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Mosquito Lake Water Quality and Non-Native Aquatic Plant Survey

Introduction:

In 2012, the Alaska Department of Environmental Conservation (DEC) funded the Takshanuk Watershed Council (TWC) in Haines, AK to conduct a water quality and non-native aquatic plant survey of Mosquito Lake located 26 miles north of Haines.

Methods:

Mapping: The first part of the study was to identify and map possible sources of pollutants from septic and outhouses on residential properties around the lake. These maps were produced in GIS by overlaying the Haines Borough parcel layer on aerial imagery of Mosquito Lake. Within the attribute table of the parcel layer, lands with development were identified and labeled as Developed lands on the map. Field technicians then boated around the lake with this information and identified which developed lands had building sites within 100 ft. of the lake (Appendix 1).

Water Quality: The second part of the study used the initial map that was created to identify three sample site locations for the water quality portion of the study. One site was selected at the main inlet of the Lake (ML-1), a second site was selected close to the densest residential area (ML-2), and the third site was selected at the outflow of the lake (ML-3). Two water samples at an approximate depth of two feet were taken at each site, one for fecal coliform and another for both nitrate and nitrite. Replicate samples at one of the three sites were taken during each sampling event for fecal coliform, nitrate and nitrite. The replicate samples rotated sites between each sampling event. These samples were immediately put on ice in a cooler and were delivered to Admiralty Environmental in Juneau, Alaska for testing within the required six hour hold time for fecal coliform.



Along with the water samples an YSI Environmental Multi Probe model YSI 556 MPS was used at each site to obtain Conductivity, ORP, pH, Temperature, and percent dissolved oxygen. At each site the Multi Probe was placed in the water at a depth of approximately two feet and was allowed to equilibrate before the readings were recorded. The Multi Probe was calibrated the day before each sampling event with standards from YSI Environmental.

A Secchi Disc was also used at a mid-lake location 400 feet southeast of sample site ML-3 to record water transparency. The Secchi disc depth is calculated by recording the depth at which the disk disappears, lowering another few feet, then recording the depth at which the disk reappears as it is slowly brought up. The average between those two measurements is recorded as the depth.

Five weekly sampling events were taken starting 7/31/12 through 8/29/12 and then another five weekly sampling events were taken starting 5/23/13 through 6/18/13 to cover ten weeks of sampling throughout the summer months.

Invasive Plants: The third part of the study involved identifying the aquatic plants associated with the three water quality sample sites. A rake was used to bring up plants from the bottom at each sampling site and they were placed in a Ziploc bag with water for preservation. The plants were brought back to the office where they were pressed and identified. Opportunistic aquatic plant surveys were conducted between sample locations or when an aquatic plant seemed different than the rest.



Applicable Water Quality Criteria

Table 1. Alaska fresh water quality criteria for fecal coliform (18 AAC 70.020)

Designated use	Description of criteria
(2) Fecal coliform bacteria (FC), for fresh water uses (not applicable to groundwater)	
(A) Water supply	
(i) Drinking, culinary, and food processing	In a 30-day period, the geometric mean may not exceed 20 FC/100 ml, and not more than 10% of the samples may exceed 40 FC/100 ml.
(ii) Agriculture, including irrigation and stock watering	The geometric mean of samples taken in a 30-day period may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml. For products not normally cooked and for dairy sanitation of unpasteurized products, the criteria for drinking water supply, (2)(A)(i), apply.
(iii) Aquaculture	For products normally cooked, the geometric mean of samples taken in a 30-day period may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml. For products not normally cooked, the criteria for drinking water supply, (2)(A)(i), apply.
(iv) Industrial	Where worker contact is present, the geometric mean of samples taken in a 30-day period may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml.
(B) Water recreation	
(i) Contact recreation	In a 30-day period, the geometric mean of samples may not exceed 100 FC/100 ml, and not more than one sample, or more than 10% of the samples if there are more than 10 samples, may exceed 200 FC/100 ml.
(ii) Secondary recreation	In a 30-day period, the geometric mean of samples may not exceed 200 FC/100 ml, and not more than 10% of the total samples may exceed 400 FC/100 ml.
(C) Growth and propagation of fish, shellfish, other aquatic life, and wildlife	Not applicable.

