San José-Santa Clara
Regional Wastewater Facility

February 1, 2017

Mr. Bruce Wolfe, Executive Director
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

SUBJECT: Pond A18 Annual Self-Monitoring Report for 2016

Dear Mr. Wolfe:

The City of San José (City) submits the Annual Self-Monitoring Report (SMR) in fulfillment of the Waste Discharge Requirements (WDR) for Pond A18 described in Order Number R2-2005-0003. This SMR includes a summary of water quality monitoring conducted in 2016 for Pond A18.

In addition to monitoring Pond A18 and receiving water quality, the City is responsible for maintaining the pond's infrastructure, including its levees and hydraulic structures. Decisions on pond operations in 2016 were focused on minimizing further deterioration of the southern hydraulic control structure and its levee. The extent of erosion and scour of the slough side levee is substantial, which has led City engineering staff and consultant geotechnical engineers to recommend an alternate flow regime to reduce risk of levee failure and breach. For all of 2016, continuous circulation of the pond was oriented for inflow at the southern structure and discharge from the northern gate.

Pond water quality was monitored continuously at the northern structure, and four receiving water stations were monitored for discrete surface and bottom water quality throughout the 2016 dry season monitoring. Discrete trigger monitoring was also conducted in the receiving water when pond DO was low enough to trigger additional evaluation. Receiving water monitoring station locations were in accordance with the north release scenario detailed in the WDR and Operations Plan.

The enclosed report provides a more detailed description of monitoring results, maintenance of Pond A18's infrastructure, and its operations in 2016. If you have questions or comments regarding this monitoring report, please contact Eric Dunlavey, Wastewater Compliance Supervisor, at 408-635-4017.

Sincerely,

Amit Mutsuddy
Acting Deputy Director, San Jose-Santa Clara Regional Wastewater Facility

Enclosures

cc: Robert Schlipf

Pond A18 2016 Annual Self Monitoring Report

Reporting Period:
June 1- October 31, 2016

San José-Santa Clara Regional Wastewater Facility
2016 Pond A18 Annual Report

Order No. R2-2005-0003

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I. Introduction

This report summarizes 2016 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 twelfth year of continuous discharge monitoring for Pond A18. Figure 1 indicates the location of Pond A18 hydraulic control structures and sampling sites in the receiving water (Artesian Slough and Coyote Creek).

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 2016 was conducted in compliance with the A18 WDR monitoring requirements on page 9, Table 2 of the Self-Monitoring Program of the Order, and subsequent revisions to the WDR. The City continuously monitored (15-min intervals) Pond A18 discharge from 1 June to 31 October, 2016 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 water. 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 2016, 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 sediment mercury and methyl mercury monitoring of receiving water sediments in August or September every other year. This monitoring was last conducted in September 2015, and was not required in 2016.

C. Pond Operations in 2016

Decisions on pond operations in 2016 were focused on minimizing further deterioration of the southern hydraulic control structure and its levee. The critical condition of the pond's northern gate structure necessitated its reconstruction in 2015. The southern structure was used to pulse slough water into and out of the pond to maintain pond elevation and water quality during the months of dewatering and construction of the northern structure. This pulsing of water accelerated bank erosion and active scouring/slumping on the outboard levee proximal to the southern structure. The extent of the slumping and erosion was substantial, leading City engineering staff and consultant geotechnical engineers to recommend an alternate flow regime to reduce risk of levee failure and breach. A more detailed description of the condition and assessment of the southern structure and levee can be found later in this report (IV. Discussion and Interpretation of 2016 Results).

Continuous circulation of Pond A18 was oriented for inflow at the southern structure and discharge from the northern gate. Water Board was consulted and updated regarding the City's ongoing monitoring efforts to evaluate effects to receiving water. Pond water quality was monitored at the northern structure, and 10th percentile weekly DO values calculated on discharge water throughout the 2016 dry season monitoring. Monitoring stations in the receiving water for monthly discrete sampling, along with trigger monitoring sites, were adopted in accordance with the north release scenario detailed in the WDR and Operations Plan (Figure 1). Station 1 was in Artesian Slough directly upstream of the northern structure, and Station 2 was in Coyote Creek, directly upstream of the confluence with Artesian Slough. Station 3 was in Coyote Creek directly downstream of the confluence with Artesian Slough, and Station 4 was farther downstream Coyote Creek.

II. Monitoring Methods and Results

San José-Santa Clara Regional Wastewater Facility (Facility) staff 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 and took water quality measurements every 15 minutes. The 600 XLM sonde was used for discrete monitoring of surface and bottom measurements. All sondes were outfitted with an optical DO probe, a conductivity/temperature probe, and a pH probe.

A. Quality Assurance/Quality Control

Facility staff 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 measurements exceeding 10% of theoretical and investigated the cause of such failures.

Calibration standards used for post-deployment accuracy checks to validate sonde data were:

- 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.

Three post-deployment QA/QC failures for pH occurred in 2016. These failures, for the weeks of June 14 through June 22, June 28 through July 5, and July 19 through July 26, were due to circuit board failure as a result of water intrusion into the sondes. Based on best professional evaluation of the corresponding data, only the pH measurements were invalidated and rejected, while the other water quality monitoring data for these periods was accepted.

In addition, water quality monitoring data for all parameters could not be recovered from sondes during the weeks of September 13 through September 20, and October 19 through October 24 due to flooding which resulted in catastrophic sonde malfunction. Malfunctioning sondes were subsequently shipped to YSI for diagnostic and repair services.

Figure 1. Pond 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, 2016 to October 31, 2016 (Figure 1).

Sondes recorded water quality data every 15 minutes. Following deployment, staff uploaded these data to a computer where they were checked for accuracy and completeness, 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. Possible examples of such responses included additional receiving water monitoring, aeration, reversing direction of flow, or strategic timing of pond discharges to limit low DO discharge.

Temperature

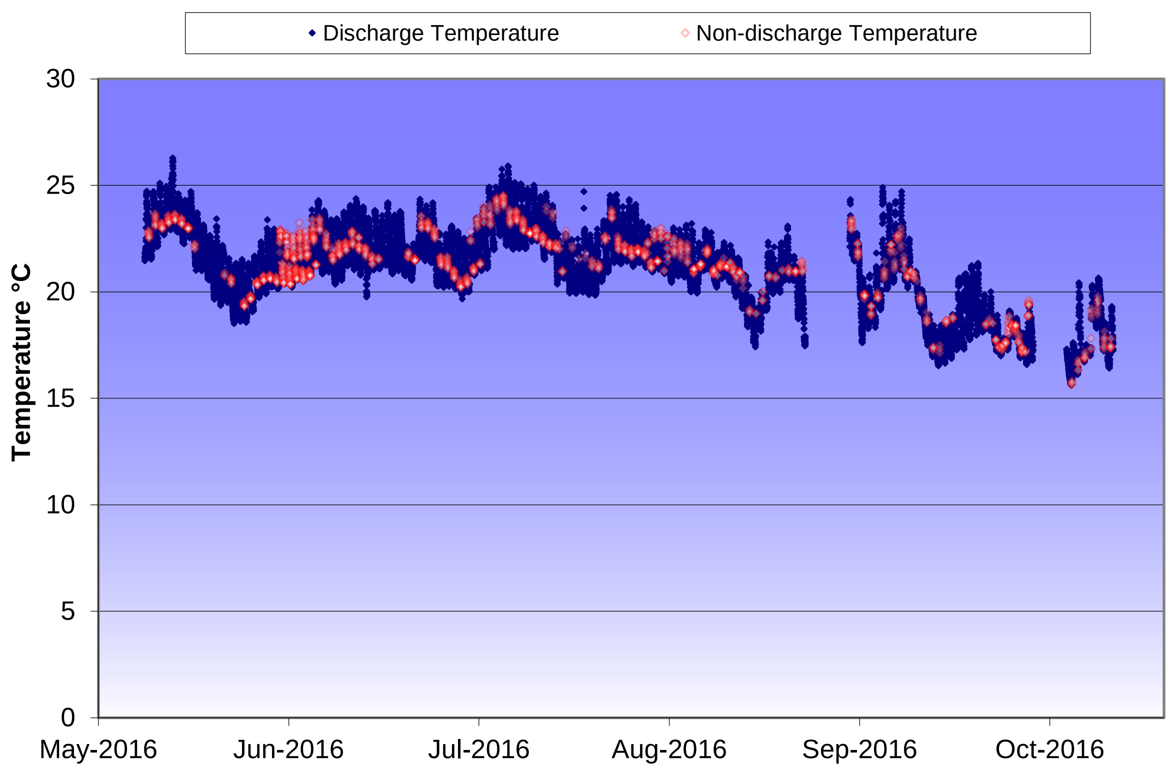
Water temperature for Pond A18 discharge is presented in Table 2.

