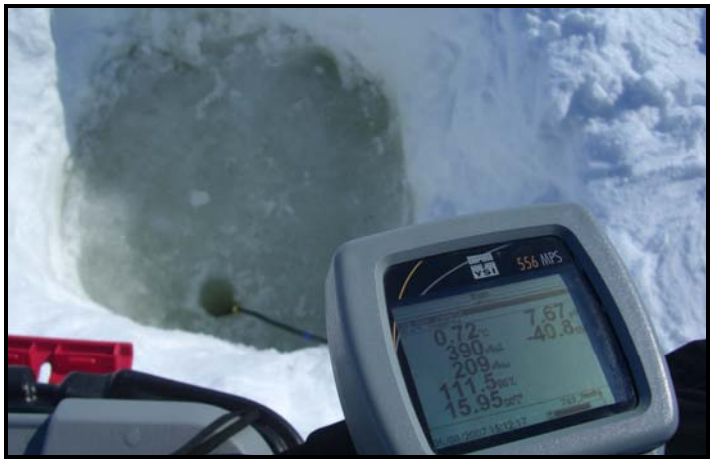
Lake Survey Data for the Coastal Plain from the Sagavanirktok River to Bullen Point: Spring 2007



YSI Meter reading water quality parameters at Badami Pit, by Greta Myerchin.

by

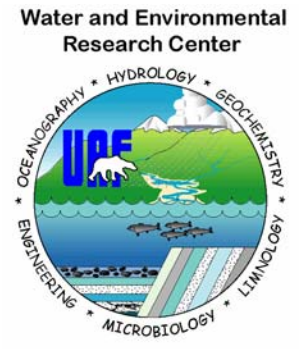
Greta Myerchin, Daniel White, Michael Lilly,

Kristie Holland, and Peter Prokein

September 2007

Sagavanirktok River/Bullen Point Hydrology Project

Report No. INE/WERC 07.14



Lake Survey Data for the Coastal Plain from the Sagavanirktok River to Bullen Point: Spring 2007

by

Greta Myerchin[1], Daniel White[1], Michael Lilly[2],
Kristie Holland[2], and Peter Prokein[1]

A report on research sponsored by the

Alaska Department of Transportation and Public Facilities

September 2007

Sagavanirktok River/Bullen Point Hydrology Project

Report Number INE/WERC 07.14

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September 2007

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CONVERSION FACTORS, UNITS, WATER QUALITY UNITS, VERTICAL AND HORIZONTAL DATUM, ABBREVIATIONS AND SYMBOLS

Conversion Factors

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (mm)
mile (mi)	1.609	kilometer (km)
	Area	
Acre	43559.826	square feet (ft^2)
Acre	0.407	hectare (ha)
square foot (ft^2)	2.590	square mile (mi^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
gallon (gal)	3785	milliliter (mL)
cubic foot (ft^3)	23.317	liter (L)
Acre-ft	1233	cubic meter (m^3)
	Velocity and Discharge	
foot per day (ft/d)	0.3048	meter per day (m/d)
Square foot per day (ft^2/d)	.0929	square meter per day (m^2/d)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/sec)
	Hydraulic Conductivity	
foot per day (ft/d)	0.3048	meter per day (m/d)
foot per day (ft/d)	0.00035	centimeter per second (cm/sec)
meter per day (m/d)	0.00115	centimeter per second (cm/sec)
	Hydraulic Gradient	
foot per foot (ft/ft)	5280	foot per mile (ft/mi)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
	Pressure	
pound per square inch (lb/in^2)	6.895	kilopascal (kPa)

Units

For the purposes of this report, both English and Metric (SI) units were employed. The choice of "primary" units employed depended on common reporting standards for a particular property or parameter measured. Whenever possible, the approximate value in the "secondary" units was also provided in parentheses. Thus, for instance, stream flow was reported in cubic feet per second (cfs) followed by the value in cubic meters per second (m^3/s) in parentheses.

Physical and Chemical Water-Quality Units:

Temperature:

Water and air temperature is given in degrees Celsius (°C) and in degrees Fahrenheit (°F). Degrees Celsius can be converted to degrees Fahrenheit by use of the following equation:

$$°F = 1.8(°C) + 32$$

Electrical Conductance (Actual Conductivity and Specific Conductance):

In this report conductivity of water is expressed as Actual Conductivity [AC] in microSiemens per centimeter (µS/cm). This unit is equivalent to micromhos per centimeter. Elsewhere, conductivity is commonly expressed as Specific Conductance at 25°C [SC25] in µS/cm which is temperature corrected. To convert AC to SC25 the following equation can be used:

$$SC25 = \frac{AC}{1 + r(T - 25)}$$

where:

SC25 = Specific Conductance at 25°C, in µS/cm

AC = Actual Conductivity, in µS/cm

R = temperature correction coefficient for the sample, in °C

T = temperature of the sample, in °C

Milligrams per liter (mg/L) or micrograms per liter (μg/L):

Milligrams per liter is a unit of measurement indicating the concentration of chemical constituents in solution as weight (milligrams) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter. For concentrations less than 7,000 mg/L, the numerical value is the same as for concentrations in parts per million (ppm).

Millivolt (mV):

A unit of electromotive force equal to one thousandth of a volt.

Vertical Datum:

"Sea level" in the following report refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929), a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called *Sea Level Datum of 1929*.

Horizontal Datum:

The horizontal datum for all locations in this report is the North American Datum of 1983 or North American Datum of 1927.