Source: 18 AAC 70.020 (ADEC 2012)

Water Quality Results

See Appendix 2.

Results and Discussions:

Mapping: The mapping survey revealed 24 parcels on the lake that have development and of those, seven had habitable structures within 100 feet of the lake.

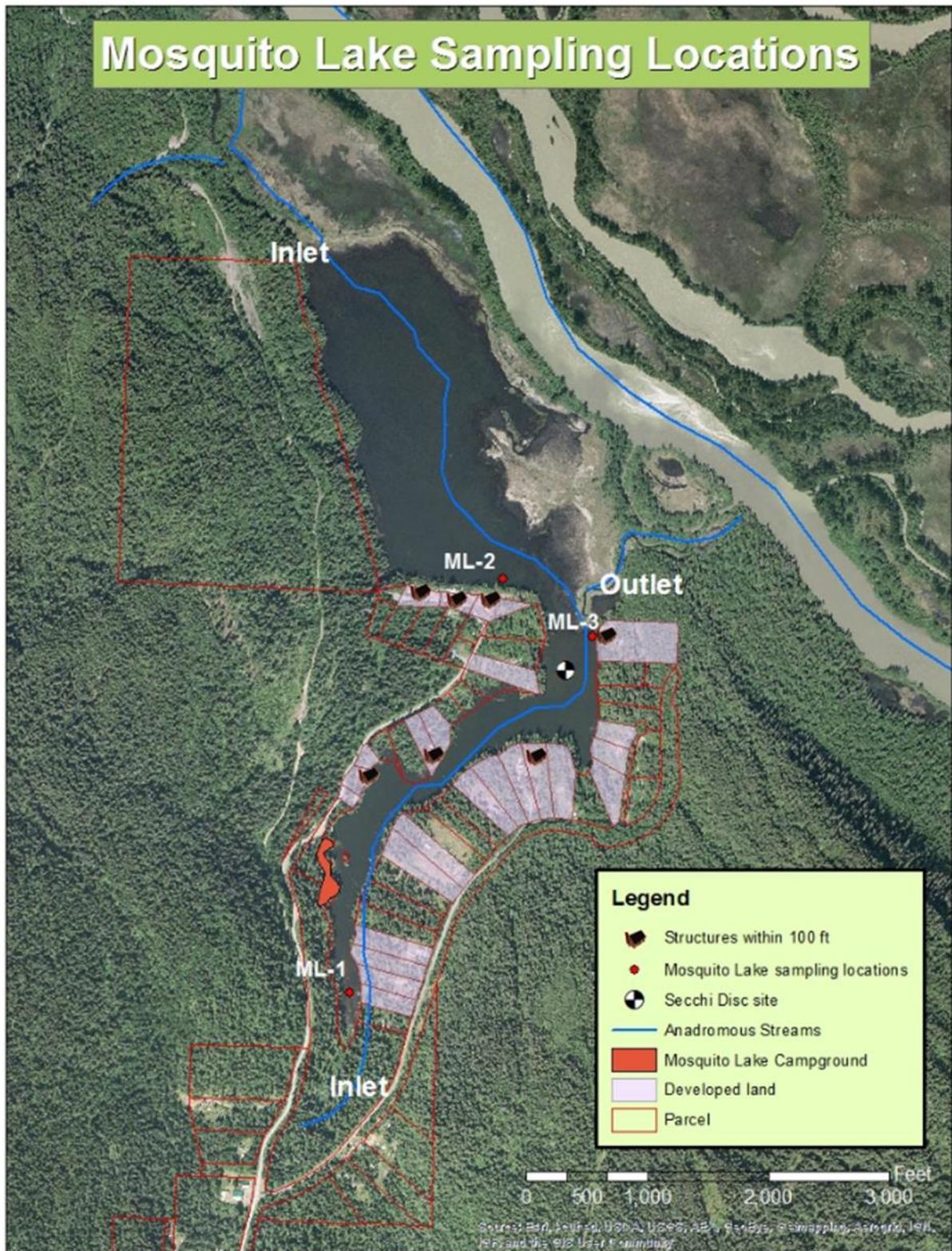
Water Quality: The results for the water quality tests were below the State of Alaska Standards for fecal coliform, nitrate, and nitrite; with the exception of fecal coliform on August 9 and 14, 2012 at sample location ML-1. As shown in Table 1, Alaska fresh water quality criteria for fecal coliform 18 AAC 70 (1)(A)(i) (amended as of April 8, 2012) states “in a 30-day period, the geometric mean may not exceed 20 CF/100ml, and not more than 10% of the samples may exceed 40 FC/100 ml.” The standards for nitrate and nitrite is designated for drinking water only; nitrate is 10 mg/L and nitrite is 1 mg/L (Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances, as amended through December 12, 2008). Based on Alaska’s 2012 Integrated Report Appendix I Supplemental Listing Methodology, Guidance for Determining Water Quality Impairments from Pathogens for Fresh Water Uses, the fecal coliform results do not represent an impairment. A waterbody is considered impaired (e.g., persistent exceedances) when at least two 30-day sampling periods demonstrate an exceedance of either provision of the criterion over a 2-year period.

