

Redwood Shores Lagoon
July 2015
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.
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August 2015

City of Redwood City staff Richard Chaffey performed the July monthly monitoring on July 15, 2015. Weather conditions were sunny, the air temperature was 63 F, 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, and dissolved ortho-phosphate as P were sampled at R-1 thru R-5 via laboratory analysis. 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 visible films	None
Floatables	None
Aquatic growths	None sufficient to cause nuisance conditions
Turbidity in Belmont, Steinberger and Bay sloughs that receive lagoon discharge	<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

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RESULTS - Water quality results for each site is provided below in Table format for 2015 to allow comparison of results from month to month.

SITE R-1

	Ortho		Fecal	Fecal	Water	Dissolved			PH	PH		
	Phosphate	Nitrate as N	Coliform	Coliform	Temp	Oxygen	DO		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	MPN/100 ml	MPN/100 ml	C°	mg/l	mg/l	PH	Limit	Limit	ppt	NTU
1.15	0.18	ND	>1,600	1,000	12.1	15.49	5	8.4	6.5	8.5	28.39	6.81
2.15	0.17	ND	7.8	1,000	16.8	15.01	5	8.7	6.5	8.5	22.2	5.94
3.15	0.15	ND	13	1,000	18.3	7.79	5	8.4	6.5	8.5	27.17	9.4
4.15	0.27	ND	7.8	1,000	18.7	6.24	5	8	6.5	8.5	27.91	22.2
5.15	0.21	ND	7.8	1,000	18.6	7.76	5	8	6.5	8.5	28.02	20.1
6.15	0.23	ND	22	1,000	23	9.02	5	8.3	6.5	8.5	26.15	12.1
7.15	0.22	ND	7.8	1,000	23.1	8.87	5	8.3	6.5	8.5	24.44	12.4
8.15				1,000			5		6.5	8.5		
9.15				1,000			5		6.5	8.5		
10.15				1,000			5		6.5	8.5		
11.15				1,000			5		6.5	8.5		
12.15				1,000			5		6.5	8.5		

SITE R-2

	Ortho		Fecal	Fecal	Water	Dissolved			PH	PH		
	Phosphate	Nitrate as N	Coliform	Coliform	Temp	Oxygen	DO		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	MPN/100 ml	MPN/100 ml	C°	mg/l	mg/l	PH	Limit	Limit	ppt	NTU
1.15	0.16	ND	2	1,000	13	7.76	5	2.8	6.5	8.5	35.12	21.7
2.15	0.13	ND	7.8	1,000	15.8	3.51	5	8.4	6.5	8.5	30.25	14.3
3.15	0.25	ND	2	1,000	17.6	5.45	5	8	6.5	8.5	31.11	60.4
4.15	0.23	ND	46	1,000	17.5	5.84	5	7.7	6.5	8.5	31.56	23.5
5.15	0.25	ND	17	1,000	17.6	6.65	5	7.9	6.5	8.5	31.58	22.2
6.15	0.34	ND	4.5	1,000	22.8	5.16	5	7.7	6.5	8.5	27.71	28.7
7.15	0.36	ND	7.8	1,000	23.2	7.27	5	7.4	6.5	8.5	27.88	30.9
8.15				1,000			5		6.5	8.5		
9.15				1,000			5		6.5	8.5		
10.15				1,000			5		6.5	8.5		
11.15				1,000			5		6.5	8.5		
12.15				1,000			5		6.5	8.5		

SITE R-3

	Ortho		Water	Dissolved			PH	PH		
	Phosphate	Nitrate as N	Temp	Oxygen	DO		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	C°	(DO)	mg/l	PH	Limit	Limit	ppt	NTU
1.15	0.13	ND	12.3	6.38	5	8.7	6.5	8.5	33.39	49.2
2.15	0.15	ND	14.6	11.31	5	3.3	6.5	8.5	31.48	21.9
3.15	0.2	ND	16.4	7.48	5	7.8	6.5	8.5	26	46.5
4.15	0.2	ND	15.6	7.26	5	7	6.5	8.5	31.26	43.8
5.15	0.25	ND	18.2	7.56	5	7.2	6.5	8.5	31.43	46.2
6.15	0.3	ND	20.7	5.52	5	6.8	6.5	8.5	26.61	92.3
7.15	0.26	ND	20.9	5.86	5	2.9	6.5	8.5	27.59	57.4
8.15					5		6.5	8.5		
9.15					5		6.5	8.5		
10.15					5		6.5	8.5		
11.15					5		6.5	8.5		
12.15					5		6.5	8.5		

