Lake Chemistry and Physical Data For Selected North Slope, Alaska, Lakes: April 2007

Drilling holes in the ice for water sampling, Photo by J. Derry.

by

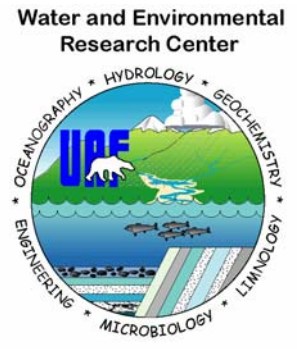
Kristie Holland, Jeff Derry, Dan Reichardt, Michael Lilly,

Richard Kemnitz, and Amanda Blackburn

June 2007

North Slope Lakes Hydrologic Project

Report No. INE/WERC 07.09



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By:

Kristie Holland[1], Jeff Derry[1], Dan Reichardt[1], Michael Lilly[1], Richard Kemnitz[2], Amanda Blackburn[1]

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- U.S. Department of Energy
- National Energy Technology Laboratory
- BP Exploration (Alaska), Inc.
- Conoco Phillips (Alaska), Inc.
- Bureau of Land Management
- Geo-Watersheds Scientific

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[1]Geo-Watersheds Scientific, Fairbanks, Alaska
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June 2007

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DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the accuracy of the data presented herein. This research was funded by the U.S. Department of Energy (DOE) and the National Energy Technology Laboratory (NETL). Funding and support was also provided by the Bureau of Land Management (BLM), BP Exploration (Alaska) Inc.(BPX), Conoco Phillips Alaska, Inc. (CPA), and Geo-Watersheds Scientific (GWS). The contents of the report do not necessarily reflect the views of policies of the DOE, NETL, BLM, BPX, CPA, GWS, or any local sponsor. This work does not constitute a standard, specification, or regulation.

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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 (m)
mile (mi)	1.609	kilometer (km)
	Area	
Acre	43560.0	square feet (ft^2)
Acre	0.405	hectare (ha)
square foot (ft^2)	3.587e-8	square mile (mi^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
gallon (gal)	3785.412	milliliter (mL)
cubic foot (ft^3)	28.317	liter (L)
Acre-ft	1233.482	cubic meter (m^3)
Acre-ft	325851.43	gallon(gal)
gallon(gal)	0.1337	cubic feet (ft^3)
	Velocity and Discharge	
foot per day (ft/d)	0.3048	meter per day (m/d)
Square foot per day (ft^2/d)	0.0929	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)	0.00116	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:

In this report, "sea level" 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, equivalent to ppm
µg/L	micrograms per liter
mi^2	square miles
mm	millimeters
µS/cm	microsiemens per centimeter
mV	Millivolt
NGVD	National Geodetic Vertical Datum
NTU	Nephelometric Turbidity Units
NWIS	National Water Information System
ORP	oxygen-reduction potential
ppm	parts per million, equivalent to mg/L
SC25	specific conductance at 25^{o}C
SWE	Snow Water Equivalent
QA	quality assurance
QC	quality control
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

Lake Nomenclature

KDA	Kuparuk Dead Arm (Prudhoe Bay field, serves Prudhoe Bay field operations)
MSB	Mine Site B(Prudhoe Bay field, serves Milne Point and Kuparuk field operations)
L9312	Lake L9312 (Alpine field, serves Alpine field operations)
L9817	Lake L9817 (Alpine field, serves Alpine field operations)
K113	Lake K113 (Prudhoe Bay field, not currently used for field operations)

PROJECT COOPERATORS

The North Slope Lakes project covers a large area of the North Slope and benefits from a number of positive partnerships, all contributing to the overall project objectives.

- BP Exploration (Alaska) Inc.
- Conoco Phillips Alaska (CPA)
- Bureau of Land Management
- Alaska Department of Natural Resources
- The Nature Conservancy
- Northern Alaska Environmental Center
- Mineral Management Service

ACKNOWLEDGEMENTS

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Lake Chemistry and Physical Data For Selected North Slope, Alaska, Lakes: April 2007

INTRODUCTION

The University of Alaska Fairbanks (UAF) Water and Environmental Research Center (WERC) and Geo-Watersheds Scientific (GWS), together with project cooperators, initiated a study in the Fall of 2002 (Phase One) to obtain baseline information about the physical and chemical characteristics of North Slope tundra lakes. The project was extended in 2005 (Phase Two). The location of study lakes changed and was expanded to include other reservoirs so as to further develop the understanding and simulation tools necessary for water-source management. K113 is an un-pumped lake in the Kuparuk oilfield and is sampled on selected field trips during the year. L9312 is a natural lake studied in the Alpine operations area. L9817 is a natural lake in eastern NPRA, west of Nuiqsut. This lake has been used in previous years for ice-road construction, but was not used during winter 2005-06, nor will be used during the winter of 2006-07. Two reservoir systems (mine sites) were added to the study in 2005. Mine Site B, also known as Six-Mile Lake, is located near the Milne Point facility at the intersection of the Spine Road with the Milne Point access road and has two cells connected to Milne Creek. The Kuparuk Reservoir System (Kuparuk Deadarm Lakes) has 9 reservoirs. The three southernmost reservoir cells (1-3) are included in the study to observe ground-water and surface-water interactions between each cell and the adjacent Kuparuk River.

Water-quality and hydrologic data is collected in the field during monthly visits to the lakes and water samples are collected from priority locations for further analysis at the UAF-WERC chemistry laboratories. The purpose of this publication is to 1) report data collected for the month of April 2007, 2) summarize accomplished field trip objectives.

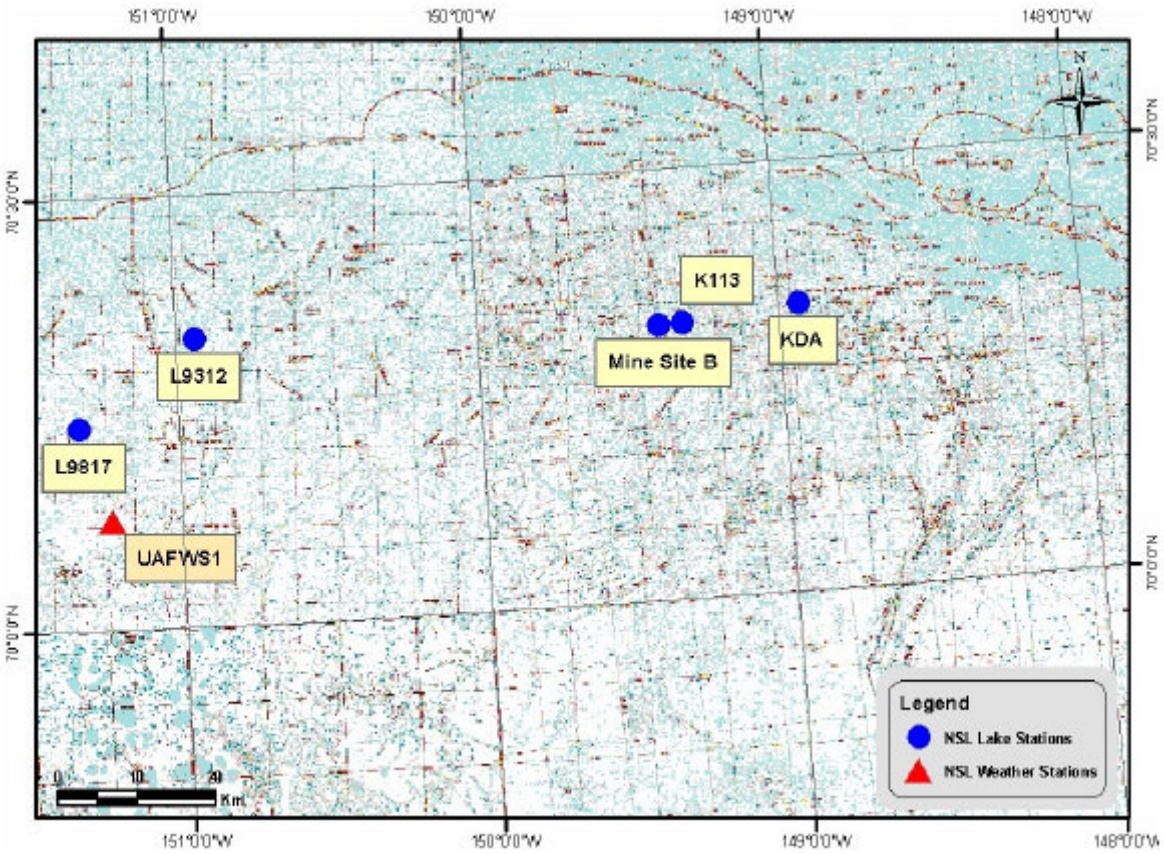

Figure 1. Location of study lakes in the NPR-A, Alpine, Kuparuk, and Prudhoe Bay field operating areas, North Slope, Alaska.

TRIP OBJECTIVES

The goal of each sampling trip is to collect physical and chemical data from each study lake. We drilled a series of holes at designated sampling locations for each lake. Logistical, personnel, and weather constraints can limit the amount of time available in the field for sampling. A project workplan was distributed before the trip outlining the sampling schedule (Lilly and others, 2007). In April 2007, we focused on the following locations/tasks:

1. Kuparuk Dead Arm Reservoirs: Prudhoe Bay operating area.
    - Water chemistry at KDA-1, KDA-2 and KDA-3.
    - Survey water levels to local elevation control.
    - Measure snow depth, ice thickness, and field water quality parameters.

- Conduct snow surveys.

2. Mine Site B: Kuparuk operating area.
    - Water chemistry at North Cell, South Cell, and southern stream junction area.
    - Survey water levels to local elevation control.
    - Measure snow depth, ice thickness, and field water quality parameters.
    - Conduct snow surveys.
3. L9312: Alpine operating area.
    - Water chemistry at various locations.
    - Survey water levels to local elevation control.
    - Measure snow depth, ice thickness, and field water quality parameters.
    - Conduct snow surveys.
4. L9817: NPR-A.
    - Water chemistry at various locations.
    - Survey water levels to local elevation control.
    - Measure snow depth, ice thickness, and field water quality parameters.
    - Conduct snow surveys.

Figure 2. Dan Reichardt performing meter QAQC check, photo by J. Derry.

PROCEDURES

Water Chemistry Sampling

All field work followed the specified health, safety, and environmental guidelines outlined by BPX and CPA (White and Lilly, 2006 *and* 2007*a, b*). Using a gas powered auger, holes were drilled through the ice at specified locations at each study lake. Physical measurements of water depth (top of water to bottom of lake), ice thickness (top of ice to bottom of ice), freeboard (top of water to top of ice), and snow depth (top of ice to top of snow), were taken at each sampling location. Water-quality parameters such as temperature, pH, turbidity, oxygen reduction potential (ORP), conductivity, and dissolved oxygen (DO) were obtained by using an In-Situ Troll 9000 (submersible meter), at multiple depths throughout the water column. The precision with which physical measurements were reported takes into account field conditions. The calibration of each parameter was checked before and after each day of sampling using the criteria in table 1.

Table 1. In-Situ Troll 9000 calibration quality control criteria.

Parameter	Standards used	Acceptable deviation from calibration standard value
Turbidity	Factory calibrated	± 2 (NTU)
pH	4.01, 7.0, 10.0	± 0.2
Conductivity	447 (µs/cm)	within 10%
100% DO	100 % saturated	within 10%
0% DO	0 % saturated solution	within 0.3 mg/L
ORP	InSitu QuickCal 224 mV	within 10%

Water samples were also collected at 3 depths (1 ft. below bottom of ice, within the central part of the water column, 1 ft. above lake bottom). Some of these samples were preserved for further analysis at UAF, while other samples were analyzed with a Hach spectrophotometer while still at the facility. UAF laboratory chemistry analysis will be reported separately.

