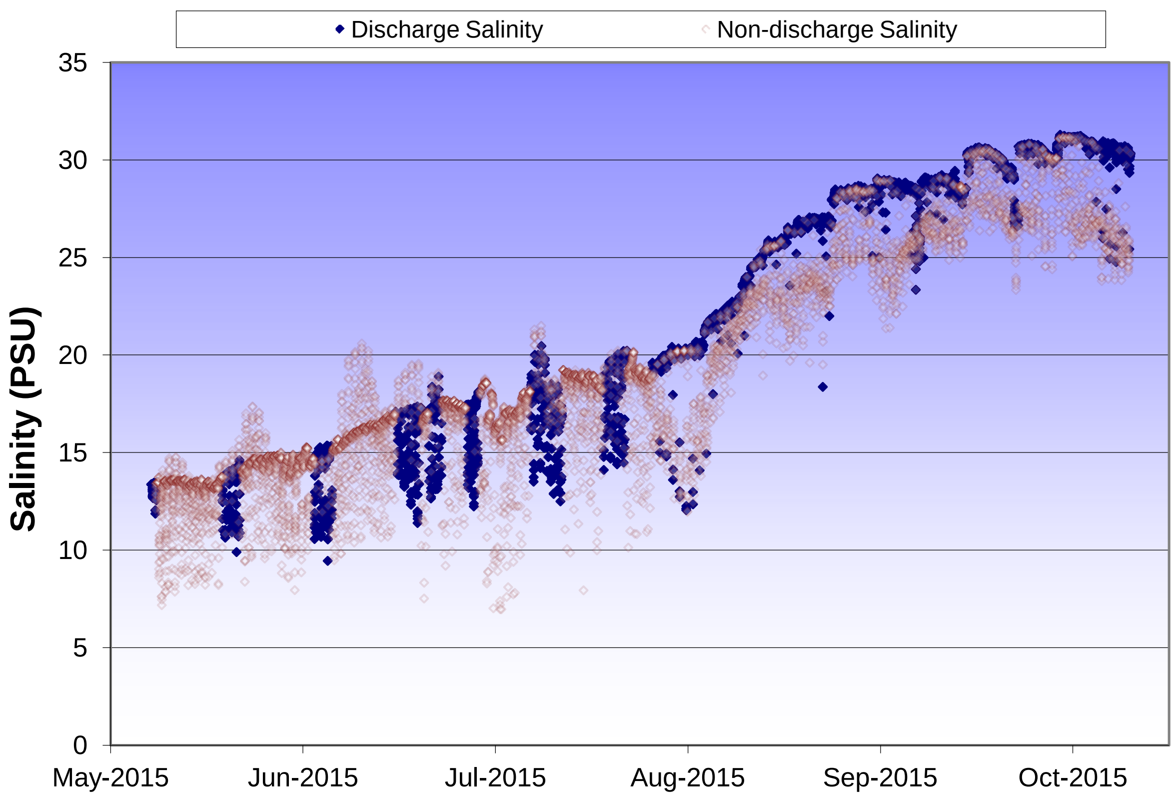
Pond salinity, under both discharge and non-discharge conditions, is detailed in Table 3.

Table 3. Salinity results - 2015 continuous monitoring (PSU[1])

Site/Condition	Minimum	Maximum	Mean	Median	# of Measurements (n)
A18 Discharge	9.5	31.3	24.0	26.3	6,705
A18 Non-Discharge	7.0	31.2	18.3	17.0	7,971

Discharge salinity remained below 44 PSU at all times during the 2015 monitoring period. Pond salinity was considerably lower than prior years from June through mid-August, with an average discharge salinity of 16.3 PSU. This condition is the result of using the southern hydraulic structure to pulse Facility effluent rich slough water into and out of the pond during the re-construction of the northern structure. Discharge salinity gradually increased when construction activities were completed and the normal operating flow regime was restored in mid-August, with salinity steadily climbing through the remainder of the monitoring season and peaking in late October (Figure 3).

Figure 3. Salinity Profile - Pond A18 2015 Dry Season



[1] Practical Salinity Units (PSU) are a measurement of salinity from the specific conductance measured in water. An algorithm based on the ion composition of natural sea water converts specific conductance into PSU. One PSU is approximately equivalent to one part-per-thousand salinity.

pH

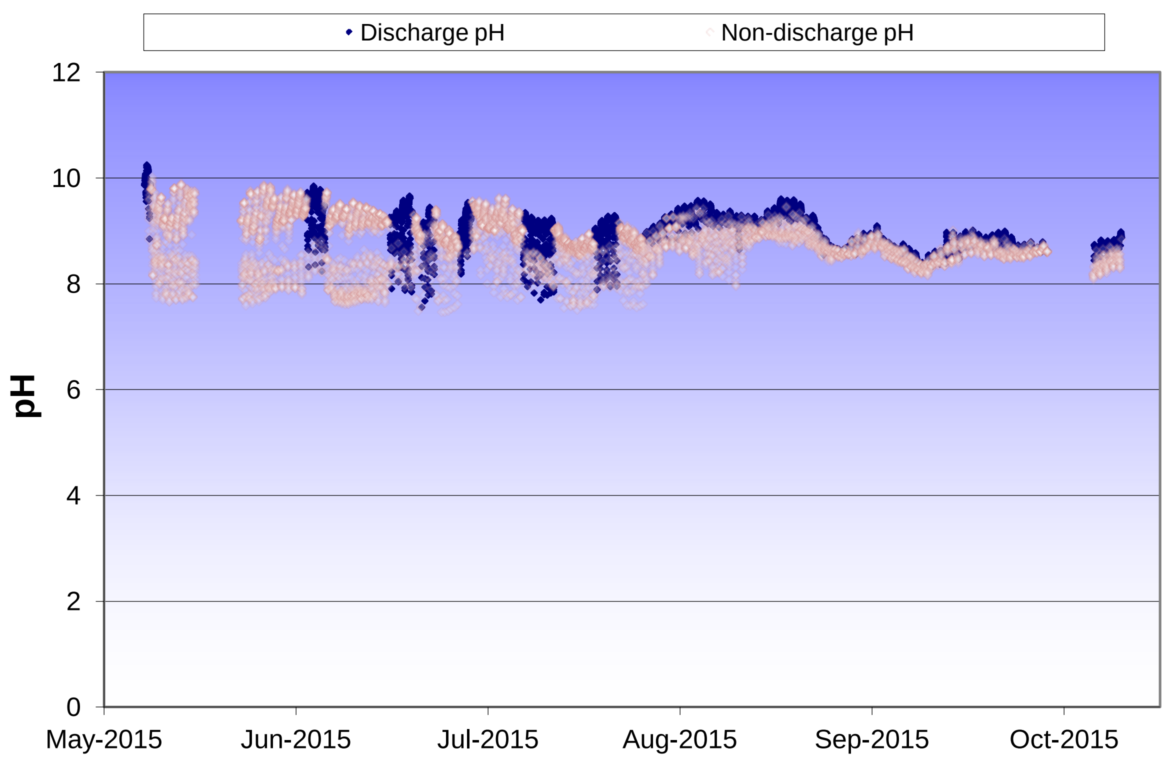
The pH of the pond discharge, under discharge and non-discharge conditions, is shown in Table 4.