Abbreviations, Acronyms, and Symbols

AC	Actual conductivity
ADOT&PF	Alaska Department of Transportation and Public Facilities
ASTM	American Society for Testing and Materials
atm	atmospheres
C	Celsius
DO	Dissolved oxygen
DVM	digital voltage multi-meter
e-tape	electric tape
F	Fahrenheit (^{o}F).
ft	feet
GWS	Geo-Watersheds Scientific
GWSI	USGS Ground-Water Site Inventory
km^2	square kilometers
kPa	kilopascal
lb/in^2	pounds per square inch
m	meters
mg/L	milligrams per liter
µg/L	micrograms per liter
mi^2	square miles
mm	millimeters
µS/cm	microsiemens per centimeter
mV	Millivolt
NGVD	National Geodetic Vertical Datum
NWIS	National Water Information System
ORP	oxygen-reduction potential
ppm	parts per million
QA	quality assurance
QC	quality control
SC25	specific conductance at 25°C
UAF	University of Alaska Fairbanks
USACE	U.S. Army Corps of Engineers, Alaska District
USGS	U.S. Geological Survey
WERC	Water and Environmental Research Center
WWW	World Wide Web
YSI	Yellow Springs Instruments

ABSTRACT

Water resources are limited in many areas of the North Slope, Alaska, particularly during mid-winter operations. Water is used for ice road construction and maintenance, drilling and facility operations, and potable water supplies. The coastal plain area between the Sagavanirktok River and Bullen Point has numerous shallow lakes. Identifying potential water sources for this region will help both industry and resource-management agencies. Sampling conducted in the spring of 2007 served as part of an ongoing study of lakes. Field chemistry measurements, lake depth, ice thickness, and snow measurements were collected at each site. Lakes with a potential for unfrozen water in mid-winter were pre-selected for field sampling. Two former gravel mine sites (also referred to as lakes) were also sampled to help identify mid-winter water availability and water chemistry characteristics. All the natural lakes sampled had under-ice water that ranged from ten inches to 1 ½ feet in depth. Overall, dissolved oxygen levels and oxidation potential were low and conductivity high in the natural lakes. The two gravel mine sites had the greatest available water volumes and also had the highest dissolved oxygen. Data from this project will also be used for analysis in the North Slope Lakes project, sponsored by the US Department of Energy.

ACKNOWLEDGEMENTS

This project was funded by grant ADN #2562122, Alaska Department of Transportation and Public Facilities. Field coordination was provided by BP Exploration (Alaska) Inc. and the Department of Natural Resources provided background data for lakes in the study area.

Lake Survey Data for the Coastal Plain from the Sagavanirktok River to Bullen Point: Spring 2007

INTRODUCTION

Water resources are essential to gravel road and ice road / pad construction on the North Slope, yet many natural lakes are too shallow to provide significant freshwater resources through the winter operations period. The coastal plain between the Sagavanirktok River and Bullen Point, east of the Canning River, has had numerous oil and gas exploration activities conducted over the last 25 years. Future development in this region will need a network of water sources, including natural lakes and gravel-mine sites. Available water sources in this region provide an opportunity for concurrent gravel procurement and water-resource development. Existing gravel pits as well as selected lakes between Prudhoe Bay and Bullen Point were visited at the end of winter, 2007. Chemical profiles of gravel pits showed the potential of deep lakes and gravel pits to provide significant water resources as well as fish over-wintering habitat. Physical and chemical measurements show that many natural lakes are insufficient for use as winter water resources. Although not monitored, the larger rivers in the area (Sagavanirktok, Kadleroshilik, Shaviovik, and Kavik Rivers) have low winter baseflows and are not generally considered potential sites for obtaining water in the winter months.

OBJECTIVES

The objectives of this report are to provide lake data collected in the early spring of 2007. Spring snowmelt had not started and lake ice conditions were at a winter maximum. Snow depth measurements on and adjacent to lakes were also collected to help with regional hydrologic analysis. This data will help resource developers and management agencies evaluate potential water sources in the region, and areas where future water sources are needed.