Snow Surveys

Small-scale snow depth measurements were conducted in "L" shaped patterns on lake surface and/or tundra surface at predetermined locations. Snow depth measurements were taken every meter for twenty-five meters, then turning 90 degrees, and continuing for another twenty-five meters. Snow samples were also collected for density measurements with an Adirondack snow sampler. Five densities were collected from points on tundra and lake and averaged to establish a representative density.

SELECTED RESULTS

Snow depths and densities at lake locations (Table 2) in the Prudhoe Bay operating area are very similar, with slightly more accumulation at the Betty Pingo site. Betty Pingo is a WERC and USDA operated meteorological station with a Wyoming precipitation gauge. The relatively long data records from Betty Pingo can be utilized in drawing comparisons and improving modeling efforts on the North Slope Lake sites. Comparisons between snow surveys on the lake surface and those on the tundra occurred at Mine Site B, L9312 and L9817. At lake L9312 in the Alpine operating area and Mine Site B near Milne Point, there was more snow accumulation on the tundra than on the ice. At lake L9817 in NPR-A there was more snow accumulation on the lake surface rather than the surrounding tundra. Figure 3 shows a graphical representation of snow depths, densities, and snow water equivalents for L9312.

Table 2. Average density and snow depth from snow courses.

	KDA [in; (cm)]	MSB [in; (cm)]	L9312 [in; (cm)]	L9817 [in; (cm)]	Betty Pingo [in; (cm)]
Lake	**2.13; (5.4)**	**4.96; (12.6)**	**5.87; (14.9)**	**14.06; (35.7)**	
Tundra		**10.35; (26.3)**	**15.91; (40.4)**	**6.38; (16.2)**	**8.31; (21.1)**
Density (%)	**0.24**	**0.245**	**0.23**	**0.285**	**0.58**

For L9312 and for most lakes in the area, snow depositional sinks are located at the transition between lake and tundra. Depending on the size of the watershed this can equate to a significant amount of snow water equivalent (SWE) being held in a relatively small area of the basin. Additionally, studies have indicated drift density is higher than lake snow density, thereby further increasing the water content in these zones (Benson and Sturm, 1993).

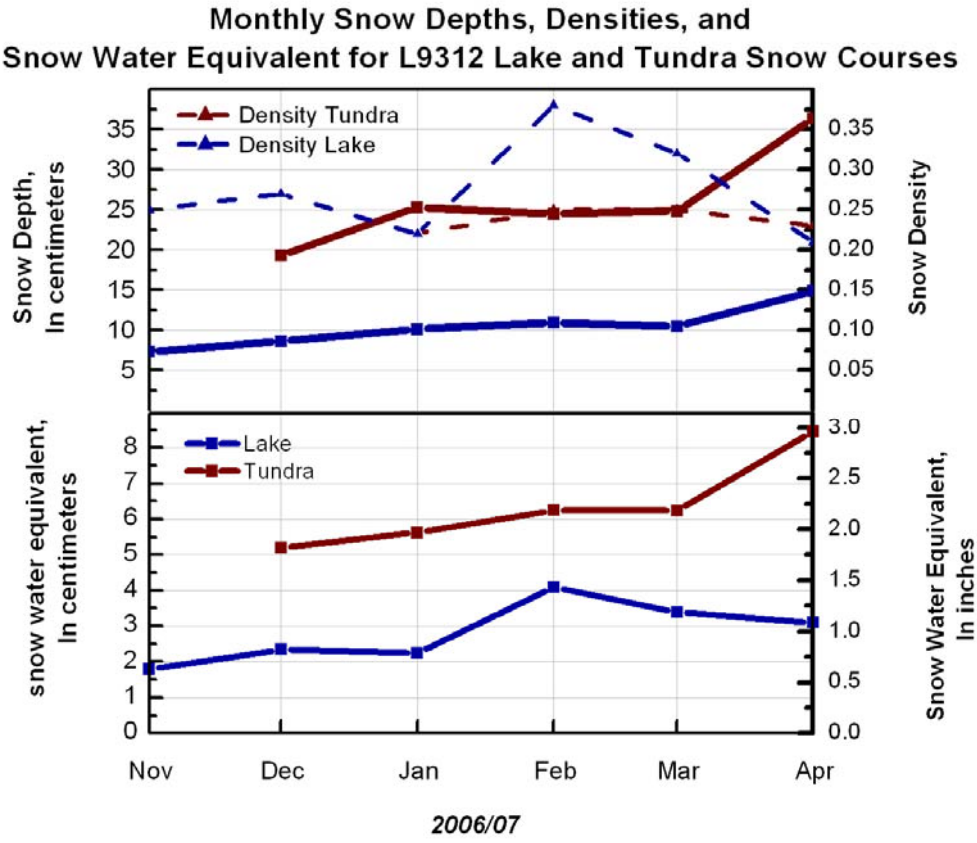

Figure 3. Graphical representation of snow depths, densities, and snow water equivalents for L9312 (lake and tundra snow courses).

SUMMARY

Sampling occurred at Kuparuk Deadarm Lakes, Mine Site B, L9312, and L9817 during April field activities. As Table 3 demonstrates, water levels in KDA Reservoir 1 and L9312 decreased slightly, whereas at Mine Site B and KDA-2 the water levels increased. The north cell of Mine Site B increased by 0.58 ft. (0.177 m), and the south cell of Mine Site B only increased by 0.15 ft

(0.046 m). This could be a result of increased water flow from the connecting stream into the north cell.

Table 3 summarizes conditions at "Priority Sampling Sites". Each lake we visit has one or more locations where we draw water samples from multiple depths for laboratory analysis. These locations have more historical data than other locations on the lakes, and have been chosen as representative of the deeper portion of the respective lakes.

Table 3. Ice thickness, Median DO Concentration, Median Actual Conductance and Monthly Water Change for North Slope lakes in mid-April.

Sampling Site	Ice Thickness [ft; (m)]	Median DO Concentration [mg/L]	Median Actual Conductivity [μS/cm]	Water level change since mid March [ft; (m)]
KDA1-CT	5.62; (1.71)	1.10	-	-0.06; (-0.018)
KDA2-CT	5.25; (1.60)	15.15	-	+0.29; (+0.088)
MSBS-CT	5.25; (1.60)	8.1	285.8	+0.15; (+0.046)
MSBN-CT	5.26; (1.60)	7.94	260.2	+0.58; (+0.177)
L9312 Raft B	5.50; (1.68)	10.38	96.35	-0.01; (-0.003)

Continuous monitoring of the water quality parameters and spatial distribution of snow cover at North Slope lakes throughout the winter will help in the understanding and development of simulation tools necessary for water resource management. As water levels change due to season and pumping activities, it is important to identify the changing water chemistry as well as the potential spring recharge. This information is important for permitting agencies as well as the industry professionals who depend on this resource for facility use and ice road/pad construction. Through monthly hydrologic assessments, water chemistry testing, and water sample analysis, we will continue to answer some of the questions brought forth on the effects of mid-winter pumping of North Slope tundra lakes.

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APPENDIX A. WATER QUALITY FIELD SAMPLING FORMS

The following forms report the data collected with the water quality meters during field sampling.

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA1-CT

Sample Purpose: **Lake Water Quality** Date: 4/13/07 Time: 12:23

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.9026' Easting: W148°56.6748' Datum: NAD83

Measurements By: DAR/GMM Time: 12:30

Water Depth (ft): 20.84 Ice Thickness (ft): 5.62

Freeboard (ft): 0.45 Snow Depth (ft): 0.20

Elev. (BPMSL +/- .02): 8.45 Survey By: DAR/GMM Date: 4/13/07 Time: 13:15

Water Sampling By: DAR/GMM Sample Depths BWS (ft): 1 5 Date: 4/13/07 Time: 14:00

2 10

WATER QUALITY METER INFORMATION 3 20

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
In-Situ	GWS	IN-SITU TROLL 9000	33033	Pass	ORP, COND FAIL

Parameters	**Field Measurements**									
Time:	12:51	12:57	13:11	13:16	13:20	13:28	13:33	13:39	13:45	
Depth BWS (ft):	5	6	7	9	11	13	15	17	18	
Temp (°C):	-0.26	-0.17	0.35	0.95	0.86	0.89	0.90	0.91	0.94	
pH:	7.87	7.87	7.85	7.86	7.86	7.84	7.83	7.83	7.81	
Barometeric (mmHg):	751.5	751.3	751.6	752.9	753.4	753.9	754.1	754.3	754.4	
Pressure (kPa):	13.497	16.843	19.527	25.397	31.178	37.181	43.167	49.104	52.226	
RDO (ppm): (mg/L)	13.79	14.27	14.08	14.37	14.57	14.70	14.95	15.20	15.18	
Turbidity (NTU):	0.6	0.7	0.9	1.0	1.1	1.2	1.1	0.9	0.8	

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft): 5**			**Depth BWS (ft): 10**			**Depth BWS (ft): 20**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)	154	131	133	126	128	129	132	132	129	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	0.02	0.06	0.02	0	0	0.01	0.04	0.01	0.02	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.01	0.01	0.02	0	0	0	0.01	0.01	0.02	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: ORP Fails by DAR judgement of results. Conductivity post-cal check failed.

Field-Form Filled Out By: DAR Date: 5/7/07

QAQC Check By: KMH Date: 5/23/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA1-CT

Sample Purpose: **Lake Water Quality** Date: 4/13/07 Time: 12:23

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.9026' Easting: W148°56.6748' Datum: NAD83

Measurements By: DAR/GMM Time: 12:30

Water Depth (ft): 20.84 Ice Thickness (ft): 5.62

Freeboard (ft): 0.45 Snow Depth (ft): 0.20

Elev. (BPMSL +/- .02): 8.45 Survey By: DAR/GMM Date: 4/13/07 Time: 13:15

Water Sampling By: DAR/GMM Sample Depths BWS (ft): 1 5 Date: 4/13/07 Time: 14:00

2 10

WATER QUALITY METER INFORMATION 3 20

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
In-Situ	GWS	IN-SITU TROLL 9000	33033	Pass	ORP, COND FAIL

Parameters	**Field Measurements**									
Time:	13:49	13:53	13:57							
Depth BWS (ft):	19	20	BOT							
Temp (°C):	0.99	1.07	1.21							
pH:	7.80	7.74	7.59							
Barometeric (mmHg):	754.5	754.6	754.9							
Pressure (kPa):	55.168	58.043	61.376							
RDO (ppm): (mg/L)	15.07	14.74	13.52							
Turbidity (NTU):	0.8	0.8	93.9							

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: DAR Date: 5/7/07

QAQC Check By: KMH Date: 5/23/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA2 - CT

Sample Purpose: **Lake Water Quality** Date: 4/13/07 Time: 10:26

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.966' Easting: W148°56.429' Datum: NAD83

Measurements By: GMM/DAR Time: 10:26

Water Depth (ft): 17.14 Ice Thickness (ft): 5.25

Freeboard (ft): 0.34 Snow Depth (ft): 0.44

Elev. (BPMSL +/- .02): 5.13 Survey By: DAR/JED Date: 4/13/07 Time: 13:15

Water Sampling By: GMM/DAR Sample Depths BWS (ft): 1 5 Date: 4/13/07 Time: 11:45

2 9

WATER QUALITY METER INFORMATION 3 16.5

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
In-Situ	GWS	IN-SITU TROLL 9000	33033	PASS	ORP, COND FAIL

Parameters	**Field Measurements**									
Time:	10:47	10:50	10:57	11:00	11:09	11:14	11:21	11:23	11:27	11:30
Depth BWS (ft):	5	6	7	9	11	13	15	16	17	BOT
Temp (°C):	-0.40	-0.40	0.11	0.63	0.70	0.71	0.73	0.77	0.90	0.91
pH:	7.08	7.08	7.08	7.50	7.35	7.68	7.76	7.72	7.57	7.55
Barometeric (mmHg):	753.2	752.5	751.8	752.5	753.2	753.4	753.4	753.5	753.5	753.6
Pressure (kPa):	13.365	16.451	19.408	25.636	31.578	37.467	43.453	46.189	49.037	50.633
RDO (ppm): (mg/L)	13.94	14.40	14.40	14.80	14.93	15.37	15.85	15.78	12.90	11.47
Turbidity (NTU):	3.1	3.2	3.2	4.1	3.8	3.8	3.6	3.8	5.0	13.9

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):___5____**			**Depth BWS (ft):__9____**			**Depth BWS (ft):___16.5_**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)	129	133	131	125	128	130	134	131	135	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	0.02	0.03	0.02	0.02	0.02	0.04	0.06	0.04	0.05	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.02	0.03	0.04	0	0	0.01	0.01	0.01	0.02	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: ORP Fails by DAR judgement of results. Conductivity post-cal check failed.

