

Hess Lake Aeration Water Quality Report

Prepared for: The Hess Lake Improvement Board

Prepared by: Savin Lake Services

Introduction:

The aeration system was installed on September 26th, 2014. The system was initially turned on April 28th, 2015. No bacterial was added to the water body during 2014 or 2015. However bacterial augmentation was used in 2016, and again in 2017, to help increase the degradation of organic muck. The purpose of the aeration project is to enhance water clarity, improve water quality, and remove organic muck. This is the 3rd year the system has been active.

Sampling Methods:

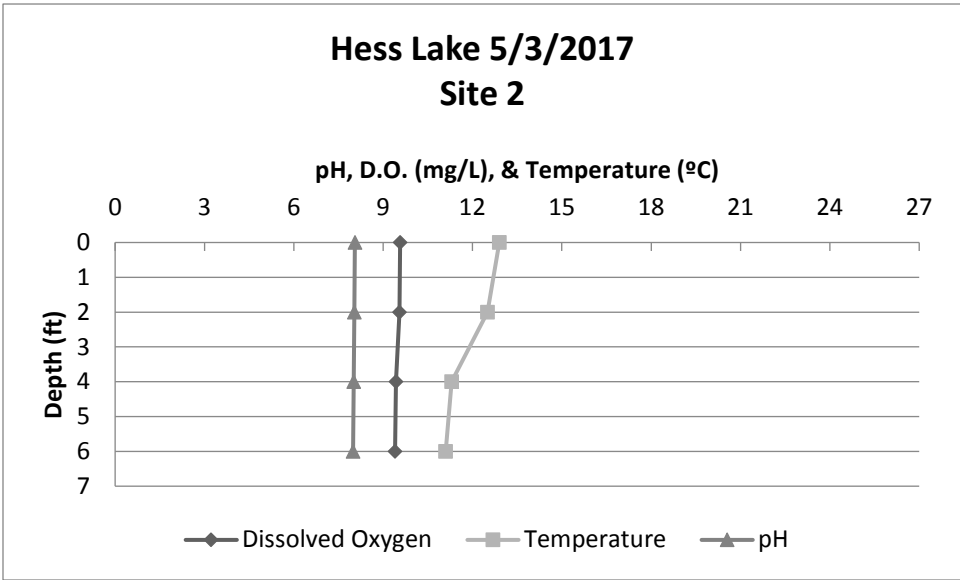
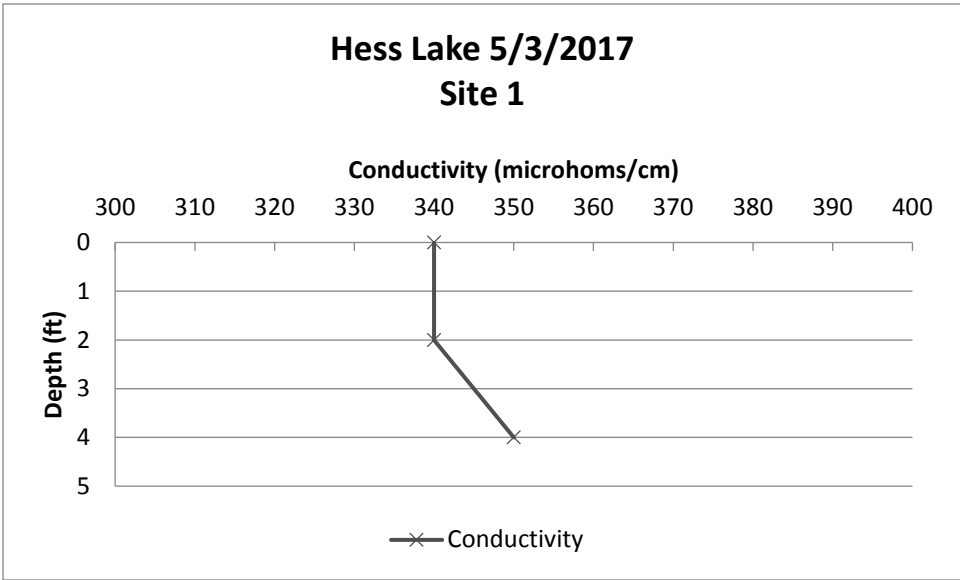
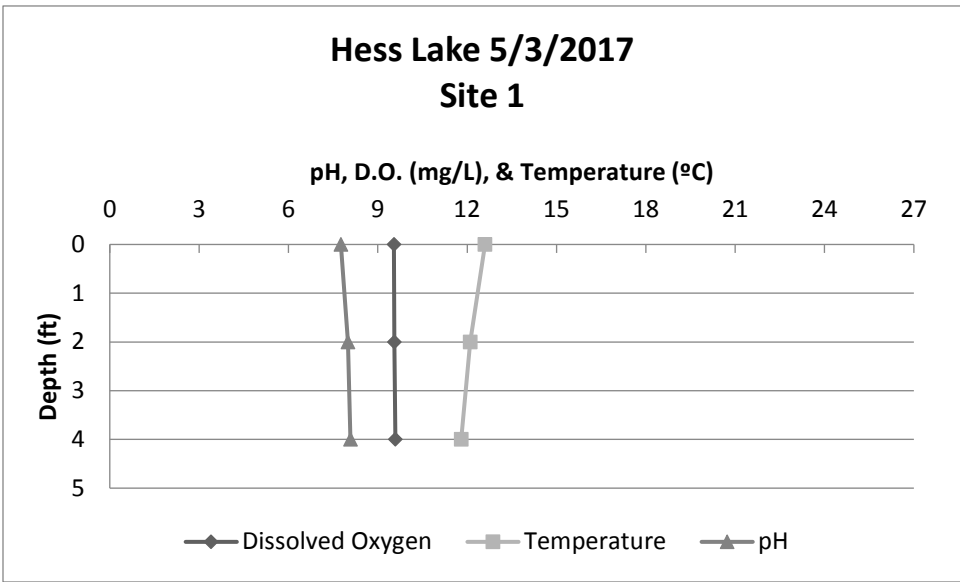
Samples were collected from the surface by hand. Samples taken at depth were collected using a Van Dorn Sampler. Samples were collected at two sites in the cove of the aeration system. Site 1: (43°22.81N, 85°46.12W), Site 2: (43°22.95N, 85°46.12W). Samples were collected for each parameter except for Temperature, pH, and Dissolved Oxygen, which were measured by a probe that was calibrated before each sampling event. Sampling dates were 6/3/14, 7/14/14, 9/15/14, 6/8/15, 7/15/15, 9/14/15, 5/25/16, 8/23/16, 9/27/16, 5/3/2017, and 9/22/2017. The dates were chosen to ensure sunny to partly cloudy conditions with no or slight wind speeds. Samples were sent to various laboratories for analysis of the required parameters.