Table 2. Temperature results – 2016 continuous monitoring (°C)

Site/Condition	Minimum	Maximum	Mean	Median	# of Measurements (n)
A18 Discharge	15.6	26.3	20.9	21.2	12,103
A18 Non-Discharge	15.6	24.5	21.4	21.6	1,374

Although pond mean temperature decreased slightly in 2016 compared to previous years, it varied little between discharge and non-discharge periods (Table 2; Figure 2).

Figure 2. Temperature profile – Pond A18 2016 dry season



Salinity

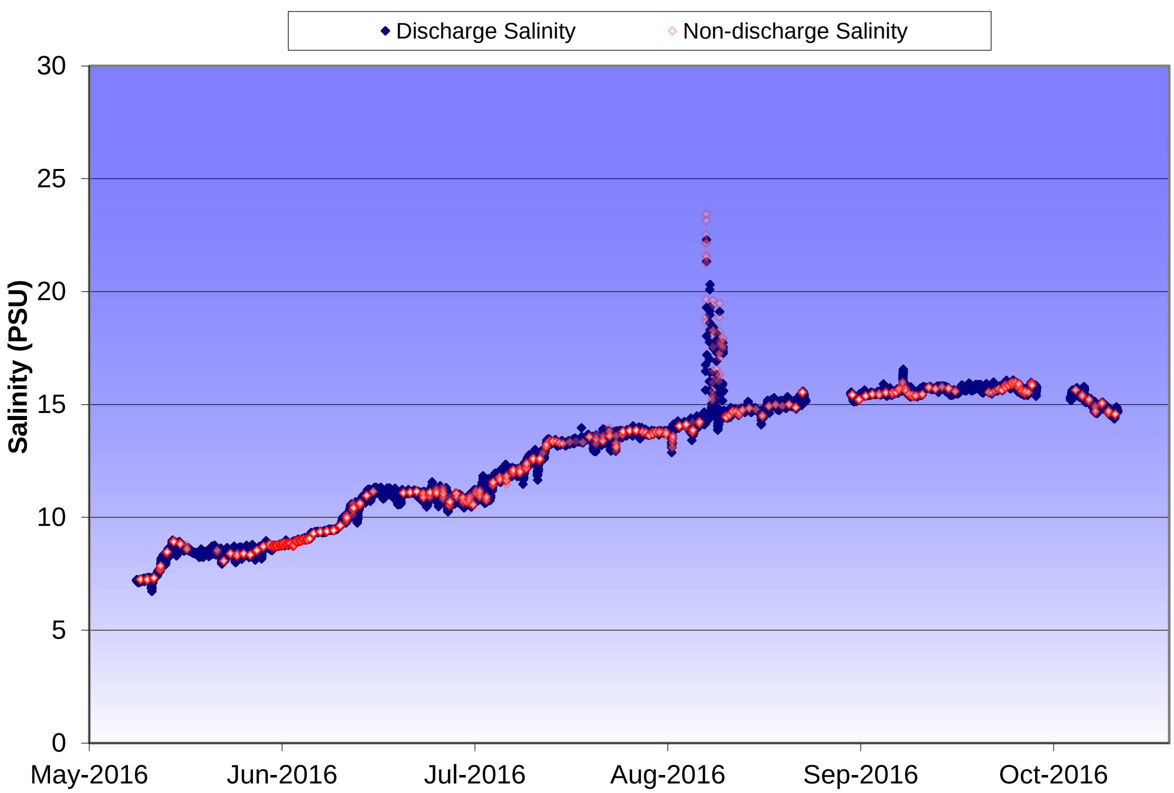
Pond salinity, under both discharge and non-discharge conditions, is detailed in Table 3.

Table 3. Salinity results - 2016 continuous monitoring (PSU[1])

Site/Condition	Minimum	Maximum	Mean	Median	# of Measurements (n)
A18 Discharge	6.7	22.3	12.6	13.5	12,092
A18 Non-Discharge	7.2	23.4	12.0	11.8	1,382

Discharge salinity remained below 44 PSU at all times during the 2016 monitoring period. Pond salinity was significantly lower than prior years throughout the entire monitoring season, reflective of the reverse flow regime in which the southern hydraulic structure was used to intake Facility effluent rich slough water into the pond. Similar to the pattern observed over the past years, salinity climbed steadily through the dry season monitoring to a peak in late September - October. (Figure 3).

Figure 3. Salinity profile - Pond A18 2016 dry season



pH

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

[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.