Table 4. pH results - 2015 continuous monitoring

Site/Condition	Minimum	Maximum	Mean	Median	# of Measurements (n)
A18 Discharge	7.6	10.3	9.0	8.9	5,992
A18 Non-Discharge	7.5	10.0	8.8	8.8	7,307

The Basin Plan Objective requires that receiving water pH remain between 6.5 and 8.5. However, receiving water data was not recorded during 2015 dry season continuous monitoring. The pulsing of slough water into and out of the pond caused pond pH levels to vary more than years past, ranging between 8 and 9.5 early in the season. Once the normal flow regime was resumed after construction of the northern structure was completed, pH increased steadily to a peak in early September. The pH gradually declined through the remainder of the monitoring season (Figure 4). This pattern is consistent with years past, with pH increases due to intense photosynthesis when solar irradiance and water temperature is high, followed by declines in pH when algae undergoes decomposition later in the season. These conditions generally coincide with shifts in the phytoplankton species composition.

Figure 4. pH Profile - Pond A18 2015 Dry Season



Dissolved Oxygen

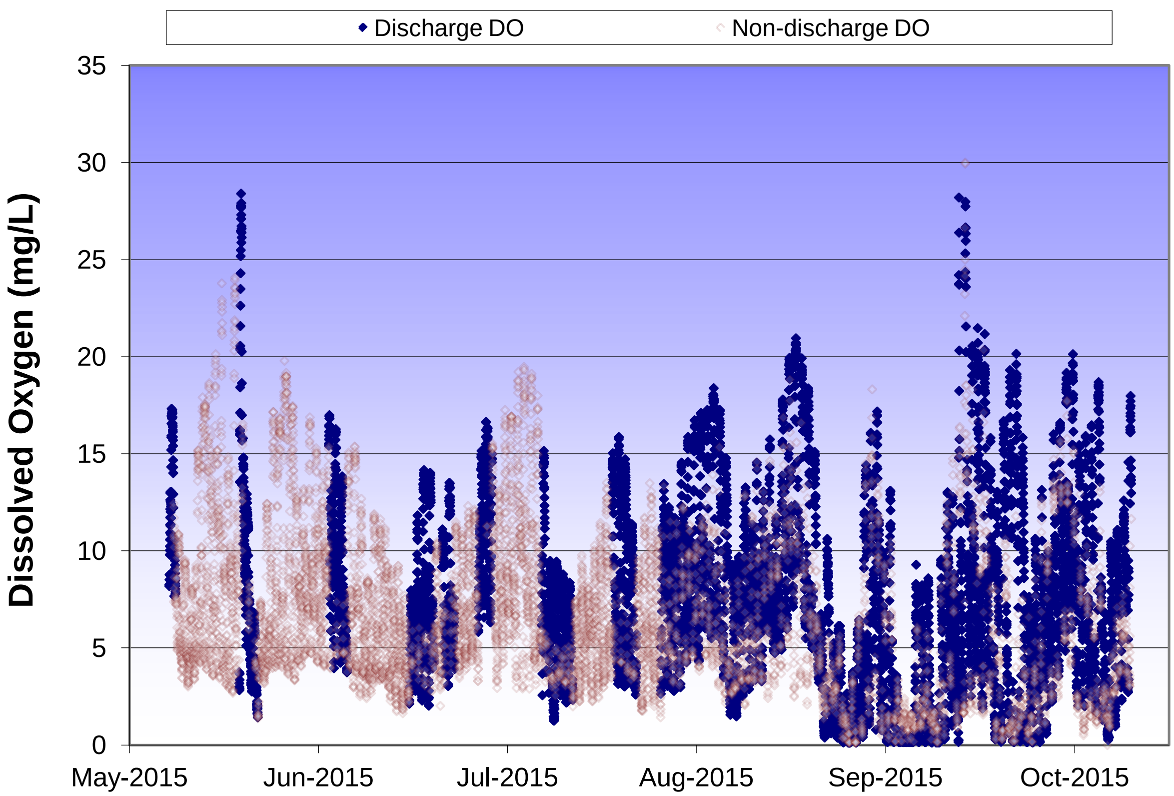
DO concentrations in the pond discharge, under both discharge and non-discharge conditions, are summarized in Table 5.

Table 5. DO results - 2015 continuous monitoring (mg/L)

Site/Condition	Minimum	Maximum	Mean	Median	# of Measurements (n)
A18 Discharge	0.1	28.4	7.4	6.8	6,650
A18 Non-Discharge	0.1	30.0	6.9	6.1	7,981

Pond DO is primarily influenced by a photosynthesis driven diurnal pattern (Figure 5) of high primary productivity by algae during the day and high net ecosystem respiration at night. Other factors influencing pond DO to lesser degrees include intensity and duration of sunlight/cloud cover, temperature, time of day, and algal community composition.

Figure 5. Dissolved Oxygen Profile - Pond A18 2015 Dry Season



A letter from the Water Board's Executive Officer Bruce Wolfe dated 9 April, 2013 eliminated the requirement of continuous receiving water monitoring. As in 2014, the City's trigger response in 2015 consisted of weekly discrete water column measurements at Stations 1, 2, and 3 in Artesian Slough (Figure 1). Trigger monitoring was conducted nine times in 2015

(Table 6) and revealed no negative effects from episodic low DO pond discharges, therefore, no additional adaptive management or monitoring actions were implemented.

Table 6. Weekly 10th percentile DO values for Pond A18 discharge and response in 2015

Week and Date Range	10th Percentile Value (mg/L)	Response
1: 6/1/15 – 6/9/15	8.4	None Required
2: 6/9/15 – 6/16/15	3.0	Trigger monitoring initiated 6/24 – No impacts
3: 6/16/15 – 6/23/15	na	Pond valves closed – Zero discharge to bay
4: 6/23/15 – 6/30/15	4.9	None Required
5: 6/30/15 – 7/7/15	na	Pond valves closed – Zero discharge to bay
6: 7/7/15 – 7/14/15	3.3	None Required
7: 7/14/15 – 7/21/15	5.1	None Required
8: 7/21/15 – 7/28/15	7.4	None Required
9: 7/28/15 – 8/4/15	2.6	Trigger monitoring conducted 8/6 – No impacts
10: 8/4/15 – 8/11/15	4.7	None Required
11: 8/11/15 – 8/18/15	3.4	None Required
12: 8/18/15 – 8/25/15	4.3	None Required
13: 8/25/15 – 9/1/15	2.8	Trigger monitoring initiated 9/3 – No impacts
14: 9/1/15 – 9/8/15	4.1	None Required
15: 9/8/15 – 9/15/15	1.5	Trigger monitoring conducted 9/16 – No impacts
16: 9/15/15 – 9/22/15	0.3	Trigger monitoring initiated 9/22 – No impacts
17: 9/22/15 – 9/29/15	0.2	Trigger monitoring conducted 9/29 – No impacts
18: 9/29/15 – 10/6/15	0.2	Trigger monitoring initiated 10/6 – No impacts
19: 10/6/15 – 10/13/15	1.3	Trigger monitoring conducted 10/14 – No impacts
20: 10/13/15 – 10/20/15	0.2	Trigger monitoring initiated 10/21 – No impacts
21: 10/20/15 – 10/27/15	3.5	None Required
22: 10/27/15 – 10/31/15	1.3	Results not representative of full week's dataset