2017 Results

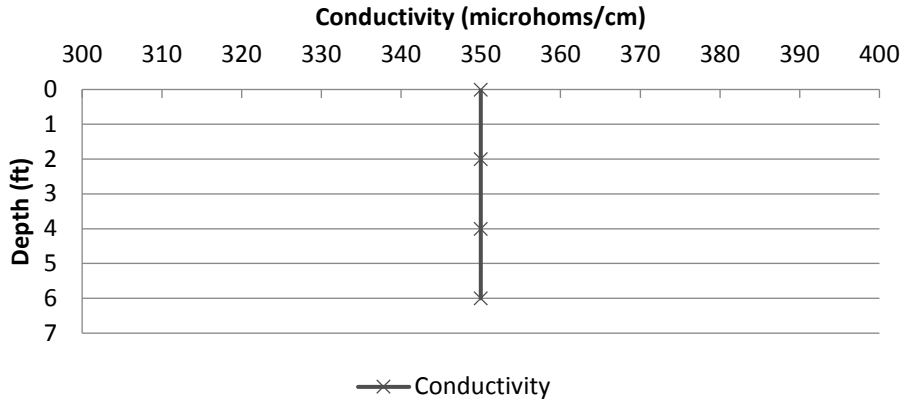
Hess Lake Aeration 2017 Data				
Date	Site	Total Suspended Solids (mg/L)	Total Phosphorus (ug/L)	Orthophosphorus (ug/L)
5/3/2017	1 Surface	6	29	<10
5/3/2017	1 Mid	6	43	19
5/3/2017	1 Deep	7	44	15
5/3/2017	2 Surface	6	35	26
5/3/2017	2 Mid	8	55	28
5/3/2017	2 Deep	8	56	36
9/22/2017	1 Surface	10	19	<10
9/22/2017	1 Mid	12	17	12
9/22/2017	1 Deep	11	27	<10
9/22/2017	2 Surface	9	21	<10
9/22/2017	2 Mid	11	31	10
9/22/2017	2 Deep	13	43	<10

Date	Site	Secchi Disk (ft)	Chlorophyll a (ug/L)
5/3/2017	1	4	1.2
5/3/2017	2	4.5	0.95
9/22/2017	1	2	4.7
9/22/2017	2	2	6.9