Field-Form Filled Out By: DAR Date: 5/7/07

QAQC Check By: KMH Date: 5/23/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA2-SH

Sample Purpose: **Lake Water Quality** Date: 4/13/07 Time: 18:18

FIELD MEASUREMENTS

GPS Coord. Northing: nr Easting: nr Datum: nr

Measurements By: GMM Time: 18:22

Water Depth (ft): 14.5 Ice Thickness (ft): 5.40

Freeboard (ft): 0.3 Snow Depth (ft): 0.80

Elev. (BPMSL +/- .02): 5.13 Survey By: DAR/JED Date: 4/13/07 Time: 13:15

Water Sampling By: DAR Sample Depths BWS (ft): 1 NA Date: NA Time: NA

2 NA

3 NA

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
In-Situ	GWS	IN-SITU TROLL 9000	33033	Pass	ORP, Cond Fail

Parameters	**Field Measurements**									
Time:	18:53	18:57	19:01	19:05	19:11	19:14	19:21	19:26		
Depth BWS (ft):	6	7	8	9	11	13	14	BOT		
Temp (°C):	-0.20	0.29	0.68	0.75	0.78	0.78	0.78	0.78		
pH:	7.82	7.81	7.79	7.82	7.84	7.82	7.79	7.79		
Barometeric (mmHg):	751.0	751.4	752.4	753.1	753.7	753.9	754.2	754.3		
Pressure (kPa):	16.756	19.612	22.406	25.413	31.123	37.219	40.165	42.681		
RDO (ppm): (mg/L)	13.72	13.94	13.83	13.88	14.29	14.43	13.76	13.79		
Turbidity (NTU):	3.0	3.2	3.5	3.5	3.6	4.1	5.6	9.9		

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: ORP Fails by DAR judgement of results. Conductivity post-cal check failed.

Field-Form Filled Out By: DAR Date: 5/7/07

QAQC Check By: KMH Date: 5/23/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA3-CT

Sample Purpose: **Lake Water Quality** Date: 4/13/07 Time: 15:18

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.025 Easting: W148°56.2044 Datum: NAD83

Measurements By: GMM/DAR Time: 15:22

Water Depth (ft): 20.83 Ice Thickness (ft): 5.58

Freeboard (ft): 0.35 Snow Depth (ft): 0.22

Elev. (BPMSL +/- .02): 5.13 Survey By: DAR/JED Date: 4/13/07 Time: 13:15

Water Sampling By: na Sample Depths BWS (ft): 1 na Date: na Time: na

2 na

WATER QUALITY METER INFORMATION 3 na

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
In-Situ	GWS	IN-SITU TROLL 9000	33033	Pass	ORP, Cond Fail

Parameters	**Field Measurements**									
Time:	15:36	15:44	15:52	15:57	16:02	16:08	16:17	16:23	16:32	
Depth BWS (ft):	6	7	9	11	13	15	17	18	19	
Temp (°C):	-0.16	0.33	0.81	0.88	0.88	0.90	0.92	0.94	1.01	
pH:	7.84	7.82	7.80	7.79	7.79	7.80	7.79	7.77	7.76	
Barometeric (mmHg):	747.3	746.5	747.5	747.8	748.0	748.2	748.3	748.4	748.5	
Pressure (kPa):	17.215	20.314	26.044	31.873	38.014	43.946	49.974	53.080	55.780	
RDO (ppm): (mg/L)	13.84	14.09	14.29	14.60	14.92	15.30	15.65	15.52	15.42	
Turbidity (NTU):	0.6	0.5	0.6	0.6	0.7	0.5	0.4	0.5	0.6	

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: ORP Fails by DAR judgement of results. Conductivity post-cal check failed.

Field-Form Filled Out By: DAR Date: 5/7/07

QAQC Check By: KMH Date: 5/23/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA3-CT

Sample Purpose: **Lake Water Quality** Date: 4/13/07 Time: 15:18

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.025 Easting: W148°56.2044 Datum: NAD83

Measurements By: GMM/DAR Time: 15:22

Water Depth (ft): 20.83 Ice Thickness (ft): 5.58

Freeboard (ft): 0.35 Snow Depth (ft): 0.22

Elev. (BPMSL +/- .02): 5.13 Survey By: DAR/JED Date: 4/13/07 Time: 13:15

Water Sampling By: na Sample Depths BWS (ft): 1 na Date: na Time: na

2 na

WATER QUALITY METER INFORMATION 3 na

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
In-Situ	GWS	IN-SITU TROLL 9000	33033	Pass	ORP, Cond Fail

Parameters	**Field Measurements**									
Time:	16:37	16:45								
Depth BWS (ft):	20	BOT								
Temp (°C):	1.09	1.15								
pH:	7.70	7.56								
Barometeric (mmHg):	748.6	748.9								
Pressure (kPa):	59.000	62.127								
RDO (ppm): (mg/L)	15.05	13.94								
Turbidity (NTU):	0.7	130.7								

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: ORP Fails by DAR judgement of results. Conductivity post-cal check failed.

Field-Form Filled Out By: DAR Date: 5/7/07

QAQC Check By: KMH Date: 5/23/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: KDA3-SH

Sample Purpose: **Lake Water Quality** Date: 4/13/07 Time: 16:57

FIELD MEASUREMENTS

GPS Coord. Northing: 70°20.031' Easting: W148°56.250' Datum: NAD 83

Measurements By: GMM Time: 16:58

Water Depth (ft): 15.45 Ice Thickness (ft): 5.95

Freeboard (ft): 0.55 Snow Depth (ft): 0.40

Elev. (BPMSL +/- .02): 5.13 Survey By: DAR/JED Date: 4/13/07 Time: 13:15

Water Sampling By: na Sample Depths BWS (ft): 1 na Date: na Time: na

2 na

WATER QUALITY METER INFORMATION 3 na

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
In-Situ	GWS	IN-SITU TROLL 9000	33033	Pass	ORP, Cond Fail

Parameters	**Field Measurements**									
Time:	17:11	17:17	17:24	17:27	17:32	17:38	17:42	17:51	17:56	
Depth BWS (ft):	6	7	8	9	11	13	14	15	BOT	
Temp (°C):	-0.17	0.32	0.69	0.82	0.87	0.89	0.88	0.90	0.90	
pH:	7.77	7.76	7.74	7.78	7.79	7.79	7.78	7.76	7.75	
Barometeric (mmHg):	750.4	751.1	752.3	752.8	753.3	753.8	754.0	754.2	754.3	
Pressure (kPa):	16.688	19.570	22.350	25.244	31.188	37.053	40.190	43.021	45.423	
RDO (ppm): (mg/L)	14.46	14.47	14.35	14.31	14.43	14.70	14.77	15.06	14.30	
Turbidity (NTU):	0.5	0.5	0.6	0.8	0.8	0.6	0.5	0.3	82.7	

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: ORP Fails by DAR judgement of results. Conductivity post-cal check failed.

Field-Form Filled Out By: DAR Date: 5/7/07

QAQC Check By: KMH Date: 5/23/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBN-CT (pg 1 of 2)

Sample Purpose: **Lake Water Quality** Date: 4/14/07 Time: 11:30

FIELD MEASUREMENTS

GPS Coord. Northing: N70 19.280 Easting: W149 24.009 Datum: NAD 83

Measurements By: DAR Time: 11:45

Water Depth (ft): 32.54 Ice Thickness (ft): 5.26

Freeboard (ft): 0.28 Snow Depth (ft): 0.25

Elev. (BPMSL +/- .02): 93.21 Survey By: DAR/GM Date: 4/14/07 Time: 15:30

Water Sampling By: DAR/JED Sample Depths BWS (ft): 1 6 Date: 4/14/07 Time: 13:00

2 22

3 32

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	Pass	Pass

Parameters	**Field Measurements**									
Time:	12:03	12:05	12:07	12:08	12:09	12:10	12:13	12:15	12:16	
Depth BWS (ft):	6	7	9	11	13	15	17	19	21	
Temp (°C):	0.08	0.08	0.07	0.08	0.08	0.08	0.08	0.10	0.14	
pH:										
Barometeric (mmHg):	753.6	753.7	753.8	753.8	753.9	754.0	754.0	754.0	754.0	
Pressure (kPa):	16.151	19.464	25.563	31.435	37.271	43.204	49.357	55.615	61.100	
Conductivity (µS/cm):	261.6	261.3	261.1	260.9	260.7	260.7	260.6	260.4	260.2	
RDO (ppm): (mg/L)	8.45	8.17	8.11	8.11	8.12	8.12	8.15	8.04	7.94	
Turbidity (NTU):	1.3	0.6	0.6	0.4	0.5	0.5	0.5	0.6	0.7	
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used) Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):___6___**			**Depth BWS (ft):___22___**			**Depth BWS (ft):___32___**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)	195	196	200	194	198	200	232	228	235	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	0.04	0.04	0.05	0.06	0.06	0.06	3.7*	3.9*	3.8*	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.03	0.02	0.03	0.01	0.03	0.04	3.13	3.24	3.21	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: * Results obtained with a 1:10 dilution, pH probe and ORP not calibrated nor recorded.
pH/ORP probe failed while stabilizing, removed probe and continued with other parameters.

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/1/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBN-CT (pg 2 of 2)

Sample Purpose: **Lake Water Quality** Date: 4/14/07 Time: 11:30

FIELD MEASUREMENTS

GPS Coord. Northing: N70 19.280 Easting: W149 24.009 Datum: NAD 83

Measurements By: DAR Time: 11:45

Water Depth (ft): 32.54 Ice Thickness (ft): 5.26

Freeboard (ft): 0.28 Snow Depth (ft): 0.25

Elev. (BPMSL +/- .02): 93.21 Survey By: DAR/GM Date: 4/14/07 Time: 15:30

Water Sampling By: DAR/JED Sample Depths BWS (ft): 1 6 Date: 4/14/07 Time: 13:00

2 22

3 32

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	Pass	Pass

Parameters	**Field Measurements**									
Time:	12:19	12:23	12:26	12:29	12:31	12:37	12:45	12:50		
Depth BWS (ft):	23	25	27	29	30	31	32	Bot		
Temp (°C):	0.26	0.39	0.50	0.54	0.58	0.63	0.69	0.71		
pH:										
Barometeric (mmHg):	754.1	754.3	754.3	754.4	754.4	754.4	754.5	754.5		
Pressure (kPa):	67.129	73.240	79.670	85.034	88.061	91.135	94.386	96.524		
Conductivity (µS/cm):	260.1	260.4	263.1	266.4	272.2	283.5	323.4	348.7		
RDO (ppm): (mg/L)	7.81	7.69	6.49	5.30	4.73	3.36	0.57	0.37		
Turbidity (NTU):	1.2	0.8	1.2	2.9	3.6	6.4	14.2	26.2		
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: pH/ORP probe failed while stabilizing, removed probe and continued with other parameters.