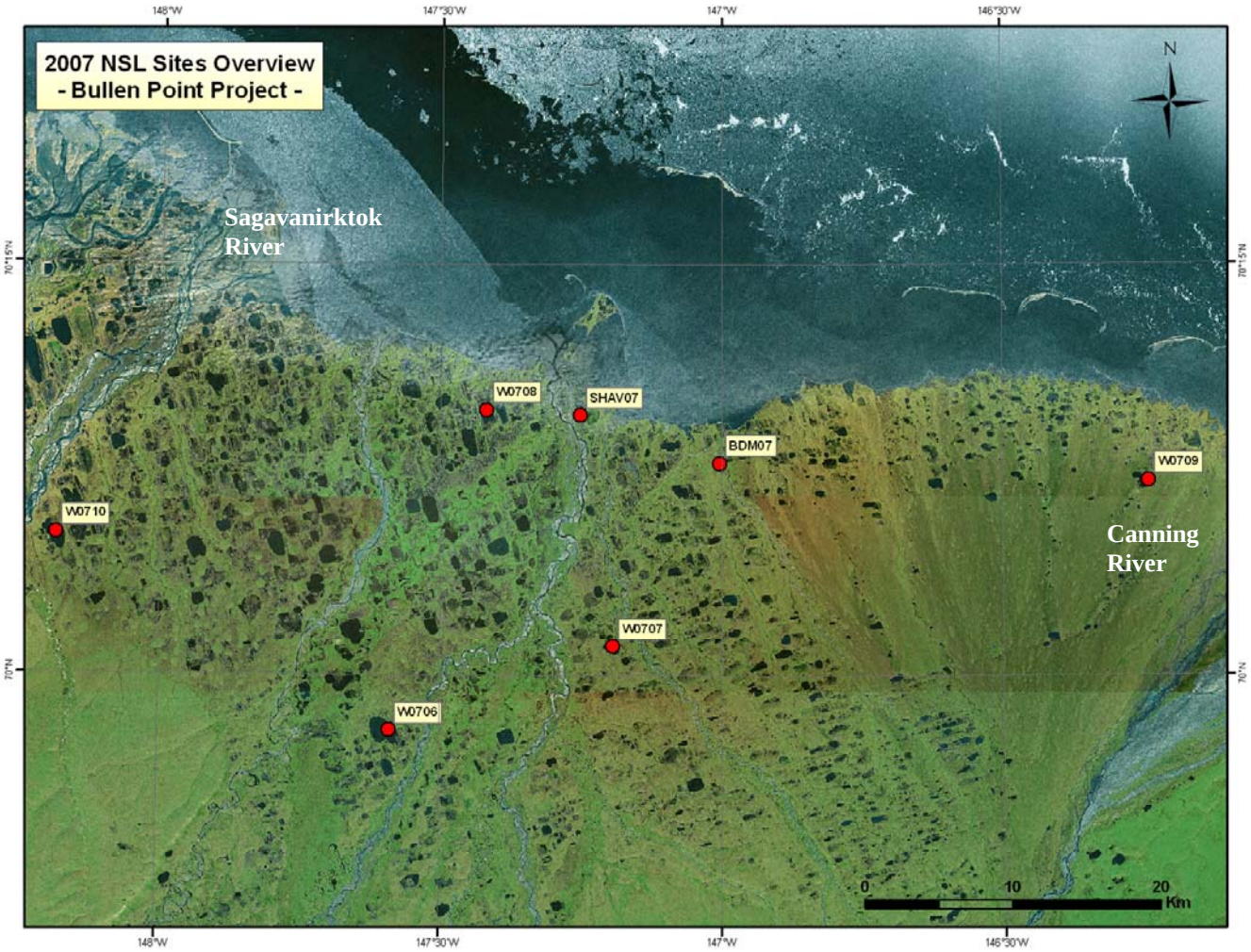


Figure 1. Study area and lake location map for the Sagavanirktok River/Bullen Point Region, North Slope, Alaska.

PROCEDURE

Lakes selected for the study fell within 15 miles of the arctic coast, from the Sagavanirktok River to Bullen Point, which is approximately 40 miles east to west (Figure 1). There is no current road access to the lakes and all lakes were accessed by helicopter. At each lake the ice was drilled with a 2-inch ice auger powered by a cordless drill. Physical measurements of depth (lake bottom to water surface), freeboard (water surface to top of ice), ice thickness (bottom of ice to top of ice), and snow depth (top of ice to top of snow, measured at the hole where snow was cleared to drill) were taken with a folding measure with a hook for feeling the bottom of ice or a

weighted flexible measuring tape. The precision with which physical measurements are reported takes into account field conditions. Temperature, pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), and electrical conductivity were measured with a Yellow Springs Instruments (YSI) 556 multi-parameter meter. The calibration of each parameter was checked before and after each day of sampling. To pass the calibration check, pH had to be within 0.2 pH units and ORP, DO, and conductivity had to be within 10% of the calibration standard value. All parameters passed each pre- and post-calibration check, with one exception (Appendix A). DO and conductivity checks failed post-calibration for lake W0710. Actual conductivity (AC) was temperature compensated to specific conductivity at 25°C (SC_{25}) by 2% per degree Celsius (Hem 1985).

RESULTS

Seven lakes and reservoirs were visited along the potential Bullen Point road corridor (Table 1). All of the lake and reservoir sites had enough sub-ice water for chemistry measurements.

The Badami and Shaviovik gravel pits, which now serve as reservoirs, are deep relative to the natural lakes in the area. Age and sediment conditions likely account for the differences in profiles observed. Badami (Table 2, Figure 2) had high oxygen levels throughout the depth of the reservoir. On the other hand, Shaviovik Pit (Table 3, Figure 3) had a dissolved oxygen curve expected of a lake with significant oxygen consumption within the sediments. Temperature and pH varied little through the vertical profile of the gravel pits, though a slight increase in temperature with depth in Shaviovik is consistent with the stratification expected of lakes in winter due to the maximum density of water near 4°C. Conductivity, indicative of dissolved salts, also increased in the lower parts of the reservoirs. ORP remained relatively high near the bottom of the deep lakes.

All natural lakes sampled in the Sagavanirktok River to Bullen Point region contained enough sub-ice water to measure chemical parameters. Chemistry data obtained for lakes W0706, W0707, W0708, W0709, and W0710 are shown in Tables 4, 5, 6, 7, and 8, respectively.

Table 1. Sampling locations and physical measurements.

Location	North Latitude (WGS 84)	West Longitude (WGS 84)	Date	Ice thickness (ft)	Water depth (ft) [b]	Freeboard (ft)	Snow depth (ft)
Badami – hole 1	70 07.766	147 00.255	5/8/2007	6.36	6.27	0.1	1.97
Badami – hole 2	70 07.768	147 00.246	5/8/2007	6.96	12.34	0.0	2.03
Shaviovik	70 09.496	145 15.153	5/8/2007	5.28	16.47	0.3	0.72
W0706	69 58.028	147 35.403	5/9/2007	5.41	7.51	0.3	0.69
W0707	70 01.115	147 11.637	5/8/2007	4.66	5.51	0.0	1.44
W0708	70 09.695	147 25.141	5/8/2007	4.89	5.74	0.16	1.21
W0709	70 07.127	146 14.469	5/8/2007	5.38	6.63	0.23	0.79
W0710[a]	70 05.140	148 11.014	5/4/2007	5.38	6.60	0.36	0.62

[a]Coordinates datum NAD 83.
[b]Too muddy for water chemistry.

Table 2. Badami gravel pit chemistry data.

Location	Badami Pit – hole 2		
Date	5/8/2007	**Depth BWS (ft)**	12.34
Latitude	N 70 07.768	**Freeboard (ft)**	0.00
Longitude	W 147 00.246	**Ice thickness (ft)**	6.96
Datum	WGS 84	**Snow depth (ft)**	2.03

Time	Depth (ft BWS)	Temp. °C	pH	ORP (mV)	DO (mg/L)	Conductivity AC (µS/cm)	Conductivity SC_{25} (µS/cm)*
14:58	7	0.71	7.66	-12.6	15.99	209	390
15:08	8	0.72	7.65	-30.4	14.62	209	390
15:17	10	0.72	7.63	-23.5	14.85	209	390
15:26	11	0.72	7.65	-13.5	14.63	209	391
15:36	12	0.72	7.63	-4.4	14.68	210	391

*Temperature corrected by 2% per degree Celsius.