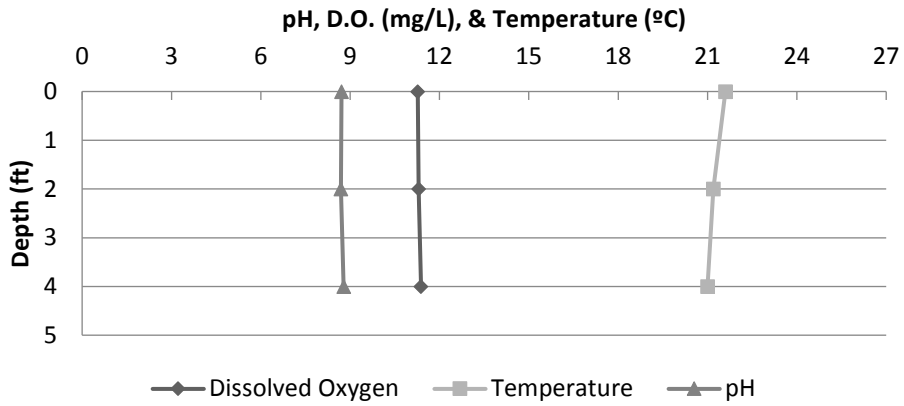
Date	Site	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (microhoms/cm)	Depth (ft)
5/3/2017	1	12.6	9.54	7.76	340	0
		12.1	9.55	8.00	340	2
		11.8	9.59	8.08	350	4
5/3/2017	2	12.9	9.57	8.05	350	0
		12.5	9.55	8.03	350	2
		11.3	9.43	8.01	350	4
		11.1	9.40	7.99	350	6
9/22/2017	1	21.6	11.27	8.71	300	0
		21.2	11.3	8.69	310	2
		21.0	11.38	8.78	310	4
9/22/2017	2	21.2	11.54	8.67	320	0
		21.1	11.56	8.66	310	2
		20.8	11.61	8.69	310	4
		19.6	8.68	8.59	320	6