SITE R-4

	Ortho		Water	Dissolved			PH	PH		
	Phosphate	Nitrate as N	Temp	Oxygen	DO		Lower	Upper	Salinity	Turbidity
Months	mg/l	mg/l	C°	(DO)	mg/l	PH	Limit	Limit	ppt	NTU
1.15	0.12	ND	12.6	8.41	5	1.2	6.5	8.5	37.44	17.1
2.15	0.12	ND	15.4	12.08	5	8.2	6.5	8.5	29.05	15.9
3.15	0.27	ND	17.8	5.48	5	8.3	6.5	8.5	23.88	35.7
4.15	0.27	ND	18.7	3.52	5	7.1	6.5	8.5	32.09	23.1
5.15	0.29	ND	17.9	5.25	5	8.1	6.5	8.5	29.54	21.4
6.15	0.34	ND	23.5	6.61	5	8.2	6.5	8.5	25.55	15.8
7.15	0.46	ND	22.7	5.65	5	7.7	6.5	8.5	28.47	21.8
8.15					5		6.5	8.5		
9.15					5		6.5	8.5		
10.15					5		6.5	8.5		
11.15					5		6.5	8.5		
12.15					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
1.15	ND	ND	12	8.06	5	3.9	6.5	8.5	36.83	6.16
2.15	0.11	ND	16	10.51	5	8.2	6.5	8.5	28.63	6.09
3.15	0.2	ND	17.5	5.46	5	8	6.5	8.5	23.88	3.81
4.15	0.1	ND	17.3	4.61	5	7.6	6.5	8.5	32.4	2.98
5.15	0.26	ND	17.5	4.98	5	7.6	6.5	8.5	32.51	15.6
6.15	0.31	ND	21.2	5.74	5	7	6.5	8.5	25.7	7.18
7.15	0.39	ND	22.3	3.91	5	7	6.5	8.5	28.71	9.21
8.15					5		6.5	8.5		
9.15					5		6.5	8.5		
10.15					5		6.5	8.5		
11.15					5		6.5	8.5		
12.15					5		6.5	8.5		

NUTRIENTS – Orthophosphate as P (ORP) was detected at all sites in a range between 0.22 and 0.46 mg/l. The lowest site for ORP was at R-1 while R-4 measured the highest. ORP concentration decreased in sites R-1 and R-3 and increased at all other sites in comparison to June. There were no detectable levels reported for Nitrate as N at any monitoring site.

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.

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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 7.8 MPN/100 mL for both R-1 and R-2. Coliform decreased at R-1 in comparison to June 2015. These results are relatively close to the laboratory detection limit of 1.8 MPN/100 ml. Fecal coliform did not exceed established limits. Single sample results over 1,000 MPN/mL are considered to exceed limits.

GENERAL WATER QUALITY ANALYSIS – The Dissolved Oxygen (DO) level in July exceeded the 5.0 mg/l threshold for all of the sites except R-5. DO was highest at Site R-1 (8.87 mg/l) and lowest at Site R-5 (3.91 mg/l). Water temperature increased or decreased marginally over July with temperatures ranging from 20.9 to 23.2 C. PH measurements were within limits at all Sites except R-3. Salinity measurements varied from approximately 24.44 ppt. to a maximum of 28.71 ppt. Turbidity was within limits and varied between 9.21 and 57.4 NTU.

Field Results

Redwood Shores Lagoon
Monthly Water Quality Monitoring Field Data

Date: <u>7/15/15</u>	Name(s) of Field Personnel: <u>Richard Chaffey</u>
Weather Conditions	Air Temperature: <u>63'</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	1145	3.0'	1.5'	23.1	8.87	8.3	24.44	12.4
R-2	1050	5.0'	2.5'	23.2	7.27	7.4	27.88	30.9
R-3	0955	2.0'	1.0'	20.9	5.86	2.9	27.59	57.4
R-4	0800	6.0'	3.0'	22.7	5.65	7.7	28.47	21.8
R-5	0857	6.0'	3.0'	22.3	3.91	7.0	28.71	9.21

<p>Samples for the following test will be collected for laboratory analyses</p> <ul style="list-style-type: none"> • Nitrate-N • Ortho-P04-P (preservative required, do not rinse bottle) • Fecal Coliform Bacteria (R-1 and R-2 only)
<p>Notes & Observations about floatables, oil & grease, films, scum water discoloration, algae, aquatic plant growth and presence of dead wildlife:</p> <p>R-1- _____ _____</p> <p>R-2- _____ _____</p> <p>R-3- _____ _____</p> <p>R-4- _____ _____</p> <p>R-5- _____ _____</p>

Laboratory Results



Alpha Analytical Laboratories Inc.