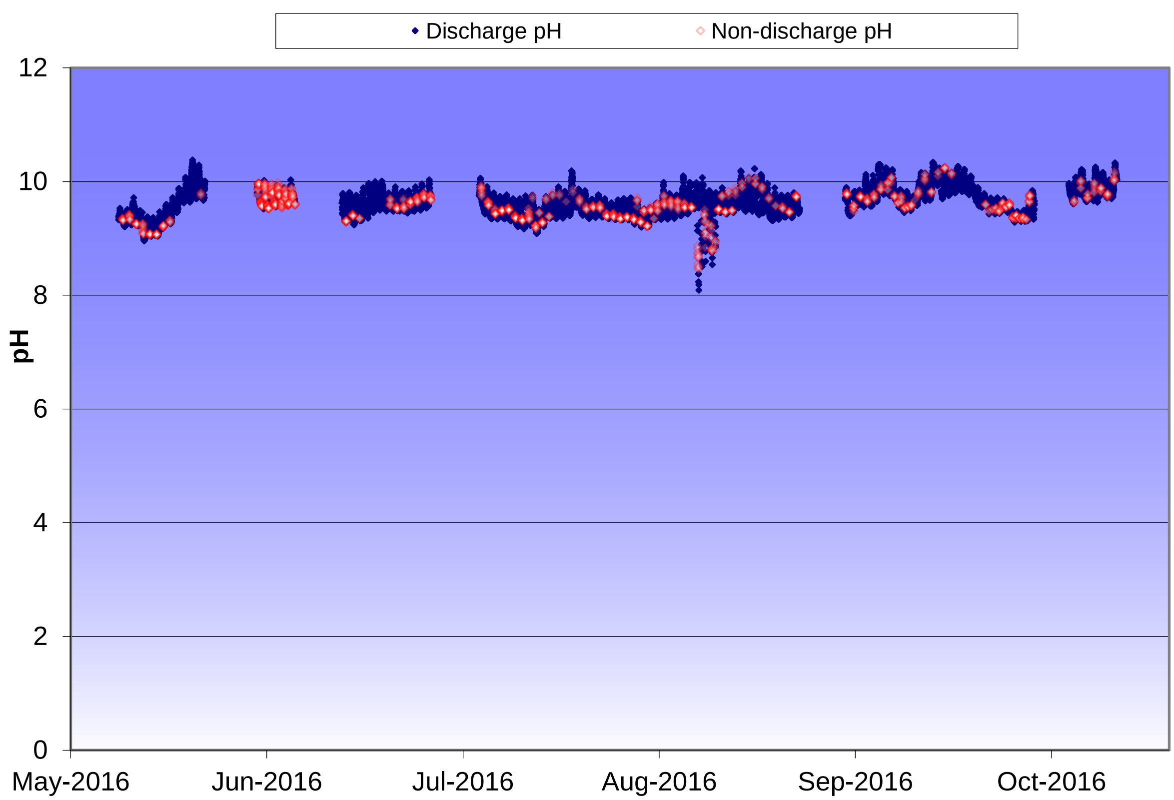
Table 4. pH results - 2016 continuous monitoring

Site/Condition	Minimum	Maximum	Mean	Median	# of Measurements (n)
A18 Discharge	8.1	10.4	9.6	9.6	10,167
A18 Non-Discharge	8.5	10.3	9.6	9.6	1,142

The Basin Plan Objective requires that receiving water pH remain between 6.5 and 8.5. However, receiving water data was not recorded during 2016 dry season continuous monitoring.

Despite the pond's reverse flow in 2016, pH was consistent with years past. Even though this year's pH was slightly elevated and more varied, the pattern throughout the monitoring season is consistent with that of previous years. The only exception is that pH remained elevated at the end of the monitoring season. Increased pond pH occurs concurrently with episodes of intense photosynthesis when water temperature and solar irradiance are high. Generally these periods are followed by declines in pH when algae experienced decomposition later in the season. These conditions usually coincide with shifts in the phytoplankton species composition.

Figure 4. pH profile - Pond A18 2016 dry season



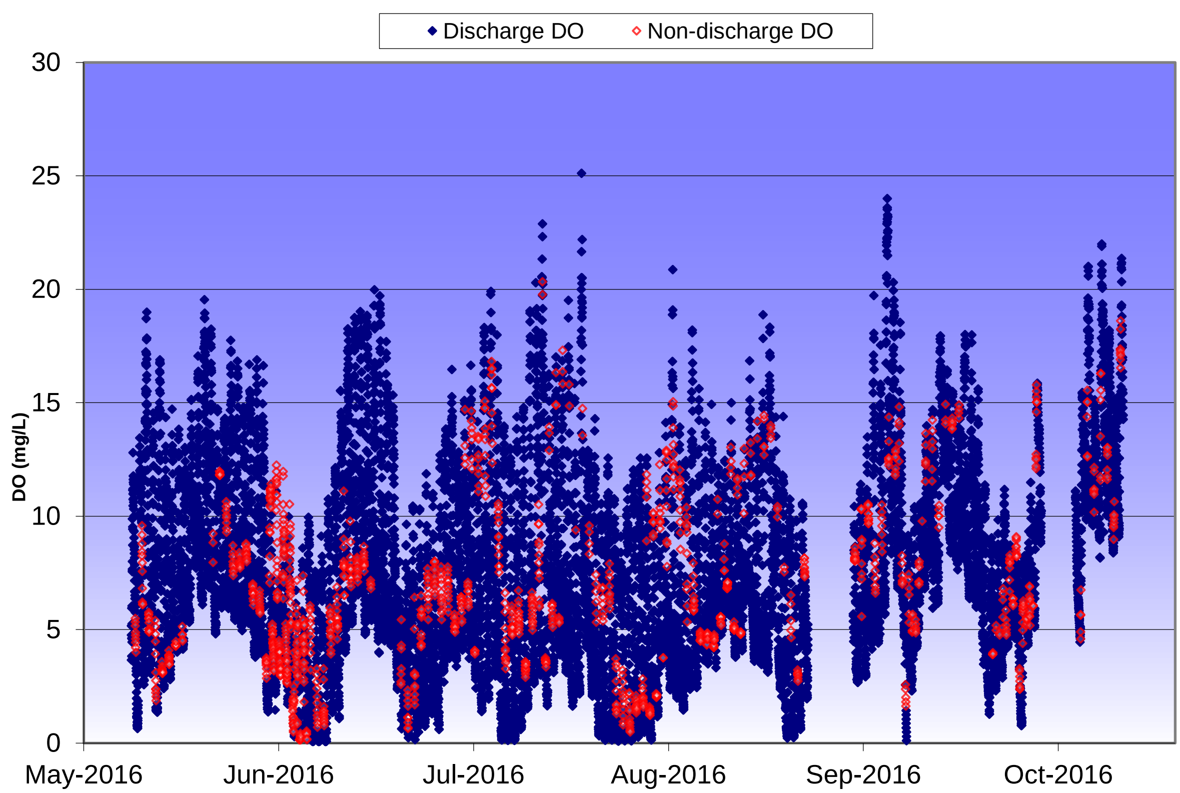
Dissolved Oxygen
DO concentrations in the pond discharge, under both discharge and non-discharge conditions, are summarized in Table 5.

Table 5. DO results - 2016 continuous monitoring (mg/L)

Site/Condition	Minimum	Maximum	Mean	Median	# of Measurements (n)
A18 Discharge	0.0	25.1	7.7	7.1	12,093
A18 Non-Discharge	0.2	20.3	6.8	6.2	1,381

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 strength and level of tides, intensity and duration of sunlight/cloud cover, temperature, time of day, and algal community composition.

Figure 5. Dissolved Oxygen profile - Pond A18 2016 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. The City's trigger response in 2016 consisted of weekly discrete water column measurements at three discrete monitoring stations whenever the pond's weekly 10th percentile DO concentration fell below the 3.3 mg/L threshold. Trigger monitoring consisted of surface and bottom sonde measurements collected at Station 1 in Artesian Slough and Stations 2 and 3 in Coyote Creek (Figure 1). Due to the northern release configuration of Pond A18, Station 1 trigger monitoring data was collected in Artesian Slough directly upstream of the pond's discharge from its northern hydraulic structure. Station 2 was located in Coyote Creek, directly upstream of the confluence with Artesian Slough, and Station 3 was positioned in Coyote Creek directly downstream of the confluence with Artesian Slough.

Trigger monitoring was conducted twelve times in 2016 (Table 6). Trigger data was evaluated by Facility staff and revealed no negative effects from episodic low DO pond discharges, therefore, no additional adaptive management or monitoring actions were implemented.