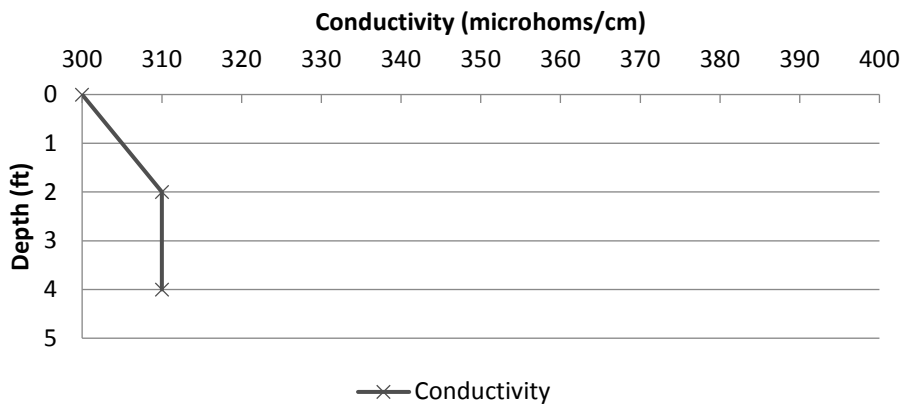
Hess Lake 5/3/2017 Site 2



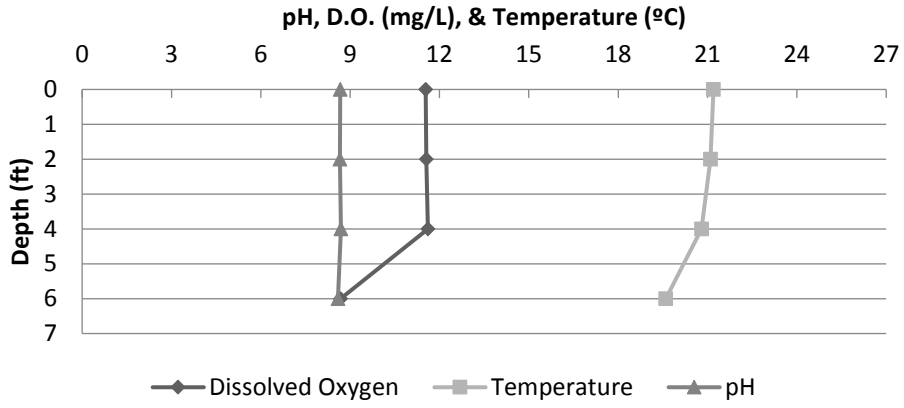
Hess Lake 9/22/2017 Site 1



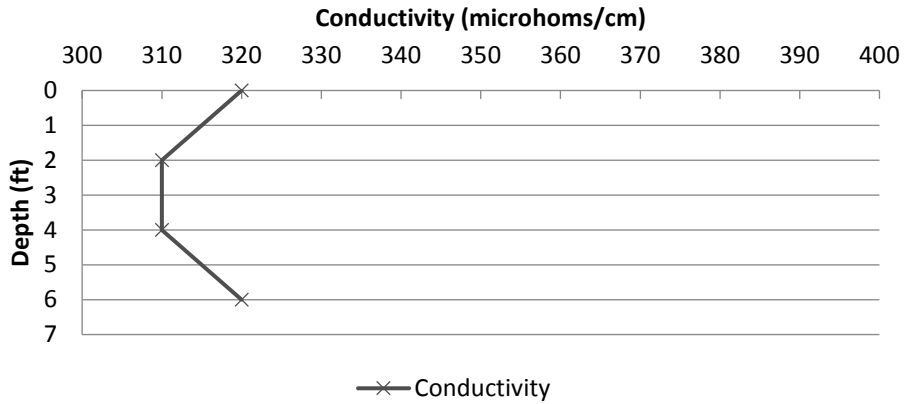
Hess Lake 9/22/2017 Site 1



Hess Lake 9/22/2017 Site 2



Hess Lake 9/22/2017 Site 2



Summary:

The water quality of Hess Lake in the cove that the aeration is running is definitely changing. As it has been stated, new aeration systems to a body of water will most likely cause the overall quality to decrease initially. As the aeration system turns the water over the sediment is releasing nutrients into the water column.

The total suspended solids (TSS) has gone from is not changing as much as previously thought. 2017 values are low compared to 2016. Total phosphorus (TP) has increased on average. Orthophosphorus (SRP) has remained relatively the same. With the increase of TP, it is understandable that both secchi disk readings and Chlorophyll a concentration is degraded. Secchi disk readings averaged 3 ft in 2014, and now average 1.5 feet in 2016. Chlorophyll a concentrations lowered again to a high of 6.9 ug/L. The other parameters (Temperature, Dissolved Oxygen, pH, and Conductivity) remained relatively the same.

Based on three year's worth of water quality testing while the aeration system is running, the immediate results show that water quality has become worse, as well as the water clarity. However in the scope of what an aeration system is supposed to accomplish, the results are as expected and planned. Immediate results of any new aeration system will display negative water quality figures. The movement of water releases bottom sediments, which will push increased nutrient figures and decrease clarity. However with the increased availability of oxygen at depth near the sediment and mixing of water the water column will lead to the desired goals. More time and testing is needed in the future in order to determine whether the aeration system is causing an adverse impact.

Sincerely,



Matthew Novotny
Savin Lake Services

Past Results:

2014 Results:

Hess Lake Aeration 2014 Data				
Date	Site	Total Suspended Solids (mg/L)	Total Phosphorus (ug/L)	Orthophosphorus (ug/L)
7/14/2014	1 Surface	10.3	21.5	7.6
7/14/2014	1 Mid	14.8	28.9	11
7/14/2014	1 Deep	104	23.5	9.3
7/14/2014	2 Surface	10.8	18.3	5.9
7/14/2014	2 Mid	11.5	24.1	9.3
7/14/2014	2 Deep	12.8	21.3	10.2
9/15/2014	1 Surface	11	<20	<20
9/15/2014	1 Mid	12	<20	<20
9/15/2014	1 Deep	13	<20	<20
9/15/2014	2 Surface	12	<20	<20
9/15/2014	2 Mid	10	<20	<20
9/15/2014	2 Deep	10	<20	<20

Date	Site	Secchi Disk (ft)	Chlorophyll a (ug/L)
7/14/2014	1	2.5	6.42
7/14/2014	2	3	7.37
9/15/2014	1	2.5	5.23
9/15/2014	2	3	3.01

Date	Site	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (microhoms/cm)
7/14/2014	1	25.6	11.06	8.94	309
		24.7	10.31	8.88	331
		24.5	9.63	8.85	330
7/14/2014	2	25.9	10.79	8.95	332
		25.8	10.81	8.96	332
		24.9	10.26	8.93	338
		24.4	9.15	8.84	335
9/15/2014	1	17.6	11.47	8.91	336
		17.3	11.37	8.87	341
		17.1	11.42	8.84	347
9/15/2014	2	17.7	11.13	8.89	338
		17.6	11.19	8.86	339
		17.5	11.23	8.84	343
		17.4	11.24	8.83	339