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/1/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBS-CT (pg 1 of 2)

Sample Purpose: **Lake Water Quality** Date: 4/14/07 Time: 13:53

FIELD MEASUREMENTS

GPS Coord. Northing: N70 19.214 Easting: W149 24.020 Datum: NAD 83

Measurements By: DAR Time: 13:55

Water Depth (ft): 26.71 Ice Thickness (ft): 5.25

Freeboard (ft): 0.29 Snow Depth (ft): 0.38

Elev. (BPMSL +/- .02): 93.88 Survey By: DAR, GM Date: 4/14/07 Time: 15:30

Water Sampling By: DAR/JED Sample Depths BWS (ft): 1 6 Date: 4/14/07 Time: 14:30

2 16

3 26

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	Pass	Pass

Parameters	**Field Measurements**									
Time:	14:02	14:03	14:05	14:09	14:16	14:18	14:19	14:21	14:22	
Depth BWS (ft):	6	7	9	11	13	15	17	19	21	
Temp (°C):	0.15	0.17	0.32	0.38	0.40	0.39	0.39	0.38	0.38	
pH:										
Barometeric (mmHg):	753.9	753.9	753.8	753.8	754.0	754.1	754.2	754.2	754.3	
Pressure (kPa):	16.385	19.760	25.552	31.536	37.586	43.264	49.246	55.350	61.276	
Conductivity (µS/cm):	287.3	287.2	286.5	286.1	286.1	285.9	285.9	285.8	285.8	
RDO (ppm): (mg/L)	9.08	9.00	8.59	8.15	8.14	8.13	8.11	8.10	8.10	
Turbidity (NTU):	1.3	0.6	0.4	0.5	0.6	0.7	0.4	0.5	0.5	
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):___6___**			**Depth BWS (ft):___16___**			**Depth BWS (ft):___26___**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)	221	221	222	216	218	217	227	225	222	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	0.07	0.08	0.09	0.07	0.07	0.08	0.95	0.96	0.96	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.03	0.03	0.04	0.01	0.02	0.05	0.17	0.17	0.2	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: pH and ORP probe was not calibrated nor recorded.

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/1/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBS-CT

Sample Purpose: **Lake Water Quality** Date: 4/14/07 Time: 13:53

FIELD MEASUREMENTS

GPS Coord. Northing: N70 19.214 Easting: W149 24.020 Datum: NAD 83

Measurements By: DAR Time: 13:55

Water Depth (ft): 26.71 Ice Thickness (ft): 5.25

Freeboard (ft): 0.29 Snow Depth (ft): 0.38

Elev. (BPMSL +/- .02): 93.88 Survey By: DAR, GM Date: 4/14/07 Time: 15:30

Water Sampling By: DAR/JED Sample Depths BWS (ft): 1 6 Date: 4/14/07 Time: 14:30

2 16

WATER QUALITY METER INFORMATION 3 26

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	Pass	Pass

Parameters	**Field Measurements**									
Time:	14:24	14:26	14:33	14:38	14:41					
Depth BWS (ft):	23	24	25	26	Bot					
Temp (°C):	0.39	0.48	0.68	0.76	0.86					
pH:										
Barometeric (mmHg):	754.3	754.4	754.4	754.5	754.5					
Pressure (kPa):	67.134	70.234	73.233	76.078	78.903					
Conductivity (µS/cm):	285.8	285.6	287.3	288.9	311.9					
RDO (ppm): (mg/L)	8.08	7.87	6.12	4.82	2.05					
Turbidity (NTU):	0.6	1.1	2.5	4.4	149.1					
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used) Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: pH and ORP probe was not calibrated nor recorded.

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/2/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: MSBS-SW

Sample Purpose: **Lake Water Quality** Date: 4/14/07 Time: 15:45

FIELD MEASUREMENTS

GPS Coord. Northing: N70 19.186 Easting: W149 24.234 Datum: NAD 83

Measurements By: DAR Time: 15:45

Water Depth (ft): 18.44 Ice Thickness (ft): 6.01

Freeboard (ft): 0.65 Snow Depth (ft): 0.20

Elev. (BPMSL +/- .02): 93.88 Survey By: DAR, GM Date: 4/14/07 Time: 15:30

Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a

2 n/a

3 n/a

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	Pass	Pass

Parameters	**Field Measurements**									
Time:	15:46	15:47	15:50	15:54	15:55	15:56	15:57	15:59	16:01	16:04
Depth BWS (ft):	6	7	9	11	13	15	16	17	18	Bot
Temp (°C):	0.16	0.19	0.34	0.38	0.37	0.38	0.38	0.38	0.37	0.38
pH:										
Barometeric (mmHg):	753.9	753.9	754.0	754.0	754.1	754.1	754.1	754.2	754.2	754.2
Pressure (kPa):	16.629	19.235	25.233	31.157	37.436	43.327	46.261	49.304	52.307	54.479
Conductivity (µS/cm):	289.8	287.8	287.0	286.9	286.8	286.8	286.7	286.7	286.7	286.7
RDO (ppm): (mg/L)	9.65	9.61	8.92	8.50	8.34	8.32	8.29	8.25	8.17	8.16
Turbidity (NTU):	0.4	0.8	0.5	1.0	0.7	1.6	0.5	0.6	5.2	4.9
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: pH and ORP probe was not calibrated nor recorded.

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/2/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: L9312 raft "A"

Sample Purpose: **Lake Water Quality** Date: 4/16/07 Time: 13:21

FIELD MEASUREMENTS

GPS Coord. Northing: N70°20.053' Easting: W150°56.600' Datum: NAD83

Measurements By: GMM Time: 13:25

Water Depth (ft): 10.1 Ice Thickness (ft): 4.90

Freeboard (ft): 0.25 Snow Depth (ft): 0.35

Elev. (BPMSL +/- .02): 7.5 Survey By: ML, DR Date: 4/16/07 Time: 15:23

Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a

2 n/a

3 n/a

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	PASS	Pass

Parameters	**Field Measurements**									
Time:	13:50	14:01	14:21	14:30	14:40	14:51	15:02			
Depth BWS (ft):	5	6	7	8	9	10	Bot			
Temp (°C):	0.16	0.26	0.97	1.34	1.72	1.89	1.92			
pH:										
Barometeric (mmHg):	757.3	757.3	757.6	757.6	757.7	757.8	757.8			
Pressure (kPa):	13.371	16.274	19.382	22.139	25.127	28.153	29.462			
Conductivity (µS/cm):	93.56	94.90	95.27	96.76	97.17	191.40	194.30			
RDO (ppm): (mg/L)	10.04	10.26	9.65	9.39	9.33	7.88	5.70			
Turbidity (NTU):	0.7	0.9	2.8	2.0	1.6	4.5	12.0			
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: pH and ORP probe nor calibrated nor recorded

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/1/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: L9312 raft "B"

Sample Purpose: **Lake Water Quality** Date: 4/16/07 Time: 11:23

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.995' Easting: W150°56.918' Datum: NAD83

Measurements By: DAR/GMM Time: 11:23

Water Depth (ft): 11.22 Ice Thickness (ft): 5.50

Freeboard (ft): 0.36 Snow Depth (ft): 0.20

Elev. (BPMSL +/- .02): 7.5 Survey By: ML, DR Date: 4/16/07 Time: 15:23

Water Sampling By: GMM/JED Sample Depths BWS (ft): 1 6 Date: 4/16/07 Time: 12:35

2 9

WATER QUALITY METER INFORMATION 3 11

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	PASS	PASS

Parameters	**Field Measurements**									
Time:	11:32	11:40	11:45	11:59	12:07	12:14	12:19			
Depth BWS (ft):	6	7	8	9	10	11	Bot			
Temp (°C):	0.42	1.08	1.52	1.67	1.77	1.88	1.96			
pH:										
Barometeric (mmHg):	756.5	756.7	756.8	757.0	757.0	757.1	757.1			
Pressure (kPa):	16.566	19.573	22.408	25.156	28.170	31.452	32.879			
Conductivity (µS/cm):	92.32	93.32	94.61	96.35	107.30	114.30	130.70			
RDO (ppm): (mg/L)	10.46	10.83	10.63	10.38	8.13	7.13	4.45			
Turbidity (NTU):	0.7	0.8	1.0	1.8	1.8	3.3	39.6			
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):____6___**			**Depth BWS (ft):___9___**			**Depth BWS (ft):__11____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)	52	54	49	58	55	56	87	89	87	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	0.14	0.14	0.15	0.32	0.32	0.3	200+	210+	230+	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.04	0.04	0.05	0.15	0.15	0.16	27.6*	27.7*	27.5*	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: * results obtained with 10:1 dilution

(+) results obtained with 100:1 dilution

pH and ORP probe not calibrated nor recorded

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/1/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: L9312-Mid

Sample Purpose: **Lake Water Quality** Date: 4/16/07 Time: 15:19

FIELD MEASUREMENTS

GPS Coord. Northing: N70o20.024' Easting: W150o56.753' Datum: NAD83

Measurements By: GMM Time: 15:22

Water Depth (ft): 10.95 Ice Thickness (ft): 5.65

Freeboard (ft): 0.4 Snow Depth (ft): 0.75

Elev. (BPMSL +/- .02): 7.5 Survey By: ML, DR Date: 4/16/07 Time: 15:23

Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a

2 n/a

3 n/a

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	PASS	PASS

Parameters	**Field Measurements**									
Time:	16:02	16:21	16:35	16:50	17:01	17:19				
Depth BWS (ft):	6	7	8	9	10	Bot				
Temp (°C):	0.26	0.97	1.49	1.72	1.86	1.93				
pH:										
Barometeric (mmHg):	758.1	758.2	758.3	758.4	758.5	758.6				
Pressure (kPa):	16.258	19.164	22.278	25.240	28.135	32.027				
Conductivity (µS/cm):	92.63	92.79	93.80	94.87	99.91	118.00				
RDO (ppm): (mg/L)	11.59	11.00	10.92	10.22	9.58	4.31				
Turbidity (NTU):	1.0	3.7	3.1	2.6	7.6	12.2				
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used) Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: pH and ORP probe not calibrated nor recorded

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/1/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: L9817-1

Sample Purpose: **Lake Water Quality** Date: 4/17/07 Time: 11:09

FIELD MEASUREMENTS

GPS Coord. Northing: N70 14.090 Easting: W151 19.931 Datum: NAD 27

Measurements By: GMM Time: 11:14

Water Depth (ft): 8.45 Ice Thickness (ft): 5.40

Freeboard (ft): 0.3 Snow Depth (ft): 0.40

Elev. (BPMSL +/- .02): 53.04 Survey By: ML, DR Date: 4/17/07 Time: 14:25

Water Sampling By: GMM/JED Sample Depths BWS (ft): 1 5 Date: 4/16/07 Time: 12:10

2 6.5

3 8

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	PASS	PASS

Parameters	**Field Measurements**									
Time:	11:42	11:46	11:50	11:55	11:58					
Depth BWS (ft):	5	6	7	8	Bot					
Temp (°C):	0.06	0.08	0.28	0.68	0.90					
pH:										
Barometeric (mmHg):	758.4	758.5	758.4	758.5	758.4					
Pressure (kPa):	13.366	16.286	19.363	22.433	24.508					
Conductivity (µS/cm):	702.50	701.80	692.10	704.30	728.10					
RDO (ppm): (mg/L)	0.28	0.24	0.18	0.16	0.15					
Turbidity (NTU):	12.5	12.2	10.8	11.7	15.1					
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):____5___**			**Depth BWS (ft):__6.5____**			**Depth BWS (ft):___8___**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)	206	204	202	201	210	214	240	236	234	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	1.21	1.25	1.24	1.09	1.08	1.06	13.2*	13.3*	13.4*	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.11	0.12	0.15	0.1	0.1	0.1	9.90*	9.90*	9.20*	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: 5' Reading redone: insturment wire disconnected and stopped collecting data. pH and OPR not calibrated or used