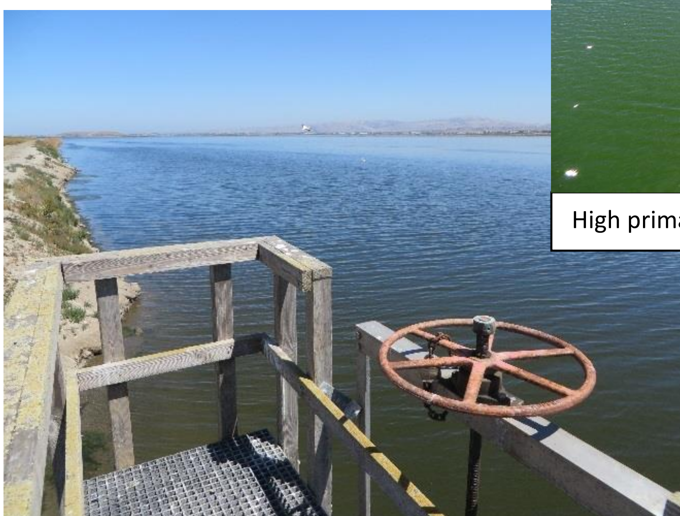
Table 6. Weekly 10th percentile DO values for Pond A18 discharge and response in 2016

Week and Date Range	10th Percentile Value (mg/L)	Response
1: 6/1/16 – 6/7/16	2.4	Results not representative of full week dataset
2: 6/7/16 – 6/14/16	5.2	None Required
3: 6/14/16 – 6/21/16	5.4	None Required
4: 6/21/16 – 6/28/16	1.7	Trigger monitoring initiated 6/29 -No impacts
5: 6/28/16 – 7/5/16	0.1	Trigger monitoring continued 7/7 -No impacts
6: 7/5/16 – 7/12/16	5.2	Trigger monitoring continued 7/12 -No impacts
7: 7/12/16 – 7/19/16	1.3	Trigger monitoring continued 7/21 -No impacts
8: 7/19/16 – 7/26/16	3.7	None Required
9: 7/26/16 – 8/2/16	0.7	Trigger monitoring conducted 8/5 -No impacts
10: 8/2/16 – 8/9/16	3.0	Trigger monitoring continued 8/10 -No impacts
11: 8/9/16 – 8/16/16	0.4	Trigger monitoring continued 8/19 -No impacts
12: 8/16/16 – 8/23/16	0.6	Trigger monitoring continued 8/25 -No impacts
13: 8/23/16 – 8/30/16	2.6	Trigger monitoring continued 8/31 -No impacts
14: 8/30/16 – 9/6/16	4.5	None Required
15: 9/6/16 – 9/13/16	1.0	Trigger monitoring performed 9/15 -No impacts
16: 9/13/16 – 9/20/16	No Data	In absence of weekly 10th percentile data, trigger monitoring conducted 9/21 -No impacts
17: 9/20/16 – 9/27/16	4.1	None Required
18: 9/27/16 – 10/4/16	4.4	None Required
19: 10/4/16 – 10/11/16	6.0	None Required
20: 10/11/16 - 10/18/16	2.8	Trigger monitoring performed 10/18 -No impacts
21: 10/18/16 - 10/25/16	5.9	None Required
22: 10/25/16 - 10/31/16	9.6	None Required

General Observations

Pond water color and clarity varied from years past throughout the 2016 monitoring season, presumably due to the southern intake flow configuration. This resulted in higher nitrogen concentrations in the water entering the pond compared to previous years due to the southern structure's proximity to the Facility final effluent discharge point. Instead of beginning the monitoring season with generally clear water associated with low phytoplankton concentrations as observed in previous years, pond water in June 2016 was a bright shade of opaque green associated with high concentrations of phytoplankton not usually seen until late July. Benthic algal mats had already accumulated along the pond's margins. Filamentous algal mats covered the surface of the eastern portion of Pond A18, and had already extended well into the western and northern periphery of the pond. In July, the pond became increasingly murky and color shifted to greenish-brown, a transition that's been accompanied by low DO values and generally not observed until September in years past. These conditions continued into August, accompanied by receding surface and benthic algal accumulations.

High primary productivity waters in June, 2016.



By comparison, clear waters in June, 2015.

In September, there was a shift in color back towards a brighter shade of green, indicating a resurgence of phytoplankton concentration likely due to shift in species composition. Water clarity remained murky, and filamentous algae returned to the levee margins, though not to the degree observed early in the monitoring season. Throughout October, water color shifted towards a greenish-brown, and then to brown at the close of the 2016 monitoring season.

Pond A18 condition on September 28, 2016.

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 to be recorded while the pond is discharging.

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

Table 7. Receiving water 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)
6/29/2016 7:31	1	Flood	Top	22.7	14.1	7.9	4.4	38.0	29.5
6/29/2016 7:33	1	Flood	Bottom	22.9	14.7	7.8	3.0	42.3	29.5
7/21/2016 9:53	1	Ebb	Top	23.6	8.8	8.1	5.7	75.3	46.1
7/21/2016 9:54	1	Ebb	Bottom	23.6	8.8	8.1	5.7	87.6	46.1
8/31/2016 9:43	1	Flood	Top	22.0	15.3	8.1	4.1	49	42.0
8/31/2016 9:45	1	Flood	Bottom	22.1	15.3	8.1	3.9	64.2	40.9
9/21/2016 10:26	1	Ebb	Top	24.3	7.5	8.0	5.5	19.1	35.8
9/21/2016 10:27	1	Ebb	Bottom	23.3	14.0	7.6	3.1	27.0	35.8
10/18/2016 7:55	1	Ebb	Top	21.6	7.7	7.6	5.1	27.4	27.8
10/18/2016 7:57	1	Ebb	Bottom	21.4	8.9	7.5	3.8	49.9	27.8
6/29/2016 7:36	2	Flood	Top	22.9	15.8	7.8	4.5	51.7	29.5
6/29/2016 7:37	2	Flood	Bottom	22.9	15.9	7.7	3.6	49.8	29.5
7/21/2016 10:01	2	Ebb	Top	22.3	10.8	8.0	4.6	29.4	46.1
7/21/2016 10:03	2	Ebb	Bottom	21.8	12.7	7.8	3.3	71.7	46.1
8/31/2016 9:59	2	Flood	Top	22.3	16.1	7.8	5.6	42.4	40.9
8/31/2016 10:00	2	Flood	Bottom	22.2	16.1	7.7	3.7	51.3	39.7
9/21/2016 10:32	2	Ebb	Top	21.7	17.5	7.6	3.9	29.8	36.8
9/21/2016 10:33	2	Ebb	Bottom	21.4	19.6	7.6	2.8	40.7	36.8
10/18/2016 8:04	2	Ebb	Top	18.1	14.0	7.5	4.4	46.5	28.7
10/18/2016 8:05	2	Ebb	Bottom	18.1	15.6	7.5	2.9	61.8	28.7
6/29/2016 7:40	3	Flood	Top	22.8	16.5	7.8	4.7	40.4	29.5
6/29/2016 7:41	3	Flood	Bottom	22.6	17.2	7.8	3.9	62.1	29.5