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 Bay Area: 6398 Dougherty Rd., Suite 35, Dublin, CA 94568 • Phone: (925) 828-6226 • Fax: (925) 828-6309
 Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

CHEMICAL EXAMINATION REPORT

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Redwood City, City of - Redwood Shores
 1400 Broadway Street
 Redwood City, CA 94063
 Attn: Brandon Gilmore

Report Date: 07/28/15 16:22
 Project No: Monthly Monitoring
 Project ID: Redwood Shores Lagoon

Order Number 15G1699	Receipt Date/Time 07/15/2015 22:45	Client Code SEL REDWOODRS	Client PO/Reference
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METHOD	BATCH	PREPARED	ANALYZED	DILUTION	RESULT	PQL	NOTE
R-1 (15G1699-01)		Sample Type: Water		Sampled: 07/15/15 11:45			
Conventional Chemistry Parameters by APHA/EPA Methods							
Orthophosphate as P	SM4500-P E	AG51705	07/17/15 07:47	07/17/15 09:58	1	0.22 mg/L	0.10
Anions by EPA Method 300.0							
Nitrate as N	EPA 300.0	AG51624	07/16/15 14:45	07/16/15 14:45	25	ND mg/L	5.0 R-01
Microbiological Parameters by APHA Standard Methods							
Fecal Coliforms	SM9221	AG52058	07/15/15 18:00	07/18/15 18:00	1	7.8 MPN/100mL	1.8
R-2 (15G1699-02)		Sample Type: Water		Sampled: 07/15/15 10:50			
Conventional Chemistry Parameters by APHA/EPA Methods							
Orthophosphate as P	SM4500-P E	AG51705	07/17/15 07:47	07/17/15 09:58	1	0.36 mg/L	0.10
Anions by EPA Method 300.0							
Nitrate as N	EPA 300.0	AG51624	07/16/15 15:34	07/16/15 15:34	25	ND mg/L	5.0 R-01
Microbiological Parameters by APHA Standard Methods							
Fecal Coliforms	SM9221	AG52058	07/15/15 18:00	07/18/15 18:00	1	7.8 MPN/100mL	1.8
R-3 (15G1699-03)		Sample Type: Water		Sampled: 07/15/15 09:55			
Conventional Chemistry Parameters by APHA/EPA Methods							
Orthophosphate as P	SM4500-P E	AG51705	07/17/15 07:47	07/17/15 09:58	1	0.26 mg/L	0.10



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Order Number 15G1699	Receipt Date/Time 07/15/2015 22:45	Client Code SEL REDWOODRS	Client PO/Reference
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Alpha Analytical Laboratories, Inc.

	METHOD	BATCH	PREPARED	ANALYZED	DILUTION	RESULT	PQL	NOTE
R-3 (15G1699-03)			Sample Type: Water		Sampled: 07/15/15 09:55			
Anions by EPA Method 300.0								
Nitrate as N	EPA 300.0	AG51624	07/16/15 15:50	07/16/15 15:50	25	ND mg/L	5.0	R-01
R-4 (15G1699-04)			Sample Type: Water		Sampled: 07/15/15 08:00			
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	SM4500-P E	AG51705	07/17/15 07:47	07/17/15 09:58	1	0.46 mg/L	0.10	
Anions by EPA Method 300.0								
Nitrate as N	EPA 300.0	AG51624	07/16/15 16:07	07/16/15 16:07	25	ND mg/L	5.0	R-01
R-5 (15G1699-05)			Sample Type: Water		Sampled: 07/15/15 08:57			
Conventional Chemistry Parameters by APHA/EPA Methods								
Orthophosphate as P	SM4500-P E	AG51705	07/17/15 07:47	07/17/15 09:58	1	0.39 mg/L	0.10	
Anions by EPA Method 300.0								
Nitrate as N	EPA 300.0	AG51624	07/16/15 16:23	07/16/15 16:23	25	ND mg/L	5.0	R-01

END OF REPORT