* results obtained with 10:1 dilution

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/1/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: L9817-2

Sample Purpose: **Lake Water Quality** Date: 4/17/07 Time: 11:45

FIELD MEASUREMENTS

GPS Coord. Northing: N70 14.071 Easting: W151 19.868 Datum: NAD 27

Measurements By: GMM Time: 12:00

Water Depth (ft): 7.04 Ice Thickness (ft): 5.20

Freeboard (ft): 0.39 Snow Depth (ft): 0.50

Elev. (BPMSL +/- .02): 53.04 Survey By: ML, DR Date: 4/17/07 Time: 14:25

Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a

2 n/a

3 n/a

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	In-Situ Trolle 9000	33033	PASS	PASS

Parameters	**Field Measurements**									
Time:	12:00	12:02	12:04	12:06						
Depth BWS (ft):	5	6	7	Bot						
Temp (°C):	-0.34	-0.34	-0.22	-0.11						
pH:	6.82	6.82	6.79	6.80						
Barometeric (mmHg):	757.4	757.4	757.4	757.4						
Pressure (kPa):	13.537	16.385	19.365	20.424						
Conductivity (µS/cm):	725.3	722.3	723.3	724.6						
RDO (ppm): (mg/L)	0.82	0.68	0.52	0.43						
Turbidity (NTU):	7.5	7.2	7.4	21.5						
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: K. Holland Date: 5/4/07

QAQC Check By: A. Blackburn Date: 5/23/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: L9817-3

Sample Purpose: **Lake Water Quality** Date: 4/17/07 Time: 12:55

FIELD MEASUREMENTS

GPS Coord. Northing: N70 14.043 Easting: W151 19.840 Datum: NAD 27

Measurements By: GMM Time: 13:00

Water Depth (ft): 8.02 Ice Thickness (ft): 5.20

Freeboard (ft): 0.45 Snow Depth (ft): 0.40

Elev. (BPMSL +/- .02): 53.04 Survey By: ML, DR Date: 4/17/07 Time: 14:25

Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a

2 n/a

3 n/a

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	In-Situ Trolle 9000	33033	PASS	PASS

Parameters	**Field Measurements**									
Time:	13:02	13:03	13:05	13:07	13:09	13:11				
Depth BWS (ft):	4	5	6	7	8	Bot				
Temp (°C):	-0.30	-0.30	-0.24	0.02	0.33	0.42				
pH:	6.96	6.94	6.91	6.92	6.84	6.86				
Barometeric (mmHg):	757.0	757.0	757.1	757.2	757.2	757.2				
Pressure (kPa):	10.489	13.423	16.298	19.757	22.599	23.375				
Conductivity (µS/cm):	721.3	720.2	714.4	714.5	734.4	738.4				
RDO (ppm): (mg/L)	0.33	0.36	0.34	0.22	0.14	0.13				
Turbidity (NTU):	13.0	13.2	12.8	12.2	20.0	36.5				
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used) Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: K. Holland Date: 5/4/07

QAQC Check By: A. Blackburn Date: 5/23/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: L9817-4

Sample Purpose: **Lake Water Quality** Date: 4/17/07 Time: 13:45

FIELD MEASUREMENTS

GPS Coord. Northing: N70 14.018 Easting: W151 19.807 Datum: NAD 27

Measurements By: GMM Time: 13:45

Water Depth (ft): 5.82 Ice Thickness (ft): 4.11

Freeboard (ft): 0.05 Snow Depth (ft): 2.20

Elev. (BPMSL +/- .02): 53.04 Survey By: ML, DR Date: 4/17/07 Time: 14:25

Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a

2 n/a

3 n/a

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	In-Situ Trolle 9000	33033	PASS	PASS

Parameters	**Field Measurements**									
Time:	13:51	13:52	13:53							
Depth BWS (ft):	4	5	Bot							
Temp (°C):	-0.24	-0.33	-0.32							
pH:	6.92	6.92	6.73							
Barometeric (mmHg):	757.2	757.2	757.2							
Pressure (kPa):	10.513	13.542	16.826							
Conductivity (µS/cm):	711.2	708.4	715.1							
RDO (ppm): (mg/L)	0.49	0.37	0.27							
Turbidity (NTU):	10.9	10.8	124.8							
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used) Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: K. Holland Date: 5/4/07

QAQC Check By: A. Blackburn Date: 5/23/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: L9817-21

Sample Purpose: **Lake Water Quality** Date: 4/17/07 Time: 14:22

FIELD MEASUREMENTS

GPS Coord. Northing: N70 14.083 Easting: W151 20.084 Datum: NAD27

Measurements By: GMM Time: 14:45

Water Depth (ft): 8.9 Ice Thickness (ft): 0.50

Freeboard (ft): 0.3 Snow Depth (ft): 1.10

Elev. (BPMSL +/- .02): 53.04 Survey By: ML, DR Date: 4/17/07 Time: 14:25

Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a

2 n/a

3 n/a

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	PASS	PASS

Parameters	**Field Measurements**									
Time:	15:01	15:04	15:07	15:11						
Depth BWS (ft):	6	7	8	Bot						
Temp (°C):	0.19	0.38	0.53	0.66						
pH:										
Barometeric (mmHg):	758.5	758.5	758.4	758.4						
Pressure (kPa):	16.253	19.277	22.340	26.027						
Conductivity (µS/cm):	692.20	695.30	699.30	750.60						
RDO (ppm): (mg/L)	0.38	0.22	0.15	0.11						
Turbidity (NTU):	17.2	16.8	17.6	41.5						
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used) Probe:					
Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: pH and ORP probe not calibrated nor recorded

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/1/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: L9817-22

Sample Purpose: **Lake Water Quality** Date: 4/17/07 Time: 14:02

FIELD MEASUREMENTS

GPS Coord. Northing: N70 14.074 Easting: W151 20.017 Datum: NAD 83

Measurements By: GMM Time: 14:04

Water Depth (ft): 9.3 Ice Thickness (ft): 5.65

Freeboard (ft): 0.35 Snow Depth (ft): 0.90

Elev. (BPMSL +/- .02): 53.04 Survey By: ML, DR Date: 4/17/07 Time: 14:25

Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a

2 n/a

3 n/a

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	PASS	PASS

Parameters	**Field Measurements**									
Time:	14:26	14:29	14:32	14:34	14:37					
Depth BWS (ft):	6	7	8	9	Bot					
Temp (°C):	0.14	0.27	0.40	0.85	0.89					
pH:										
Barometeric (mmHg):	758.3	758.3	758.7	758.4	758.4					
Pressure (kPa):	16.325	19.383	22.243	25.191	26.871					
Conductivity (µS/cm):	703.40	710.70	720.00	778.50	784.10					
RDO (ppm): (mg/L)	0.23	0.17	0.16	0.14	0.40					
Turbidity (NTU):	15.5	13.2	13.9	15.3	59.3					
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: pH and ORP probe not calibrated nor recorded

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/1/07

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-004a: Water Quality Field-Sampling General

Project ID: **North Slope Lakes** Site Location/Lake ID: L9817-23

Sample Purpose: **Lake Water Quality** Date: 4/14/07 Time: 12:55

FIELD MEASUREMENTS

GPS Coord. Northing: N70 14.071 Easting: W151 20.067 Datum: NAD 83

Measurements By: GMM Time: 12:59

Water Depth (ft): 8.7 Ice Thickness (ft): 5.70

Freeboard (ft): 0.4 Snow Depth (ft): 0.40

Elev. (BPMSL +/- .02): 53.04 Survey By: ML, DR Date: 4/17/07 Time: 14:25

Water Sampling By: n/a Sample Depths BWS (ft): 1 n/a Date: n/a Time: n/a

2 n/a

3 n/a

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	UAF	In-Situ Trolle 9000	33205	PASS	PASS

Parameters	**Field Measurements**									
Time:	13:23	13:33	13:39	13:44						
Depth BWS (ft):	6	7	8	Bot						
Temp (°C):	0.11	0.31	0.60	0.81						
pH:										
Barometeric (mmHg):	758.1	758.1	758.1	758.1						
Pressure (kPa):	16.200	19.146	22.350	24.937						
Conductivity (µS/cm):	711.80	718.80	733.30	759.30						
RDO (ppm): (mg/L)	0.67	0.23	0.18	0.15						
Turbidity (NTU):	12.5	11.1	10.6	17.0						
ORP										

FIELD TESTING OF WATER SAMPLES (if small probe is used)

Probe:

Depth (ft)					
Temp (°C)					
pH					
Eh					

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Parameter	**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Depth BWS (ft):_____**			**Method**
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Oxygen (mg/L)										Hach spec 0.3-15 mg/L
Alkalinity (mg/L as $CaCO_3$)										Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)										Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)										Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH_3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: pH and ORP probe not calibrated nor recorded

Field-Form Filled Out By: A. Blackburn Date: 4/23/07

QAQC Check By: K. Holland Date: 5/1/07

APPENDIX B. WATER QUALITY METER CALIBRATION FORMS

The following forms report the pre- and post-calibration checks for the 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 Initial Trip Check

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: GWS S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (°C)	Pass/Fail
pH	4/12/07	nr	Oakton 4.01	2612530	12/1/08	3.97	21.50	Pass
pH	4/12/07	nr	Oakton 7.00	2512282	12/1/07	6.92	21.90	Pass
pH	4/12/07	nr	Oakton 10.00	2610413	4/1/08	10.02	25.40	Pass
ORP	4/12/07	nr	InSitu QuickCal	2207B	8/1/07	226	20.90	Pass
RDO - 100% DO	4/12/07	nr	Bubbled Nanopure	n/a	n/a	91.30	18.86	Pass
Conductivity	4/12/07	nr	Oakton 447uS	2701471	1/1/08	395.6	18.90	Pass

ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Pre sample cal check KDA.

Field-Form Filled Out By:	A.Blackburun	Date:	4/25/2007			
QAQC Check By:	K. Holland	Date:	5/1/2007			

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: Pre- Mine Site B

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: GWS S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	4/13/07	nr	Oakton 4.01	2610411	2/1/11	3.80	21.59	Pass
pH	4/13/07	nr	Oakton 7.00	2512282	12/1/07	7.01	21.37	Pass
pH	4/13/07	nr	Oakton 10.00	2610413	4/1/08	10.21	22.77	Pass
ORP	4/13/07	nr	InSitu QuickCal	22078	1/1/08	251	22.42	Fail
RDO - 100% DO	4/13/07	nr	Bubbled Nanopure	na	na	101.30	21.17	Pass
RDO - Zero DO	4/13/07	nr	HANNA HI7040	G1012	2/1/11	0.10	19.86	Pass
Conductivity	4/13/07	nr	Oakton 447uS	2701471	1/1/08	423.1	22.42	Pass

ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Pre sample cal check MSBN/S. NOTE: ORP failed

	A.Blackburun	Date:	4/25/2007			
QAQC Check By:	K. Holland	Date:	5/1/2007			

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: Post- L9312

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: GWS S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	4/16/07	nr	Oakton 4.01	2610411	2/1/11	3.88	17.34	Pass
pH	4/16/07	nr	Oakton 7.00	2512282	12/1/07	7.03	17.16	Pass
pH	4/16/07	nr	Oakton 10.00	2610413	4/1/08	10.12	24.23	Pass
ORP	4/16/07	nr	InSitu QuickCal	22078	1/1/08	na	na	na
RDO - 100% DO	4/16/07	nr	Bubbled Nanopure	na	na	104.50	17.54	Pass
RDO - Zero DO	4/16/07	nr	HANNA HI7040	G1012	2/1/11	0.00	18.37	Pass
Conductivity	4/16/07	nr	Oakton 447uS	2701471	1/1/08	420.4	22.19	Pass

ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check L9312. NOTE: ORP data not collected and Conductivity was recalibrated after failing at 563.1 @ 23.23 Degrees C.