General Observations

Pond water color and clarity varied from years past during the 2015 monitoring season, resultant of managing the southern hydraulic structure to pulse slough water into and out of the pond during the re-construction of the northern structure. Throughout June, pond water was green and color and very clear, indicative of low phytoplankton concentrations. In mid-June, filamentous algal mats covered the surface of the eastern portion of Pond A18, with slender fingers extending towards the northern periphery of the pond. In late June, benthic algal mats accumulated along the margins. These conditions extended through July and into early August. In mid-August, the water color shifted to a brighter shade of green, indicating increased concentration of phytoplankton. The algae along the pond's margins receded, and biota, including grass shrimp and prickly sculpin, were observed in the sonde apparatus during retrievals. On August 18th, construction of the pond's northern hydraulic structure was completed and the normal flow regime (intake through northern and outflow through southern structure) was restored. Throughout September, the pond became increasingly murky and water color shifted from bright green to greenish-brown. This transition in water color has been historically accompanied by low DO values, and coincides with a series of trigger events beginning in September 2015. These conditions continued through October to the close of the monitoring season.

City of San José biologist, Bryan Frueh collects a discrete water sample from Artesian Slough.

C. Discrete Monitoring

The WDR requires discrete water quality monitoring in both the pond and receiving water at monthly intervals.

Receiving Water Discrete Monitoring

Discrete monthly water quality sampling is required at four receiving water locations (Figure 1) during the monitoring season. These surface and bottom measurements of DO, pH, temperature, salinity and turbidity (Table 7) characterize the mixing of fresh slough water with Bay salt water during tidal exchange, and illustrate the effects (if any) that Pond A18 discharge may have on water quality. The WDR requires these measurements are recorded while the pond is discharging.

Table 7. Artesian Slough monthly surface and bottom water quality measurements

Date and Time	Site	Tide	Depth	Temp (°C)	Salinity (PSU)	pH	DO (mg/L)	Turbidity	A18 Flow (cfs)
6/24/2015 11:28	1	Ebb	Top	26.1	1.0	7.6	8.2	1.0	36.6
6/24/2015 11:29	1	Ebb	Bottom	26.1	0.9	7.5	8.1	1.0	36.6
7/15/2015 11:31	1	Flood	Top	26.8	0.9	7.2	7.5	0.9	67.1
7/15/2015 11:32	1	Flood	Bottom	24.0	17.0	8.5	5.4	12.6	67.1
8/12/2015 10:41	1	Flood	Top	27.1	1.3	7.2	7.0	1.2	65.6
8/12/2015 10:42	1	Flood	Bottom	24.3	19.5	8.8	4.7	9.0	65.6
9/21/2015 12:37	1	Ebb	Top	27.5	1.9	7.7	7.4	1.8	32.2
9/21/2015 12:39	1	Ebb	Bottom	24.0	26.1	8.4	3.9	21.5	32.2
10/26/2015 9:28	1	Flood	Top	25.6	0.7	7.1	6.5	1.4	15.6
10/26/2015 9:30	1	Flood	Bottom	21.2	19.0	7.4	5.0	12.6	13.8
6/24/2015 11:11	2	Ebb	Top	25.9	1.7	7.5	7.0	1.3	36.6
6/24/2015 11:13	2	Ebb	Bottom	24.0	13.4	8.3	3.6	10.3	36.6
7/15/2015 11:39	2	Flood	Top	26.1	6.8	8.2	6.8	3.1	67.1
7/15/2015 11:41	2	Flood	Bottom	24.1	15.2	7.9	4.6	13.2	67.1
8/12/2015 10:54	2	Flood	Top	26.7	5.0	8.1	6.9	3.6	61.9
8/12/2015 10:57	2	Flood	Bottom	24.5	18.1	8.3	4.1	19.7	61.9

Date and Time	Site	Tide	Depth	Temp (°C)	Salinity (PSU)	pH	DO (mg/L)	Turbidity	A18 Flow (cfs)
9/21/2015 12:15	2	Ebb	Top	27.0	5.0	7.8	8.0	2.2	30.1
9/21/2015 12:18	2	Ebb	Bottom	23.8	26.0	8.4	2.6	20.2	30.1
10/26/2015 9:37	2	Flood	Top	24.0	5.7	7.5	6.3	4.6	13.8
10/26/2015 9:39	2	Flood	Bottom	20.8	20.1	7.7	3.7	26.2	13.8
6/24/2015 10:56	3	Ebb	Top	24.9	4.1	7.6	5.3	7.7	37.9
6/24/2015 10:59	3	Ebb	Bottom	23.8	12.4	8.2	2.3	17.8	37.9
7/15/2015 11:58	3	Flood	Top	25.7	14.5	7.9	3.9	29.4	62.6
7/15/2015 11:59	3	Flood	Bottom	23.7	19.0	7.5	2.8	56.4	62.6
8/12/2015 11:06	3	Flood	Top	25.0	17.0	8.0	3.5	29.3	57.0
8/12/2015 11:08	3	Flood	Bottom	24.0	19.3	7.7	2.8	71.0	57.0
9/21/2015 12:03	3	Ebb	Top	26.8	6.6	7.8	7.0	5.3	28.3
9/21/2015 12:04	3	Ebb	Bottom	24.4	24.0	8.2	1.5	13.9	28.3
10/26/2015 9:53	3	Flood	Top	20.3	19.4	7.5	3.5	5.3	11.8
10/26/2015 9:54	3	Flood	Bottom	20.3	19.5	7.5	3.0	37.7	11.8
6/24/2015 10:43	4	Ebb	Top	24.6	6.3	7.7	4.7	15.6	39.1
6/24/2015 10:45	4	Ebb	Bottom	23.1	15.1	7.6	1.7	21.7	37.9
7/15/2015 12:13	4	Flood	Top	23.3	24.1	7.7	4.1	80.9	57.9
7/15/2015 12:15	4	Flood	Bottom	23.2	24.4	7.7	4.1	89.1	52.7
8/12/2015 11:17	4	Flood	Top	23.7	24.7	7.8	3.8	60.7	51.8
8/12/2015 11:18	4	Flood	Bottom	23.6	25.3	7.8	3.9	53.1	51.8
9/21/2015 11:47	4	Ebb	Top	26.4	8.5	7.9	6.3	8.8	26.6
9/21/2015 11:49	4	Ebb	Bottom	23.5	22.4	7.7	1.7	16.3	26.6
10/26/2015 1004	4	Flood	Top	19.7	24.9	7.6	4.2	41.5	9.3
10/26/2015 1005	4	Flood	Bottom	19.7	24.9	7.6	4.2	59.4	9.3

Trigger Monitoring and Adaptive Management Actions

In 2015, the response to Pond A18's weekly 10th percentile DO concentration falling below the trigger threshold of 3.3 mg/L consisted of recording additional weekly discrete water column measurements at stations 1, 2, and 3 in Artesian Slough (Figure 1). Monitoring was performed in response to the trigger events in weeks 3, 9, 13, and 15 through 20 and results are detailed in Table 8. Due to a mechanical problem with our outboard (impeller failure), data could be collected from only Station 1 on 10/14/15 in response to the week 19 trigger event. Additionally, shallow water prevented the collection of measurements at Site 1 on 9/29/2015.

