

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



*Jeff Derry taking field notes at Mine Site B - Kuparuk , by D. Reichardt*

by

Jeff Derry, Dan Reichardt, Michael Lilly, Chad Cormack, Hannah  
Clilverd, and Matthew Whitman

March 2007

North Slope Lakes Hydrologic Modeling Project  
Report No. INE/WERC 07.05

Water and Environmental  
Research Center



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By:

Jeff Derry<sup>1</sup>, Dan Reichardt<sup>1</sup>, Michael R. Lilly<sup>1</sup>, Chad Cormack<sup>2</sup>, Hannah Clilverd<sup>2</sup>,  
and Matthew Whitman<sup>3</sup>

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

March 2007

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<sup>1</sup>Geo-Watersheds Scientific

<sup>2</sup>University of Alaska Fairbanks, Water and Environmental Research Center

<sup>3</sup>Bureau of Land Management – Alaska, Arctic Field Office

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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), ConocoPhillips 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.

The use of trade and firm names in this document is for the purpose of identification only and does not imply endorsement by the University of Alaska Fairbanks, DOE, NETL, BLM, BPX, CPA, GWS, or other project sponsors.

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

## Conversion Factors

Multiply	By	To obtain
<u>Length</u>		
inch (in)	25.4	millimeter (mm)
inch (in)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
<u>Area</u>		
Acre	43560.0	square feet (ft <sup>2</sup> )
Acre	0.405	hectare (ha)
square foot (ft <sup>2</sup> )	3.587e-8	square mile (mi <sup>2</sup> )
square mile (mi <sup>2</sup> )	2.590	square kilometer (km <sup>2</sup> )
<u>Volume</u>		
gallon (gal)	3.785	liter (L)
gallon (gal)	3785.412	milliliter (mL)
cubic foot (ft <sup>3</sup> )	28.317	liter (L)
Acre-ft	1233.482	cubic meter (m <sup>3</sup> )
Acre-ft	325851.43	gallon(gal)
gallon(gal)	0.1337	cubic feet (ft <sup>3</sup> )
<u>Velocity and Discharge</u>		
foot per day (ft/d)	0.3048	meter per day (m/d)
Square foot per day (ft <sup>2</sup> /d )	0.0929	square meter per day (m <sup>2</sup> /d)
cubic foot per second (ft <sup>3</sup> /s)	0.02832	cubic meter per second (m <sup>3</sup> /sec)
<u>Hydraulic Conductivity</u>		
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)
<u>Hydraulic Gradient</u>		
foot per foot (ft/ft)	5280	foot per mile (ft/mi)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
<u>Pressure</u>		
pound per square inch (lb/in <sup>2</sup> )	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<sup>3</sup>/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:

$$^{\circ}\text{F} = 1.8(^{\circ}\text{C}) + 32$$

#### 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 (°F).
ft	feet
GWS	Geo-Watersheds Scientific
GWSI	USGS Ground-Water Site Inventory
km <sup>2</sup>	square kilometers
kPa	kilopascal
lb/in <sup>2</sup>	pounds per square inch
m	meters
mg/L	milligrams per liter, equivalent to ppm
µg/L	micrograms per liter
mi <sup>2</sup>	square miles
mm	millimeters
µS/cm	microsiemens per centimeter
mV	Millivolt
NGVD	National Geodetic Vertical Datum
NPR-A	National Petroleum Reserve - Alaska
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°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.
- ConocoPhillips Alaska (CPA)
- Bureau of Land Management
- Alaska Department of Natural Resources
- The Nature Conservancy
- Northern Alaska Environmental Center

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# **Lake Chemistry and Physical Data For Selected North Slope, Alaska, Lakes: January 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 (Figure 1). 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 it 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 Road and has two cells connected to East Milne Creek. The Kuparuk Reservoir System (Kuparuk Deadarm Lakes) has 9 reservoirs. The three southernmost reservoir cells (1-3) are included to observe ground-water and surface-water interactions between each cell and the adjacent Kuparuk River. Big Lake serves as the main water supply for the Base Operations Center (BOC) facility. Periodic sampling of this lake was added in 2007.

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 1) to report data collected for the month of January 2007, and 2) to summarize accomplished field trip objectives.

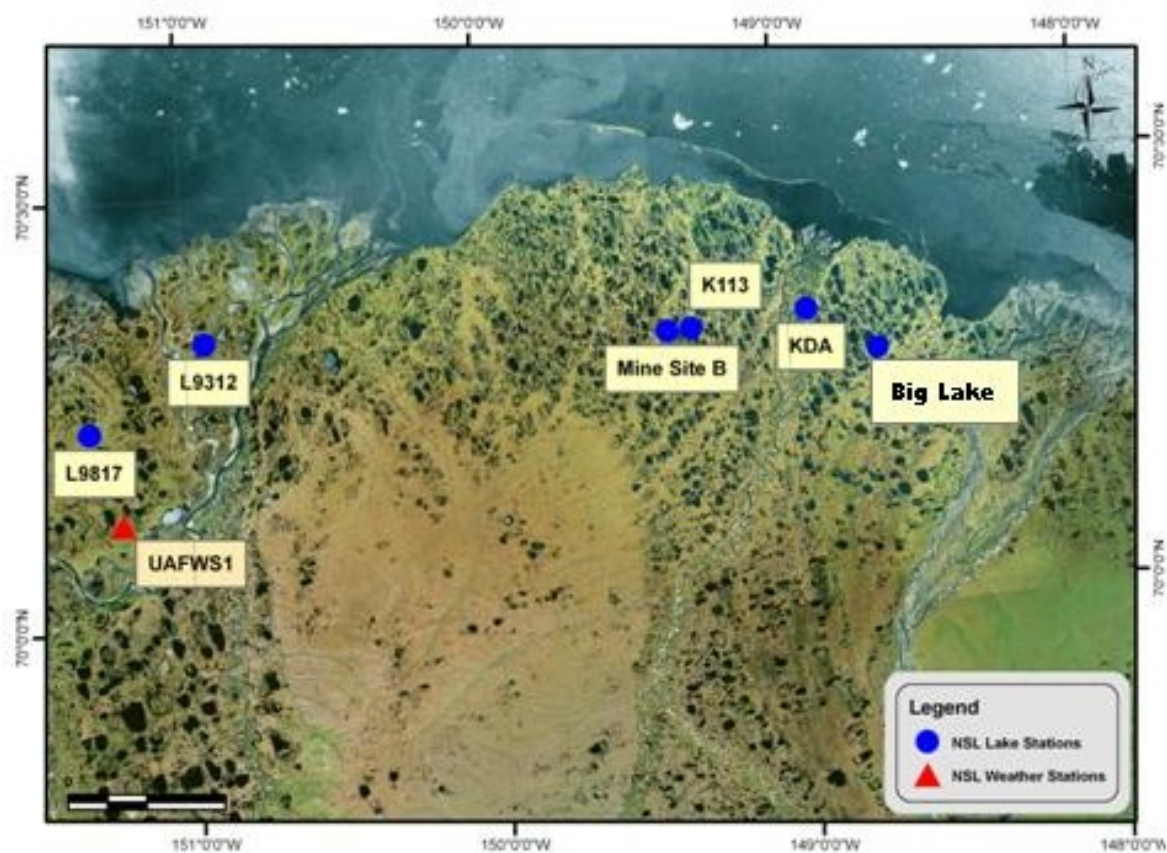


Figure 1. Location of study lakes in the NPR-A, Alpine, Kuparuk, and Prudhoe Bay field operating areas, North Slope, Alaska.

## TRIP OBJECTIVES

The goal of each sampling trip is to collect physical and chemical data from each study lake. For each lake, a series of holes are drilled at designated sampling locations. 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, 2006). In January 2007, we focused on the following locations/tasks:

1. Kuparuk Dead Arm (KDA) Reservoirs: Prudhoe Bay operating area.
  - Measure water-quality profile parameters in cells KDA-1, KDA-2 and KDA-3.
  - Survey water levels to local elevation control at KDA-1, KDA-2 and KDA-3.
  - Collect water-column samples from KDA-1 and KDA-2

- Measure snow depth, ice thickness, and field water quality parameters.
  - Training of new UAF project participants.
2. Mine Site B: Kuparuk operating area.
    - Measure water-quality profile parameters in North Cell (MSBN) and South Cell (MSBS).
    - Survey water levels to local elevation control at North Cell and South Cell
    - Collect water-column samples from sampling locations MSBN-CT and MSBS-CT
    - Measure snow depth, ice thickness, and field water quality parameters.
  3. K113: Kuparuk operating area.
    - Measure water-quality profile parameters in North Cell (MSBN) and South Cell (MSBS).
    - Survey water level to local elevation control.
    - Collect water-column samples from center of the lake.
    - Measure snow depth, ice thickness, and field water quality parameters.
  4. Big Lake: Prudhoe Bay operating area.
    - Measure water-quality profile parameters in the infiltration channel and the reservoir.
    - Measure snow depth, ice thickness, and field water quality parameters.
    - Collect water samples from both raw water taps.
  5. Lake L9312: Alpine operating area.
    - Measure water-quality profile parameters.
    - Survey water level to local elevation control.
    - Collect water-column samples from sampling location “L9312 Raft-B”
    - Measure snow depth, ice thickness, and field water quality parameters.
    - Automated data collection station maintenance
  6. Lake L9817: NPR-A.
    - Measure water-quality profile parameters.
    - Survey water level to local elevation control.
    - Collect water-column samples from sampling location “L9312 Raft-B”
    - Measure snow depth, ice thickness, and field water quality parameters.
    - Automated data collection station maintenance

## PROCEDURES

### Water Chemistry Sampling

All field work follows the specified health, safety, and environmental guidelines outlined by BPX and CPA (White and Lilly, 2006*a,b,c*). 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-surface elevation surveys were conducted using closed level loops and optical levels (Figure 2). 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 calibration of each parameter was checked before and after each day of sampling using the criteria in Table 1.