	A.Blackburun	Date:	4/25/2007			
QAQC Check By:	K. Holland	Date:	5/1/2007			

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: Post- L9817

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: GWS S/N: 33033

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	4/17/07	nr	Oakton 4.01	2610411	2/1/11	3.76	19.04	Fail
pH	4/17/07	nr	Oakton 7.00	2512282	12/1/07	6.96	18.23	Fail
pH	4/17/07	nr	Oakton 10.00	2610413	4/1/08	10.23	18.05	Fail
ORP	4/17/07	nr	InSitu QuickCal	22078	1/1/08	na	na	na
RDO - 100% DO	4/17/07	nr	Bubbled Nanopure	na	na	102.40	19.55	Pass
RDO - Zero DO	4/17/07	nr	HANNA HI7040	G1012	2/1/11	0.01	17.49	Pass
Conductivity	4/17/07	nr	Oakton 447uS	2701471	1/1/08	310.8	19.74	Fail

ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check L9817. NOTE: ORP data not collected. pH and Conductivity failed.

	A.Blackburun	Date:	4/25/2007			
QAQC Check By:	K. Holland	Date:	5/1/2007			

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: Pre- KDA

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: UAF S/N: 33205

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	4/12/07	nr	Oakton 4.01	2612530	12/1/08	4.09	20.46	Pass
pH	4/12/07	nr	Oakton 7.00	2512282	12/1/07	7.08	23.00	Pass
pH	4/12/07	nr	Oakton 10.00	2610413	4/1/08	10.00	33.30	Pass
ORP	4/12/07	nr	InSitu QuickCal	2207B	8/1/07	229	21.32	Pass
RDO - 100% DO	4/12/07	nr	Bubbled Nanopure	n/a	n/a	92.7	18.6	Pass
Conductivity	4/12/07	nr	Oakton 447uS	2701471	1/1/08	368.7	14.90	Pass

ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Pre sample cal check KDA.

Field-Form Filled Out By:	A.Blackburun	Date:	4/25/2007			
QAQC Check By:	K. Holland	Date:	5/4/2007			

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: Post- MSB

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: UAF S/N: 33205

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	4/14/07	nr	Oakton 4.01	2612530	12/1/08	nr	nr	Fail
pH	4/14/07	nr	Oakton 7.00	2512282	12/1/07	nr	nr	Fail
pH	4/14/07	nr	Oakton 10.00	2610413	4/1/08	nr	nr	Fail
ORP	4/14/07	nr	InSitu QuickCal	2207B	8/1/07	nr	nr	Fail
RDO - 100% DO	4/14/07	nr	Bubbled Nanopure	n/a	n/a	98.14	20.84	Pass
RDO - Zero DO	4/14/07	nr	HANNA HI7040	G1012	2/1/11	0.02	20.78	Pass
Conductivity	4/14/07	nr	Oakton 447uS	2701471	1/1/08	423.3	22.09	Pass

ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check MSBN/S. NOTE: ORP and pH probe failed, standards not calibrated.

	A.Blackburun	Date:	4/25/2007			
QAQC Check By:	K. Holland	Date:	5/4/2007			

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: Post- L9312

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: UAF S/N: 33205

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (^{o}C)	Pass/Fail
pH	4/16/07	nr	Oakton 4.01	2612530	12/1/08	nr	nr	Fail
pH	4/16/07	nr	Oakton 7.00	2512282	12/1/07	nr	nr	Fail
pH	4/16/07	nr	Oakton 10.00	2610413	4/1/08	nr	nr	Fail
ORP	4/16/07	nr	InSitu QuickCal	2207B	8/1/07	nr	nr	Fail
RDO - 100% DO	4/16/07	nr	Bubbled Nanopure	n/a	n/a	109.10	17.91	Pass
RDO - Zero DO	4/16/07	nr	HANNA HI7040	G1012	2/1/11	0.00	16.00	Pass
Conductivity	4/16/07	nr	Oakton 447uS	2701471	1/1/08	440.9	23.95	Pass

ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check L9312 Raft A, B. NOTE: ORP and pH probe failed, standards not calibrated.

	A.Blackburun	Date:	4/25/2007			
QAQC Check By:	K. Holland	Date:	5/4/2007			

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: Post- L9817

Sample Purpose: **Lake Water Quality**

WATER QUALITY METER INFORMATION

Meter Make: In-Situ Model: Troll 9000

Owner: UAF S/N: 33205

CALIBRATION AND QUALITY ASSURANCE INFORMATION

Pre/Post-Sampling QA

Parameter	Date	Time	Standard	Lot No.	Exp.	Meter Reading	Temp (°C)	Pass/Fail
pH	4/17/07	nr	Oakton 4.01	2612530	12/1/08	nr	nr	Fail
pH	4/17/07	nr	Oakton 7.00	2512282	12/1/07	nr	nr	Fail
pH	4/17/07	nr	Oakton 10.00	2610413	4/1/08	nr	nr	Fail
ORP	4/17/07	nr	InSitu QuickCal	2207B	8/1/07	nr	nr	Fail
RDO - 100% DO	4/17/07	nr	Bubbled Nanopure	n/a	n/a	105.60	20.12	Pass
RDO - Zero DO	4/17/07	nr	HANNA HI7040	G1012	2/1/11	0.01	16.60	Pass
Conductivity	4/17/07	nr	Oakton 447uS	2701471	1/1/08	404.9	20.06	Pass

ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check L9817. NOTE: ORP and pH probe failed, standards not calibrated.

	A.Blackburun	Date:	4/25/2007			
QAQC Check By:	K. Holland	Date:	5/4/2007			

APPENDIX C. ELEVATION SURVEY FORMS

The following form reports the elevation survey information obtained during field sampling.

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-011: Elevation Survey Form

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

Survey Purpose: **Water-Level Elevations** Date: 4/13/2007 Time: 13:15

Location:	Kuparuk Deadarm Reservoirs Cells 1, 2, 3							
Survey objective:	Lake water elevation survey					Weather Observations:		
Instrument Type:	Leica NA720	Instrument ID:	5482372 (GWS owned)			~5 Degrees F 5MPH wind, bright sunshine		
Rod Type:	Craine fiberglass 20'	Rod ID:	GWS owned					
Bench Mark Information:						Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)		DAR,JED		
TBM___	nr	100' Temp.	na	na				

Station	**BS (ft)**	**HI (ft)**	**FS (ft)**	**Elevation (fasl)**	**Distance (ft)**	**Horizontal Angle**	**Vertical Angle**	**Remarks**
TBM_1	3.78	23.10		19.32				
KDA3-SH		23.10	17.96	**5.14**				**KDA3-WL**
MID		23.10	17.97	5.13				
KDA2-SH1		23.10	17.97	**5.13**				**KDA2-WL**
Turn on KDA2-SH1, move instrument to ^2								
KDA2-SH1	17.95	23.08		5.13				
mid		23.08	17.95	5.13				
KDA3-SH		23.08	17.95	5.13				
TBM_1		23.08	3.77	19.31				
Move instrument to Island, turn on KDA2 Water Surface. Shooting from ^3								
KDA2-SH2	10.96	16.09		5.13				
KDA1-SH		16.09	7.64	**8.45**				**KDA1 WL**
Move instrument to ^4, turn on KDA1-SH								
KDA1-SH	7.28	15.73		8.45				
KDA2-SH		15.73	10.61	5.12				

Abbreviations: backsight, BS; degrees, dd; feet, ft; feet above mean sea level, fasml; foresight, FS; height of instrument, HI; minutes, mm; seconds, ss; BP Mean Sea Level, BPMSL

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-011: Elevation Survey Form

Project ID: **North Slope Lakes** Site Location/Lake ID: Mine Site B

Survey Purpose: **Water-Level Elevations** Date: 4/14/2007 Time: 15:30

Location:	Mine Site B, NE corner of North Cell, temporary datum						
Survey objective:	Lake water elevation survey				Weather Observations:		
Instrument Type:	Leica NA720	Instrument ID:	Leica Runner 24 Serial # 5482372		7F, 5 mph wind, clear		
Rod Type:	Craine Fiberglass 20'	Rod ID:	GWS				
Bench Mark Information:					Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)	Daniel Reichardt Greta Myerchin		
"Post"	WERC	100 Temp.	na	na			

Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasl)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
Post TBM1	5.92	105.92		100.00				Top of nail in post, temp elevation
NC-WL		105.92	12.71	93.21				North Cell, closest to north bank
TBM4		105.92	4.54	101.38				Top of old cutoff VSM
TBM3		105.92	2.45	103.47				VSM 387A on Pipeline, north side
TBM2		105.92	2.08	103.84				VSM 387B on Pipeline, south side
Move instrument to ^2, turn on TBM2								
TBM2	1.54	105.38		103.84				VSM 387B on Pipeline
TBM3		105.38	1.90	103.48				VSM 387A on Pipeline, +0.01
TBM4		105.38	4.00	101.38				Top of old cutoff VSM, +0.00
NC-WL		105.38	12.16	**93.22**				North Cell, closest to north bank, +0.01
TBM1		105.38	5.38	100.00				close survey to -0.00
Move instrument to island, turn on MSBN Water Level.								
NC-WL	9.34	102.56		93.22				Frozen water level
SC-WL		102.56	8.67	**93.89**				TBM, tripod
Move to ^4, use MSBS as TP.								
SC-WL	8.38	102.27		93.89				South Cell, frozen water level
NC-WL		102.27	9.04	93.23				close survey to +0.01
NSC-East Channel		102.27	8.34	**93.93**				East Channel Water Level
NSC-West Channel		102.27	8.62	**93.65**				West Channel Water Level

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-011: Elevation Survey Form

Project ID: **North Slope Lakes** Site Location/Lake ID: L9312

Survey Purpose: **Water-Level Elevations** Date: 4/16/2007 Time: 15:23

Location:	Lake L9312, located southeast of Alpine pad, survey by pump house benchmarks						
Survey objective:	Lake water elevation survey				Weather Observations:		
Instrument Type:	Optical Survey Level	Instrument ID:	na		Cold, clear, no wind, sunny		
Rod Type:	Fiberglass	Rod ID:	na				
Bench Mark Information:					Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)	Michael Lilly Daniel Reichardt		
L9312 "P"	CP	11.72 BPMSL	na	na			

Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasl)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
P	1.47	13.19		11.72				Top of inlet pipe support
O		13.19	1.74	11.45				Top of inlet pipe support
PH-VSM		13.19	-1.37	14.56				Top of VSM plate, SE corner of pump house
WL		13.19	5.69	**7.50**				Top of ice in refrozen hole
								moved Instr., used WL ice as turn point
WL	5.23	12.73		7.50				
PH-VSM		12.73	-1.82	14.55				-0.01
O		12.73	1.28	11.45				+0.00
P		12.73	1.01	11.72				close survey to +0.00

Abbreviations: backsight, BS; degrees, dd; feet, ft; feet above mean sea level, fasml; foresight, FS; height of instrument, HI; minutes, mm; seconds, ss; BP Mean Sea Level, BPMSL

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-011: Elevation Survey Form

Project ID: **North Slope Lakes** Site Location/Lake ID: L9817

Survey Purpose: **Water-Level Elevations** Date: 4/17/2007 Time: 14:25

Location:	Lake L9817, located west of Nuiqsut, survey control at southeast corner of lake						
Survey objective:	Lake water elevation survey				Weather Observations:		
Instrument Type:	Leica NA720	Instrument ID:	5482372 (GWS)		Mild, overcast, 20-30 mph winds		
Rod Type:	Craine fiberglass 20'	Rod ID:	GWS				
Bench Mark Information:					Survey Team Names		
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)	Michael Lilly Daniel Reichardt		
L9817 "B"	BLM	54.98 BPMSL	na	na			

Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasl)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
B	4.96	59.94		54.98				SE TBM, rebar stake
A		59.94	4.81	55.13				NE TBM, rebar stake
D		59.94	5.26	54.68				NW TBM, rebar stake
C		59.94	4.01	55.93				south-central TBM, rebar stake
E		59.94	3.47	56.47				SW TBM, rebar stake
WL		59.94	6.90	53.04				WL, holding Rod on unfrozen WL
Ice		59.94	6.74	53.20				Lip of Ice on survey hole
								moved Instr., used WL ice as turn point
Ice	7.29	60.49		53.20				Lip of Ice on survey hole
WL		60.49	7.45	**53.04**				**L9817 WL**
E		60.49	4.02	56.47				+0.01
C		60.49	4.57	55.92				-0.01
D		60.49	5.81	54.68				+0.00
A		60.49	5.37	55.12				-0.01
B		60.49	5.51	54.98				close survey to +0.00

Abbreviations: backsight, BS; degrees, dd; feet, ft; feet above mean sea level, fasml; foresight, FS; height of instrument, HI; minutes, mm; seconds, ss; BP Mean Sea Level, BPMSL

APPENDIX D. SNOW SURVEY FORMS

The following forms report the snow survey information obtained during field sampling.