2015 Results:

Hess Lake Aeration 2015 Data				
Date	Site	Total Suspended Solids (mg/L)	Total Phosphorus (ug/L)	Orthophosphorus (ug/L)
6/8/2015	1 Surface	19	50	6
6/8/2015	1 Mid	23	47	5
6/8/2015	1 Deep	20	48	5
6/8/2015	2 Surface	15	43	6
6/8/2015	2 Mid	22	53	6
6/8/2015	2 Deep	21	59	6
7/15/2015	1 Surface	18	30	6
7/15/2015	1 Mid	19	30	ND
7/15/2015	1 Deep	18	30	ND
7/15/2015	2 Surface	19	20	ND
7/15/2015	2 Mid	15	30	ND
7/15/2015	2 Deep	17	50	ND
9/14/2015	1 Surface	24	30	4.4
9/14/2015	1 Mid	23	40	5
9/14/2015	1 Deep	24	40	8.6
9/14/2015	2 Surface	21	40	4.8
9/14/2015	2 Mid	21	40	6.1
9/14/2015	2 Deep	29	50	4.4

Date	Site	Secchi Disk (ft)	Chlorophyll a (ug/L)
6/8/2015	1	2	22
6/8/2015	2	2.5	15
7/15/2015	1	1.5	13
7/15/2015	2	2	14
9/14/2015	1	2	8.5
9/14/2015	2	2	29

Date	Site	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (microhms/cm)
6/8/2015	1	20.1	11.33	9.15	340
		20.1	11.4	9.13	340
		20.1	11.34	9.15	340
6/8/2015	2	19.8	10.73	9.13	340
		19.7	10.73	9.11	350
		19.6	10.76	9.11	350
		19.4	10.7	9.11	350
7/15/2015	1	23.7	8.64	9.26	320
		23.5	8.65	9.13	320
		23.4	8.67	9.12	320
7/15/2015	2	23.8	8.97	9.12	320
		24	8.93	9.1	320
		23.6	8.93	9.09	320
		23.2	8.58	9.06	320
9/14/2015	1	20	9.72	8.95	330
		19.9	9.77	8.95	330
		19.7	9.65	8.95	330
9/14/2015	2	20.3	9.74	8.94	330
		20.3	9.71	8.94	330
		20	9.37	8.92	330
		19.9	8.62	8.88	330

2016 Results:

Hess Lake Aeration 2016 Data				
Date	Site	Total Suspended Solids (mg/L)	Total Phosphorus (ug/L)	Orthophosphorus (ug/L)
5/25/2016	1 Surface	33	64	<8
5/25/2016	1 Mid	33	84	<8
5/25/2016	1 Deep	42	63	<8
5/25/2016	2 Surface	30	55	<8
5/25/2016	2 Mid	29	81	<8
5/25/2016	2 Deep	30	97	<8
8/23/2016	1 Surface	17	46	14
8/23/2016	1 Mid	18	43	<10
8/23/2016	1 Deep	18	41	<10
8/23/2016	2 Surface	17	35	<10
8/23/2016	2 Mid	17	40	<10
8/23/2016	2 Deep	17	38	<10
9/27/2016	1 Surface	17	45	<10
9/27/2016	1 Mid	21	58	18
9/27/2016	1 Deep	21	57	12
9/27/2016	2 Surface	19	39	<10
9/27/2016	2 Mid	19	44	10
9/27/2016	2 Deep	19	45	<10

Date	Site	Secchi Disk (ft)	Chlorophyll a (ug/L)
5/25/2016	1	1	30
5/25/2016	2	1	35
8/23/2016	1	2.5	30
8/23/2016	2	2	23
9/27/2016	1	1.5	6.1
9/27/2016	2	1.5	19

Date	Site	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (microhoms/cm)	Depth (ft)
5/25/2016	1	19.6	11.67	9.15	320	0
		19.4	11.66	9.14	320	2
		19.2	11.57	9.14	320	4
5/25/2016	2	20.3	12.27	9.08	320	0
		19.8	12.15	9.11	320	2
		18.8	10.14	9.03	320	4
		18	9.59	9.01	320	6
8/23/2016	1	23.6	9.79	8.66	320	0
		23.4	9.81	8.62	320	2
		23.1	9.6	8.66	320	4
8/23/2016	2	24.1	9.83	8.77	320	0
		24.1	9.81	8.79	320	2
		23.9	9.74	8.7	320	4
		23.5	9.8	8.73	330	6
9/27/2016	1	17.4	11.17	8.69	300	0
		17.3	11.25	8.79	320	2
		17.2	11.25	8.75	330	4
9/27/2016	2	18.1	11.52	8.67	320	0
		18	11.48	8.84	320	2
		17.4	10.78	8.67	320	4
		17.3	10.5	8.75	320	6