Sampled by: Myerchin, Derry
Instrument: YSI 556 SN#04D5945AB
Pre-sampling calibration check: pass 5/3/07
Post-sampling calibration check: pass 5/8/07

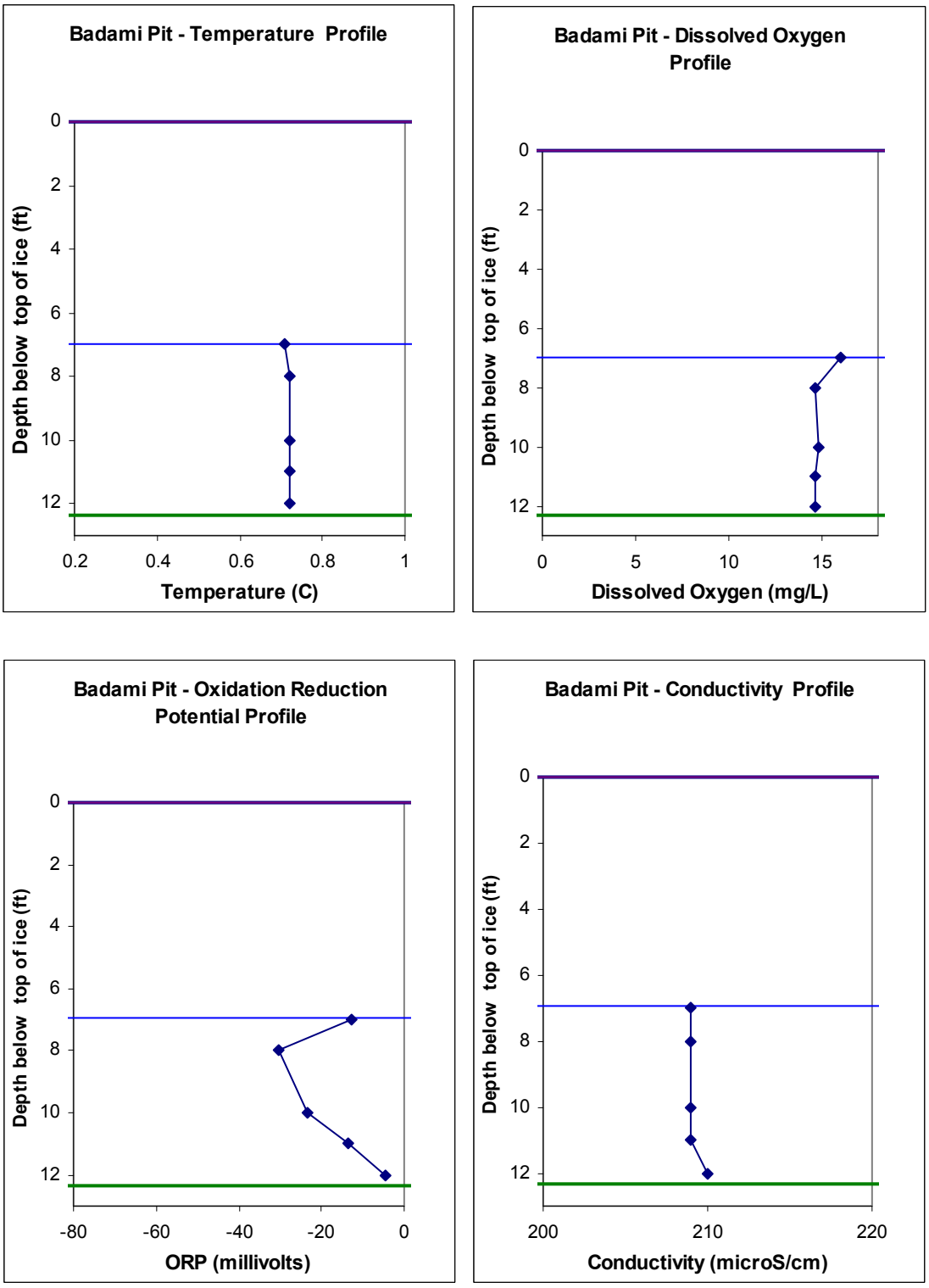


Figure 2. Badami gravel pit chemistry profiles.

Table 3. Shaviovik gravel pit chemistry data.

Location	SHAV07: Shaviovik Pit		
Date	5/8/2007	**Depth BWS (ft)**	16.47
Latitude	N 70 09.496	**Freeboard (ft)**	0.3
Longitude	W 145 15.153	**Ice thickness (ft)**	5.28
Datum	WGS 84	**Snow depth**	0.72

Time	Depth (ft BWS)	Temp. °C	pH	ORP (mV)	DO (mg/L)	Conductivity AC (µS/cm)	Conductivity SC_{25} (µS/cm)*
12:38	6	0.21	7.73	-10.7	16.71	184	349
12:49	7	0.29	7.91	-48.1	16.03	184	348
12:55	9	0.35	7.87	-40.9	15.49	183	347
13:06	11	0.36	7.83	-35.9	15.55	184	347
13:13	13	0.36	7.96	-40.0	15.45	184	347
13:20	15	0.36	7.68	-7.0	15.23	183	346
13:29	16	0.37	7.58	-30.0	16.01	183	345
13:34	Bottom	0.37	9.20	-57.3	15.87	183	345

*Temperature corrected by 2% per degree Celsius.