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-012: Snow Depth and Water Content Survey Form

Project ID:	**North Slope Lakes Project**	Site Location/Lake ID:	**Betty Pingo**
Survey Purpose:	**Snow Depth and Water Content**	Date: 4/15/2007	Time: 12:40

Location Description:	App. 25 yards north-east of Wyoming gauge. L-shaped, 25 m east by 25 m north. Measurments took every 1 meter.				
Survey objective:	Snow depths and snow-water content for comparison with lake snow survey				
Latitude:	N 70° 16.832	Longitude:	W 148° 53.856	Datum:	NAD83 Alaska
Elevation:		Elevation Datum:		Reference Markers:	Wyoming precipitation gauge
Drainage Basin:		Slope Direction:	Flat	Vegetation Type:	Tussock
Slope Angle:	Flat	Access Notes:	truck	Other:	1 meter increments
Snow Depth Probe Type:		T-handle snow depth probe		Snow-Survey Team Names:	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			DAR, GMM	

Snow Course Depths, in cm.

	1	2	3	4	5
1	16.5	14.0	37.0	15.0	5.5
2	12.0	21.0	43.0	9.0	3.0
3	13.0	31.0	30.0	9.5	6.0
4	14.0	28.0	21.5	13.0	11.0
5	17.5	39.0	22.0	3.0	22.0
6	25.0	34.0	24.5	12.5	27.0
7	27.0	31.5	26.0	15.0	28.0
8	44.0	29.0	27.0	6.0	25.5
9	35.0	33.5	25.0	5.0	26.0
10	10.0	34.0	15.0	8.5	25.0

	(cm)
Average snow depth =	**21.1**
Maximum snow depth =	44.0
Minimum snow depth =	3.0
Standard variation =	10.8

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW4-1	7.5	141.7	267.8	0.53
DW4-2	10	317.2	357.0	0.89
DW4-3	17	310.8	606.9	0.51
DW4-4	9	157.4	321.3	0.49
DW4-5	6.5	110.9	232.1	0.48

Average Density =	**0.58**	
Average Snow Water Equivalent (SWE) =	**12.2**	cm H2O
Average Snow Water Equivalent =	**4.82**	inches H2O
Average Snow Water Equivalent =	**0.40**	feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-012: Snow Depth and Water Content Survey Form

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

Survey Purpose: **Snow Depth and Water Content** Date: 4/13/2007 Time: nr

Location Description:	Located at center of Cell 2. went sw and then se.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather Observations	Fresh light snow
Latitude:	N70°19.9776'	Longitude:	W148°56.4462'	Datum:	WGS84
Elevation:		Elevation Datum:		Reference Markers:	Site staked with lathe
Drainage Basin:	Kuparuk	Slope Direction:	flat	Vegetation Type:	Snow Survey located on ice
Slope Angle:	Flat	Access Notes:	none	Other:	1 meter increments
Snow Depth Probe Type:	T-handle snow depth probe,			Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			JED	

Snow Course Depths, in cm.

	1	2	3	4	5
1	5.0	3.0	9.0	3.5	2.5
2	3.0	10.0	7.0	4.0	2.5
3	2.0	10.5	6.5	4.0	4.0
4	2.0	11.0	6.0	5.5	4.5
5	4.5	7.0	5.0	2.0	2.5
6	5.0	7.0	12.0	3.0	3.0
7	5.0	7.0	15.0	3.0	3.0
8	5.0	8.0	6.5	6.0	3.0
9	6.0	8.0	4.5	3.0	3.5
10	5.0	10.5	5.5	3.0	3.0

	(cm)
Average snow depth =	**5.4**
Maximum snow depth =	15.0
Minimum snow depth =	2.0
Standard variation =	2.9

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW4-1	5.08	28.6	181.4	0.16
DW4-2	10.16	55.2	362.7	0.15
DW4-3	16.51	180.6	589.4	0.31
DW4-4	13.97	167.1	498.7	0.34
DW4-5	5.08	45.1	181.4	0.25

Average Density =	**0.24**	
Average Snow Water Equivalent (SWE) =	**1.3**	cm H2O
Average Snow Water Equivalent =	**0.51**	inches H2O
Average Snow Water Equivalent =	**0.04**	feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-012: Snow Depth and Water Content Survey Form

Project ID:	**North Slope Lakes Project**	Site Location/Lake ID:	**MSBN-CT**
Survey Purpose:	**Snow Depth and Water Content**	Date: 4/14/2007	Time: nr

Location Description:	Located on north cell of lake. "L" shaped pattern, first going south 1 meter for 25 meters and then west 1 meter for 25 meters.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather Observations:	clear, unrestricted
Latitude:		Longitude:		Datum:	
Elevation:		Elevation Datum:		Reference Markers:	representative area
Drainage Basin:	Mine Site B	Slope Direction:	Flat	Vegetation Type:	Ice Surface
Slope Angle:	Flat	Access Notes:	none	Other:	1 meter increments
Snow Depth Probe Type:		T-handle snow depth probe,		Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			JED	

Snow Course Depths, in cm.

	1	2	3	4	5
1	17.0	11.5	7.0	15.5	13.5
2	17.0	10.0	6.5	15.0	11.0
3	17.5	10.5	8.0	15.5	12.0
4	17.5	9.0	7.0	15.0	12.0
5	17.5	9.0	8.5	15.0	13.0
6	17.0	6.0	10.0	12.0	12.5
7	18.0	11.0	11.0	11.0	11.5
8	18.5	12.0	13.0	12.0	12.5
9	15.0	12.0	13.0	14.0	12.0
10	12.0	9.0	15.0	14.0	12.5

	(cm)
Average snow depth =	**12.6**
Maximum snow depth =	18.5
Minimum snow depth =	6.0
Standard variation =	3.2

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW4-1	17.78	152.4	634.7	0.24
DW4-2	11.43	90.2	408.1	0.22
DW4-3	10.16	105.1	362.7	0.29
DW4-4	13.97	147.1	498.7	0.29
DW4-5	12.95	128.0	462.3	0.28

Average Density =	**0.26**	
Average Snow Water Equivalent (SWE) =	**3.3**	cm H2O
Average Snow Water Equivalent =	**1.31**	inches H2O
Average Snow Water Equivalent =	**0.11**	feet H2O

SWE = avg. snow depth*(density snow/density water)

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Form F-012: Snow Depth and Water Content Survey Form

Project ID: **North Slope Lakes Project** Site Location/Lake ID: **MSB-Tundra**

Survey Purpose: **Snow Depth and Water Content** Date: 4/14/2007 Time: nr

Location Description:	Beginning at stakes starting in west direction, toward cylindrical structure beyond pipes. Survey in-line with cylinder structure and survey stakes approx. 40m behind start point. 25m, survey turns north toward pipelines.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather Observations:	clear, unrestricted
Latitude:	site in green GWS GPS	Longitude:		Datum:	
Elevation:		Elevation Datum:		Reference Markers:	representative area
Drainage Basin:	Mine Site B	Slope Direction:	Flat	Vegetation Type:	
Slope Angle:	Flat	Access Notes:	none	Other:	1 meter increments
Snow Depth Probe Type:		T-handle snow depth probe,		Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			JED	

Snow Course Depths, in cm.

	1	2	3	4	5
1	30.0	30.5	24.5	22.5	33.0
2	19.5	32.5	18.0	23.0	22.0
3	14.5	25.5	23.5	21.0	20.0
4	25.5	24.5	23.0	20.5	32.0
5	24.0	26.0	21.5	22.0	32.0
6	23.0	25.0	23.5	28.0	32.5
7	19.5	19.0	22.0	30.5	34.0
8	16.5	23.0	26.5	34.5	37.5
9	17.0	22.5	22.0	41.0	47.5
10	23.5	24.5	22.5	32.0	57.0

	(cm)
Average snow depth =	**26.3**
Maximum snow depth =	57.0
Minimum snow depth =	14.5
Standard variation =	7.8

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW4-1	17.78	104.0	634.7	0.16
DW4-2	17.78	110.0	634.7	0.17
DW4-3	10.16	82.1	362.7	0.23
DW4-4	25.4	273.6	906.8	0.30
DW4-5	30.48	293.0	1088.1	0.27

Average Density =	**0.23**	
Average Snow Water Equivalent (SWE) =	**6.0**	cm H2O
Average Snow Water Equivalent =	**2.35**	inches H2O
Average Snow Water Equivalent =	**0.20**	feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-012: Snow Depth and Water Content Survey Form

Project ID: **North Slope Lakes Project** Site Location/Lake ID: **L9312- Tundra**

Survey Purpose: **Snow Depth and Water Content** Date: 4/16/2007 Time: 14:30

Location Description:	Near Wx Station.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather Observations:	Wind from S. and Sunny
Latitude:	N 70º19.9444'	Longitude:	W 150º 57.047'	Datum:	NAD27 Alaska
Elevation:	100' approximately	Elevation Datum:	BPMSL	Reference Markers:	Site marked with GPS
Drainage Basin:	L9312	Slope Direction:	flat	Vegetation Type:	snow depth on tundra surface
Slope Angle:	Flat	Access Notes:		Other:	1 meter increments
Snow Depth Probe Type:		T-handle snow depth probe,		Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			JED, DAR	

Snow Course Depths, in cm.