Ryan Mayfield records water quality measurements using a multi-probe YSI.

Trigger monitoring detects negative impacts of pond discharge on receiving water quality. Any confirmed negative impacts trigger additional adaptive management actions (e.g., additional water quality monitor ing or valve adjustments). Negative impacts from pond discharges are defined as follows:

- Receiving water DO is < 5.0 mg/L at surface or < 3.3 mg/L at the bottom at Artesian Station 2.
- Pond DO remains below the 10th percentile trigger value

Low DO conditions in the receiving water must be linked to Pond A18 discharge to necessitate additional adaptive management measures. In 2015, there were two instances when receiving water DO measured less than 3.3 mg/L at the bottom at Artesian Slough station 2 (2.2 mg/L on 8/6/2015 and 2.5 mg/L on 10/6/2015). Accordingly, continuous sonde data in the pond was evaluated to determine if pond discharge contributed to these receiving water values, and in each instance pond DO measured higher than the corresponding receiving water DO (average 1-hr pond DO was 3.6 mg/L on 8/6/15 and 3.3 mg/L on 10/6/15). Therefore, additional management actions were not implemented.

Table 8. Discrete trigger monitoring results in 2015

Date and Time	Site	Tide	Depth	Temp (°C)	Salinity (PSU)	pH	DO (mg/L)
6/24/2015 11:28	1	Ebb	Top	26.1	1.0	7.6	8.2
6/24/2015 11:29	1	Ebb	Bottom	26.1	0.9	7.5	8.1
6/24/2015 11:11	2	Ebb	Top	25.9	1.7	7.5	7.0
6/24/2015 11:13	2	Ebb	Bottom	24.0	13.4	8.3	3.6
6/24/2015 10:56	3	Ebb	Top	24.9	4.1	7.6	5.3
6/24/2015 10:59	3	Ebb	Bottom	23.8	12.4	8.2	2.3
8/6/2015 10:01	1	Ebb	Top	26.9	1.2	7.2	6.2
8/6/2015 10:03	1	Ebb	Bottom	25.8	9.5	7.2	4.5
8/6/2015 10:18	2	Ebb	Top	26.6	2.9	7.2	5.4
8/6/2015 10:19	2	Ebb	Bottom	24.3	18.9	7.5	2.2
8/6/2015 10:35	3	Ebb	Top	25.6	6.7	7.4	4.9
8/6/2015 10:37	3	Ebb	Bottom	24.1	19.6	7.5	1.6
9/3/2015 10:33	1	Ebb	Top	26.8	1.2	7.2	7.3
9/3/2015 10:34	1	Ebb	Bottom	26.9	1.1	7.3	7.3
9/3/2015 10:37	2	Ebb	Top	26.1	5.5	7.9	6.8
9/3/2015 10:39	2	Ebb	Bottom	23.3	23.3	8.9	5.2
9/3/2015 10:43	3	Ebb	Top	25.0	11.7	8.3	5.6
9/3/2015 10:45	3	Ebb	Bottom	23.9	16.7	8.5	4.8
9/16/2015 11:03	1	Flood	Top	26.4	.8	7.6	7.5
9/16/2015 11:05	1	Flood	Bottom	23.3	17.7	8.3	3.8
9/16/2015 11:08	2	Flood	Top	24.4	9.4	8.0	6.8
9/16/2015 11:09	2	Flood	Bottom	20.6	24.1	8.0	6.2
9/16/2015 11:15	3	Flood	Top	22.7	15.0	8.0	4.1
9/16/2015 11:16	3	Flood	Bottom	22.3	15.9	8.30	3.4
9/22/2015 11:34	1	Ebb	Top	26.7	3.8	7.6	6.0
9/22/2015 11:35	1	Ebb	Bottom	25.1	18.2	8.2	1.9
9/22/2015 11:38	2	Ebb	Top	26.9	4.7	7.8	6.4
9/22/2015 11:39	2	Ebb	Bottom	25.1	20.8	8.2	3.9
9/22/2015 11:42	3	Ebb	Top	26.3	6.8	7.8	6.6
9/22/2015 11:43	3	Ebb	Bottom	24.4	19.9	7.9	2.9

Date and Time	Site	Tide	Depth	Temp (°C)	Salinity (PSU)	pH	DO (mg/L)
9/29/2015 09:28	1	Flood	Top	26.3	1.2	7.9	7.5
9/29/2015 09:28	1	Flood	Bottom	No data	No data	No data	No data
9/29/2015 09:31	2	Flood	Top	25.1	9.4	7.8	6.6
9/29/2015 09:32	2	Flood	Bottom	23.2	20.3	8.1	4.2
9/29/2015 09:37	3	Flood	Top	23.4	15.8	8.2	6.0
9/29/2015 09:38	3	Flood	Bottom	23.4	15.9	8.3	5.6
10/6/2015 12:12	1	Ebb	Top	26.2	2.1	7.6	6.0
10/6/2015 12:12	1	Ebb	Bottom	21.4	21.7	7.6	2.7
10/6/2015 12:12	2	Ebb	Top	25.6	4.9	7.5	6.5
10/6/2015 12:12	2	Ebb	Bottom	21.6	21.1	7.7	2.5
10/6/2015 12:12	3	Ebb	Top	25.2	6.4	7.6	7.3
10/6/2015 12:12	3	Ebb	Bottom	21.3	23.8	7.8	1.5
10/14/2015 12:18	1	Flood	Top	26.5	4.7	7.2	9.0
10/14/2015 12:20	1	Flood	Bottom	24.5	15.2	7.8	4.9
10/14/2015 12:20	2	Flood	Top	No data	No data	No data	No data
10/14/2015 12:20	2	Flood	Bottom	No data	No data	No data	No data
10/14/2015 12:20	3	Flood	Top	No data	No data	No data	No data
10/14/2015 12:20	3	Flood	Bottom	No data	No data	No data	No data
10/21/2015 13:27	1	Ebb	Top	26.3	0.9	7.4	7.2
10/21/2015 13:27	1	Ebb	Bottom	21.3	25.3	8.1	4.0
10/21/2015 13:27	2	Ebb	Top	21.6	0.0	7.6	8.2
10/21/2015 13:27	2	Ebb	Bottom	22.2	18.4	8.0	4.3
10/21/2015 13:27	3	Ebb	Top	25.0	5.3	7.7	7.7
10/21/2015 13:27	3	Ebb	Bottom	21.6	19.8	7.9	4.3

Pond Discrete Monitoring

The WDR requires the collection of discrete water quality measurements in Pond A18 once per month. Monthly discrete DO and chlorophyll a readings for the pond need to be taken between 0800 and 1000 hours. Staff measured the discrete pond water quality using temperature, salinity, pH, and DO from the continuous discharge monitoring sonde to fulfill these discrete monitoring requirements (Table 9). These measurements were recorded at the same date and time as the required monthly chlorophyll *a* sampling.

