

**Redwood Shores Lagoon
March 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.
P. O. Box 3186
Martinez, CA 94553**

April 2015

City of Redwood City staff Richard Chaffey performed the March monthly monitoring on March 25, 2015. Weather conditions were partly cloudy (20%), the air temperature was 54 F, and winds were light. 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 visable 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

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		Dissolved							
	Phosphate	Nitrate as N	Fecal Coliform	Coliform	Water Temp	Oxygen (DO)	DO		pH	pH		
Months	mg/l	mg/l	MPN/100 mL	MPN/100 mL	C°	mg/l	Limit	pH	Limit	Limit	ppt	Turbidity NTU
1.15	0.18	ND	>1,600	1,000	12.1	15.49	5	8.40	6.5	8.5	28.39	6.81
2.15	0.17	ND	7.8	1,000	16.8	15.01	5	8.70	6.5	8.5	22.20	5.94
3.15	0.15	ND	13.0	1,000	18.3	7.79	5	8.40	6.5	8.5	27.17	9.4
4.15				1,000			5		6.5	8.5		
5.15				1,000			5		6.5	8.5		
6.15				1,000			5		6.5	8.5		
7.15				1,000			5		6.5	8.5		
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		Dissolved							
	Phosphate	Nitrate as N	Fecal Coliform	Coliform	Water Temp	Oxygen (DO)	DO		pH	pH		
Months	mg/l	mg/l	MPN/100 mL	MPN/100 mL	C°	mg/l	Limit	pH	Limit	Limit	ppt	Turbidity NTU
1.15	0.16	ND	2.0	1,000	13.0	7.76	5	2.80	6.5	8.5	35.12	21.7
2.15	0.13	ND	7.8	1,000	15.8	3.51	5	8.40	6.5	8.5	30.25	14.3
3.15	0.25	ND	2.0	1,000	17.6	5.45	5	8.00	6.5	8.5	31.11	60.4
4.15				1,000			5		6.5	8.5		
5.15				1,000			5		6.5	8.5		
6.15				1,000			5		6.5	8.5		
7.15				1,000			5		6.5	8.5		
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°	mg/l	Limit	pH	Limit	Limit	ppt	NTU
1.15	0.13	ND	12.30	6.38	5	8.70	6.5	8.5	33.39	49.20
2.15	0.15	ND	14.60	11.31	5	3.30	6.5	8.5	31.48	21.90
3.15	0.20	ND	16.40	7.48	5	7.80	6.5	8.5	26.00	46.50
4.15					5		6.5	8.5		
5.15					5		6.5	8.5		
6.15					5		6.5	8.5		
7.15					5		6.5	8.5		
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°	mg/l	Limit	pH	Limit	Limit	ppt	NTU
1.15	0.12	ND	12.60	8.41	5	1.20	6.5	8.5	37.44	17.10
2.15	0.12	ND	15.40	12.08	5	8.20	6.5	8.5	29.05	15.90
3.15	0.27	ND	17.80	5.48	5	8.30	6.5	8.5	23.88	35.70
4.15					5		6.5	8.5		
5.15					5		6.5	8.5		
6.15					5		6.5	8.5		
7.15					5		6.5	8.5		
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	12.00	8.06	5	3.90	6.5	8.5	36.83	6.16
2.15	0.11	ND	16.00	10.51	5	8.20	6.5	8.5	28.63	6.09
3.15	0.20	ND	17.50	5.46	5	8.00	6.5	8.5	32.40	3.81
4.15					5		6.5	8.5		
5.15					5		6.5	8.5		
6.15					5		6.5	8.5		
7.15					5		6.5	8.5		
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 0.15 and 0.27 mg/l. The lowest site for ORP was at R-1 while R-4 measured the highest. ORP increased at all sites except R-1 in comparison to February. Phosphorus can stimulate algae blooms, so the City and Waterworks (the maintenance contractor) should monitor conditions closely for potential algae blooms in the coming months as water and air temperatures increase. 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.

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 at 13 MPN/100 mL and 2.0 MPN/100 mL for R-1 and R-2, respectively. There was no significant change in results compared with February 2015. These values are close to the laboratory detection limit of 1.8 MPN/100 ml. Single sample results over 1,000 MPN/mL are considered to exceed limits.

GENERAL WATER QUALITY ANALYSIS – The Dissolved Oxygen (DO) levels in March were not below 5.0 mg/l at any site. DO was highest at Site R-1 (7.79 mg/l) and lowest at Site R-2 (5.45 mg/l). Water temperature increased several degrees over February with temperatures ranging from 16.4 to 18.3 C. pH measurements were within limits at all Sites. Salinity measurements varied from approximately 23.8 ppt to a maximum of 32.4 ppt. Turbidity was within limits and varied between 3.81 and 60.5 NTU.