Invasive Plants: The results for the non-native plant survey identified only native plants. There was concern that a non-native watermilfoil (*Myriophyllum* spp.) and Elodea (*Elodea canadensis*) were possibly present in the lake. The watermilfoil was identified as the native Siberian watermilfoil (*Myriophyllum sibiricum*) and the Elodea might have been confused with the native coon’s tail (*Ceratophyllum demersum*) and/or common mare’s tail (*Hippuris vulgaris*). It was determined that since the plants were positively identified as native plants they did not need to be submitted for DNA analysis.

Summary

The Mosquito Lake water quality and non-native plant survey has successfully shown that the lake’s water quality is of high standards and that it has not been invaded by non-native aquatic plants. The benefit of this project is that it has given us baseline information on the water quality of this system and that the amount of development on the lake has not significantly affected the water quality. Also, the use of the lake has not brought in non-native aquatic plants to this ecosystem.

Appendix 1 – Figure 1



Appendix 2 - Table 1

Sample Site	Date	Fecal Coliform (FC/100ml) ¹	Nitrate (mg/L) ²	Nitrite (mg/L) ³	Conductivity (µs/cm)	ORP (mV)	pH ⁴	Temp (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Geometric Mean
ML-1	7/31/12	2	< 0.5	< 0.3	131	209.8	6.92	15.05	115.5	11.7	9.54
ML-1-R	7/31/12	2	< 0.5	< 0.3	131	209.8	6.92	15.05	115.5	11.7	
ML-2	7/31/12	< 2	< 0.5	< 0.3	96	160.2	8.81	18.22	126.3	12.0	3.50
ML-3	7/31/12	< 2	< 0.5	< 0.3	104	181.3	8.38	17.15	118.4	11.5	2.49
ML-1	8/9/12	54	< 0.5	< 0.3	144	251.4	6.45	12.4	109.4	11.85	
ML-1-R	8/9/12	64	< 0.5	< 0.3	144	251.4	6.45	12.4	109.4	11.85	
ML-2	8/9/12	6.6	< 0.5	< 0.3	131	238.3	6.58	14.4	106.3	10.95	
ML-3	8/9/12	6	< 0.5	< 0.3	133	244.4	6.98	14.29	104.9	10.9	
ML-1	8/14/12	44	< 0.5	< 0.3	152	277	7.02	13.8	105	11.0	
ML-2	8/14/12	10	< 0.5	< 0.3	117	271.8	8.37	17.8	130.6	12.6	
ML-2-R	8/14/12	4	< 0.5	< 0.3	117	271.8	8.37	17.8	130.6	12.6	
ML-3	8/14/12	< 2	< 0.5	< 0.3	128	319	7.2	16.1	108.6	10.8	
ML-1	8/21/12	2	< 0.5	< 0.3	158	153	7.47	14.08	103	10.75	