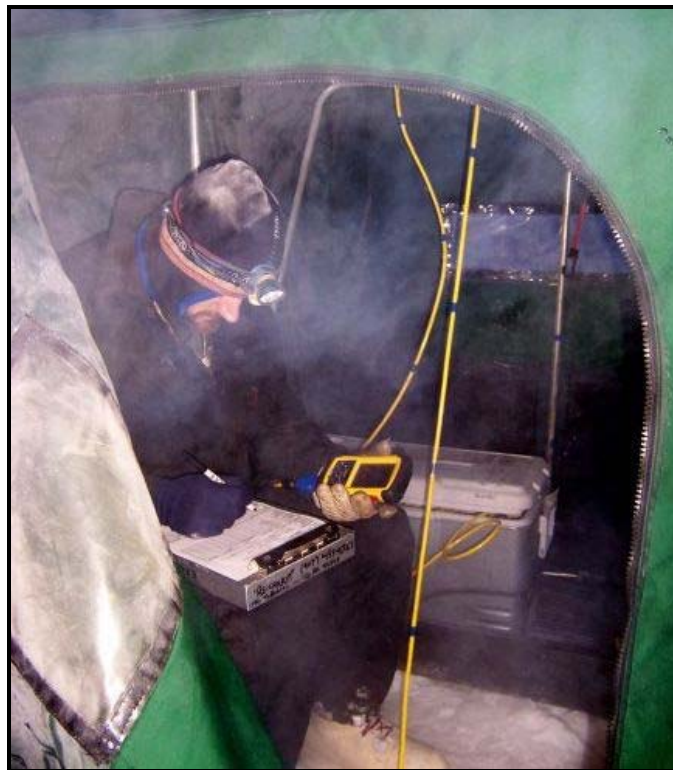
**Table 1. In-Situ Troll 9000 calibration quality control criteria.**

<b>Parameter</b>	<b>Standards used</b>	<b>Acceptable deviation from calibration standard value</b>
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 the 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. Larger-scale snow depth measurements were conducted at L9312 and K113 along general east/west and north/south transects. At L9312 depth measurements were typically recorded every 10 feet (2 paces). Measurements at transition zones from tundra to lake were recorded at five feet increments (1 pace), and on homogeneous lake surfaces depths were recorded every 20 feet (4 paces). All measurements were taken at 20 foot intervals at K113.



**Figure 2. Dan Reichardt recording water-quality data at Mine Site B, photo by J. Derry.**



## SELECTED RESULTS

Lake L9312 is a naturally formed thaw lake, and is the primary water source for the Alpine Water Treatment Plant. It is recharged by local precipitation and snowmelt, in addition to overland flooding by the Colville River during spring snowmelt. Under normal lake-level conditions L9312 drains through an outlet channel located on the northern shore, as annotated in Figure 3. During flood events, water will additionally drain through a higher secondary outlet channel located on the south shore. The primary outlet channel was surveyed by project staff in October 2006, and the outlet-control elevation was determined to be 7.73' BPMSL. For the purposes of this project, we describe the lake to be in an over-full condition whenever the water-surface elevation is above this outlet-control elevation. Flow through the channel is through a broad low area, covered in grasses and tussocks, without the presence of a typical stream channel.



Figure 3. Lake L9312, with outlet control and inlet/outlet channels, photo from Aeromap.



L9312 is permitted for withdrawal of 35 million gallons of water each calendar year, which represents 35% of its under ice volume at a maximum expected ice thickness of 6 feet. In recent years the annual permit period started June 1. Figure 4 shows historical record of this water use from 2002 until present and water surface elevations measured periodically since December 2004. As Figure 4 shows, the lake was only recharged by precipitation and snowmelt in 2005, and was in a near-full condition for most of June and part of July, while in 2006 the lake was recharged by floodwaters of the Colville River and remained in an over-full condition from late May through mid-September. When considering the implications of pumping large volumes of water from this lake it's informative to consider that in 2006 over 10 million gallons (28% of the total permit volume) of water was extracted during the summer over-full condition.

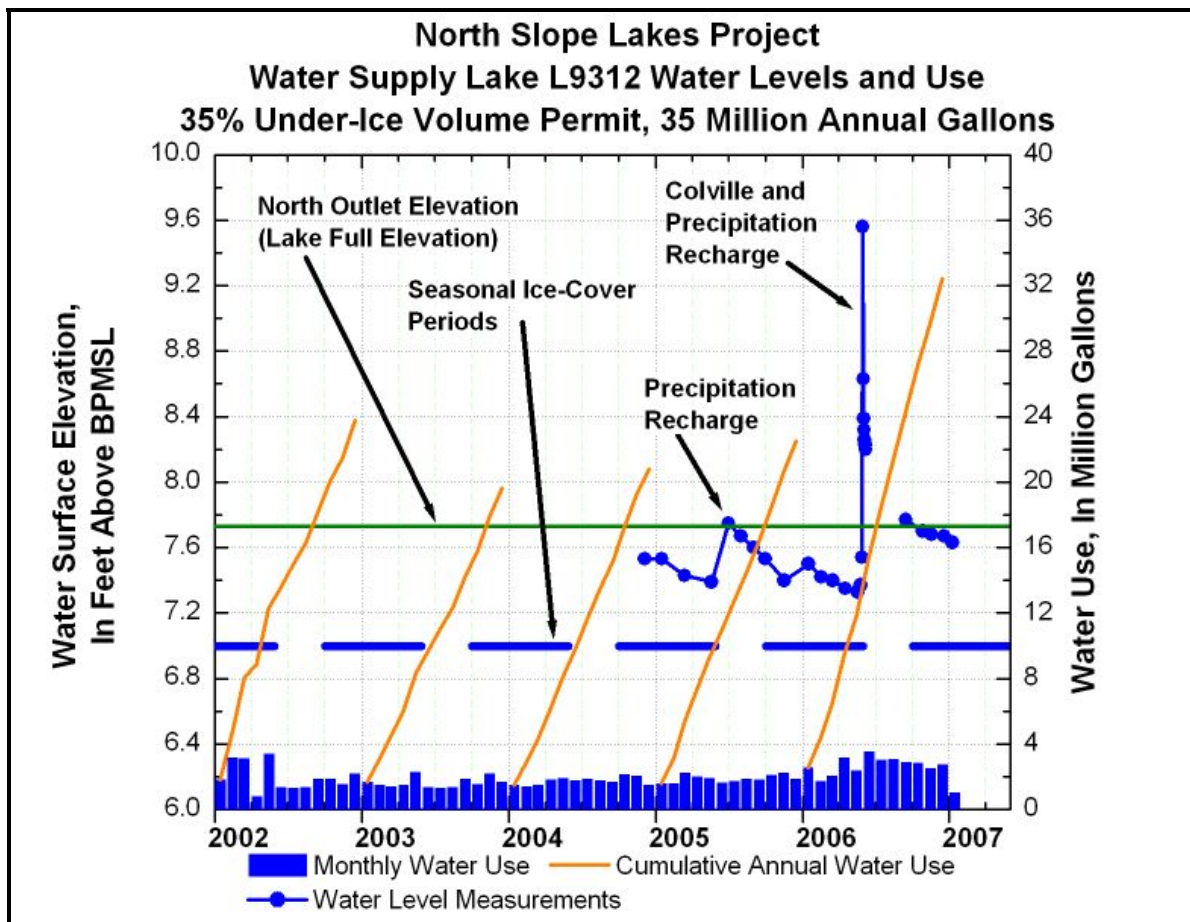


Figure 4. Plot of Lake L9312 historical water use and water surface elevations. January 2007 water use is for a partial month.

## SUMMARY

Sampling occurred at Kuparuk Deadarm Lakes, Mine Site B, K113, Big Lake, L9312 and L9817 during January field activities. As Table 2 demonstrates, water levels in KDA Reservoir 2 and Mine Site “B” are dropping at a rate of 0.2 ft (0.06 m) and 0.5 ft (0.15 m) per month, respectively. KDA Reservoir 1 and L9312 do not show a similarly rapid drop in level. This is because KDA Reservoir 1 is not being pumped, and L9312 has a large surface area relative to its. KDA Reservoir 3 water-surface elevation is the same as Reservoir 2, suggesting that these two reservoirs are hydraulically connected to each other. Similarly, Mine Site B North and South Cells have the same water-surface elevation, and are hydraulically connected.

Table 2 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 are representative of the deeper portion of the respective lakes.

**Table 2. Ice thickness, median DO concentration, median actual conductance and monthly water drop for North Slope lakes in early- to mid-January.**

<b>Sampling Site</b>	<b>Ice Thickness [ft; (m)]</b>	<b>Median DO Concentration [mg/L]</b>	<b>Median Actual Conductivity [µS/cm]</b>	<b>Water level drop since mid December [ft; (m)]</b>
<b>KDA1-CT</b>	3.00; (0.91)	15.42	132.6	-0.03; (-0.009)
<b>KDA2-CT</b>	2.70; (0.82)	15.49	127.6	0.20; (0.061)
<b>MSBS-CT</b>	2.85; (0.87)	9.95	241.6	0.50; (0.15)
<b>MSBN-CT</b>	2.80; (0.85)	10.53	230.3	0.50; (0.15)
<b>L9312 Raft B</b>	2.92; (0.89)	14.69	55.9	0.03; (0.009)
<b>K113-CT</b>	2.98; (0.91)	10.75	234.4	No Data from Dec
<b>L9817-4</b>	2.50; (0.76)	4.35	317.7	No Data from Dec

Continuous monitoring of 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 adaptive water-resources management. As lake water levels change due to freezing and pumping activities in the winter, it is important to identify the changing water chemistry as well as the potential spring-snowmelt recharge. This information is important for permitting agencies as well as industry professionals who depend on water assets 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 on the hydrology of North Slope lakes and adaptive management strategies.

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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: 1/5/07 Time: 15:10

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°19.9026' Easting: W148°56.6748' Datum: NAD83  
 Measurements By: DAR Time: 15:15  
 Water Depth (ft): 20.6 Ice Thickness (ft): 3.00  
 Freeboard (ft): 0.22 Snow Depth (ft): 0.20  
 Elev. (BPMSL +/- .02): 8.34 Survey By: JED Date: 1/5/07 Time: 13:15  
 Water Sampling By: DAR Sample Depths BWS (ft): 1 3 Date: 1/5/07 Time: 16:30  
 2 10  
 3 20

**WATER QUALITY METER INFORMATION**

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	InSitu Troll 9000	33033	Pass	Pass, pH Fail

Parameters	Field Measurements									
Time:	16:12	16:18	16:21							
Depth BWS (ft):	19	20	BOT							
Temp (°C):	0.80	0.93	1.01							
pH:	7.67	7.61	7.58							
Barometric (mmHg):	751.3	751.4	751.4							
Pressure (kPa):	54.758	57.863	60.883							
Conductivity (µS/cm):	133.3	135.8	138.8							
RDO (ppm): (mg/L)	6.56	4.84	3.64							
Turbidity (NTU):	0.7	4.1	48.1							
ORP	214	216	152							

**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): <u>3</u>			Depth BWS (ft): <u>10</u>			Depth BWS (ft): <u>20</u>			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 CaCO3)	109	106	109	104	100	103	106	109	107	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	ur	ur	0.02	0.02	0.05	0.06	ur	ur	ur	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.03	0.03	ur	0.03	0.02	0.04	0.02	ur	0.06	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: LOG 2007-01-05 151138

Field-Form Filled Out By: DAR Date: 1/5/07  
 QAQC Check By: J Derry Date: 1/13/07

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: 1/5/07 Time: 13:20

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°19.9776' Easting: W148°56.4462' Datum: NAD83  
 Measurements By: DAR Time: 13:20  
 Water Depth (ft): 19.18 Ice Thickness (ft): 2.70  
 Freeboard (ft): 0.13 Snow Depth (ft): 0.20  
 Elev. (BPMSL +/- .02): 7.16 Survey By: JED Date: 1/5/07 Time: 13:15  
 Water Sampling By: DAR Sample Depths BWS (ft): 1 3 Date: 1/5/07 Time: 18:00  
 2 9  
 3 19