Table 9. Discrete monthly water quality measurements at A18 discharge

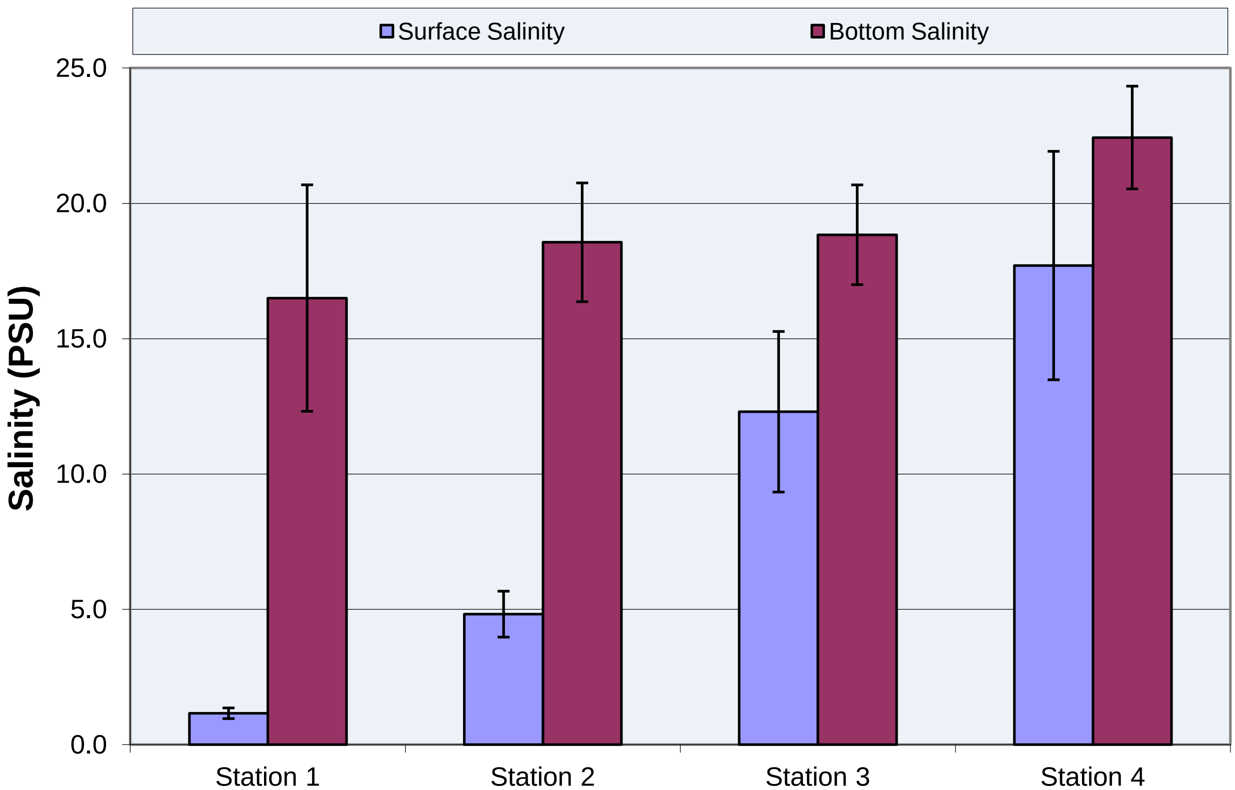
Date and Time	Temperature (C)	Salinity (PSU)	pH	DO (mg/L)
6/16/2015 09:30	22.3	15.1	No data	3.4
7/21/2015 09:30	25.7	17.4	9.1	7.8
8/11/2015 09:30	24.3	18.8	8.9	5.6
9/29/2015 08:00	25.5	22.2	9.2	2.1
10/20/2015 09:45	20.1	30.1	8.6	3.2

Temperature

Receiving water temperature decreased in a downstream direction and with depth (Table 7). The pond is large and shallow with a limited flow so pond water temperature is highly influenced by ambient air temperature (Table 9).

Salinity
In years past, the salinity profile for receiving water has been dictated by upstream stratification and downstream mixing (Figure 6). This recurring pattern, resultant of tidal influence and Facility effluent, was observed regardless of pond discharge or tides. In 2015, the cessation of surface water inflow at the pond's northern structure resulted in slight increases in surface water salinities in Artesian Slough Stations 3 and 4. Further, reflective of the recurrent pulsing of freshwater Facility effluent into and out of the pond, bottom salinity dipped slightly at Station 2 nearest the pond's point of intake/discharge. Salinity at Station 1 remained consistent with previous years, as this most upstream site is shallow and dominated by Facility effluent.

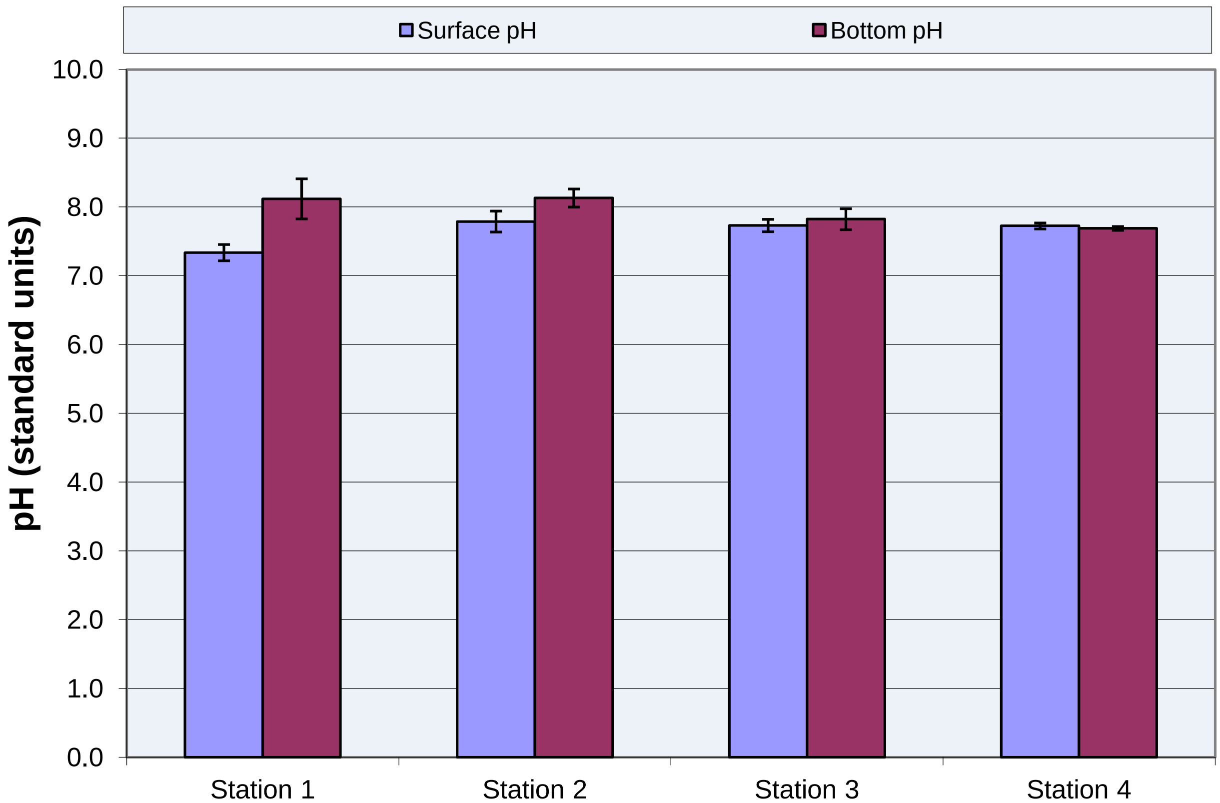
Figure 6. Mean (± SE) Monthly Salinity in Artesian Slough for 2015