Date and Time	Site	Tide	Depth	Temp (°C)	Salinity (PSU)	pH	DO (mg/L)	Turbidity	A18 Flow (cfs)
7/21/2016 10:06	3	Ebb	Top	22.5	11.5	7.9	4.3	30.9	46.1
7/21/2016 10:07	3	Ebb	Bottom	21.6	13.4	7.8	3.4	62.7	46.1
8/31/2016 10:08	3	Flood	Top	22.1	17.3	7.8	4.2	35.1	39.7
8/31/2016 10:10	3	Flood	Bottom	22.1	17.5	7.8	3.7	45.9	39.7
9/21/2016 10:35	3	Ebb	Top	23.1	13.1	7.7	3.8	31.0	36.8
9/21/2016 10:36	3	Ebb	Bottom	22.0	17.7	7.6	3.0	37.5	36.8
10/18/2016 8:08	3	Ebb	Top	18.9	13.5	7.5	4.4	44.7	28.7
10/18/2016 8:09	3	Ebb	Bottom	18.2	15.5	7.5	2.9	77.6	28.7
6/29/2016 7:43	4	Flood	Top	22.6	18.5	7.8	4.9	174	29.5
6/29/2016 7:44	4	Flood	Bottom	22.6	18.5	7.8	4.3	81.2	29.5
7/21/2016 10:12	4	Ebb	Top	22.2	12.5	7.8	4.6	25.8	46.1
7/21/2016 10:13	4	Ebb	Bottom	21.9	13.1	7.8	3.7	51.1	46.1
8/31/2016 10:17	4	Flood	Top	22.0	18.2	7.8	3.8	78.6	38.1
8/31/2016 10:18	4	Flood	Bottom	21.9	18.2	7.8	3.7	86.8	38.1
9/21/2016 10:38	4	Ebb	Top	22.5	15.7	7.6	4.4	23.3	36.8
9/21/2016 10:39	4	Ebb	Bottom	21.3	20.4	7.6	3.4	55.3	36.8
10/18/2015 8:12	4	Ebb	Top	19.6	12.1	7.6	4.5	38.5	28.7
10/18/2015 8:13	4	Ebb	Bottom	18.3	16.8	7.5	3.1	119	28.7

Trigger Monitoring and Adaptive Management Actions

In 2016, 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 three stations in Artesian Slough and Coyote Creek to determine if lower DO dischargers were adversely affecting receiving water DO. Due to Pond A18's northern release configuration, Station 1 trigger monitoring data was collected in Artesian Slough directly upstream of the pond's hydraulic structure. Station 2 was located in Coyote Creek, directly upstream of the confluence with Artesian Slough, and Station 3 was positioned in Coyote Creek directly downstream of the confluence with Artesian Slough (Figure 1).

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

Monitoring was performed in response to the trigger events in weeks 4 through 7, 9 through 13, 15, 16, and 20, and results are detailed in Table 8.

Trigger monitoring is designed to detect impacts of pond discharge on receiving water quality. Any confirmed negative impacts trigger additional adaptive management actions (e.g., additional water quality monitoring 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 also be linked to Pond A18 discharge to necessitate additional adaptive management measures.

In 2016, there were eleven instances when receiving water DO measured less than 5.0 mg/L at the surface and/or less than 3.3 mg/L at the bottom at either of the Stations 1, 2, or 3. Continuous sonde data in the pond was evaluated to determine if pond discharge contributed to these values, and in all but three cases, pond DO measured higher than the corresponding receiving water DO. Accordingly, additional management actions were not implemented.

The three occasions in which continuous sonde data revealed pond DO measuring less than the receiving water warranted evaluation on a case by case basis. In each occurrence, discrete trigger monitoring was continued through the following week to further characterize any relationship between pond discharge and receiving water. Evaluation of the ongoing monitoring data revealed perpetual sags in receiving water DO below the aforementioned thresholds even when pond DO increased by order of magnitude. This pattern continued regardless of tidal condition. Considering this variability in receiving water DO regardless of low or significantly higher DO in the pond, the City suspended additional monitoring, and additional adaptive management actions were not implemented because factors other than pond discharge DO were clearly influencing the receiving water DO.

Table 8. Discrete trigger monitoring results in 2016

Date and Time	Site	Tide	Depth	Temp (°C)	Salinity (PSU)	pH	DO (mg/L)
6/29/2016 7:31	1	Flood	Top	22.7	14.1	7.9	4.4
6/29/2016 7:33	1	Flood	Bottom	22.9	14.7	7.8	3.0
6/29/2016 7:36	2	Flood	Top	22.9	15.8	7.8	4.5
6/29/2016 7:37	2	Flood	Bottom	22.9	15.9	7.7	3.6
6/29/2016 7:40	3	Flood	Top	22.8	16.5	7.8	4.7
6/29/2016 7:41	3	Flood	Bottom	22.6	17.2	7.8	3.9
7/7/2016 12:41	1	Flood	Top	23.0	14.1	8.1	4.3
7/7/2016 12:43	1	Flood	Bottom	23.0	14.7	7.8	3.6
7/7/2016 12:49	2	Flood	Top	22.9	15.3	7.7	3.8
7/7/2016 12:50	2	Flood	Bottom	22.8	15.4	7.7	3.7
7/7/2016 12:53	3	Flood	Top	23.0	16.1	7.7	5.3
7/7/2016 12:54	3	Flood	Bottom	23.0	16.2	7.7	4.0
7/12/2016 11:43	1	Ebb	Top	25.3	3.4	7.8	5.4
7/12/2016 11:45	1	Ebb	Bottom	24.6	4.8	8.1	1.6
7/12/2016 11:38	2	Ebb	Top	23.1	12.7	7.8	3.6
7/12/2016 11:39	2	Ebb	Bottom	22.5	16.2	7.8	3.6
7/12/2016 11:34	3	Ebb	Top	23.3	6.2	7.9	4.0
7/12/2016 11:35	3	Ebb	Bottom	22.8	13.7	7.8	3.2
7/21/2016 9:53	1	Ebb	Top	23.6	8.8	8.1	5.7
7/21/2016 9:54	1	Ebb	Bottom	23.6	8.8	8.1	5.7