**WATER QUALITY METER INFORMATION**

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check					
Multi	GWS	InSitu Troll 9000	33033	Pass	Pass					
<b>Parameters</b>										
	<b>Field Measurements</b>									
Time:	13:44	13:46	13:53	14:02	14:03	14:06	14:07	14:08	14:15	14:31
Depth BWS (ft):	3	4	5	7	9	11	13	15	17	18
Temp (°C):	-0.45	-0.49	-0.44	-0.30	-0.26	-0.13	-0.05	0.30	0.77	1.03
pH:	8.09	8.14	8.10	8.13	8.12	8.12	8.11	8.10	7.74	7.45
Barometric (mmHg):	750.0	750.0	750.0	750.2	750.3	750.3	750.4	750.5	750.6	750.7
Pressure (kPa):	7.383	10.182	13.123	18.934	24.918	31.039	36.928	43.004	48.721	52.211
Conductivity (µS/cm):	129.5	128.4	128.4	127.6	127.6	127.5	127.4	127.60	133.30	143.90
RDO (ppm): (mg/L)	15.49	15.73	15.76	15.81	15.82	15.80	15.76	15.42	8.57	4.08
Turbidity (NTU):	-0.3	-0.3	-0.4	-0.4	-0.4	-0.3	-0.3	-0.4	-0.2	1.6
ORP	258	258	257	256	255	255	255	255	262	263

**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): <u>3</u>			Depth BWS (ft): <u>9</u>			Depth BWS (ft): <u>19</u>			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 CaCO3)	101	101	102	95	95	100	118	127	122	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	0.02	0.02	0.05	ur	0.02	0.02	ur	ur	ur	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.02	0.02	0.05	ur	0.02	0.03	ur	ur	ur	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: LOG 2007-01-05 132755

Field-Form Filled Out By: DAR Date: 1/5/07  
 QAQC Check By: J Derry Date: 1/13/07





**University of Alaska Fairbanks, Water and Environmental Research Center**

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

Project ID: North Slope Lakes  
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: KDA2-T1  
 Date: 1/5/07 Time: 18:03

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°20.011' Easting: W148°56.365' Datum: NAD83  
 Measurements By: DAR Time: 18:03  
 Water Depth (ft): 17.55 Ice Thickness (ft): \_\_\_\_\_  
 Freeboard (ft): 0.24 Snow Depth (ft): \_\_\_\_\_  
 Elev. (BPMSL +/- .02): 7.16 Survey By: J Derry Date: 1/4/07 Time: 13:15  
 Water Sampling By: \_\_\_\_\_ Sample Depths BWS (ft): 1 \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 2 \_\_\_\_\_  
 3 \_\_\_\_\_

**WATER QUALITY METER INFORMATION**

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check					
Multi	GWS	InSitu Troll 9000	33033	Pass	Pass					
<b>Parameters</b>										
	<b>Field Measurements</b>									
Time:	18:03	18:04	18:06	18:07	18:09	18:12	18:15	18:20	18:28	
Depth BWS (ft):	3	4	5	7	9	11	13	15	16	
Temp (°C):	-0.46	-0.45	-0.44	-0.41	-0.32	-0.14	0.08	0.37	0.47	
pH:	8.11	8.09	8.14	8.13	8.13	8.10	8.07	7.96	7.64	
Barometric (mmHg):	765.5	765.5	765.5	765.6	765.7	765.7	765.7	765.8	765.9	
Pressure (kPa):	7.371	10.083	13.059	19.235	25.065	30.993	37.289	43.145	46.052	
Conductivity (µS/cm):		128.8	128.7	127.8	127.5	127.6	127.5	127.70	131.90	
RDO (ppm): (mg/L)	16.39	16.52	16.62	16.68	16.54	16.22	15.95	14.20	8.26	
Turbidity (NTU):	5.7	-0.2	-0.3	-0.3	-0.3	-0.2	-0.2	0.2	0.4	
ORP	226	227	226	226	226	227	228	229	235	

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)										
Alkalinity (mg/L as CaCO3)										
Total iron--UF (mg/L)										
Filtered Iron--F tot Fe (mg/L)										
Ammonia (mg/L NH3-N)****										
Ammonia/ Iron dilution										

Remarks: LOG 2007-01-07 180240

Field-Form Filled Out By: DAR Date: 1/7/07  
 QAQC Check By: J Derry Date: 1/13/07



**University of Alaska Fairbanks, Water and Environmental Research Center**

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

Project ID: North Slope Lakes  
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: KDA3-CT  
 Date: 1/5/07 Time: 10:55

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°20.025' Easting: W148°56.204' Datum: NAD83  
 Measurements By: DAR Time: 10:57  
 Water Depth (ft): 22.9 Ice Thickness (ft): 2.85  
 Freeboard (ft): 0.15 Snow Depth (ft): 0.25  
 Elev. (BPMSL +/- .02): 7.16 Survey By: JED Date: 1/5/07 Time: 13:15  
 Water Sampling By: \_\_\_\_\_ Sample Depths BWS (ft): 1 \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 2 \_\_\_\_\_  
 3 \_\_\_\_\_

**WATER QUALITY METER INFORMATION**

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	InSitu Troll 9000	33033	Pass	Pass

Parameters	Field Measurements									
	11:17	11:26	11:29	11:32	11:35	11:37	11:39	11:41	11:44	
Time:	3	4	5	7	9	11	13	15	17	
Depth BWS (ft):	-0.43	-0.47	-0.39	-0.27	-0.20	-0.15	-0.07	-0.01	0.22	
Temp (°C):	7.95	8.17	8.16	8.16	8.15	8.15	8.11	8.13	8.07	
pH:	749.2	149.3	149.3	749.4	749.4	749.5	749.6	749.6	749.7	
Barometric (mmHg):	7.449	10.366	13.194	19.221	25.110	31.205	37.136	43.108	48.991	
Pressure (kPa):	127.3	125.6	124.9	124.3	124.0	123.8	123.3	123.00	122.30	
Conductivity (µS/cm):	15.37	15.70	15.70	15.73	15.73	15.75	15.63	15.52	15.19	
RDO (ppm): (mg/L)	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	
Turbidity (NTU):	255	249	249	249	249	248	249	248	248	
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)										
Alkalinity (mg/L as CaCO3)										
Total iron--UF (mg/L)										
Filtered Iron--F tot Fe (mg/L)										
Ammonia (mg/L NH3-N)****										
Ammonia/ Iron dilution										

Remarks: Ambient Tem -22F, 5 mph wind. Measured by Chord Bottom seems to be at 23.1 ft BWS.  
 Log 2007-01-05 110705

Field-Form Filled Out By: DAR Date: 1/5/07  
 QAQC Check By: J Derry Date: 1/13/07

**University of Alaska Fairbanks, Water and Environmental Research Center**

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

Project ID: North Slope Lakes  
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: KDA3-CT  
 Date: 1/5/07 Time: 10:55

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°20.025' Easting: W148°56.204' Datum: NAD83  
 Measurements By: DAR Time: 10:57  
 Water Depth (ft): 22.9 Ice Thickness (ft): 2.85  
 Freeboard (ft): 0.15 Snow Depth (ft): 0.25  
 Elev. (BPMSL +/- .02): 7.16 Survey By: JED Date: 1/5/07 Time: 13:15  
 Water Sampling By: \_\_\_\_\_ Sample Depths BWS (ft): 1 \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 2 \_\_\_\_\_  
 3 \_\_\_\_\_

**WATER QUALITY METER INFORMATION**

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	InSitu Troll 9000	33033	Pass	Pass
<b>Parameters</b>					
	<b>Field Measurements</b>				
Time:	11:48	11:54	12:03	12:12	12:17
Depth BWS (ft):	19	20	21	22	BOT
Temp (°C):	0.50	0.68	0.83	0.96	1.05
pH:	7.98	7.83	7.55	7.40	7.43
Barometric (mmHg):	749.7	749.9	749.9	749.9	749.9
Pressure (kPa):	55.013	57.985	60.870	63.938	67.658
Conductivity (µS/cm):	122.2	122.1	123.6	127.5	129.0
RDO (ppm): (mg/L)	14.39	12.49	7.49	4.90	4.51
Turbidity (NTU):	-0.2	-0.2	0.5	1.0	12.0
ORP	249	250	253	255	230

**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)										
Alkalinity (mg/L as CaCO3)										
Total iron--UF (mg/L)										
Filtered Iron--F tot Fe (mg/L)										
Ammonia (mg/L NH3-N)****										
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: DAR Date: 1/5/07  
 QAQC Check By: J Derry Date: 1/13/07





University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: North Slope Lakes  
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: MSBN-CT  
 Date: 1/6/07 Time: 13:05

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.280' Easting: W149°24.009' Datum: NAD83  
 Measurements By: DAR Time: 13:05  
 Water Depth (ft): 34.08 Ice Thickness (ft): 2.80  
 Freeboard (ft): 0.15 Snow Depth (ft): 0.30  
 Elev. (BPMSL +/- .02): 94.59 Survey By: J. Derry Date: 1/6/07 Time: 14:00  
 Water Sampling By: DAR Sample Depths BWS (ft): 1 3 Date: 1/6/07 Time: 14:35  
 2 24  
 3 33.5

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model		Serial No.		Pre-Sampling QAQC Check		Post-Sampling QAQC Check		
Multi	GWS	InSitu Troll 9000		33033		Pass		Pass		
<b>Parameters</b>										
	<b>Field Measurements</b>									
Time:	13:45	13:47	13:49	13:52	13:57	14:07	14:16	14:21	14:24	14:27
Depth BWS (ft):	21	23	25	27	29.0	31	32	33	34	BOT
Temp (°C):	-0.22	-0.11	0.00	0.14	0.34	0.59	0.69	0.76	0.81	0.82
pH:	7.75	7.75	7.77	7.72	7.67	7.56	7.51	7.48	7.51	7.59
Barometric (mmHg):	757.6	757.7	757.7	757.8	757.9	758.0	758.0	758.1	758.1	758.1
Pressure (kPa):	60.990	67.061	72.818	78.998	85.038	90.957	94.024	96.986	99.804	100.972
Conductivity (µS/cm):	227.1	226.5	226.1	226.5	227.6	232.9	239.8	252.30	278.70	285.30
RDO (ppm): (mg/L)	10.53	10.39	10.30	9.90	9.45	5.67	3.73	0.88	0.50	0.37
Turbidity (NTU):	0.1	0.1	0.1	0.2	0.4	2.0	2.5	3.6	5.5	121.7
ORP	191	192	193	194	196	201	203	152	-4	-40
Hach LDO (UAF) mg/L										
Hach temp °C										

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 CaCO3)										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 NH3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: DAR Date: 1/6/07  
 QAQC Check By: J. Derry Date: 1/12/07