ML-2	8/21/12	< 2	< 0.5	< 0.3	107	138.5	8.7	17.58	114.1	10.85	
ML-3	8/21/12	2	< 0.5	< 0.3	138	141.5	7.85	15.86	100	10.05	
ML-3-R	8/21/12	< 2	< 0.5	< 0.3	138	141.5	7.85	15.86	100	10.05	
ML-1	8/29/12	8.3	-	-	210	94.3	7.4	12.18	105.8	11.6	
ML-2	8/29/12	2	-	-	156	72.4	8.15	14.08	115.4	12.0	
ML-3	8/29/12	2	-	-	197	52.3	7.7	13.26	108.6	11.45	
ML-3-R	8/29/12	12	-	-	197	52.3	7.7	13.26	108.6	11.45	
ML-1	5/23/13	2	0.83	<0.1	78	188.2	7.67	3.7	92.3	12.4	4.36
ML-1-R	5/23/13	<2	0.8	<0.1	78	188.2	7.67	3.7	92.3	12.4	
ML-2	5/23/13	<2	0.10	<0.1	131	192.2	8.4	12.18	103.8	11.25	2.30
ML-3	5/23/13	<2	0.28	<0.1	123	199.1	7.87	10.05	89.8	10.25	2.76
ML-1	5/29/13	33	0.68	<0.1	80	223.1	7.69	6.2	95.7	12.0	
ML-2	5/29/13	4	0.21	<0.1	146	163.6	8.69	18.54	120.3	11.95	
ML-2-R	5/29/13	4	0.12	<0.1	146	163.6	8.69	18.54	120.3	11.95	
ML-3	5/29/13	4	0.66	<0.1	131	182.8	7.94	11.8	98	10.7	
ML-1	6/4/13	2	0.48	<0.1	115	189.6	7.48	8.9	122.7	14.4	
ML-2	6/4/13	<2	<0.1	<0.1	132	192.8	8.31	14.59	141.5	14.5	
ML-3	6/4/13	<2	<0.1	<0.1	134	171.5	8.14	11.05	130.4	14.5	
ML-3-R	6/4/13	<2	<0.1	<0.1	134	171.5	8.14	11.05	130.4	14.5	
ML-1	6/11/13	<2	0.32	<0.1	121	146	7.56	10.94	97.9	10.85	
ML-1-R	6/11/13	<2	0.32	<0.1	121	146	7.56	10.94	97.9	10.85	
ML-2	6/11/13	<2	<0.1	<0.1	121	143	8.74	17.5	127.1	12.25	
ML-3	6/11/13	5	0.27	<0.1	124	142	7.86	14.45	103	10.65	
ML-1	6/18/13	6	0.14	<0.1	120	173.6	7.4	13.24	120.1	12.7	
ML-2	6/18/13	2	<0.1	<0.1	108	164.1	8.41	17.86	119	11.4	

¹ In a 30-day period, the geometric mean may not exceed 20 FC/100 mL, and not more than 10% of the samples may exceed 40 FC/100 mL (18 AAC 70 (1)(A)(i))

² Nitrate 10 mg/L - Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances (as amended through December 12, 2008)

³ Nitrite 1 mg/L - Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances (as amended through December 12, 2008)

⁴ May not be less than 6.0 or greater than 8.5 (18 AAC 70 (6)(A)(i))

ML-2-R	6/18/13	8	<0.1	<0.1	108	164.1	8.41	17.86	119	11.4	
ML-3	6/18/13	2	0.1	<0.1	111	172.2	7.65	14.25	119	12.3	

Appendix 2 - Table 2

Date	Secchi Disc (m)
7/31/2012	1.75
8/9/2012	1.45
8/14/2012	1.75
8/21/2012	2.1
8/29/2012	2.9
5/23/2013	1.8
5/29/2013	0.5
6/4/2013	2.2
6/11/2013	0.7
6/18/2013	0.55