Date and Time	Site	Tide	Depth	Temp (°C)	Salinity (PSU)	pH	DO (mg/L)
7/21/2016 10:01	2	Ebb	Top	24.4	9.4	8.0	6.8
7/21/2016 10:03	2	Ebb	Bottom	20.6	24.1	8.0	6.2
7/21/2016 10:06	3	Ebb	Top	22.5	11.5	8.0	4.3
7/21/2016 10:07	3	Ebb	Bottom	21.6	13.4	7.8	3.4
8/5/2016 13:48	1	Flood	Top	22.8	19.7	7.9	5.1
8/5/2016 13:50	1	Flood	Bottom	22.8	20.2	7.8	4.1
8/5/2016 13:55	2	Flood	Top	22.6	21.2.	7.8	4.6
8/5/2016 13:56	2	Flood	Bottom	22.5	21.7	7.8	4.3
8/5/2016 14:00	3	Flood	Top	22.4	21.9	7.8	4.6
8/5/2016 14:01	3	Flood	Bottom	22.3	22.5	7.8	4.4
8/10/2016 14:02	1	Ebb	Top	25.9	8.9	8.0	5.6
8/10/2016 14:01	1	Ebb	Bottom	23.4	15.8	7.7	4.2
8/10/2016 14:10	2	Ebb	Top	25.8	10.9	7.8	5.5
8/10/2016 14:11	2	Ebb	Bottom	22.6	19.2	7.6	3.7
8/10/2016 14:28	3	Ebb	Top	25.1	14.6	7.8	5.7
8/10/2016 14:30	3	Ebb	Bottom	22.7	19.6	7.7	4.1
8/19/2016 8:14	1	Ebb	Top	24.4	8.6	7.9	6.3
8/19/2016 8:16	1	Ebb	Bottom	24.4	8.6	7.8	4.9
8/19/2016 8:19	2	Ebb	Top	22.8	15.9	7.7	3.6
8/19/2016 8:19	2	Ebb	Bottom	22.5	18.9	7.7	2.9
8/19/2016 8:23	3	Ebb	Top	23.3	13.2	7.8	4.5
8/19/2016 8:24	3	Ebb	Bottom	22.9	16.5	7.7	3.4
8/25/2016 10:59	1	Ebb	Top	24.1	7.6	7.28	5.0
8/25/2016 11:01	1	Ebb	Bottom	22.1	16.7	7.7	2.4
8/25/2016 11:08	2	Ebb	Top	22.4	16.6	7.7	No data
8/25/2016 11:09	2	Ebb	Bottom	21.9	18.9	7.7	3.4
8/25/2016 11:11	3	Ebb	Top	22.8	15.2	7.8	3.6
8/25/2016 11:12	3	Ebb	Bottom	21.9	18.5	7.7	3.2
8/31/2016 9:43	1	Flood	Top	22.0	15.3	8.1	4.1
8/31/2016 9:45	1	Flood	Bottom	22.1	15.3	8.1	3.9
8/31/2016 9:59	2	Flood	Top	22.3	16.1	7.8	5.6
8/31/2016 10:00	2	Flood	Bottom	22.2	16.1	7.7	3.7
8/31/2016 10:08	3	Flood	Top	22.1	17.3	7.8	4.2
8/31/2016 10:10	3	Flood	Bottom	22.1	17.5	7.8	3.7
9/15/2016 9:02	1	Flood	Top	20.8	14.5	7.7	4.0
9/15/2016 9:03	1	Flood	Bottom	20.5	14.6	8.0	3.8
9/15/2016 9:06	2	Flood	Top	21.0	15.0	7.7	3.8
9/15/2016 9:08	2	Flood	Bottom	21.0	15.0	7.7	3.6
9/15/2016 9:11	3	Flood	Top	21.0	15.6	7.7	3.7
9/15/2016 9:12	3	Flood	Bottom	21.0	15.6	7.7	3.6
9/21/2016 10:26	1	Ebb	Top	24.2	7.5	8.0	5.5
9/21/2016 10:27	1	Ebb	Bottom	23.3	14.0	7.6	3.1
9/21/2016 10:32	2	Ebb	Top	21.7	17.5	7.6	3.9
9/21/2016 10:33	2	Ebb	Bottom	21.4	19.6	7.6	2.8
9/21/2016 10:35	3	Ebb	Top	23.1	13.1	7.7	3.8
9/21/2016 10:36	3	Ebb	Bottom	22.0	17.7	7.6	3.0
10/18/2016 7:55	1	Ebb	Top	21.6	7.7	7.6	5.1
10/18/2016 7:57	1	Ebb	Bottom	21.4	8.9	7.5	3.8

Date and Time	Site	Tide	Depth	Temp (°C)	Salinity (PSU)	pH	DO (mg/L)
10/18/2016 8:04	2	Ebb	Top	18.1	14.0	7.5	4.4
10/18/2016 8:05	2	Ebb	Bottom	18.1	15.6	7.5	2.9
10/18/2016 8:08	3	Ebb	Top	18.9	13.5	7.5	4.4
10/18/2016 8:09	3	Ebb	Bottom	18.2	15.5	7.5	2.9
10/26/2016 11:12	1	Flood	Top	17.2	23.1	7.7	6.0
10/26/2016 11:13	1	Flood	Bottom	17.0	25.2	7.7	6.1
10/26/2016 11:17	2	Flood	Top	17.1	26.1	7.7	6.5
10/26/2016 11:19	2	Flood	Bottom	17.0	27.0	7.7	6.5
10/26/2016 11:22	3	Flood	Top	17.0	27.2	7.7	6.7
10/26/2016 11:23	3	Flood	Bottom	17.0	27.8	7.7	6.7

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 on the same date and time as the required monthly chlorophyll *a* sampling.

Table 9. Discrete monthly water quality measurements at Pond A18 discharge

Date and Time	Temperature (C)	Salinity (PSU)	pH	DO (mg/L)
6/30/2016 08:45	21.0	9.4	7.1	0.4
7/28/2016 09:45	22.2	11.8	9.4	0.4
8/30/2016 08:00	20.4	14.5	9.6	5.7
9/28/2016 09:30	21.0	15.7	9.7	5.0
10/29/2016 09:00	17.7	15.8	9.7	10.3

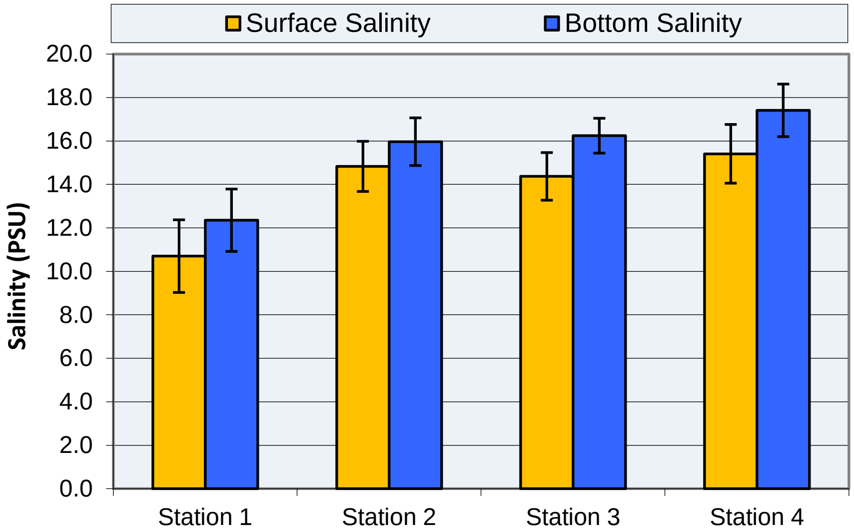
Temperature

Receiving water temperature measured highest at Station 1 and was relatively consistent across the three stations in Coyote Creek (Table 7). Similar to previous years, temperature decreased with depth. 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 prior years, the salinity profile for receiving water has been dictated by upstream stratification and downstream mixing in Artesian Slough. This pattern, caused by interactions between saltier tidal influence and fresher Facility effluent, was observed regardless of pond discharge or tides. In 2016, the adoption of a downstream set of monitoring stations yielded elevated surface salinity at Station 1, and slightly higher surface salinity at Station 2. Bottom salinity at these two stations dipped slightly in comparison to years past. Salinity stratification across all stations was less pronounced in 2016, indicating more mixing, which makes sense since all stations are much further downstream from the Facility freshwater effluent discharge. As expected, bottom salinity measured higher than surface salinity at all stations.