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: 1/6/07 Time: 15:40

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°19.214' Easting: W149°24.020' Datum: NAD83  
 Measurements By: DAR Time: 15:30  
 Water Depth (ft): 27.45 Ice Thickness (ft): 2.85  
 Freeboard (ft): 0.20 Snow Depth (ft): 0.25  
 Elev. (BPMSL +/- .02): 94.59 Survey By: J Derry Date: 1/6/07 Time: 14:00  
 Water Sampling By: DAR Sample Depths BWS (ft): 1 3 Date: 1/6/07 Time: 16:45  
 2 17  
 3 27

**WATER QUALITY METER INFORMATION**

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	InSitu Troll 9000	33033	Pass	Pass

Parameters	Field Measurements									
Time:	15:41	15:43	15:45	15:47	15:49	15:50	15:52	15:54	15:58	
Depth BWS (ft):	3	4	5	7	9	11	13	15	17	
Temp (°C):	-0.43	-0.45	-0.44	-0.44	-0.45	-0.45	-0.44	-0.29	-0.08	
pH:	7.63	7.66	7.65	7.63	7.65	7.65	7.64	7.65	7.62	
Barometric (mmHg):	757.3	757.3	757.3	757.3	757.4	757.4	757.5	757.5	757.6	
Pressure (kPa):	7.255	10.087	12.991	19.045	24.988	30.993	37.148	43.140	48.776	
Conductivity (µS/cm):	243.1	241.9	241.6	241.6	241.6	241.5	241.4	239.90	239.00	
RDO (ppm): (mg/L)	10.26	10.26	10.26	10.27	10.31	10.34	10.32	9.95	9.60	
Turbidity (NTU):	0.2	0.2	0.1	0.3	0.2	0.1	0.2	0.2	0.4	
ORP	181	182	183	185	185	186	187	188	189	

**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): <u>3</u>			Depth BWS (ft): <u>17</u>			Depth BWS (ft): <u>27</u>			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 CaCO3)	186	184	179	182	182	182	188	190	195	Digital titrator 10-4000 mg/L as CaCO3
Total iron--UF (mg/L)	0.13	0.15	0.14	0.14	0.14	0.15	3.10*	3.10*	3.10*	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	UR	0.05	0.06	0.03	0.03	0.04	2.26	2.21	2.23	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: \*CONCENTRATION REQUIRED 1:10 DILUTION. REPORTED [Fe] IS ACTUAL CONCENTRATION  
 LOG 2007-01-06 1540 05

Field-Form Filled Out By: DAR Date: 1/6/07  
 QAQC Check By: J. Derry Date: 1/12/07





University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: North Slope Lakes  
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: MSBN-NE  
 Date: 1/7/07 Time: 14:41

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°11.567' Easting: W149°14.413' Datum: NAD83  
 Measurements By: DAR Time: 14:41  
 Water Depth (ft): 27.95 Ice Thickness (ft): 2.70  
 Freeboard (ft): 0.27 Snow Depth (ft): 0.25  
 Elev. (BPMSL +/- .02): 94.59 Survey By: J Derry Date: 1/6/07 Time: 14:00  
 Water Sampling By: na Sample Depths BWS (ft): 1 \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 2 \_\_\_\_\_  
 3 \_\_\_\_\_

**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 Troll 9000	33033	Pass	Pass					
<b>Parameters</b>										
	<b>Field Measurements</b>									
Time:	14:42	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Depth BWS (ft):	3	4	5	7	9	11	13	15	17	
Temp (°C):	-0.43	-0.41	-0.40	-0.40	-0.38	-0.35	-0.33	-0.32	-0.30	
pH:	7.75	7.77	7.82	7.78	7.78	7.78	7.79	7.77	7.77	
Barometric (mmHg):	762.8	762.8	762.9	763.0	763.1	763.1	763.2	763.2	763.3	
Pressure (kPa):	7.321	10.223	13.111	19.068	25.081	31.059	37.035	42.969	48.952	
Conductivity (µS/cm):	228.1	227.6	227.4	227.4	227.3	226.8	226.6	226.30	226.20	
RDO (ppm): (mg/L)	10.80	10.72	10.72	10.73	10.73	10.70	10.68	10.66	10.60	
Turbidity (NTU):	-0.1	0.0	-0.1	-0.1	0.0	-0.1	-0.1	0.0	0.1	
ORP	237	236	236	235	235	235	235	235	235	
Hach LDO (UAF) mg/L										
Hach temp °C										

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 CaCO3)										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 NH3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks:

Field-Form Filled Out By: DAR Date: 1/7/07  
 QAQC Check By: JER Date: 1/12/07





**University of Alaska Fairbanks, Water and Environmental Research Center**

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

Project ID: North Slope Lakes  
 Sample Purpose: Lake Water Quality

Site Location/Lake ID: MSBS-SW  
 Date: 1/7/07 Time: 13:31

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°19.182' Easting: W149°24.234' Datum: NAD83  
 Measurements By: DAR/HMC Time: 13:31  
 Water Depth (ft): 19.1 Ice Thickness (ft): 3.35  
 Freeboard (ft): 0.25 Snow Depth (ft): 0.20  
 Elev. (BPMSL +/- .02): 94.59 Survey By: J Derry Date: 1/6/07 Time: 14:00  
 Water Sampling By: Reichardt Sample Depths BWS (ft): 1 \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 2 \_\_\_\_\_  
 3 \_\_\_\_\_

**WATER QUALITY METER INFORMATION**

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	InSitu Troll 9000	33033	Pass	Pass
Parameters		Field Measurements			
Time:	14:10	14:14	14:16		
Depth BWS (ft):	18	19	BOT		
Temp (°C):	-0.08	-0.03	0.01		
pH:	7.70	7.62	7.64		
Barometric (mmHg):	763.0	763.0	763.0		
Pressure (kPa):	51.840	54.985	56.224		
Conductivity (µS/cm):	239.7	239.7	239.8		
RDO (ppm): (mg/L)	9.71	9.19	8.94		
Turbidity (NTU):	0.3	0.5	5.5		
ORP	213	214	215		

**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 CaCO3)										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 NH3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: LOG 2007 - 01 -05

Field-Form Filled Out By: DAR Date: 1/7/07  
 QAQC Check By: J Derry Date: 1/12/07

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-W  
 Sample Purpose: Lake Water Quality Date: 1/7/07 Time: 12:40

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°19.232' Easting: W149°24.089' Datum: NAD83  
 Measurements By: DAR/HMC Time: 12:40  
 Water Depth (ft): 14.62 Ice Thickness (ft): 3.26  
 Freeboard (ft): 0.39 Snow Depth (ft): 0.22  
 Elev. (BPMSL +/- .02): 94.59 Survey By: J. Derry Date: 1/6/07 Time: 14:00  
 Water Sampling By: \_\_\_\_\_ Sample Depths BWS (ft): 1 \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 2 \_\_\_\_\_  
 3 \_\_\_\_\_

**WATER QUALITY METER INFORMATION**

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
Multi	GWS	InSitu Troll 9000	33033	Pass	Pass

Parameters	Field Measurements									
	12:47	12:49	12:50	12:52	12:53	12:54	12:55	12:57	12:58	13:01
Time:	12:47	12:49	12:50	12:52	12:53	12:54	12:55	12:57	12:58	13:01
Depth BWS (ft):	3	4	5	7	9	11	12	13	14	BOT
Temp (°C):	-0.38	-0.43	-0.44	-0.45	-0.45	-0.46	-0.45	-0.45	-0.42	-0.33
pH:	7.68	7.68	7.65	7.66	7.66	7.65	7.70	7.71	7.73	7.70
Barometric (mmHg):	762.2	762.3	762.3	762.4	762.4	762.5	762.5	762.5	762.5	762.6
Pressure (kPa):	7.515	10.479	13.068	19.087	25.287	31.028	33.986	36.805	39.926	42.633
Conductivity (µS/cm):	241.9	240.7	240.6	240.3	240.3	240.3	240.0	239.80	239.20	238.70
RDO (ppm): (mg/L)	9.91	9.82	9.84	9.87	9.91	9.94	9.93	9.93	9.91	9.65
Turbidity (NTU):	0.3	0.2	0.2	0.2	0.1	0.3	0.2	0.3	0.2	1.5
ORP	179	180	182	183	184	184	185.00	187.00	188.00	189.00

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 CaCO3)										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 NH3-N)****										0.01-0.50 mg/L NH3-N
Ammonia/ Iron dilution										

Remarks: LOG 2007 - 01 - 07 124526. MSBS-W IS 21 METER SOUTH OF ICE ROAD PUMP HOUSE SITE. ICE PUMPING OCCURRED IN DEC. PER MIKE LILLY

Field-Form Filled Out By: Reichardt Date: 1/7/07  
 QAQC Check By: J Derry Date: 1/12/07

**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: K113-CT  
 Sample Purpose: Lake Water Quality Date: 1/14/07 Time: 11:30

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°19.178' Easting: W149°19.324' Datum: NAD83  
 Measurements By: DAR Time: 13:35  
 Water Depth (ft): 6.77 Ice Thickness (ft): 2.98  
 Freeboard (ft): 0.17 Snow Depth (ft): TRACE  
 Elev. (BPMSL +/- .02): na Survey By: na Date: na Time: na  
 Water Sampling By: DAR Sample Depths BWS (ft): 1 3 Date: 1/14/07 Time: nr  
 2 5  
 3 6

**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 Troll 9000	33205	Pass, ORP?	Pass, pH fail				
<b>Parameters</b>									
	<b>Field Measurements</b>								
Time:	11:44	11:46	11:48	11:51	11:57	11:59			
Depth BWS (ft):	3	4	5	6	6.5	Bot			
Temp (°C):	0.17	0.14	0.30	0.74	0.99	1.11			
pH:	7.25	7.27	7.29	7.28	7.27	7.22			
Barometric (mmHg):	757.7	757.9	758.0	758.0	758.1	758.1			
Pressure (kPa):	7.321	10.154	13.031	16.226	17.814	19.133			
Conductivity (µS/cm):	234.8	232.7	232.5	234.0	234.4	235.2			
RDO (ppm): (mg/L)	10.18	10.47	10.75	11.08	11.10	10.81			
Turbidity (NTU):	1.4	1.4	1.5	1.7	2.1	5.2			
ORP	49	50	52	54	54	53			

**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): <u>3</u>			Depth BWS (ft): <u>5</u>			Depth BWS (ft): <u>6</u>			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 <sub>3</sub> )	158	156	154	153	153	151	153	151	150	Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
Total iron--UF (mg/L)	0.13	0.13	0.13	0.14	0.10	0.08	0.26	0.25	0.25	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.02	0.03	0.03	ur	ur	ur	0.03	0.02	0.04	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: 033205 used with UAF "B" pH/ORP probe

In-Situ Log 07\_01\_14 1139##

Field-Form Filled Out By: A. Blackburn Date: 1/15/07  
 QAQC Check By: Reichardt Date: 1/16/07