Sampled by: Myerchin, Derry
Instrument: YSI 556 SN#04D5945AB
Pre-sampling calibration check: pass 5/3/07
Post-sampling calibration check: pass 5/8/07

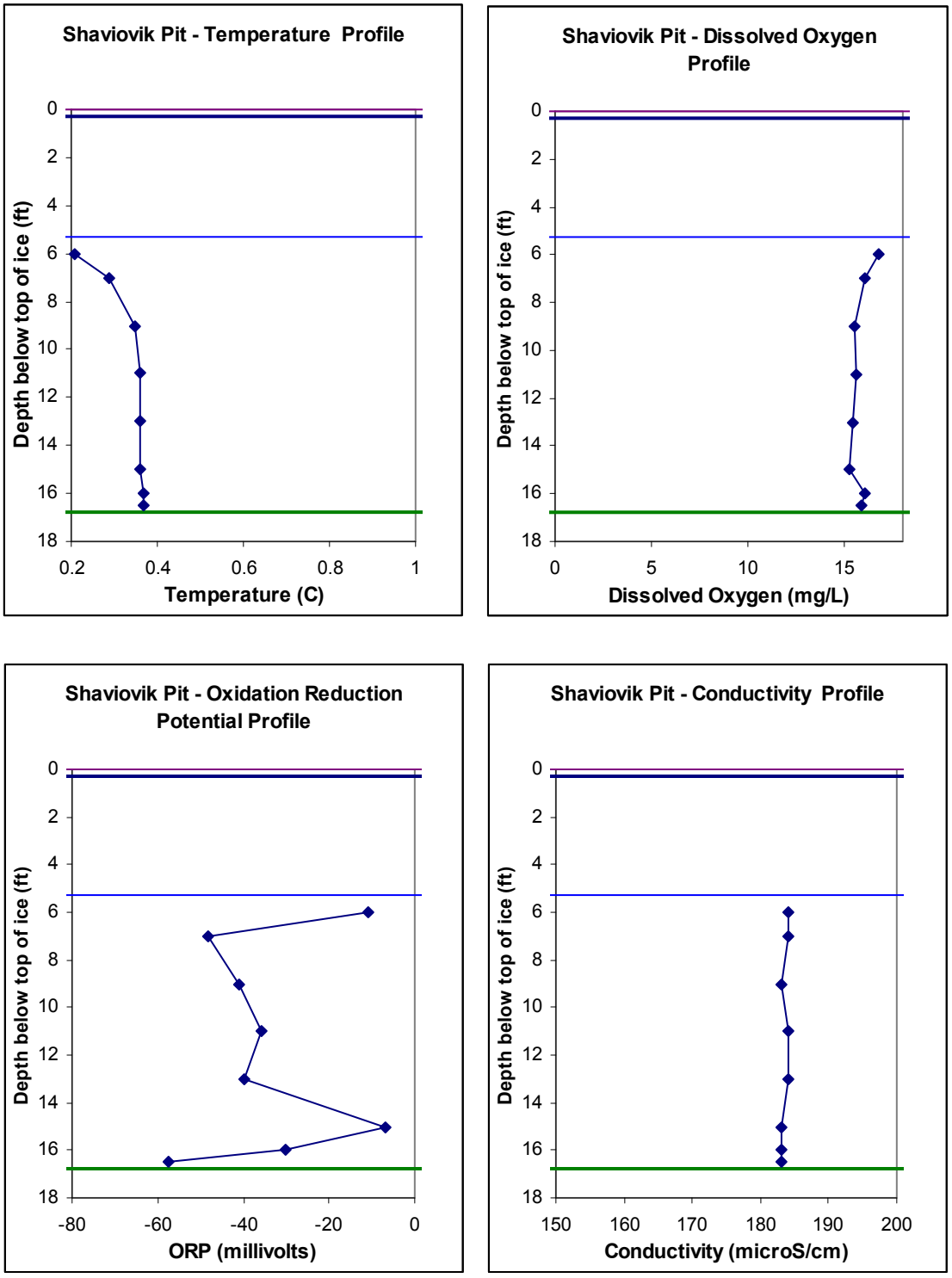


Figure 3. Shaviovik gravel pit chemistry profiles.

Table 4. Lake W0706 chemistry data.

Location	W0706		
Date	5/9/2007	**Depth BWS (ft)**	7.51
Latitude	N 69 58.028	**Freeboard (ft)**	0.3
Longitude	W 147 35.403	**Ice thickness (ft)**	5.41
Datum	WGS 84	**Snow depth (ft)**	0.69

Time	Depth (ft BWS)	Temp. °C	pH	ORP (mV)	DO (mg/L)	Conductivity AC (µS/cm)	SC_{25} (µS/cm)*
9:51	5.5	0.39	7.08	84.90	7.91	352	663
10:00	6.0	0.55	7.20	7.7	6.87	353	662
10:09	6.5	0.82	7.25	-0.9	6.32	355	659
10:11	Bottom	0.86	7.12	22.7	6.39	356	661

*Temperature corrected by 2% per degree Celsius.

Sampled by: Myerchin, Derry
Instrument: YSI 556 SN#04D5945AB
Pre-sampling calibration check: pass 5/8/07
**Post-sampling calibration check: pass 5/9/07 for pH, ORP & conductivity/ DO unverified

Table 5. Lake WO707 chemistry data.

Location	W0707		
Date	5/8/2007	**Depth BWS (ft)**	5.51
Latitude	N 70 01.115	**Freeboard (ft)**	0.0
Longitude	W 147 11.637	**Ice thickness (ft)**	4.66
Datum	WGS 84	**Snow depth (ft)**	1.44

Time	Depth (ft BWS)	Temp. °C	pH	ORP (mV)	DO (mg/L)	Conductivity AC (µS/cm)	SC_{25} (µS/cm)*
17:55	4.5	0.27	7.02	-15.7	0.91	592	1122
17:57	5.0	0.16	7.00	-19.3	0.71	590	1122
17:59	Bottom	0.10	6.96	-23.2	0.63	590	1124

*Temperature corrected by 2% per degree Celsius.

Sampled by: Myerchin, Derry
Instrument: YSI 556 SN#04D5945AD
Pre-sampling calibration check: pass 5/3/07
Post-sampling calibration check: pass 5/8/07

Table 6. Lake WO708 chemistry data.

Location	W0708		
Date	5/8/2007	**Depth BWS (ft)**	5.74
Latitude	N 70 09.695	**Freeboard (ft)**	0.16
Longitude	W 147 25.141	**Ice thickness (ft)**	4.89
Datum	WGS 84	**Snow depth (ft)**	1.21

Time	Depth (ft BWS)	Temp. °C	pH	ORP (mV)	DO (mg/L)	Conductivity AC (µS/cm)	Conductivity SC_{25} (µS/cm)*
11:19	4.5	0.08	6.90	-47.3	4.00	467	890
	5.0	0.27	7.12	-54.5	4.40	465	882
	Bottom	0.20	7.01	-52.5	4.88	468	889

*Temperature corrected by 2% per degree Celsius.