Figure 6. Mean (+ SE) monthly Salinity in receiving water for 2016

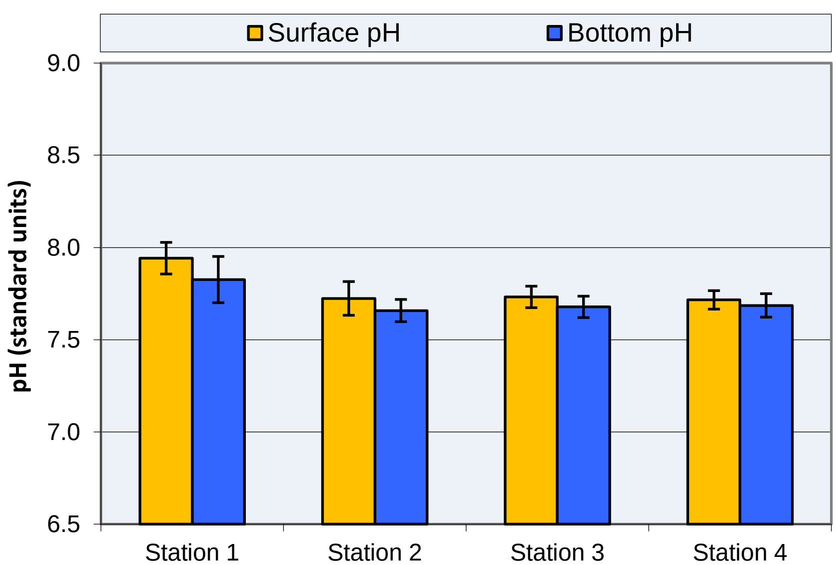


pH

Stratification of pH in the receiving water was most pronounced at Station 1, with higher pH at the surface. pH was considerably higher at Station 1 than all other stations. Stations 2 and 3 exhibited slight stratification, and Station 4 was the most mixed.

Pond pH was higher (8.1 – 10.4,) than the surface and bottom measurements of the receiving water (7.5 – 8.1). Consistent with previous years, the higher pond pH did not have a measurable effect on receiving water pH.

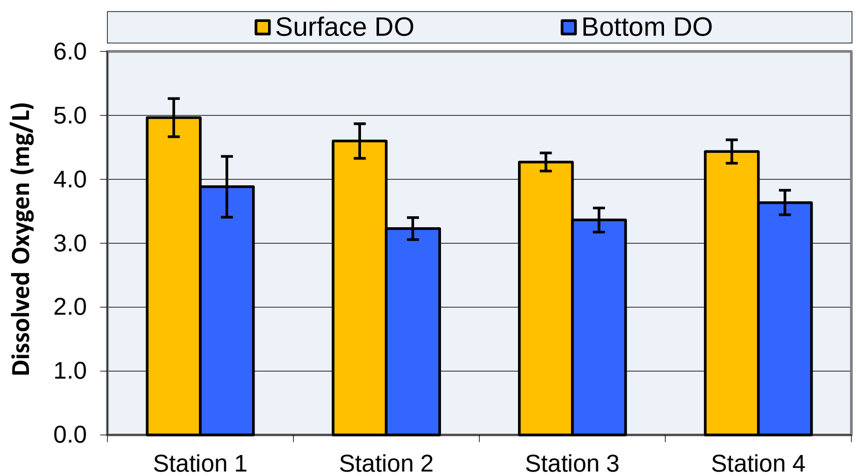
Figure 7. Mean (+ SE) monthly pH in receiving water for 2016



Dissolved Oxygen

Monthly DO measurements at the four monitoring stations (Table 7) reveal surface DO was substantially higher than bottom DO across all stations. DO recorded at the surface and bottom was highest at Station 1. The adoption of an alternate set of monitoring stations in 2016 yielded lower DO at Stations 1 and 2 in comparison to prior years. This is likely due to re-locating these stations farther away from the oxygen-rich effluent discharged from the Facility. 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 occurred twice during the first two months of the 2016 season (Table 9). In both cases, trigger monitoring was already implemented, so these exceedances warranted continued trigger monitoring at Stations 1-3 in Artesian Slough and Coyote Creek. Trigger monitoring for temperature, salinity, pH and DO was initiated on June 29 (Table 6) when pond DO levels fell below the 10th percentile weekly trigger of 3.3 mg/l.

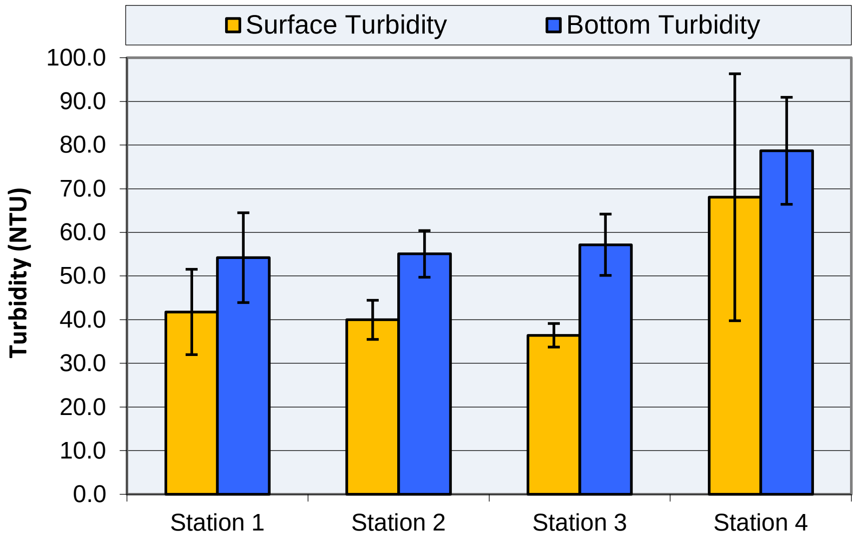
Figure 8. Mean (+ SE) monthly Dissolved Oxygen in receiving water for 2016



Turbidity

Turbidity was measured monthly at the four stations in Artesian Slough. These measurements confirmed both surface and bottom turbidity was relatively consistent across stations 1-3 (Figure 9). Turbidity at Station 4 was slightly higher, perhaps due to its proximity to the breach of Pond A17. As expected, bottom turbidity was higher at each station.

Figure 9. Mean (+ SE) monthly Turbidity in receiving water for 2016



Chlorophyll-*a* Monitoring

The City measured chlorophyll *a* as an index of phytoplankton biomass 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 were much higher in 2016 as a whole than years past (Table 10). At the onset of the 2016 monitoring season, chlorophyll *a* concentration was an order of magnitude greater than all previous years. Chlorophyll *a* concentrations remained elevated throughout the monitoring season, with the highest measurements in August and at the conclusion of the season.

Table 10. Monthly chlorophyll *a* measurements at Pond 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	6/30/2016	200	0.4	9.4
July	7/28/2016	131	0.4	11.8
August	8/10/2016	208	4.7	13.6
September	9/28/2016	156	5.0	15.7
October	10/29/2016	250	10.3	15.8

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. Sediment sampling was performed in Artesian Slough in 2011, 2012, and 2013, and 2015. Consistent with the revised sampling frequency, the City did not conduct sediment sampling in 2016.

III. Exceedances and Triggered Actions

A. Summary of Exceedances and Triggers

Table 6 lists the DO trigger events for pond discharges in 2016 and subsequent responses.

B. Summary of Corrective Action

There were twelve weeks in which the weekly 10^{th} percentile DO level in the pond's discharge dipped 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). An evaluation of trigger data revealed no negative effects in the receiving water that could be attributed to Pond A18 discharge, so no additional protective actions were implemented.