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: 1/9/07 Time: 10:07

FIELD MEASUREMENTS

GPS Coord. Northing: N70°19.995' Easting: W150°56.918' Datum: NAD83  
 Measurements By: HCM Time: 10:07  
 Water Depth (ft): 11.4 Ice Thickness (ft): 2.92  
 Freeboard (ft): 0.21 Snow Depth (ft): NA  
 Elev. (BPMSL): 7.63 Survey By: C. Cormack Date: 1/9/07 Time: 11:40  
 Water Sampling By: DAR Sample Depths BWS (ft): 1 3 Date: 1/9/07 Time: 10:07  
 2 8  
 3 11

WATER QUALITY METER INFORMATION

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check					
Multi	GWS	InSitu Troll 9000	33033	PASS	Pass					
<b>Parameters</b>		<b>Field Measurements</b>								
Time:	10:53	10:59	11:01	11:03	11:09	11:23	11:26	11:30	11:34	11:38
Depth BWS (ft):	3	4	5	6	7	8	9	10	11	BOT
Temp (°C):	-0.16	0.12	0.23	0.45	0.92	1.3	1.18	1.22	1.46	1.55
pH:	7.07	7.08	7.06	7.07	6.91	6.73	6.80	6.74	6.69	6.94
Barometric (mmHg):	773.7	773.7	773.8	773.8	773.9	773.9	773.9	773.9	773.9	773.8
Pressure (kPa):	x	x	x	x	x	28.416	25.630	28.285	31.627	33.449
Conductivity (µS/cm):	56.76	55.94	56.03	55.09	54.44	55.61	54.01	54.34	69.86	96.00
RDO (ppm): (mg/L)	15.19	15.26	15.51	15.53	14.69	5.80	5.26	6.30	3.80	1.85
Turbidity (NTU):	0.4	0.6	0.5	0.6	1.0	2.5	1.5	2.4	6.7	165.6
ORP	245	246	247	247	251	239	219	222	66	-23

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): 3 ft			Depth BWS (ft): 8ft			Depth BWS (ft): 11			Method
	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	rep 1	rep 2	rep 3	
Alkalinity (mg/L as CaCO <sub>3</sub> )	41	43	36	31	33	31	60	65	58	
Total iron--UF (mg/L)	0.06	0.04	0.05	0.06	0.05	0.06	9.3*	9.6*	10.0*	
Filtered Iron--F tot Fe (mg/L)	0.02	0.04	0.09	0.09	0.10	0.10	10.7*	10.6*	10.4*	

Remarks: \*1:10 DILUTION. REPORTED VALUE IS CALCULATED CONCENTRATION.

Field-Form Filled Out By: Jeff Derry Date: 1/9/07  
 QAQC Check By: DAR Date: 1/13/07



**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: 1/9/07 Time: 15:24

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°20.053' Easting: W150°56.600' Datum: NAD83  
 Measurements By: DMW Time: 15:24  
 Water Depth (ft): 10.2 Ice Thickness (ft): 3.0  
 Freeboard (ft): 0.05 Snow Depth (ft): 0.8  
 Elev. (BPMSL): 7.63 Survey By: C. Cormack Date: 1/9/07 Time: 11:40  
 Water Sampling By: \_\_\_\_\_ Sample Depths BWS (ft): 1 \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 2 \_\_\_\_\_  
 3 \_\_\_\_\_

**WATER QUALITY METER INFORMATION**

Calibration Information

Parameter (s)	Owner	Meter Make/Model	Serial No.	Pre-Sampling QAQC Check	Post-Sampling QAQC Check
All	UAF	In-Situ Troll 9000	33033	pass	Pass

Parameters	Field Measurements										
Time:	15:24	15:25	15:26	15:27	15:28	15:30	15:42	15:48	15:50		
Depth BWS (ft):	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	BOT		
Temp (°C):	-0.41	-0.36	-0.19	-0.03	0.11	0.57	0.84	0.95	0.97		
pH:	7.06	7.00	7.00	7.02	7.00	8.89	6.71	6.65	6.70		
Barometric (mmHg):	771.9	772.0	772.1	772.0	772.1	772.0	771.8	771.8	771.8		
Pressure (kPa):	7.235	10.362	13.593	16.391	19.411	22.290	25.442	28.142	29.976		
Conductivity (µS/cm):	57.87	57.05	56.81	56.35	56.20	54.91	57.89	68.33	68.68		
RDO (ppm):	15.54	15.82	15.98	15.98	15.92	13.93	6.28	3.49	3.18		
Turbidity (NTU):	0.5	0.2	0.2	0.2	0.3	1.6	5.3	9.3	254.1		
ORP	143	148	152	155	159	167	179	156	103		

**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	
Alkalinity (mg/L as CaCO <sub>3</sub> )										
Total iron--UF (mg/L)										
Ferrous (II) Iron--F tot Fe (mg/L)										

Remarks: \_\_\_\_\_

Field-Form Filled Out By: J Derry Date: 1/9/07  
 QAQC Check By: DAR Date: 1/13/07





University of Alaska Fairbanks, Water and Environmental Research Center  
Form F-004a: Water Quality Field-Sampling General

Project ID: North Slope Lakes  
Sample Purpose: Lake Water Quality

Site Location/Lake ID: L9817-1  
Date: 1/10/07 Time: 12:00

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°14.070' Easting: W151°20.121' Datum: NAD83  
Measurements By: DAR Time: 12:00  
Water Depth (ft): 8.45 Ice Thickness (ft): 2.80  
Freeboard (ft): 0.15 Snow Depth (ft): 0.27  
Elev. (BPMSL +/- .02): 53.05 Survey By: J Derry, MRL Date: 1/10/2007 Time: 15:00  
Water Sampling By: DAR Sample Depths BWS (ft): 1 3 Date: 1/10/2007 Time: 13:25  
2 5  
3 8  
4 7

**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 TROLL 9000	33033	PASS	PASS

Parameters	Field Measurements									
	Time:	12:50	12:52	12:54	12:57	13:59	13:02	13:18		
Depth BWS (ft):	3	4	5	6	7	8	BOT			
Temp (°C):	-0.33	-0.21	0.22	0.45	0.97	1.24	1.65			
pH:	6.96	6.97	6.97	7.01	6.98	6.95	7.19			
Barometric (mmHg):	762.5	762.6	762.6	762.6	762.6	762.6	762.5			
Pressure (kPa):	7.587	10.307	13.604	16.366	19.505	22.434	24.703			
Conductivity (µS/cm):	300.2	299.2	301.5	303.0	306.5	307.2	254.1			
RDO (ppm): (mg/L)	6.99	7.11	7.35	7.54	7.11	2.08	1.83			
Turbidity (NTU):	0.5	0.5	0.5	0.5	1.6	4.4	38.0			
ORP	264	263	262	259	256	30	-3			

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): <u>3</u>			Depth BWS (ft): <u>5</u>			Depth BWS (ft): <u>8</u>			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 <sub>3</sub> )	84	89	86	83	86	86	98	100	99	Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
Total iron--UF (mg/L)	0.06	0.06	0.06	0.06	0.04	0.05	6.80*	6.80*	7.0*	Hach spec 0.02-3.00 mg/L
Filtered Iron--F tot Fe (mg/L)	0.08	0.1	0.1	0.04	0.03	0.06	7.60*	7.60*	7.50*	Hach spec 0.02-3.00 mg/L
Ammonia (mg/L NH <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks:

\*1:10 DILUTION. REPORTED VALUE IS CALCULATED CONCENTRATION. ADDITIONAL SAMPLES TAKEN AT 7FT.

TOTAL Fe (mg/L) = 0.25, 0.21, 0.23. FILTERED Fe (mg/L) = 0.11, 0.12, 0.10. ALKALINITY (mg/L as CaCO<sub>3</sub>) = 86, 91, 89.

Field-Form Filled Out By: DAR Date: 1/10/07  
QAQC Check By: J Derry Date: 1/13/07



**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: 1/10/07 Time: 13:30

**FIELD MEASUREMENTS**

GPS Coord. Northing: N70°14.022' Easting: W151°20.037' Datum: NAD83  
Measurements By: DMW Time: 13:30  
Water Depth (ft): 8 Ice Thickness (ft): 3.00  
Freeboard (ft): 0.25 Snow Depth (ft): 0.17  
Elev. (BPMSL +/- .02): 53.05 Survey By: J Derry Date: 1/10/2007 Time: 15:00  
Water Sampling By: \_\_\_\_\_ Sample Depths BWS (ft): 1 \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
2 \_\_\_\_\_  
3 \_\_\_\_\_

**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 TROLL 9000	33205	PASS	PASS					
					FAIL ORP					
Parameters		Field Measurements								
Time:	13:37	13:40	13:44	13:45	13:55	14:00	14:12			
Depth BWS (ft):	3	4	5	6	7.0	7.5	8			
Temp (°C):	0.16	0.42	0.81	1.10	1.51	1.68	1.87			
pH:	7.02	7.01	6.99	6.98	6.90	6.88	7.01			
Barometric (mmHg):	763.1	763.2	763.2	763.3	763.3	763.3	763.4			
Pressure (kPa):	7.783	10.773	13.522	16.618	19.562	21.257	22.880			
Conductivity (µS/cm):	298.6	296.3	297.4	298.6	305.9	306.2	323.6			
RDO (ppm): (mg/L)	7.29	7.24	7.21	7.12	4.81	3.82	2.91			
Turbidity (NTU):	0.5	0.5	0.6	1.0	2.9	3.7	9.0			
ORP	9	7	7	5	-13	-20	-72			

**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): <u>3</u>			Depth BWS (ft): <u>5</u>			Depth BWS (ft): <u>8</u>			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 <sub>3</sub> )										Digital titrator 10-4000 mg/L as CaCO <sub>3</sub>
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 <sub>3</sub> -N)****										0.01-0.50 mg/L NH <sub>3</sub> -N
Ammonia/ Iron dilution										

Remarks: \_\_\_\_\_

Field-Form Filled Out By: DMW Date: 1/10/07  
QAQC Check By: J Derry Date: 1/13/07

University of Alaska Fairbanks, Water and Environmental Research Center

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

Project ID: North Slope Lakes
Sample Purpose: Lake Water Quality

Site Location/Lake ID: L9817-4
Date: 1/10/07 Time: 14:07

FIELD MEASUREMENTS

GPS Coord. Northing: N70°13.998' Easting: W151°19.997' Datum: NAD83
Measurements By: DAR Time: 14:02
Water Depth (ft): 5.8 Ice Thickness (ft): 2.50
Freeboard (ft): 0.1 Snow Depth (ft): 0.40
Elev. (BPMSL +/- .02): 53.05 Survey By: J Derry, MRL Date: 1/10/2007 Time: 15:00
Water Sampling By: Sample Depths BWS (ft): 1 2 3

WATER QUALITY METER INFORMATION

Calibration Information

Table with 6 columns: Parameter (s), Owner, Meter Make/Model, Serial No., Pre-Sampling QAQC Check, Post-Sampling QAQC Check. Row 1: MULTI, GWS, IN-SITU TROLL 9000, 33033, PASS, PASS. Below is a 'Field Measurements' table with columns for Time (14:07, 14:19, 14:20, 14:29, 14:31) and rows for Depth BWS, Temp, pH, Barometric, Pressure, Conductivity, RDO, Turbidity, and ORP.