Sampled by: Myerchin, Derry
Instrument: YSI 556 SN#04D5945AD
Pre-sampling calibration check: pass 5/3/07
Post-sampling calibration check: pass 5/8/07

Table 7. Lake WO709 chemistry data.

Location	W0709		
Date	5/8/2007	**Depth BWS (ft)**	6.63
Latitude	N 70 07.127	**Freeboard (ft)**	0.23
Longitude	W 146 14.469	**Ice thickness (ft)**	5.38
Datum	WGS 84	**Snow depth (ft)**	0.79

Time	Depth (ft BWS)	Temp. °C	pH	ORP (mV)	DO (mg/L)	Conductivity AC (µS/cm)	Conductivity SC_{25} (µS/cm)*
16:39	5.5	0.11	7.32	-96.2	3.33	550	1048
16:44	6.0	0.05	7.23	-26.2	2.61	548	1047
16:46	Bottom	0.04	7.23	-37.7	2.59	551	1054

*Temperature corrected by 2% per degree Celsius.

Sampled by: Myerchin, Derry
Instrument: YSI 556 SN#04D5945AD
Pre-sampling calibration check: pass 5/3/07
Post-sampling calibration check: pass 5/8/07

Table 8. Lake WO710 chemistry data.

Location	W0710		
Date	5/4/2007	**Depth BWS (ft)**	6.60
Latitude	N 70 05.140	**Freeboard (ft)**	0.36
Longitude	W 148 11.014	**Ice thickness (ft)**	5.38
Datum	NAD 83	**Snow depth (ft)**	0.62

Time	Depth (ft BWS)	Temp. °C	pH	ORP (mV)	**DO (mg/L)	Conductivity **AC (µS/cm)	**SC_{25} (µS/cm)*
18:13	5.5	0.64	7.06	111.8	5.87	288	538
	6.0	0.53	7.04	107.2	5.67	289	542
	6.5	0.74	7.00	106.7	4.78	290	546

*Temperature corrected by 2% per degree Celsius.

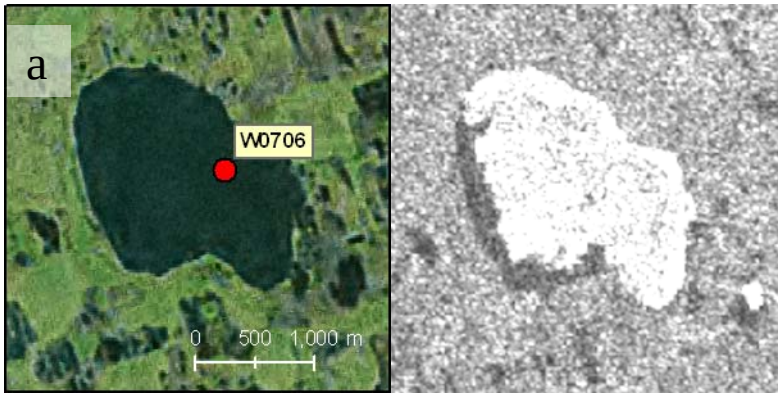
Sampled by: Myerchin, Derry
Instrument: YSI 556 SN#04D5945AD
Pre-sampling calibration check: pass 5/1/07
**Post-sampling calibration check: pass 5/4/07 for pH and ORP/ failed DO and conductivity

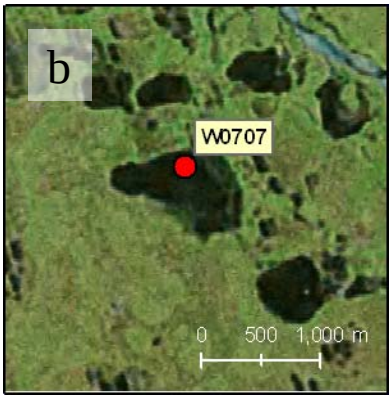
The short water column in lakes of W0707 (Table 5) and W0709 (Table 7) had low dissolved oxygen (~ 0.8 – 3.0 mg/L) and oxidation reduction potential (minus 40 – minus 20 mV). Specific conductivities were also high at approximately 1050 - 1100 µS/cm. Exclusion of dissolved salts during the formation of ice likely increased the conductivity from unfrozen levels. While oxygen is also excluded from freezing ice, consumption by sediments had depleted the small store of oxygen in the lake to levels unsuitable for most fish.

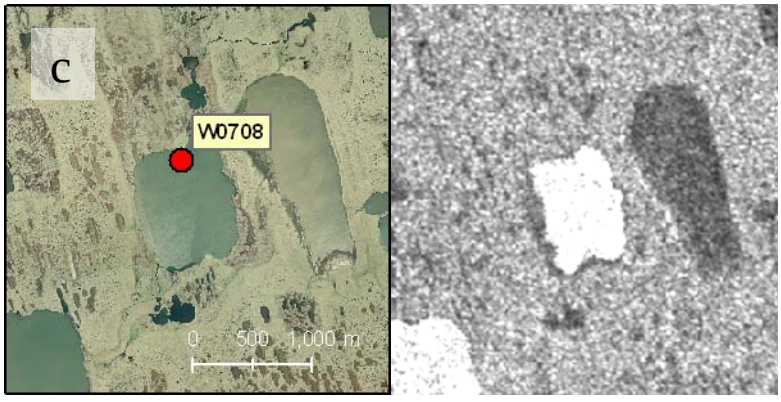
Compared with these lakes, the dissolved oxygen levels increased slightly (~ 4.4 to 6.8 mg/L) in lakes W0706 (Table 4), W0708 (Table 7) and W0710 (Table 8), while actual conductivity decreased slightly (540 – 880 µS/cm).