pH
As in previous years, slight stratification of pH in the receiving water occurred at the upstream Stations 1 and 2. In general, Station 1 is the most variable of all the stations with regards to pH, and 2015 yielded slightly lower surface pH and higher bottom pH (Table 7 and Figure 7). All other stations were consistent with prior years. Downstream Stations 3 and 4 were less stratified, indicating more mixing.

Pond pH was higher (7.6 – 10.3) than the surface and bottom measurements of the receiving water (7.1 – 8.2 and 7.4 – 8.8, respectively). As in previous years, the higher pond pH did not have a measureable effect on slough pH. In fact, pond pH was considerably lower in 2015 than in prior years, reflective of the flushing of the pond with fresher slough water, rather than more saline Bay water for approximately half of the monitoring season.

Figure 7. Mean (+ SE) Monthly pH in Artesian Slough for 2015

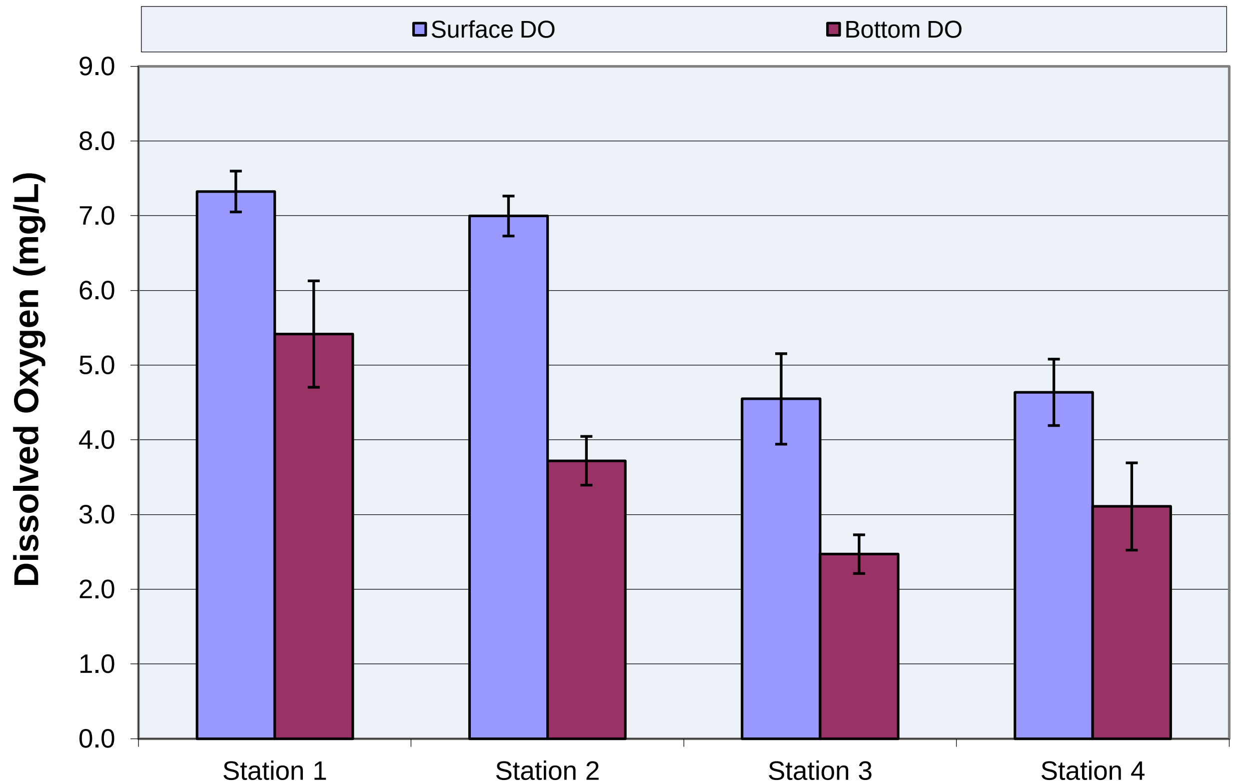


Dissolved Oxygen

Monthly DO measurements at the four Artesian Slough stations (Table 7) show that surface DO was substantially higher than bottom DO along the length of the slough. DO recorded at the surface was highest at Stations 1 and 2, and decreased downstream (Figure 8). This is likely due to the oxygen-rich effluent discharged from the Facility. This pattern is consistent with prior years, with the exception of Station 4 which experienced slightly higher surface DO.

The WDR requires the Discharger to monitor, report, and take corrective action if monthly discrete DO levels in Pond A18 fall below 1.0 mg/L. This scenario never occurred during the 2015 season (Table 9). Trigger monitoring for temperature, salinity, pH and DO was initiated on June 24 (Table 6) when pond DO levels fell below the 10th percentile weekly trigger of 3.3 mg/l. The Basin Plan Objective requires Pond A18 discharge will not exceed the instantaneous DO minimum concentration of 5.0 mg/L measured at the surface at station 2. The receiving water DO at station 2 did not fall below this requirement at any time.

