

**Redwood Shores Lagoon
July 2019
Monthly Water Quality Monitoring Report**



Prepared for

**Redwood City
Public Works Services Department
1400 Broadway
Redwood City, CA 94063-2594**

Prepared by

**Clean Lakes, Inc.
P. O. Box 3186
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July 2019

City of Redwood City staff member Cory Cattaneo performed the July monthly monitoring on July 25, 2019. Weather conditions were 0% cloudy, the air temperature was 65 Fahrenheit, and light winds were recorded.

General water quality measurements for dissolved oxygen, clarity (as turbidity), salinity, pH, and temperature were recorded at Sites R-1 thru R-5. Nutrients, nitrate as N were sampled at R-1 thru R-5 via laboratory analysis (dissolved ortho-phosphate as P were not collected during July). Water samples were collected for Fecal Coliform analysis at Sites R-1 and R-2. During each sample visit observations are noted for floatables, oil/grease films and scum, water discoloration, algae and aquatic plant growth, and any presence of dead birds or fish. Water Quality Objectives for Redwood Shores Lagoon is provided below as well Dissolved Oxygen (DO) requirements in Non-Salmonid waters by which to compare field and laboratory results.

Table 1. Redwood Shores Lagoon Water Quality Objectives

Parameter	Criteria								
pH	6.5 – 8.5								
Dissolved oxygen	Minimum of 5.0 mg/L								
Chlorophyll-a	50.0 ug/l								
Fecal coliform bacteria	A median not to exceed 240 MPN/100 mL in 5 consecutive samples with no single sample exceeding 1,000 MPN/100 mL								
Color	No significant increase over that in sloughs								
Oil, grease, and visable films	None								
Floatables	None								
Aquatic growths	None sufficient to cause nuisance conditions								
Turbidity in Belmont, Steinberger and Bay sloughs that receive lagoon discharge	<table border="0"> <tr> <td><u>Background Levels</u></td> <td><u>Max. Incremental Increase</u></td> </tr> <tr> <td>50 NTU</td> <td>5 NTU</td> </tr> <tr> <td>50-100 NTU</td> <td>10 MTU</td> </tr> <tr> <td>100 NTU</td> <td>10 % of background</td> </tr> </table>	<u>Background Levels</u>	<u>Max. Incremental Increase</u>	50 NTU	5 NTU	50-100 NTU	10 MTU	100 NTU	10 % of background
<u>Background Levels</u>	<u>Max. Incremental Increase</u>								
50 NTU	5 NTU								
50-100 NTU	10 MTU								
100 NTU	10 % of background								

II. NON-SALMONID WATERS	DO mg/l
A. Early life stages	
No production impairment	6.5
Slight production impairment	5.5
Moderate production impairment	5
Severe production impairment	4.5
Limit to avoid acute mortality	4
B. Other life stages	
No production impairment	6
Slight production impairment	5
Moderate production impairment	4
Severe production impairment	3.5
Limit to avoid acute mortality	3

RESULTS - Water quality results for each site is provided below in Table format for 2019 to allow comparison of results from month to month.

SITE R-1

			Fecal		Dissolved							
	Ortho		Fecal	Coliform	Water	Oxygen	DO		PH	PH		
	Phosphate	Nitrate as N	Coliform	MPN/100 ml	Temp	(DO)	mg/l		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	MPN/100 ml	Limit	C°	mg/l	Limit	PH	Limit	Limit	ppt	NTU
1.19	ND	ND	79	1,000	11.8	6.22	5	8.2	6.5	8.5	21.36	6.25
2.19	0.15	ND	7.8	1,000	16	6.9	5	7.3	6.5	8.5	29.24	12.9
3.19	0.1	ND	4.5	1,000	21.3	7.72	5	8	6.5	8.5	23.66	6.1
4.19	0.23	ND	22	1,000	20.8	6.56	5	7.6	6.5	8.5	24.19	5.31
5.19	0.12	ND	540	1,000	20.6	8.33	5	7.5	6.5	8.5	26.97	22.3
6.19	0.17	ND	ND	1,000	23.2	8.18	5	7.6	6.5	8.5	27.81	16.3
7.19	N/A	ND	2	1,000	25.2	7.94	5	7.4	6.5	8.5	26.31	9.4
8.19				1,000			5		6.5	8.5		
9.19				1,000			5		6.5	8.5		
10.19				1,000			5		6.5	8.5		
11.19				1,000			5		6.5	8.5		
12.19				1,000			5		6.5	8.5		