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

Table with 5 columns for time/depth and 4 rows for Probe, Depth (ft), Temp (°C), pH, Eh.

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Table with 10 columns: Parameter, Depth BWS (ft): 3 (rep 1-3), Depth BWS (ft): 5 (rep 1-3), Depth BWS (ft): 8 (rep 1-3), Method. Rows include Oxygen, Alkalinity, Total iron--UF, Filtered Iron--F tot Fe, Ammonia (mg/L NH3-N), and Ammonia/ Iron dilution.

Remarks: LOG 2007-01-10 140331

Field-Form Filled Out By: DAR Date: 1/10/07
QAQC Check By: J Derry Date: 1/13/07

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: L9817-20
Sample Purpose: Lake Water Quality Date: 1/10/07 Time: 12:00

FIELD MEASUREMENTS

GPS Coord. Northing: N70°14.079' Easting: W151°19.969' Datum: NAD83
Measurements By: DMW Time: 12:10
Water Depth (ft): 8.98 Ice Thickness (ft): 2.74
Freeboard (ft): 0.03 Snow Depth (ft): 0.30
Elev. (BPMSL +/- .02): 53.05 Survey By: J Derry, MRL Date: 1/10/2007 Time: 15:00
Water Sampling By: Sample Depths BWS (ft): 1 2 3

WATER QUALITY METER INFORMATION

Calibration Information

Table with 6 columns: Parameter (s), Owner, Meter Make/Model, Serial No., Pre-Sampling QAQC Check, Post-Sampling QAQC Check. Includes a detailed 'Field Measurements' section with 10 rows and 10 columns for time-based readings.

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

Table for field testing with columns for Probe, Depth (ft), Temp (°C), pH, and Eh.

NORTH SLOPE LAB CHEMISTRY ANALYSIS

Table for chemistry analysis with columns for Parameter, Depth BWS (ft) at 3, 5, and 8 feet, and Method.

Remarks:

Field-Form Filled Out By: DMW Date: 1/10/07
QAQC Check By: J Derry Date: 1/13/07

















## **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 Prudhoe SRT Lab  
 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	1/4/07	15:52	Oakton 4.01	2610411	10/1/08	4.06	13.77	Pass
pH	1/4/07	15:52	Oakton 7.00	2616413	4/1/08	7.07	13.41	Pass
pH	1/4/07	15:52	Oakton 10.00	2610412	10/1/08	10.12	13.11	Pass
ORP	1/4/07	15:52	InSitu QuickCal	3006B	5/1/07	243	16.98	Pass
RDO - 100% DO	1/4/07	15:52	Bubbled Nanopure	n/a	n/a	9.33	14.72	Pass
RDO - Zero DO	1/4/07	15:52	HANNA HI7040	G1012	2/1/11	0.00	14.37	Pass
Conductivity	1/4/07	15:52	Oakton 447uS	2609077	9/1/07	364.0	14.01	Pass

Remarks: Barometer = 747.8 mm Hg. 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:	Cormack	Date:	1/11/2007			
QAQC Check By:	DAR	Date:	3/8/2007			

**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 | Prudhoe SRT Lab  
 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	1/4/07	15:52	Oakton 4.01	2610411	10/1/08	4.06	14.27	Pass
pH	1/4/07	15:52	Oakton 7.00	2616413	4/1/08	7.01	14.05	Pass
pH	1/4/07	15:52	Oakton 10.00	2610412	10/1/08	10.09	13.74	Pass
ORP	1/4/07	15:52	InSitu QuickCal	3006B	5/1/07	244	12.12	Pass
RDO - 100% DO	1/4/07	15:52	Bubbled Nanopure	n/a	n/a	9.58	14.39	Pass
RDO - Zero DO	1/4/07	15:52	HANNA HI7040	G1012	2/1/11	0.00	13.45	Pass
Conductivity	1/4/07	15:52	Oakton 447uS	2609077	9/1/07	362.7	14.16	Pass

Remarks: Barometer = 748.7 mm Hg. 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:	Cormack	Date:	1/11/2007			
QAQC Check By:	DAR	Date:	3/8/2007			

**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 Prudhoe SRT Lab  
 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	1/6/07	7:50	Oakton 4.01	2512012	11/1/07	4.03	13.46	Pass
pH	1/6/07	7:50	Oakton 7.00	2616413	4/1/08	7.02	12.40	Pass
pH	1/6/07	7:50	Oakton 10.00	2610412	10/1/08	10.15	13.05	Pass
ORP	1/6/07	7:50	InSitu QuickCal	30006B	5/1/07	239	14.37	Pass
RDO - 100% DO	1/6/07	7:50	Bubbled Nanopure	n/a	n/a	10.19	16.81	Pass
RDO - Zero DO	1/6/07	7:50	HANNA HI7040	G1012	2/1/11	0.01	16.00	Pass
Conductivity	1/6/07	7:50	Oakton 447uS	2609077	9/1/07	340.5	12.59	Pass

Remarks: Barometer = 755.6 mm Hg. 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:	Cormack	Date:	1/11/2007			
QAQC Check By:	DAR	Date:	3/8/2007			

**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 Prudhoe SRT Lab  
 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	1/7/07	8:30	Oakton 4.01	2512012	11/1/07	4.01	11.75	Pass
pH	1/7/07	8:30	Oakton 7.00	2616413	4/1/08	7.07	16.78	Pass
pH	1/7/07	8:30	Oakton 10.00	2610412	10/1/08	10.18	14.60	Pass
ORP	1/7/07	8:30	InSitu QuickCal	30006B	5/1/07	247	9.72	Pass
RDO - 100% DO	1/7/07	8:30	Bubbled Nanopure	n/a	n/a	9.45	15.92	Pass
RDO - Zero DO	1/7/07	8:30	HANNA HI7040	G1012	2/1/11	0.00	15.52	Pass
Conductivity	1/7/07	8:30	Oakton 447uS	2609077	9/1/07	335.3	14.11	Pass

Remarks: Barometer = 760.6 mm Hg. ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Pre sample cal check for MSB.

Field-Form Filled Out By:	Cormack	Date:	1/11/2007			
QAQC Check By:	DAR	Date:	3/8/2007			

**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 Prudhoe SRT Lab  
 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	1/7/07	21:16	Oakton 4.01	2512012	11/1/07	4.12	12.69	Fail
pH	1/7/07	21:16	Oakton 7.00	2616413	4/1/08	7.01	16.20	Pass
pH	1/7/07	21:16	Oakton 10.00	2610412	10/1/08	10.07	18.00	Pass
ORP	1/7/07	21:16	InSitu QuickCal	30006B	5/1/07	242	9.02	Pass
RDO - 100% DO	1/7/07	21:16	Bubbled Nanopure	n/a	n/a	10.38	18.65	Pass
RDO - Zero DO	1/7/07	21:16	HANNA HI7040	G1012	2/1/11	0.00	16.73	Pass
Conductivity	1/7/07	21:16	Oakton 447uS	2609077	9/1/07	348.9	12.46	Pass

Remarks: Barometer = 765.4 mm Hg. ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check for KDA.

Field-Form Filled Out By:	Cormack	Date:	1/11/2007			
QAQC Check By:	DAR	Date:	3/8/2007			

**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 Prudhoe SRT Lab  
 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	1/8/07	10:00	Oakton 4.01	2610411	10/1/08	3.99	13.64	Pass
pH	1/8/07	10:00	Oakton 7.00	2512282	12/1/07	7.02	19.14	Pass
pH	1/8/07	10:00	Oakton 10.00	2610413	4/1/08	10.01	23.15	Pass
ORP	1/8/07	10:00	InSitu QuickCal	30006B	5/1/07	243	10.40	Pass
RDO - 100% DO	1/8/07	10:00	Bubbled Nanopure	n/a	n/a	11.29	10.95	Pass
RDO - Zero DO	1/8/07	10:00	HANNA HI7040	G1012	2/1/11	0.01	13.43	Pass
Conductivity	1/8/07	10:00	Oakton 447uS	2609077	9/1/07	345.4	11.70	Pass

Remarks: Barometer = 774.7 mm Hg. ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check for MSB.

Field-Form Filled Out By:	Cormack	Date:	1/11/2007			
QAQC Check By:	DAR	Date:	3/8/2007			

**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 Prudhoe SRT Lab  
 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	1/8/07	22:00	Oakton 4.01	2610411	10/1/08	4.00	13.98	Pass
pH	1/8/07	22:00	Oakton 7.00	2512282	12/1/07	7.02	21.46	Pass
pH	1/8/07	22:00	Oakton 10.00	2610413	4/1/08	10.03	24.56	Pass
ORP	1/8/07	22:00	InSitu QuickCal	30006B	5/1/07	245	11.42	Pass
RDO - 100% DO	1/8/07	22:00	Bubbled Nanopure	n/a	n/a	10.75	11.13	Pass
RDO - Zero DO	1/8/07	22:00	HANNA HI7040	G1012	2/1/11	0.00	14.21	Pass
Conductivity	1/8/07	22:00	Oakton 447uS	2609077	9/1/07	343.1	12.23	Pass

Remarks: Barometer = 775.7 mm Hg. ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check for MSB.

Field-Form Filled Out By:	Cormack	Date:	1/11/2007			
QAQC Check By:	DAR	Date:	3/8/2007			

**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 Alpine WTP  
 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	1/9/07	n/a	Oakton 4.01	2610411	10/1/08	3.98	11.03	Pass
pH	1/9/07	n/a	Oakton 7.00	2512282	12/1/07	7.08	11.23	Pass
pH	1/9/07	n/a	Oakton 10.00	2610413	4/1/08	10.21	11.23	Pass
ORP	1/9/07	n/a	InSitu QuickCal	30006B	5/1/07	240	11.69	Pass
RDO - 100% DO	1/9/07	n/a	Bubbled Nanopure	n/a	n/a	11.77	10.87	Pass
RDO - Zero DO	1/9/07	n/a	HANNA HI7040	G1012	2/1/11	0.00	7.69	Pass
Conductivity	1/9/07	n/a	Oakton 447uS	2609077	9/1/07	332.4	10.10	Pass

Remarks: Barometer = 774.7 mm Hg. ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Pre sample cal check for L9312.