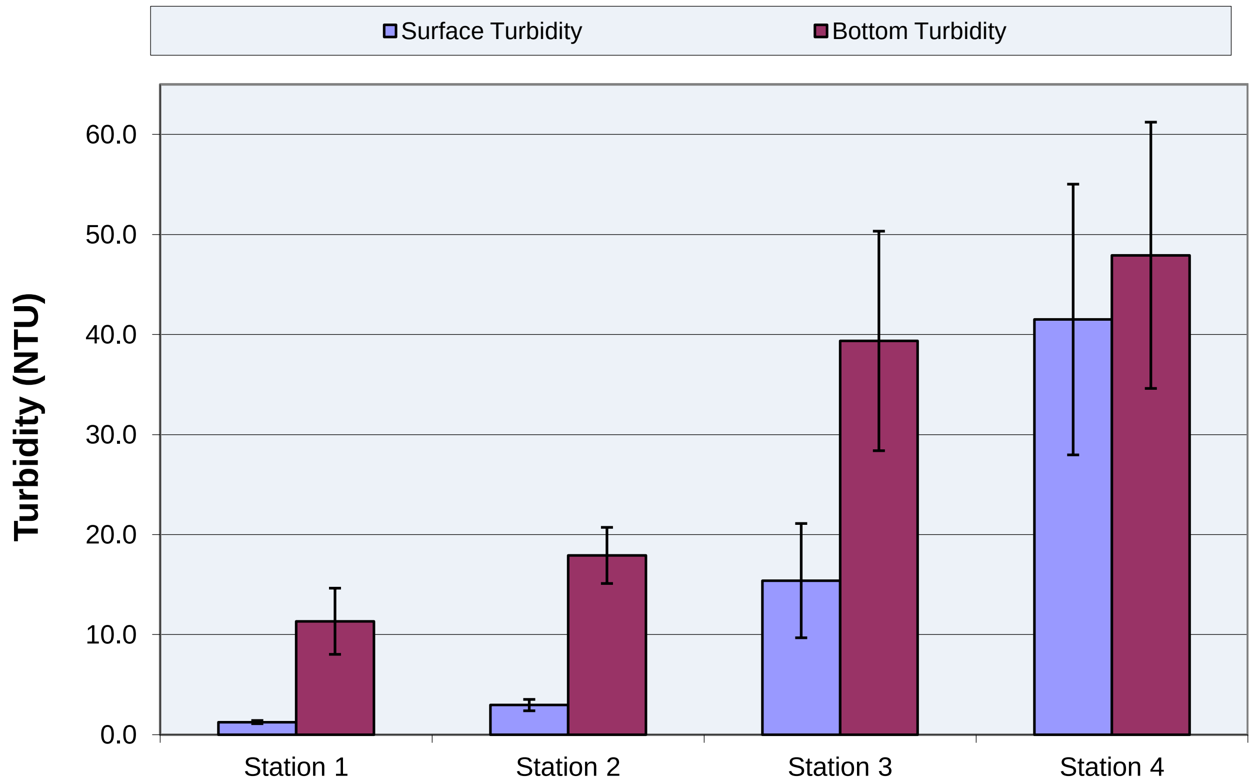
Figure 8. Dissolved Oxygen - Monthly Mean (± SE) in Artesian Slough for 2015



Turbidity

Turbidity was measured monthly at the four stations in Artesian Slough. These measurements confirmed both surface and bottom turbidity increased in a downstream direction from Station 1 to Station 4 (Figure 9). As expected, bottom turbidity was higher at each station. Flooding tides and silty downstream stream beds contribute to higher turbidity in the lower segments of Artesian Slough. The lower turbidity measurements recorded at the upstream stations are due to the low turbidity Facility effluent that dominates the upstream portions of Artesian Slough coupled with a relatively scoured and cobbled substrate.

Figure 9. Turbidity - Monthly Mean (± SE) in Artesian Slough for 2015



Chlorophyll-*a* Monitoring

The City measured chlorophyll *a* in Pond A18 by collecting a monthly grab sample in a 1-liter amber glass jar. This sample, kept cool and out of direct light, was sent by same-day courier to Basic Laboratory services in Redding, CA for analysis.

Chlorophyll *a* concentrations in Pond A18 generally increased throughout 2015, reaching a peak in September follow ed by a decline at the conclusion of the season (Table 10). In September, the water became increasingly murky and the color shifted from green to brown, conditions which extended through October.

Table 10. Monthly chlorophyll *a* measurements at A18 discharge

Salinity measurements are included for context to indicate general changes in pond characteristics.

Month	Date sampled	Chlorophyll *a* (µg/L)	DO (mg/L)	Salinity (PSU)
June	6/16/2015	22	3.4	27.0
July	7/21/2015	62	7.8	29.2
August	8/11/2015	40	5.6	32.0
September	9/29/2015	125	2.1	33.7
October	10/20/2015	54	8.6	32.4

D. Sediment Monitoring

A letter from the Water Board's Executive Officer Bruce Wolfe dated 15 September, 2010 modified the annual mercury sediment monitoring requirement, allowing for a change in location from Pond A18 to the receiving water and adjusting the sampling frequency to every other year during the months of August through September. Consistent with the revised sampling frequency, the City contracted USGS to conduct sediment sampling on September 9, 2015. Sediment sampling was performed in Artesian Slough in 2011, 2012 and 2013.

Mercury/Methyl Mercury

Artesian Slough sediment was sampled for total mercury and methyl mercury at six locations (Appendix II; Figure 1) by the United States Geological Survey (USGS). Total mercury in sediment samples ranged from 144 to 325 ng/g dry weight (Table 9), which is well below USEPA criteria for total mercury in sediment (1000 ng/g dry weight). Methyl mercury concentrations in sediment ranged from 0.5 to 10.0 ng/g. Both total mercury and methyl mercury concentrations in 2015 were lower at all four stations compared to 2013.

Table 11. 2011-2015 sediment mercury & methyl mercury results for Artesian Slough.

Analyte	Year	Station 1	Station 2	Station 3	Station 4
Total Hg (ng/g)	2011	131	310	329	232
	2012	198	433	387	253
	2013	242	448	501	368
	2015	222	261	325	144
Me Hg (ng/g)	2011	2.0	13.1	1.6	1.5
	2012	6.7	3.5	19.3	1.7
	2013	9.9	17.9	3.0	2.5
	2015	0.9	10.0	1.8	0.5
Percent Fines (%)	2011	33	92	92	68
	2012	36	80	94	50
	2013	63	90	92	69
	2015	71	99	96	38

III. Exceedances and Triggered Actions

A. Summary of Exceedances and Triggers

Table 6 lists the DO trigger events for pond discharges in 2015 and subsequent responses.

B. Summary of Corrective Action

There were nine weeks in which the weekly 10^{th} percentile DO level in the discharge fell below the trigger threshold. The City responded by conducting additional weekly discrete water column measurements at three stations in Artesian Slough (Figure 1, Table 8). Despite this decrease in pond DO, no negative effects were detected in the receiving water that could be attributed to Pond A18 discharge so no additional protective actions were implemented in 2015. The two instances where trigger monitoring measured DO in the bottom water of the slough falling below 3.3 mg/L at station 2 corresponded to periods where the pond was discharging water with DO above 3.3 mg/L.

IV. Discussion and Interpretation of 2015 Results

Temperature

Pond water temperatures in 2015 (Table 2; Figures 2) were consistent with previous years. Pond temperatures generally peak in July/August and show large fluctuations depending on heat waves or cloud cover.

Salinity

In years past, pond salinity shows the most variation of the measured parameters, peaking in August/September. As a result of pulsing Facility effluent rich water into and out of the pond during the re-construction of the northern hydraulic structure, pond salinity in 2015 was lower than previous years. Salinity steadily increased with the resumption of the normal flow regime from mid-August onward, peaking in late October. Specifically, during the construction activities from June through mid-August, mean salinity was 16.3 PSU, and mean salinity increased to 27.3 PSU from the completion of construction onwards. In comparison, mean salinity in 2014 measured 30.5 PSU.