SITE R-2

			Fecal		Dissolved							
	Ortho		Fecal	Coliform	Water	Oxygen	DO		PH	PH		
	Phosphate	Nitrate as N	Coliform	MPN/100 ml	Temp	(DO)	mg/l		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	MPN/100 ml	Limit	C°	mg/l	Limit	PH	Limit	Limit	ppt	NTU
1.19	ND	ND	79	1,000	12.4	5.89	5	8	6.5	8.5	23.44	12.8
2.19	0.14	ND	4	1,000	16.1	9.72	5	7.5	6.5	8.5	29.42	14.6
3.19	0.19	ND	4	1,000	21.5	9.49	5	7.4	6.5	8.5	25	24.3
4.19	0.29	ND	4.5	1,000	21.3	7.21	5	7.3	6.5	8.5	24.67	23.9
5.19	0.35	ND	49	1,000	19.2	7.13	5	7.1	6.5	8.5	29.23	30.4
6.19	0.46	ND	ND	1,000	22.8	7.87	5	7.2	6.5	8.5	29.18	21.8
7.19	N/A	ND	ND	1,000	28.2	7.26	5	6.9	6.5	8.5	23.92	20
8.19				1,000			5		6.5	8.5		
9.19				1,000			5		6.5	8.5		
10.19				1,000			5		6.5	8.5		
11.19				1,000			5		6.5	8.5		
12.19				1,000			5		6.5	8.5		

SITE R-3

				Dissolved						
	Ortho		Water	Oxygen	DO		PH	PH		
	Phosphate	Nitrate as N	Temp	(DO)	mg/l		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	C°	mg/l	Limit	PH	Limit	Limit	ppt	NTU
1.19	ND	ND	12.5	7.22	5	7.9	6.5	8.5	26.38	38.7
2.19	ND	ND	12.66	10.77	5	8.1	6.5	8.5	32.02	9.12
3.19	0.19	ND	18.1	10.31	5	7.9	6.5	8.5	24.66	23.2
4.19	0.21	ND	21.4	8.69	5	7.5	6.5	8.5	26.83	38.3
5.19	0.22	ND	18.8	8.46	5	7.1	6.5	8.5	29.77	27
6.19	0.22	ND	23.7	8.11	5	7.1	6.5	8.5	29.41	14.4
7.19	N/A	ND	24.5	6.93	5	7.2	6.5	8.5	27.76	12.7
8.19					5		6.5	8.5		
9.19					5		6.5	8.5		
10.19					5		6.5	8.5		
11.19					5		6.5	8.5		
12.19					5		6.5	8.5		

SITE R-4

				Dissolved						
	Ortho		Water	Oxygen	DO		PH	PH		
	Phosphate	Nitrate as N	Temp	(DO)	mg/l		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	C°	mg/l	Limit	PH	Limit	Limit	ppt	NTU
1.19	ND	ND	11.6	5.77	5	7.7	6.5	8.5	25.46	13.5
2.19	0.14	ND	12.4	10.75	5	7.4	6.5	8.5	32.75	11.9
3.19	0.19	ND	21.3	9.08	5	7.2	6.5	8.5	25.5	23.5
4.19	0.32	ND	19.7	5.93	5	7.3	6.5	8.5	24.66	33.3
5.19	0.36	ND	21.3	5.63	5	7	6.5	8.5	27.69	16.1
6.19	0.5	ND	24.1	7.01	5	7.2	6.5	8.5	27.72	12.3
7.19	N/A	ND	25.3	7.11	5	7.2	6.5	8.5	26.38	27.2
8.19					5		6.5	8.5		
9.19					5		6.5	8.5		
10.19					5		6.5	8.5		
11.19					5		6.5	8.5		
12.19					5		6.5	8.5		