IV. Discussion and Interpretation of 2016 Results

Temperature

Although pond mean temperature decreased slightly in 2016 in comparison to previous years, it varied little between discharge and non-discharge periods. Pond temperatures generally peak in July/August and show large fluctuations depending on heat waves or cloud cover.

Salinity

Discharge salinity in 2016 was reduced compared to years past due to lower salinity water entering the pond from the southern intake point. In past years, the intake point was the northern structure, where the average salinity is greater. The mean pond salinity in 2016 was 12.6 PSU, compared to mean salinities of 30.5 PSU and 29.4 PSU for years 2014 and 2013, respectively, in which the pond was managed in a southern release scenario throughout its entire dry season monitoring. Similar to patterns observed over the previous years, salinity climbed steadily through the season and peaked in late September into early October.

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 saltier bay water that is pushed into the slough by the flooding tide.

pH

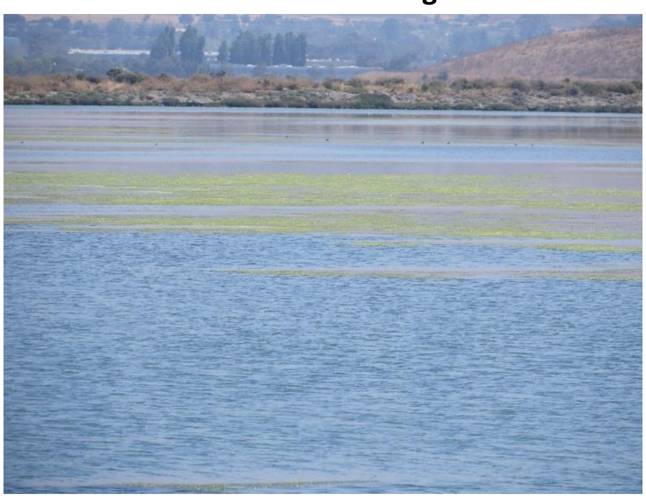
Increases in pond pH are a result of photosynthesis, accompanied by high irradiance and temperatures. Conversely, high salinity acts as a buffer, limiting pH increases. Despite the reversal of the pond's continuous circulation regime, pH in 2016 was consistent with years past, albeit marginally elevated and more varied. pH increased due to episodes of intense photosynthesis, followed by declines when algae experienced periodic decomposition. Pond pH followed the typical pattern of climbing gradually throughout the dry season in 2016, but it remained elevated at the close of the monitoring season.

Dissolved Oxygen

Pond dissolved oxygen concentrations in 2016 were slightly higher (mean DO of 7.7 mg/L) compared to the previous year (mean DO of 7.4 mg/L). Pond DO was more variable at the start of the 2016 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 higher load of nitrogen entering the pond due through a southern intake point proximal to the Facility. Higher nitrogen loads in a shallow, freshwater system can lead to high algal biomass (> 60 ug/L chlorophyll-a), and Pond A18's chlorophyll concentrations never measured below 131 ug/L). As abundant phytoplankton or macro-algae die and decay, the decomposition process consumes dissolved oxygen in the water column and drives DO concentrations down. Consequently, there were a total of twelve trigger events in 2016, compared to nine in 2015.

Pond A18 discharge into Artesian Slough.

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 benthic filter feeders and 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. Filamentous algal mats covered the surface of the eastern portion of Pond A18 at the onset of the 2016 season, with well-established extensions into the western and northern portions of the pond. Benthic algal mats had already accumulated along the pond's margins, as well. Surface and benthic algal accumulations receded in August, and subsequently returned to the levee margins, though not to the degree observed early in the monitoring season.

Condition Assessment of Southern Hydraulic Structure

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. During the reconstruction of this structure from June through August 2015, the southern structure was used to pulse slough water into and out of the pond to maintain pond water elevation and water quality. This pulsing of water exacerbated bank erosion and active scouring/slumping on the outboard levee proximal to the southern structure.

Google Earth satellite imagery details the erosion on the outboard side of the southern hydraulic structure.

Once the northern structure's construction was completed in August 2015, the water control structures were configured to return to the pond's normal continuous circulating regime of intake at the northern structure and discharge from the southern structure. While operating under this configuration, the erosion around the southern structure progressed to the extent that Facility engineering staff and consultant geotechnical engineers recommended an alternate flow regime to mitigate risk of levee failure and breach.

Due to the size and depth of the active scouring on the outboard side of the structure, the trash rack had become ineffective in preventing fish from entering the pond. Facility staff fabricated and installed fish screens in early 2016, and continuous circulation of Pond A18 was subsequently reoriented for inflow at the southern structure and discharge from the northern gate.

Steel flap gates were replaced with slotted fish screens to allow for inflow while preventing fish passage.

Water Board was consulted and updated regarding the City's ongoing monitoring efforts to evaluate effects to receiving water. Staff changed the location of continuous pond water quality monitoring from the south structure to the northern structure, and calculated 10th percentile weekly DO values on north discharge water throughout the 2016 dry season monitoring. Monitoring stations in the receiving water for monthly discrete sampling, along with trigger monitoring sites, were adopted in accordance with the north release scenario detailed in the WDR and A18 Operations Plan.

Pond Infrastructure

The City has contracted HydroScience Engineers, Inc. to prepare a biddable set of plans and specifications to repair/reinforce the levee embankments and channel bottom in the vicinity of Pond A18's southern structure to allow for flow in either direction. Repairs will likely include, but not be limited to:

-Installing sheet piles along the inboard and outboard levee banks on each side of the structure.

-Rebuilding levee banks in the vicinity of the gate with engineered fill and installing articulated concrete block mats to armor these embankments.

- Filling and reinforcing the below-water scouring structure with fill material such as riprap or layered articulated concrete block mats.

- Repairing/replacing the structure's deck framing.

The City continues to monitor the mechanical and geotechnical vulnerabilities of the pond's southern structure, and adjust operations to minimize sediment transport, scour and levee erosion.

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.

2016 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 many waterfowl species.

V. Lessons Learned and Recommendations

1. Twelve years of monitoring demonstrates that Pond A18 discharge has no measurable effect on the water quality of the receiving water. Changes in water quality of Artesian Slough and Coyote Creek 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 Stations 1-3. If impacts to receiving water are verified, evaluate and implement additional adaptive management actions and assessments.

2. Sampling chlorophyll *a* is useful for characterizing the variability of phytoplankton abundance 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 twelve years of monitoring.

   Recommendation: 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. Adoption of a northern discharge regime in 2016 resulted in higher nitrogen inputs to the pond due to a greater percentage of Facility effluent rich slough water entering the pond. Consequently, phytoplankton biomass was higher throughout the entire monitoring season than in previous years. Dissolved oxygen concentrations were more variable earlier in the year and low DO occurred more frequently this monitoring season, likely due to the increased algal biomass. As with all previous years, the low DO conditions in 2016 did not affect water quality in either Artesian Slough or Coyote Creek, indicating that the pond discharges have minimal spatial influence on receiving water DO.

   Recommendation: Considering the negligible effect of pond discharges on receiving water DO, the City shall continue to manage the pond's operations to minimize sediment transport, scour and levee erosion by adjusting flow and discharge configuration as ongoing monitoring dictates.