Additionally, the range of 2015 discharge salinity exceeded that of previous years, ranging from 9.5 PSU to 31.3 PSU, compared to a minimum of 24.5 PSU and a maximum of 34.1 PSU for 2014. The frequent pulsing of water into and out of the pond also caused additional wear and tear on the flap gates that seal the twin 48 inch discharge pipes on the southern structure, resulting in an incomplete seal of the pipes. These gates are currently being assessed for replacement.

Consistent with prior years, salinity gradients in the receiving waters are driven by tidal cycles and fresh water effluent from the Facility. The less dense freshwater tends to float on top of the saline bay water pushed into the slough by the flooding tide.

pH

Increases in pond pH are a result of photosynthesis, accompanied by high irradiance and temperatures. Conversely, high salinity acts as a buffer, limiting pH increases. Pond pH in 2015 was slightly lower than that of 2014 (mean pH of 9.0 compared to 9.4). Once the normal flow regime was resumed, pond pH was similar to last year, gradually climbing to a peak in early September, followed by a gradual decline through the remainder of the monitoring season. This decline corresponds to changes in the algal community, which was also observed in water color, water clarity changes, and chlorophyll a measurements.

Dissolved Oxygen

Pond dissolved oxygen concentrations in 2015 were slightly lower (mean DO of 7.4 mg/L) compared to the previous year (mean DO of 8.1 mg/L). There were a total of nine trigger events in 2015, compared to five in 2014. Pond DO was more variable earlier in the season with the boom and bust cycle of super-saturation to low DO occurring in June and throughout the remainder of the monitoring season. This is likely due to the longer hydraulic residence time from operating the pond using a single water control structure and a higher load of nitrogen entering the pond due to a southern intake point. Higher nitrogen loads in a shallow, freshwater system can lead to high algal biomass (> 60 ug/L chlorophyll-a) as was seen in Pond A18 throughout most of the 2015 monitoring season. As abundant phytoplankton or macro-algae die and decay, the decomposition process consumes dissolved oxygen in the water column and drives DO concentrations down.

Nuisance Filamentous Macro-algae

The presence of filamentous macro-algae in Pond A18 varies from year to year. Filamentous algae consist of macroscopic filaments which are of little value to pond productivity since filter-feeding zooplankton (copepods, cladocerans, rotifers, shrimp, aquatic insects) are not able to utilize them effectively. Further, filamentous algal mats impede light penetration through the water column, thereby decreasing phytoplankton production and overall pond productivity. In mid-June 2015, filamentous algal mats covered the surface of the eastern portion of Pond A18, with slender fingers extending towards the northern periphery of the pond. In late June, benthic algal mats accumulated along the margins. These conditions extended through July and into early August.

Re-construction of Northern Hydraulic Structure

In November 2014, the City contracted an engineering consultant to perform a condition assessment of Pond A18's aging hydraulic structures. This evaluation included divers' inspection of the 11 year old structures' condition below the water line. The assessment concluded the southern structure to be fully operational, but the northern structure's condition was deemed critical in the engineering report. It was determined that the structure's degree of deterioration put the pond at risk of imminent breach from structure or failure around the

northern structure. Because of the multitude of public health/safety, flood protection, financial and ecological consequences of such a breach adjacent to the Facility, emergency repairs were imperative.

On March 3, 2015, the San Jose City Council declared emergency replacement of Pond A18's northern structure was necessary to prevent critical structural failure and subsequent breach of the levee system. The City received authorization from the U.S. Army Corps of Engineers to replace the northern structure under an emergency permit.

Galindo Construction Company was contracted to conduct the re-construction. In May 2015, a cofferdam was successfully installed to isolate the project footprint from Pond A18 and Artesian Slough.

Over the next two months, the failing structure was excavated and replaced.

Twin 48 inch pipes were set and configured with one-way flapper gate valves.

The northern structure's re-construction was completed in mid-August 2015, and the gates were configured for inflow on August 18, thus resuming the pond's normal circulating flow regime of intake at the northern structure and discharge through the southern structure.

Pond Infrastructure
The City continues to monitor the condition and functionality of the pond's southern structure. HydroScience Engineers, Inc. has been contracted to conduct further condition assessments of the southern structure's mechanical and geotechnical vulnerabilities.

Avian Habitat Value
The City partners with the Santa Clara Valley Audubon Society to evaluate local Christmas Bird Count (CBC) data to assess avian population trends. The Alviso Complex CBC dataset, encompassing the Facility and surrounding wetlands, most notably Pond A18, extends back to 1975 and provides 40 years of data which has been instrumental in evaluating bird recovery in the context of Facility treatment advancements and large-scale wetlands restoration efforts.

The 2015 waterfowl abundance data underscores the habitat value of the Alviso Complex system, with overall counts roughly double the population tallies before Pond A18, along with nearby Ponds A16, A17, A19, and A20 were breached and managed for long-term restoration in 2005-2006. Such positive trending illustrates Pond A18 continues to provide foraging and congregating habitat for a multitude of waterfowl species.

V. Lessons Learned and Recommendations

1. Eleven years of monitoring demonstrates that Pond A18 discharge has no measurable effect on the water quality of the receiving waters. Changes in water quality of Artesian Slough are primarily influenced by Bay water associated with tidal cycles.

   Recommendation: Continue to forego continuous monitoring of the receiving water. If pond DO falls below the weekly 10^{th} percentile 3.3 mg/L trigger, assess possible impacts to receiving water through weekly receiving water column profile monitoring at Station Artesian-02. If impacts to receiving water are verified, evaluate and implement additional adaptive management actions.

2. Sampling chlorophyll *a* is useful for characterizing phytoplankton variability in pond A18.

   Recommendation: Continue monitoring chlorophyll *a.*

3. Pond A18's primary productivity can decrease with cloud cover and rain events, which can decrease photosynthesis and temporarily lower DO. No adverse effects on receiving water DO have been measured during these short-term decreases in the eleven years of monitoring.

   Recommendation: Continue with regular pond discharge operations. Continuous pond discharge provides the most stable conditions in the pond. Shutting the discharge valve as a result of temporary low DO due to uncontrollable conditions may exacerbate low DO due to stagnation of pond water.

4. Modified operations in 2015 during construction of the new northern hydraulic control structure necessitated using the southern structure as an intake point and increasing the hydraulic residence time in the pond. The combination of higher nitrogen inputs from the upstream portions of Artesian Slough entering the pond and less flushing of pond water appeared to have increased the phytoplankton biomass compared to all previous years. Dissolved oxygen concentrations were more variable earlier in the year and low DO occurred earlier in the monitoring season, likely due to the increased algal biomass. As with all previous years, the low DO conditions in 2015 did not affect Artesian Slough water quality indicating that the pond discharges have minimal spatial influence on Artesian Slough DO.

   Recommendation: Consider possibilities of southern intake and northern discharge (reverse flow) scenario in 2016 due to negligible influence of pond discharges on receiving water DO.