Hole locations (Table 1) are plotted on Landsat images of lakes W0706, W0707, and W0709, and orthographic images of W0708, and W0710 in figure 4. Synthetic aperture radar (SAR) images adjacent to the Landsat and orthographic images give some indication of the likelihood of finding liquid water (Duguay and Lefleur, 2003; Jeffries and others, 1995). The Landsat

images (left, color) show the locations of sampling sites. The SAR images (right, grayscale) are spring images near to the date of maximum ice thickness. Dark areas on the SAR image during this stage of the winter indicate grounded ice. Bright or white areas indicate liquid water under the ice at the time of the image. Sampling locations were selected based on the brightest spots indicated by the SAR imagery.







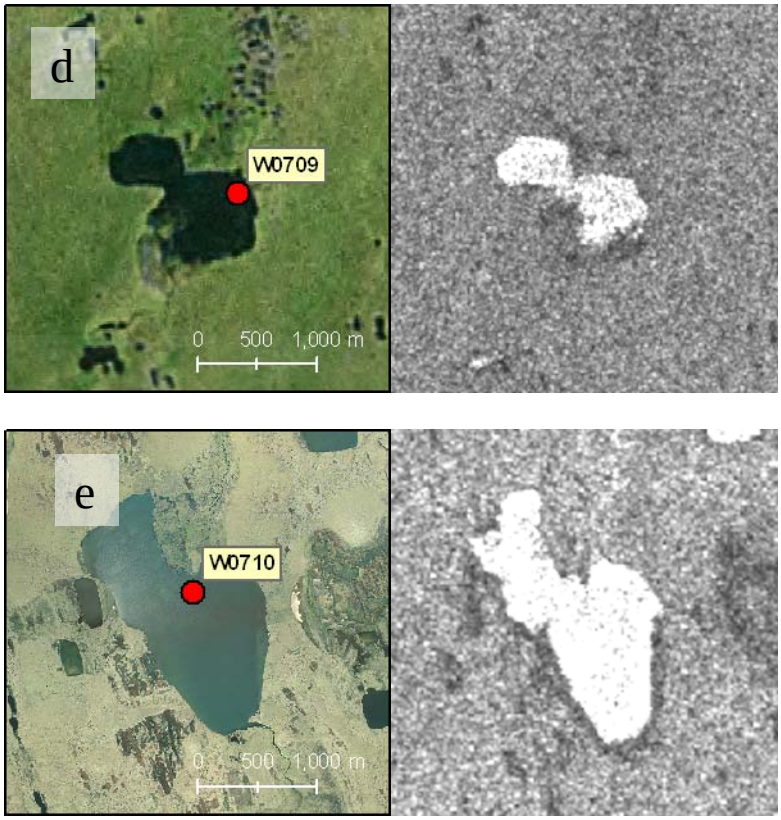


Figure 4. Satellite imagery of lakes (a) W0706, (b) W0707, (c) W0708, (d) W0709, and (e) W0710 (MDA Federal 2004, ESA 1994-1999).

SUMMARY

The collected data indicate that little mid- to late-winter water is available in the natural lakes sampled in the coastal plain between Prudhoe Bay and Bullen Point. The two gravel mines, now serving as water sources, both had high dissolved oxygen levels through all, or most, of the water column. Neither mine site indicated high salinity levels. These sites help serve as a good example of converting gravel mines to winter water-use reservoirs. The use of SAR satellite data helped indicate lakes with potential water under ice. Additional investigation of water availability in late winter through SAR imagery would help better characterize regional water availability. The location of gravel mine sites in areas with adequate recharge characteristics will help improve the distribution and volume of winter water availability.

REFERENCES

Duguay, C.R. and Lafleur, P.M., 2003. Determining depth and ice thickness of shallow sub-Arctic lakes using space-borne optical and SAR data. *Int. J. Remote Sensing* **24**(3): 475-489.

Hem, J.D., 1985. Study and interpretation of the chemical characteristics of natural water 3rd ed. USGS Report 2254.

ESA 1994-1999. ERS-1/ERS-2 Standard Beam Full Resolution. Fairbanks, Alaska: Alaska SAR Facility.

Jeffries, M.O., Morris, K., and Liston, G.E., 1995. A method to determine lake depth and water availability on the North Slope of Alaska with Spaceborne Imaging Radar and Numerical Ice Growth Modeling. Arctic vol. 48, no.4, p.367-374.

MDA Federal 2004. Landcover 2000/ETM+ Edition Mosaics. Tile N-06-65, N-06-70. Sioux Falls, Dakota: USGS.

APPENDIX A. WATER QUALITY ASSURANCE DATA

The following table reports the pre- and post-calibration checks for water quality meters used during field sampling.

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004e: Water Quality Meter Calibration Form

Project ID: **North Slope Lakes** Site Location/Lake ID: W0710

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: YSI Make: 556 MPS

Owner: TTT Environmental S/N: 04D55945 AD (yellow)

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/1/07	1600	Oakton	2610086	Oct-08	3.99 @ 15.9	Pass
pH 7.00	5/1/07	1600	Oakton	2610087	Oct-08	7.04 @ 15.01	Pass
pH 10.00	5/1/07	1600	Oakton	2612532	Jun-08	10.12 @ 14.10	Pass
Conductivity	5/1/07	1600	Oakton 447us/cm	2701471	Jan-08	448 @ 24.85	Pass
DO 100	5/1/07	1600	Bubbled Nanopure	---	---	103.5 @ 10.98	Pass
ORP	5/1/07	1600	Quickcal	33240	Apr-07	237.3 @ 16.46	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/4/07	2032	Oakton	2610086	Oct-08	4.07 @ 17.10	Pass
pH 7.00	5/4/07	2032	Oakton	2610087	Oct-08	7.15 @ 17.95	Pass
pH 10.00	5/4/07	2032	Oakton	2612532	Jun-08	10.17 @ 17.97	Pass
Conductivity	5/4/07	2032	Oakton 447us/cm	2701471	Jan-08	447 @ 25.03	FAIL
DO 100	5/4/07	2032	Bubbled Nanopure	---	---	84.9 @ 18.22	FAIL
ORP	5/4/07	2032	Quickcal	33240	Apr-07	227 @ 19.30	Pass