SITE R-5

				Dissolved						
	Ortho		Water	Oxygen	DO		PH	PH		
	Phosphate	Nitrate as N	Temp	(DO)	mg/l		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	C°	mg/l	Limit	PH	Limit	Limit	ppt	NTU
1.19	ND	ND	12.4	7.62	5	8	6.5	8.5	22.44	8.21
2.19	0.13	ND	12.6	9.69	5	7.5	6.5	8.5	30.03	16.9
3.19	0.15	ND	19.9	9.55	5	7.6	6.5	8.5	24.3	23.2
4.19	0.19	ND	21.3	7.1	5	7.6	6.5	8.5	27.51	15.8
5.19	0.2	ND	18.5	7.45	5	7	6.5	8.5	29.83	12.5
6.19	0.25	ND	22.9	7.92	5	7.5	6.5	8.5	29.46	17.4
7.19	N/A	0.27	25.6	6.73	5	7	6.5	8.5	26.53	23.4
8.19					5		6.5	8.5		
9.19					5		6.5	8.5		
10.19					5		6.5	8.5		
11.19					5		6.5	8.5		
12.19					5		6.5	8.5		

NUTRIENTS – Orthophosphate as P (ORP) samples were not taken during month of July. Nitrate as N was detected in R-5 at 0.27 mg/l. Nitrate as N was not detected in R-1 – R-4.

Phosphorus and nitrogen are essential nutrients for the plants and animals that make up the aquatic food web. Since phosphorus is the nutrient in short supply in most fresh waters, even a modest increase in phosphorus can, under the right conditions, set off a whole chain of undesirable events in a stream including accelerated plant growth, algae blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals.

There are many sources of phosphorus, both natural and human. These include soil and rocks, wastewater treatment plants, runoff from fertilized lawns and cropland, failing septic systems, runoff from animal manure storage areas, disturbed land areas, drained wetlands, water treatment, and commercial cleaning preparations.

Inorganic nitrate as N should be less than 0.3 mg/L to avoid algal blooms. Excessive concentrations of nitrate in lakes and streams greater than about 5 milligrams per liter (measured as nitrogen), depending on the water body, can cause excessive growth of algae and other plants, leading to accelerated eutrophication or "aging" of lakes, and occasional loss of dissolved oxygen. Animals and humans cannot use inorganic forms of nitrogen.

Since phosphorus is often scarce in freshwater ecosystems, it is typically a limiting nutrient, meaning that it limits the amount of life the system can sustain. When humans add phosphate-rich sewage or agricultural runoff, algae growth may no longer be limited by the scarcity of phosphorus in its environment and may grow out of control. In order to control algae growth, the EPA recommends that phosphate levels not exceed 0.05 milligrams per liter for streams discharging into lakes or reservoirs, 0.1 milligrams per liter for lakes and reservoirs, and 0.1 milligrams per liter for other streams and rivers.

FECAL COLIFORM - The fecal coliform levels were measured at R-1 and R-2. R-1 sample was at 2.0 MPN/100mL and R-2 sample was not detected (ND). R-1 had fecal coliform increase from the previous month of June, R-2 fecal coliform sample resulted in ND which is the same from previous month of June. Fecal coliform levels did not exceed the established limits. Single sample results over 1,000 MPN/100mL are considered to exceed limits.

GENERAL WATER QUALITY ANALYSIS – The Dissolved Oxygen (DO) levels in July exceeded the 5.0 mg/l threshold in all five sites. DO was highest at Site R-1 (7.94 mg/l) and lowest at Site R-5 (6.73 mg/l). The water temperature for July ranged from 24.5 to 28.2 Celsius. PH measurements were within the limit at every site, ranging from 6.9 to 7.4. Salinity measurements varied from approximately 23.92 ppt. to a maximum of 27.76 ppt. Turbidity was within limits and varied between 9.4 NTU to 27.2 NTU. It was noted in the field data sheet that algae and aquatic plant life were present at the sample sites in R-1 and R-2. It also was noted in the field data sheet that the pumps were running at the time of sampling in sites R-4 and R-5.