Field-Form Filled Out By:	Cormack	Date:	1/11/2007			
QAQC Check By:	DAR	Date:	3/8/2007			



**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 | Alpine WTP  
 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	1/9/07	n/a	Oakton 4.01	2610411	10/1/08	3.92	11.45	Pass
pH	1/9/07	n/a	Oakton 7.00	2512282	12/1/07	7.00	11.78	Pass
pH	1/9/07	n/a	Oakton 10.00	2610413	4/1/08	10.17	12.01	Pass
ORP	1/9/07	n/a	InSitu QuickCal	30006B	5/1/07	244	11.56	Pass
RDO - 100% DO	1/9/07	n/a	Bubbled Nanopure	n/a	n/a	10.51	11.25	Pass
RDO - Zero DO	1/9/07	n/a	HANNA HI7040	G1012	2/1/11	0.02	9.79	Pass
Conductivity	1/9/07	n/a	Oakton 447uS	2609077	9/1/07	336.0	12.15	Pass

Remarks: Barometer = 769.3 mm Hg. ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Pre sample cal check for L9312.

Field-Form Filled Out By:	Cormack	Date:	1/11/2007			
QAQC Check By:	DAR	Date:	3/8/2007			

**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 | Alpine WTP  
 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	1/10/07	n/a	Oakton 4.01	2512012	11/1/07	3.91	17.62	Pass
pH	1/10/07	n/a	Oakton 7.00	2512282	12/1/07	6.97	19.12	Pass
pH	1/10/07	n/a	Oakton 10.00	2610413	4/1/08	10.60	17.15	Pass
ORP	1/10/07	n/a	InSitu QuickCal	30006B	5/1/07	227	17.28	Pass
RDO - 100% DO	1/10/07	n/a	Bubbled Nanopure	n/a	n/a	9.99	17.76	Pass
RDO - Zero DO	1/10/07	n/a	HANNA HI7040	G1012	2/1/11	0.00	16.65	Pass

Remarks: Barometer = 763.8 mmHg. ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check for L9312.

Field-Form Filled Out By:	Cormack	Date:	1/11/2007			
QAQC Check By:	DAR	Date:	3/8/2007			

**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 | Alpine WTP  
 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	1/10/07	n/a	Oakton 4.01	2512012	11/1/07	3.90	16.75	Pass
pH	1/10/07	n/a	Oakton 7.00	2512282	12/1/07	6.99	18.99	Pass
pH	1/10/07	n/a	Oakton 10.00	2610413	4/1/08	10.04	18.15	Pass
ORP	1/10/07	n/a	InSitu QuickCal	30006B	5/1/07	232	17.33	Pass
RDO - 100% DO	1/10/07	n/a	Bubbled Nanopure	n/a	n/a	9.76	17.75	Pass
RDO - Zero DO	1/10/07	n/a	HANNA HI7040	G1012	2/1/11	0.00	15.12	Pass
Conductivity	1/10/07	n/a	Oakton 447uS	2609077	9/1/07			pass

Remarks: Barometer = 763.3 mmHg. ORP read in mV, RDO read in mg/L, Conductivity read in uS/cm AC. Post sample cal check for L9312. Treat Conductivity as a pass, since it passed on Jan14.

Field-Form Filled Out By:	Cormack	Date:	1/11/2007			
QAQC Check By:	DAR	Date:	3/8/2007			

**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 | Prudhoe SRT Lab  
 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	1/14/07	n/a	Oakton 4.01	2512012	11/1/07	3.91	14.45	Pass
pH	1/14/07	n/a	Oakton 7.00	2512282	12/1/07	7.01	14.93	Pass
pH	1/14/07	n/a	Oakton 10.00	2512278	6/1/07	10.27	14.32	Fail
ORP								
RDO - 100% DO	1/14/07	n/a	Bubbled Nanopure	n/a	n/a	9.35 mg/ L	18.46	Pass
RDO - Zero DO	1/14/07	n/a	HANNA HI7040	G1012	2/1/11	0.01 mg/ L	17.21	Pass
Conductivity	1/14/07	n/a	Oakton 447uS	2609077	9/1/07	367.1	13.32	Pass

Note: ORP not tested. Solution is expired due to be opened longer than 7 days. Atmospheric Press. = 759.1 mm Hg. Post Sample Check for L9817.

Field-Form Filled Out By:	JED	Date:	1/18/2007			
QAQC Check By:	DAR	Date:	1/18/2007			

## **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: Kuparuk Dead Arm  
 Survey Purpose: Water-Level Elevations Date: 1/4/2007 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)		Unrestricted, minus 20F at 5 mph		
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)		Jeff Derry, Horacio Toniolo		
BM #1 WQ040768	BP	19.32	N70 20.048 NAD83	W148 56.367 NAD83				
Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasl)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
BM#1	2.57	21.89		19.32				Shot to flagged benchmark
KDA3		21.89	14.73	7.16				<b>WS Elevation for Reservoir #3</b>
KDA2		21.89	14.73	7.16				<b>WS Elevation for Reservoir #2</b>
								Turn point, Moved instrument.
KDA2	15.05	22.21		7.16				
KDA3		22.21	15.04	7.17				
BM#1		22.21	2.89	19.32				Survey closes within 0'
KDA2	8.95	16.11		7.16				Used water level of KDA2 to acquire KDA1
KDA1		16.11	7.77	8.34				<b>WS Elevation for Reservoir #1</b>
								Turn point. Moved on KDA1
KDA1	7.34	15.68		8.34				
KDA2		15.68	8.52	7.16				Close survey to 0.00

Abbreviations: backsight, BS; degrees, dd; feet, ft; feet above mean sea level, fasm; 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: 1/6/2006 Time: 14:00

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: 5482372 (GWS owned)		minus 35F at 3mph		
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)		Horacio Toniolo, Jeff Derry		
TBM__	nr	100 Temp.	na	na				
Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasl)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
TBM_1	6.57	106.57		100.00				
MSB_N		106.57	11.98	94.59				
TBM_4		106.57	5.17	101.40				
TBM_3		106.57	3.10	103.47				
TBM_2		106.57	2.73	103.84				
								Turn point, Moved instrument.
TBM_2	2.06	105.90		103.84				
TBM_3		105.90	2.43	103.47				
TBM_4		105.90	4.51	101.39				
MSB_N		105.90	11.31	94.59				
TBM_1		105.90	5.90	100.00				Survey closes within 0.00'
MSB_N	8.85	103.44		94.59				Set up on island.
MSB_S		103.44	8.85	94.59				
								Turn point. Moved on MSB_S
MSB_S	8.93	103.52		94.59				
MSB_N		103.52	8.93	94.59				close survey 0.00'

Abbreviations: backsight, BS; degrees, dd; feet, ft; feet above mean sea level, fasm; 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: K113 - SH1  
 Survey Purpose: Water-Level Elevations Date: 1/14/2007 Time: 12:00

Location:		K113, Survey to BM elevations located on VSM 615 and VSM 617.								
Survey objective:		Lake water elevation survey.			Weather Observations:		Minus 9 @ 5 mph			
Instrument Type:		Leica NA 720	Instrument ID:	5482372 (GWS owned)				Overcast with light snowfall.		
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)		Chad Cormack, Jeff Derry				
VSM 615	na	59.3	N 70 18.111'	W 149 19.183'						
<b>Station</b>	<b>BS (ft)</b>	<b>HI (ft)</b>	<b>FS (ft)</b>	<b>Elevation (fasl)</b>	<b>Distance (ft)</b>	<b>Horizontal Angle</b>	<b>Vertical Angle</b>	<b>Remarks</b>		
615	-1.41	57.89		59.30						
617		57.89	-0.60	58.49						
Water Level		57.89	4.77	53.12						
								Turn Point, Move Instrument		
Water Level	4.79	57.91		53.12						
617		57.91	-0.58	58.49						
615		57.91	-1.39	59.30				Survey closes within 0.00'		

Abbreviations: backsight, BS; degrees, dd; feet, ft; feet above mean sea level, fasm; 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: L9312  
 Survey Purpose: Water-Level Elevations Date: 1/9/2007 Time: 1:45

Location:		L9312, Survey to LCMF BM elevations. Point "P" is 11.73'						
Survey objective:		Lake water elevation survey			Weather Observations:		Clear	
Instrument Type:		Leica NA720	Instrument ID:	5482372 (GWS owned)				minus 28 F at 0 mph, unrestricted
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)		Jeff Derry, Chad Cormack		
P	LCMF	11.73	na	na				
<b>Station</b>	<b>BS (ft)</b>	<b>HI (ft)</b>	<b>FS (ft)</b>	<b>Elevation (fasl)</b>	<b>Distance (ft)</b>	<b>Horizontal Angle</b>	<b>Vertical Angle</b>	<b>Remarks</b>
P	2.06	13.79		11.73				
O		13.79	2.30	11.49				
PH-VSM		13.79	-0.80	14.59				
Water Surface		13.79	6.16	7.63				
								Turn point. Moved on Water Surface
Water Surface	6.31	13.94		7.63				
PH-VSM		13.94	-0.65	14.59				close point to 0.00
O		13.94	2.45	11.49				close point to 0.00
P		13.94	2.21	11.73				close survey 0.00'

Abbreviations: backsight, BS; degrees, dd; feet, ft; feet above mean sea level, fasm; 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: 1/10/2007 Time: 14:30:00 AM

Location: Near rebar on west side of lake. Water surface elevation taken near sample point #4								
Survey objective: Lake water elevation survey					Weather Observations: minus 25F @ 5 mph			
Instrument Type: Leica NA 720		Instrument ID: 5482372 (GWS owned)			High overcast, visibility unrestricted			
Rod Type: Craine fiberglass 20'		Rod ID:						
Bench Mark Information:					Survey Team Names			
Name	Agency Responsible	Elevation (ft)	Latitude (dd-mm.mmm)	Longitude (ddd-mm.mmm)	Jeff Derry, Mike Lilly			
B	nr	54.98	na	na				
Station	BS (ft)	HI (ft)	FS (ft)	Elevation (fasl)	Distance (ft)	Horizontal Angle	Vertical Angle	Remarks
B	5.53	60.51		54.98				
A		60.51	5.40	55.11				
D		60.51	5.81	54.70				
C		60.51	4.58	55.93				
E		60.51	4.04	56.47				
Water surface		60.51	7.46	53.05				All measuements to water level
								Turn point, moved instrument.
Water surface	7.16	60.21		53.05				
E		60.21	3.74	56.47				
C		60.21	4.28	55.93				
D		60.21	5.51	54.70				
A		60.21	5.10	55.11				
B		60.21	5.23	54.98				Survey closes within 0.00'

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

## **APPENDIX D. SNOW DEPTH AND WATER CONTENT 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: Kuparuk Dead Arm  
 Survey Purpose: Snow Depth and Water Content Date: 1/5/2007 Time: 16:00

Location Description:	Located at center of Lake 2 near KDA2-CT. "L" shaped pattern, first going north, then going west 1 meter for 25 meters.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather	Visibility unrestricted. Dark. Observations: Minus 35 at 0 mph
Latitude:	Longitude:		Datum:	NAD83	
	N70°19.9776'		W148°56.4462'		
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 <sup>2</sup>			Jeff Derry, Horacio Toniolo	

Snow Course Depths, in cm.