Field Results

Redwood Shores Lagoon
Monthly Water Quality Monitoring Field Data

Date: <u>3/25/15</u>	Name(s) of Field Personnel: <u>Richard Chaffey</u>
Weather Conditions	Air Temperature: <u>54'</u>
Wind Conditions: <u>Light</u> / Moderate / High	Percent Cloud: <u>20 %</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	1220	3'	1.5'	18.3	7.79	8.4	27.17	9.40
R-2	1118	4'	2.0'	17.6	5.45	8.0	31.11	60.4
R-3	1003	3'	1.5'	16.4	7.48	7.8	26.00	46.5
R-4	0811	4'	2.0'	17.8	5.48	8.3	23.88	35.7
R-5	0906	4'	2.0'	17.5	5.46	8.0	32.40	3.81

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- _____

R-2- _____

R-3- _____

R-4- _____

R-5- Aquatic plant growth in area.

Laboratory Results



Alpha Analytical Laboratories Inc.

e-mail: clientservices@alpha-labs.com

Corporate: 208 Mason St., Ukiah, CA 95482 • Phone: (707) 468-0401 • Fax: (707) 468-5267
 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

Page 2 of 4

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

Report Date: 04/01/15 11:01
 Project No: Monthly Monitoring
 Project ID: Redwood Shores Lagoon

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
15C2483	03/25/2015 22:10	SEL_REDWOODRS	

Alpha Analytical Laboratories, Inc.

METHOD	BATCH	PREPARED	ANALYZED	DILUTION	RESULT	PQL	NOTE
R-1 (15C2483-01)		Sample Type: Water		Sampled: 03/25/15 12:20			
Conventional Chemistry Parameters: by APHA/EPA Methods:							
Orthophosphate as P	SM4500-PE	AC52631	03/26/15 13:30	03/26/15 14:48	1	0.15 mg/L	0.10
Anion: by EPA Method 300.0							
Nitrate as N	EPA 300.0	AC52634	03/26/15 16:50	03/26/15 16:50	1	ND mg/L	10 QM-01
Microbiological Parameters: by APHA Standard Methods:							
Fecal Coliforms	SM9221	AC53048	03/25/15 17:00	03/28/15 17:00	1	13 MPN/100mL	1.8
R-2 (15C2483-02)		Sample Type: Water		Sampled: 03/25/15 11:18			
Conventional Chemistry Parameters: by APHA/EPA Methods:							
Orthophosphate as P	SM4500-PE	AC52631	03/26/15 13:30	03/26/15 14:48	1	0.25 mg/L	0.10
Anion: by EPA Method 300.0							
Nitrate as N	EPA 300.0	AC52634	03/26/15 16:50	03/26/15 16:50	1	ND mg/L	10 QM-01
Microbiological Parameters: by APHA Standard Methods:							
Fecal Coliforms	SM9221	AC53048	03/25/15 17:00	03/28/15 17:00	1	2.0 MPN/100mL	1.8
R-3 (15C2483-03)		Sample Type: Water		Sampled: 03/25/15 10:03			
Conventional Chemistry Parameters: by APHA/EPA Methods:							
Orthophosphate as P	SM4500-PE	AC52631	03/26/15 13:30	03/26/15 14:48	1	0.20 mg/L	0.10

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.



Alpha Analytical Laboratories Inc.

e-mail: clientservices@alpha-labs.com

Corporate: 208 Mason St., Ukiah, CA 95482 • Phone: (707) 468-0401 • Fax: (707) 468-5267

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

Page 3 of 4

Redwood City, City of - Redwood Shores

1400 Broadway Street

Redwood City, CA 94063

Attn: Brandon Gilmore

Report Date: 04/01/15 11:01

Project No: Monthly Monitoring

Project ID: Redwood Shores Lagoon

Order Number	Receipt Date/Time	Client Code	Client PO/Reference
15C2483	03/25/2015 22:10	SEL_REDWOODRS	

Alpha Analytical Laboratories, Inc.

METHOD	BATCH	PREPARED	ANALYZED	DILUTION	RESULT	PQL	NOTE
R-3 (15C2483-03)		Sample Type: Water		Sampled: 03/25/15 10:03			
Anions by EPA Method 300.0							
Nitrate as N	EPA 300.0	AC32634	03/26/15 16:30	03/26/15 16:30	1	ND mg/L	12 QM-01
R-4 (15C2483-04)		Sample Type: Water		Sampled: 03/25/15 08:11			
Conventional Chemistry Parameters by APHA/EPA Method:							
Orthophosphate as P	SM4500-PE	AC32631	03/26/15 13:30	03/26/15 14:48	1	0.27 mg/L	0.10
Anions by EPA Method 300.0							
Nitrate as N	EPA 300.0	AC32634	03/26/15 16:30	03/26/15 16:30	1	ND mg/L	10 QM-01
R-5 (15C2483-05)		Sample Type: Water		Sampled: 03/25/15 09:06			
Conventional Chemistry Parameters by APHA/EPA Method:							
Orthophosphate as P	SM4500-PE	AC32631	03/26/15 13:30	03/26/15 14:48	1	0.20 mg/L	0.10
Anions by EPA Method 300.0							
Nitrate as N	EPA 300.0	AC32634	03/26/15 16:30	03/26/15 16:30	1	ND mg/L	10 QM-01

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

END OF REPORT