Field Results

Redwood Shores Lagoon
Monthly Water Quality Monitoring Field Data

Date: <u>7/25/19</u>	Name(s) of Field Personnel: <u>CATTANED</u>
Weather Conditions	Air Temperature: <u>65°</u>
Wind Conditions: <u>(Light)</u> Moderate / High	Percent Cloud: <u>0%</u>
Field Measurements	

Sampling Station	Time	Maximum Depth (ft)	Sample Depth (ft)	Water Temp°C	Dis. Oxy. Mg/l	pH units	Salinity ppt	Turbidity NTU
R-1	<u>11:32</u>	<u>6'</u>	<u>3'</u>	<u>25.2</u>	<u>7.94</u>	<u>7.4</u>	<u>26.31</u>	<u>9.4</u>
R-2	<u>11:13</u>	<u>6'</u>	<u>3'</u>	<u>28.2</u>	<u>7.26</u>	<u>6.9</u>	<u>23.92</u>	<u>20.0</u>
R-3	<u>10:17</u>	<u>3'</u>	<u>2'</u>	<u>24.5</u>	<u>6.93</u>	<u>7.2</u>	<u>27.76</u>	<u>12.7</u>
R-4	<u>9:25</u>	<u>6'</u>	<u>3'</u>	<u>25.3</u>	<u>7.11</u>	<u>7.2</u>	<u>26.38</u>	<u>27.2</u>
R-5	<u>9:44</u>	<u>6'</u>	<u>3'</u>	<u>25.6</u>	<u>6.73</u>	<u>7.0</u>	<u>26.53</u>	<u>23.4</u>

Samples for the following test will be collected for laboratory analyses

- Nitrate-N
- Ortho-P04-P (preservative required, do not rinse bottle)
- Fecal Coliform Bacteria (R-1 and R-2 only)

Notes & Observations about floatables, oil & grease, films, scum water discoloration, algae, aquatic plant growth and presence of dead wildlife:

R-1- ALGAE, AQUATIC PLANT LIFE PRESENT AT SAMPLE SITE

R-2- ALGAE, AQUATIC PLANT LIFE PRESENT AT SAMPLE SITE

R-3- _____

R-4- PUMPS RUNNING AT TIME OF SAMPLE

R-5- PUMPS RUNNING AT TIME OF SAMPLE

Laboratory Results



Alpha Analytical Laboratories, Inc. email: clientservices@alpha-labs.com
 Corporate: 208 Mason Street | Ukiah, CA 95482 | T: 707-468-0401 | F: 707-468-5267 | ELAP# 1551

Redwood City, City of - Redwood Shores 1400 Broadway Street Redwood City, CA 94063	Project Manager: Michael Patolo Project: Redwood Shores Lagoon Project Number: Monthly Monitoring	Reported: 08/12/19 09:16
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	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
R-1 (19G3034-01)			Sample Type: Water		Sampled: 07/25/19 11:32			
Conventional Chemistry Parameters by APHA/EPA Methods								
Nitrate + Nitrite as N	ND mg/L	0.20	1	AG94483	07/30/19 07:30	07/31/19 13:00	SM4500-NO3 E	
Microbiological Parameters by APHA Standard Methods								
Fecal Coliforms	2.0 MPN/100mL	1.8	1	AG94522	07/25/19 16:15	07/27/19 15:00	SM9221	
R-2 (19G3034-02)			Sample Type: Water		Sampled: 07/25/19 11:13			
Conventional Chemistry Parameters by APHA/EPA Methods								
Nitrate + Nitrite as N	ND mg/L	0.20	1	AG94483	07/30/19 07:30	07/31/19 13:00	SM4500-NO3 E	
Microbiological Parameters by APHA Standard Methods								
Fecal Coliforms	ND MPN/100mL	1.8	1	AG94522	07/25/19 16:15	07/27/19 15:00	SM9221	
R-3 (19G3034-03)			Sample Type: Water		Sampled: 07/25/19 10:17			
Conventional Chemistry Parameters by APHA/EPA Methods								
Nitrate + Nitrite as N	ND mg/L	0.20	1	AG94483	07/30/19 07:30	07/31/19 13:00	SM4500-NO3 E	

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R-4 (19G3034-04)

Sample Type: Water

Sampled: 07/25/19 09:25

Conventional Chemistry Parameters by APHA/EPA Methods

Nitrate + Nitrite as N	ND mg/L	0.20	1	AG94483	07/30/19 07:30	07/31/19 13:00	SM4500-NO3 E
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R-5 (19G3034-05)

Sample Type: Water

Sampled: 07/25/19 09:44

Conventional Chemistry Parameters by APHA/EPA Methods

Nitrate + Nitrite as N	0.27 mg/L	0.20	1	AG94483	07/30/19 07:30	07/31/19 13:00	SM4500-NO3 E
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END OF REPORT