	1	2	3	4	5
1	37.0	47.0	30.0	44.5	55.0
2	42.0	50.0	26.0	33.0	44.0
3	36.0	43.0	30.0	31.0	31.0
4	40.0	35.5	43.0	20.0	32.0
5	47.0	33.0	43.0	27.0	42.0
6	49.5	39.0	30.0	18.0	49.0
7	52.0	50.0	23.0	23.0	61.0
8	51.0	57.0	28.0	48.0	58.0
9	51.0	42.0	25.0	41.0	57.0
10	49.0	27.0	49.0	50.0	52.0

	(cm)
Average snow depth =	**40.4**
Maximum snow depth =	61.0
Minimum snow depth =	18.0
Standard variation =	11.1

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW4-1	53.34	586.0	1904.2	0.31
DW4-2	25.4	160.0	906.8	0.18
DW4-3	53.34	575.0	1904.2	0.30
DW4-4	20.32	132.0	725.4	0.18
DW4-5	55.88	589.0	1994.9	0.30

Average Density =	**0.25**	
Average Snow Water Equivalent (SWE) =	**10.2**	cm H2O
Average Snow Water Equivalent =	**4.02**	inches H2O
Average Snow Water Equivalent =	**0.34**	feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-012: Snow Depth and Water Content Survey Form

Project ID: **North Slope Lakes Project** Site Location/Lake ID: **L9312- Tundra, South**

Survey Purpose: **Snow Depth and Water Content** Date: 4/16/2007 Time: 14:30

Location Description:	Taken at Orange Poles marking snow course site				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather Observations:	Wind from S. and Sunny
Latitude:	N 70º19.9444'	Longitude:	W 150º 57.047'	Datum:	NAD27 Alaska
Elevation:	100' approximately	Elevation Datum:	BPMSL	Reference Markers:	Site marked with GPS
Drainage Basin:	L9312	Slope Direction:	flat	Vegetation Type:	snow depth on tundra surface
Slope Angle:	Flat	Access Notes:		Other:	1 meter increments
Snow Depth Probe Type:		T-handle snow depth probe,		Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			JED, DAR	

Snow Course Depths, in cm.

	1	2	3	4	5
1	24.0	17.0	29.0	30.0	28.0
2	22.0	17.0	27.0	30.0	37.0
3	33.0	14.0	35.0	31.0	32.0
4	41.5	35.0	38.0	31.0	25.0
5	47.0	22.0	48.0	36.0	30.0
6	47.0	33.5	51.0	44.0	15.0
7	36.0	33.0	34.0	45.0	40.0
8	35.0	26.0	24.0	32.0	24.0
9	52.0	30.0	27.0	39.0	22.0
10	48.0	28.0	25.0	39.0	24.0

	(cm)
Average snow depth =	**32.3**
Maximum snow depth =	52.0
Minimum snow depth =	14.0
Standard variation =	9.3

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
c1	27.94	164.0	997.5	0.16
c4	27.94	289.0	997.5	0.29
c3	27.94	191.0	997.5	0.19
c2	21.59	130.0	770.8	0.17
c1	27.94	221.0	997.5	0.22

Average Density =	**0.21**	
Average Snow Water Equivalent (SWE) =	**6.7**	cm H2O
Average Snow Water Equivalent =	**2.63**	inches H2O
Average Snow Water Equivalent =	**0.22**	feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-012: Snow Depth and Water Content Survey Form

Project ID: **North Slope Lakes Project** Site Location/Lake ID: **L9312**

Survey Purpose: **Snow Depth and Water Content** Date: 4/16/2007 Time: nr

Location Description:	On lake surface, towards south end. Did "L" shape, started at North and went West 25 x 25m for 1m increments				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather Observations:	Clear, sunny
Latitude:	N70°19.995'	Longitude:	W150°56.918'	Datum:	WGS84
Elevation:	8' aproximately	Elevation Datum:	BPMSL	Reference Markers:	Site staked with lathe
Drainage Basin:	L9312	Slope Direction:	Flat	Vegetation Type:	Tussock
Slope Angle:	Flat	Access Notes:		Other:	1 meter increments
Snow Depth Probe Type:		T-handle snow depth probe,		Snow-Survey Team Names	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			Jeff Derry	

Snow Course Depths, in cm.

	1	2	3	4	5
1	9.0	15.0	26.0	18.0	9.0
2	10.0	11.0	25.0	22.0	9.0
3	7.5	10.0	26.0	21.0	8.0
4	6.0	10.0	26.0	20.0	7.0
5	6.5	6.0	18.0	20.0	10.0
6	7.0	24.5	23.0	17.0	8.0
7	9.0	27.0	17.0	14.0	7.0
8	10.0	29.0	12.0	15.0	10.0
9	9.5	32.0	13.0	14.0	10.0
10	14.5	27.0	14.0	12.0	12.0

	(cm)
Average snow depth =	**14.9**
Maximum snow depth =	32.0
Minimum snow depth =	6.0
Standard variation =	7.2

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW4-1	10.16	82.0	362.7	0.23
DW4-2	15.24	148.0	544.1	0.27
DW4-3	21.59	178.0	770.8	0.23
DW4-4	7.62	32.0	272.0	0.12
DW4-5				

Average Density =	**0.21**	
Average Snow Water Equivalent (SWE) =	**3.1**	cm H2O
Average Snow Water Equivalent =	**1.24**	inches H2O
Average Snow Water Equivalent =	**0.10**	feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-012: Snow Depth and Water Content Survey Form

Project ID: **North Slope Lakes Project** Site Location/Lake ID: **L9817-Lake**

Survey Purpose: **Snow Depth and Water Content** Date: 4/17/2007 Time: 3:10pm

Location Description:	Did at staked lathe. Hole # 3. Went south and then east					
Survey objective:	Snow depths and snow-water content for comparison with lake snow survey			Weather Observations:	Blowing snow	
Latitude:		Longitude:		Datum:		
Elevation:	100' approximately	Elevation Datum:	BPMSL	Reference Markers:	Site staked with lathe	
Drainage Basin:	L9312	Slope Direction:	Flat	Vegetation Type:	Tussock	
Slope Angle:	Flat	Access Notes:	Hagglund	Other:	1 meter increments	
Snow Depth Probe Type:		T-handle snow depth probe,		Snow-Survey Team Names		
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			JED		

Snow Course Depths, in cm.

	1	2	3	4	5
1	15.0	23.0	27.0	12.0	14.0
2	20.0	23.0	14.0	9.0	17.0
3	19.0	23.0	8.0	12.0	19.0
4	19.0	21.0	8.0	11.0	25.0
5	20.0	10.0	5.0	16.0	22.0
6	19.0	12.0	6.0	19.0	25.0
7	17.0	11.0	7.0	20.0	26.0
8	16.5	14.0	11.0	17.0	23.0
9	17.0	11.0	13.0	15.0	21.0
10	20.5	12.0	14.0	10.0	19.0

	(cm)
Average snow depth =	**16.2**
Maximum snow depth =	27.0
Minimum snow depth =	5.0
Standard variation =	5.6

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW4-1	12.7	131.0	453.4	0.29
DW4-2	7.62	92.0	272.0	0.34
DW4-3	31.75	404.0	1133.5	0.36
DW4-4	12.7	119.0	453.4	0.26
DW4-5	15.24	169.0	544.1	0.31

Average Density =	**0.31**	
Average Snow Water Equivalent (SWE) =	**5.0**	cm H2O
Average Snow Water Equivalent =	**1.98**	inches H2O
Average Snow Water Equivalent =	**0.17**	feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center

Form F-012: Snow Depth and Water Content Survey Form

Project ID:	**North Slope Lakes Project**	Site Location/Lake ID:	**L9817- Tundra**
Survey Purpose:	**Snow Depth and Water Content**	Date: 4/17/2007	Time: 10:30

Location Description:	Conducted on the tundra at staked snowcourse site, a few hundred feet from weather station going west.				
Survey objective:	Snow depths and snow-water content for comparison with lake snow survey			Weather Observations:	Blowing snow
Latitude:		Longitude:		Datum:	
Elevation:		Elevation Datum:		Reference Markers:	
Drainage Basin:		Slope Direction:	Flat	Vegetation Type:	Tussock
Slope Angle:	Flat	Access Notes:	Hagglund	Other:	1 meter increments
Snow Depth Probe Type:	T-handle snow depth probe			Snow-Survey Team Names:	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			JED	

Snow Course Depths, in cm.

	1	2	3	4	5
1	23.0	25.0	32.0	32.0	33.0
2	27.5	27.0	30.0	41.0	38.0
3	28.0	33.0	28.0	41.5	42.0
4	26.5	27.0	29.0	41.0	34.0
5	25.0	42.0	33.0	40.0	43.0
6	25.0	46.0	38.0	49.0	46.5
7	26.0	50.0	24.0	40.5	46.5
8	43.0	41.0	32.0	39.0	49.5
9	36.0	45.0	30.0	46.0	48.0
10	24.0	32.0	29.0	38.0	37.0

	(cm)
Average snow depth =	**35.7**
Maximum snow depth =	50.0
Minimum snow depth =	23.0
Standard variation =	8.0

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
DW4-1	21.59	151.0	770.8	0.20
DW4-2	26.67	258.0	952.1	0.27
DW4-3	41.91	447.0	1496.2	0.30
DW4-4	45.72	505.0	1632.2	0.31
DW4-5	25.4	201.0	906.8	0.22

Average Density =	**0.26**	
Average Snow Water Equivalent (SWE) =	**9.2**	cm H2O
Average Snow Water Equivalent =	**3.64**	inches H2O
Average Snow Water Equivalent =	**0.30**	feet H2O

SWE = avg. snow depth*(density snow/density water)

University of Alaska Fairbanks, Water and Environmental Research Center
Form F-012: Snow Depth and Water Content Survey Form

Project ID:	**Umiat Snow Surveys**	Site Location/Lake ID:	**Umiat**
Survey Purpose:	**Snow Depth and Water Content**	Date: 3/28/2007	Time: 1000hrs

Location Description:	App. 260 meters NW of BLM hut. T-shaped, 25 m by 25 m by 50 m Measurements taken every 1 meter. Went SE from WPT 179 to 181, then NE from WPT 179 to 183, then SW from WPT 179 to 180, WPT 179 is center point (top of "T")				
Survey objective:	Snow depths and snow-water content for comparison with lake snow survey				
Latitude:	N 69° 22.075 (WPT 179)	Longitude:	N 152° 8.977	Datum:	NAD83 Alaska
Elevation:	265 FT	Elevation Datum:		Reference Markers:	
Drainage Basin:		Slope Direction:	Flat	Vegetation Type:	Tussock with low shrubs
Slope Angle:	Flat	Access Notes:	snowmachines	Other:	1 meter increments
Snow Depth Probe Type:		collapsible avalanche probe		Snow-Survey Team Names:	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm^2			Kemnitz, Whitman	

Snow Course Depths, in cm.

	1	2	3	4	5
1	39.0	35.0	33.5	51.5	56.0
2	41.5	39.5	28.0	47.0	52.0
3	49.0	40.0	33.0	47.0	48.0
4	36.0	38.0	37.0	40.5	35.5
5	45.5	38.5	41.0	40.0	41.0
6	47.5	34.0	31.5	43.5	51.0
7	40.0	49.0	27.5	56.0	34.0
8	48.0	39.0	32.5	51.5	43.5
9	43.0	43.5	41.0	48.0	40.5
10	36.5	42.5	40.0	48.5	45.0
11	42.0	47.0	41.0	50.5	53.5
12	46.0	33.5	38.0	57.5	41.0
13	41.5	34.0	27.0	53.5	37.5
14	33.0	32.0	32.5	55.0	54.0
15	37.0	34.0	30.0	47.0	53.5
16	41.0	31.5	33.0	34.5	51.0
17	50.5	31.0	42.0	40.5	55.5
18	49.0	35.0	40.0	41.0	53.5
19	48.0	41.5	27.0	46.0	50.5
20	44.0	30.0	40.5	51.5	47.5

	(cm)
Average snow depth =	**42.0**
Maximum snow depth =	57.5
Minimum snow depth =	27.0
Standard variation =	7.7

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm^3)	Density (gr/cm^3)
A	39	255	1392.3	0.18
B	37	331	1320.9	0.25
C	35	358	1249.5	0.29
D	40	273	1428.0	0.19
E	34	207	1213.8	0.17

Average Density =	**0.22**	
Average Snow Water Equivalent (SWE) =	**9.1**	cm H2O
Average Snow Water Equivalent =	**3.58**	inches H2O
Average Snow Water Equivalent =	**0.30**	feet H2O

SWE = avg. snow depth*(density snow/density water)