Remarks:

Field-Form Filled Out By: Greta Myerchin Date: 6/12/2007

QAQC Check By: K. Holland Date: 6/30/2007

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004e: Water Quality Meter Calibration Form

Project ID: **North Slope Lakes**
Sample Purpose: **Lake Water Quality**
Site Location/Lake ID: W0707, SHAV07, BDM07, W0708 W0709

WATER QUALITY METER INFORMATION

Meter Make: YSI
Owner: TTT Environmental
Make: 556 MPS
S/N: 04D55945 AB (red)

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/3/07	1910	Oakton	2610086	Oct-08	4.05 @ 16.39	Pass
pH 7.00	5/3/07	1910	Oakton	2610087	Oct-08	7.03 @ 17.61	Pass
pH 10.00	5/3/07	1910	Oakton	2612532	Jun-08	10.02 @ 17.49	Pass
Conductivity	5/3/07	1910	Oakton 447us/cm	2701471	Jan-08	447 @ 24.96	Pass
DO 100	5/3/07	1910	Bubbled Nanopure	---	---	96.8 @ 17.45	Pass
ORP	5/3/07	1910	Quickcal	33240	Apr-07	225.7 @ 19.90	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/8/07	2100	Oakton	2612530	Oct-08	4.03 @ 17.99	Pass
pH 7.00	5/8/07	2100	Oakton	2610087	Oct-08	7.01 @ 19.28	Pass
pH 10.00	5/8/07	2100	Oakton	2617532	Jun-08	10.0 @ 19.86	Pass
Conductivity	5/8/07	2100	Oakton 447us/cm	2701471	Jan-08	388 @ 18.08	Pass
DO 100	5/8/07	2100	Bubbled Nanopure	---	---	106.2 @ 19.85	Pass
DO 0	5/8/07	2100	Hanna H17040	G1012	Feb-11	0.35 @16.84	Pass
ORP	5/8/07	2100	Quickcal	33240	Apr-07	227.7 @ 19.30	Pass

Remarks:

Field-Form Filled Out By: Greta Myerchin Date: 6/12/2007
QAQC Check By: K. Holland Date: 6/30/2007

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004e: Water Quality Meter Calibration Form

Project ID: **North Slope Lakes** Site Location/Lake ID: W0709

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: YSI Make: 556 MPS

Owner: TTT Environmental S/N: 04D55945 AD (yellow)

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/4/07	2032	Oakton	2610086	Oct-08	4.07 @ 17.10	Pass
pH 7.00	5/4/07	2032	Oakton	2610087	Oct-08	7.15 @ 17.95	Pass
pH 10.00	5/4/07	2032	Oakton	2612532	Jun-08	10.17 @ 17.97	Pass
Conductivity	5/4/07	2032	Oakton 447us/cm	2701471	Apr-08	447 @ 25.03	Pass
DO 100	5/4/07	2032	Bubbled Nanopure	---	---	100.7 @ 18.23	Pass
DO 0	5/4/07	2032	Hanna H17040	G1012	Feb-11	0.12 @16.19	Pass
ORP	5/4/07	2032	Quickcal	33240	May-07	227 @ 19.30	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/8/07	2100	Oakton	2610086	Oct-08	4.01 @ 19.22	Pass
pH 7.00	5/8/07	2100	Oakton	2610087	Oct-08	7.00 @ 18.94	Pass
pH 10.00	5/8/07	2100	Oakton	2612532	Jun-08	9.99 @ 19.29	Pass
Conductivity	5/8/07	2100	Oakton 447us/cm	2701471	Apr-08	701 @ 19.50	FAIL
DO 100	5/8/07	2100	Bubbled Nanopure	---	---	124.0 @ 19.87	FAIL
DO 0	5/8/07	2100	Hanna H17040	G1012	Feb-11	0.11 @18.53	Pass
ORP	5/8/07	2100	Quickcal	33240	May-07	225.6 @ 20.74	Pass

Remarks:

Field-Form Filled Out By: Greta Myerchin Date: 6/12/2007

QAQC Check By: K. Holland Date: 6/30/2007

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004e: Water Quality Meter Calibration Form

Project ID: **North Slope Lakes** Site Location/Lake ID: W0706

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: YSI Make: 556 MPS

Owner: TTT Environmental S/N: 04D55945 AB (red)

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/8/07	2100	Oakton	2610086	Oct-08	4.03 @ 17.99	Pass
pH 7.00	5/8/07	2100	Oakton	2610087	Oct-08	7.01 @ 19.28	Pass
pH 10.00	5/8/07	2100	Oakton	2612532	Jun-08	10.0 @ 19.86	Pass
Conductivity	5/8/07	2100	Oakton 447us/cm	2701471	Apr-08	388 @ 18.08	Pass
DO 100	5/8/07	2100	Bubbled Nanopure	---	---	106.2 @ 19.85	Pass
DO 0	5/8/07	2100	Hanna H17040	G1012	Feb-11	0.35 @16.84	Pass
ORP	5/8/07	2100	Quickcal	33240	May-07	227.7 @ 19.30	Pass

Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Pass/Fail
pH 4.01	5/9/07	2222	Oakton	2612530	Dec-08	4.01 @ 21.56	Pass
pH 7.00	5/9/07	2225	Oakton	2612531	Dec-08	7.06 @ 21.42	Pass
pH 10.00	5/9/07	2228	Oakton	2612532	Jun-08	10.02 @ 20.13	Pass
Conductivity	5/9/07	2215	Oakton 447us/cm	2701471	Jan-08	412 @ 21.38	Pass
DO 100	5/9/07		Bubbled Nanopure	---	---		
DO 0	5/9/07		Hanna H17040	G1012	Feb-11		
ORP	5/9/07	2100	Quickcal	33240	May-07	224.7 @ 21.27	Pass

Remarks: DO 100 and 0 not recorded into field notebook

Field-Form Filled Out By: Greta Myerchin Date: 6/12/2007

QAQC Check By: K. Holland Date: 6/30/2007