	1	2	3	4	5
1	12.0	8.0	25.0	9.0	13.0
2	11.0	9.0	23.0	8.0	13.0
3	12.0	9.0	18.0	8.0	13.0
4	13.0	10.0	14.0	8.0	11.0
5	12.0	11.0	12.0	8.0	11.0
6	10.0	12.0	12.0	9.0	12.0
7	10.0	12.0	12.0	13.0	11.0
8	10.0	13.0	13.0	15.0	6.0
9	9.0	16.0	11.0	16.0	7.0
10	8.0	21.0	10.0	13.0	7.0

(cm)  
 Average snow depth = 11.8  
 Maximum snow depth = 25.0  
 Minimum snow depth = 6.0  
 Standard variation = 3.8

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
DW4-1	10.16	99.0	362.7	0.27
DW4-2	19.69	188.0	702.9	0.27
DW4-3	16.51	180.0	589.4	0.31
DW4-4	17.78	182.0	634.7	0.29
DW4-5	20.32	164.0	725.4	0.23

Average Density = 0.27  
 Average Snow Water Equivalent (SWE) = 3.2 cm H2O  
 Average Snow Water Equivalent = 1.26 inches H2O  
 Average Snow Water Equivalent = 0.11 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: Mine Site B  
 Survey Purpose: Snow Depth and Water Content Date: 1/6/2006 Time: 16:00

Location Description:	Located at center of north cell near MSBN-CT. "L" shaped pattern, first going west 1 meter for 25 meters and then south 1 meter for 25 meters.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather	Dark. Visibility unrestricted
Latitude:	N70°10.751'		Longitude:	W149°46.297'	
Elevation:		Elevation Datum:		Reference Markers:	Center of north cell
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 <sup>2</sup>			Jeff Derry, Horacio Toniolo	

Snow Course Depths, in cm.

	1	2	3	4	5
1	8	8	7	6	8
2	8	8	7	9	9
3	9	8	7	9	10
4	8	7	7	7	9
5	9	7	8	7	8
6	10	7	8	8	9
7	10	8	7	8	11
8	8	9	8	8	12
9	7	8	7	8	12
10	8	7	6	7	13

(cm)  
 Average snow depth = 8.2  
 Maximum snow depth = 13.0  
 Minimum snow depth = 6.0  
 Standard variation = 1.5

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
DW4-1	17.78	157.0	634.7	0.25
DW4-2	15.24	176.0	544.1	0.32
DW4-3	17.78	152.0	634.7	0.24
DW4-4	25.40	245.0	906.8	0.27
DW4-5	10.16	72.0	362.7	0.20

Average Density = 0.26  
 Average Snow Water Equivalent (SWE) = 2.1 cm H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.83 inches H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.07 feet H<sub>2</sub>O

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: K113  
 Survey Purpose: Snow Depth and Water Content Date: 1/14/2006 Time: 13:00

Location Description:	Located on lake beginning at lathe "K113-SH". Went 20' south to undisturbed area, did "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	Calm. Visibility
				Observations:	unrestricted. -10 at 5mph
Latitude:	N70°19.250'		Longitude:	W149°19.183'	
Elevation:		Elevation Datum:		Reference Markers:	Center of north cell
Drainage Basin:	K113	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 <sup>2</sup>			Jeff Derry, Chad Cormack	

Snow Course Depths, in cm.

	1	2	3	4	5
1	15	16	8	15	14
2	11	15	9	13	7
3	10	14	11	14	9
4	12	13	7	15	8
5	11	10	8	15	8
6	11	9	8	19	7
7	11	8	10	20	10
8	12	7	12	19	10
9	12	6	13	14	11
10	15	7	13	15	10

(cm)  
 Average snow depth = 11.5  
 Maximum snow depth = 20.0  
 Minimum snow depth = 6.0  
 Standard variation = 3.4

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
SWE 1	9.50	81.0	339.2	0.24
SWE 2	12.50	135.0	446.3	0.30
SWE 3	35.00	570.0	1249.5	0.46
SWE 4	18.00	236.0	642.6	0.37
SWE 5	22.50	345.0	803.3	0.43

Average Density = 0.36  
 Average Snow Water Equivalent (SWE) = 4.1 cm H2O  
 Average Snow Water Equivalent = 1.63 inches H2O  
 Average Snow Water Equivalent = 0.14 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: K113  
 Survey Purpose: Snow Depth and Water Content Date: 1/14/2006 Time: 13:45

Location Description:	Located on lake beginning at lathe "K113-CT", headed for drill tower in distance. Went 20' south to undisturbed area did "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	Calm. Visibility
				Observations:	unrestricted. -10 at 5mph
Latitude:	N70°19.9.648'		Longitude:	W149°30.578'	
Elevation:		Elevation Datum:		Reference Markers:	Center of north cell
Drainage Basin:	K113	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 <sup>2</sup>			Jeff Derry, Chad Cormack	

Snow Course Depths, in cm.

	1	2	3	4	5
1	6	8	7	9	10
2	12	7	5	6	26
3	23	10	6	5	29
4	35	15	9	2	11
5	40	13	10	0.5	7
6	50	13	8	1	2
7	47	12	9	2	6
8	41	10	19	0.5	6
9	31	7	24	9	5
10	15	5	13	6	5

(cm)  
 Average snow depth = 13.2  
 Maximum snow depth = 50.0  
 Minimum snow depth = 0.5  
 Standard variation = 12.2

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
SWE 1	9.50	81.0	339.2	0.24
SWE 2	12.50	135.0	446.3	0.30
SWE 3	35.00	570.0	1249.5	0.46
SWE 4	18.00	236.0	642.6	0.37
SWE 5	22.50	345.0	803.3	0.43

Average Density = 0.36  
 Average Snow Water Equivalent (SWE) = 4.7 cm H2O  
 Average Snow Water Equivalent = 1.86 inches H2O  
 Average Snow Water Equivalent = 0.15 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: K113  
 Survey Purpose: Snow Depth and Water Content Date: 1/14/2006 Time: 14:15

Location Description:	Located on tundra west of lake. Did "L" shaped pattern, first going west 1 meter for 25 meters and then south 1 meter for 25 meters.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather	Dark. Visibility unrestricted. Observations: -10 at 5mph
Latitude:	N 70° 19.059'		Longitude:	W 149° 19.866'	
Elevation:		Elevation Datum:		Reference Markers:	Center of north cell
Drainage Basin:	K113	Slope Direction:	East	Vegetation Type:	Tussic
Slope Angle:	2-3 degrees	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 <sup>2</sup>			Jeff Derry, Chad Cormack	

Snow Course Depths, in cm.

	1	2	3	4	5
1	22	21	33	17	15
2	22	15	22	16	25
3	17	31	20	16	15
4	25	34	15	20	30
5	28	19	21	22	31
6	20	20	19	20	17
7	20	11	15	13	17
8	22	8	18	20	31
9	16	24	16	21	29
10	18	35	16	25	18

(cm)  
 Average snow depth = 20.8  
 Maximum snow depth = 35.0  
 Minimum snow depth = 8.0  
 Standard variation = 6.1

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
SWE 1	22.86	262.0	816.1	0.32
SWE 2	19.30	114.0	689.2	0.17
SWE 3	30.48	270.0	1088.1	0.25
SWE 4	29.46	316.0	1051.9	0.30
SWE 5	17.78	104.0	634.7	0.16

Average Density = 0.24  
 Average Snow Water Equivalent (SWE) = 5.0 cm H<sub>2</sub>O  
 Average Snow Water Equivalent = 1.97 inches H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.16 feet H<sub>2</sub>O

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



L9312: Snow depth transects:

Project ID:	North Slope Lakes Project	Site Location/Lake ID:	K113
Survey Purpose:	Spatial Distribution of Snow	Date:	1/14/2007 Time: 13:30
Location Description:	Transect runs NE from K113-RG (N70°18.988', W149°20.241') to the Spine Road beyond VSM 644 (N70°19.22', W149°18.816' NAD83). Increment length is approximated by pacing 6 strides per 20 feet. K113-RG is on top of a ridge on the west shore of K113, terrain quickly drops down onto flat tundra. The tundra near VSM 644 is flat.		
Survey objective:	Snow depths and snow-water content for lake recharge estimates	Weather Observations:	Visibility unrestricted.
Elevation:	8' approximately BPMSL	Reference Markers:	Lathe and Pumphouse
Drainage Basin:	L9312	Vegetation Type:	snow depth on ice surface and tundra

K113 TRANSECT

increment (ft)	depth (cm)	Comments	increment (ft)	depth (cm)	Comments	increment (ft)	depth (cm)	Comments	increment (ft)	depth (cm)	Comments
0	15	Tundra	1200	22		2400	5		3600	43	
20	15	5% grade	1220	56		2420	37		3620	45	
40	15		1240	23		2440	25		3640	36	
60	8		1260	14		2460	16		3660	17	
80	9		1280	16		2480	5		3680	60	
100	12		1300	15		2500	9		3700	41	
120	15		1320	15		2520	4		3720	21	
140	10		1340	16		2540	1		3740	44	
160	15		1360	18		2560	11		3760	19	
180	16		1380	15		2580	2		3780	5	VSM 645/644
200	17		1400	15		2600	6		3800	26	
220	28		1420	15		2620	3	Center of lake	3820	39	Spine road
240	30		1440	17		2640	0				
260	29		1460	18		2660	2				
280	21		1480	15		2680	10				
300	18		1500	17		2700	7				
320	22		1520	16		2720	4				
340	36		1540	13		2740	5				
360	18		1560	14		2760	6				
380	15	1% grade	1580	13		2780	1				
400	8		1600	16		2800	4				
420	20		1620	14		2820	3				
440	14		1640	14		2840	16				
460	21		1660	15		2860	6				
480	23		1680	29	Tundra/lake	2880	7				
500	16		1700	16		2900	11				
520	42		1720	8		2920	6				
540	20		1740	3		2940	11				
560	21		1760	10		2960	3				
580	15		1780	6		2980	0				
600	16		1800	4		3000	0				
620	18		1820	5		3020	4				
640	15		1840	6		3040	3				
660	15		1860	7		3060	1				
680	15		1880	17		3080	3				
700	16		1900	10		3100	6				
720	16	Flat	1920	6		3120	6				
740	11		1940	6		3140	18				
760	15		1960	28		3160	13				
780	27		1980	7		3180	2				
800	44		2000	5		3200	3				
820	35		2020	3		3220	3				
840	38		2040	3		3240	3				
860	26		2060	16		3260	5				
880	25		2080	7		3280	22				
900	20		2100	7		3300	25				
920	16		2120	4		3320	7				
940	14		2140	2		3340	6				
960	15		2160	2		3360	7				
980	36		2180	7		3380	4				
1000	8		2200	3		3400	5				
1020	14		2220	1		3420	37				
1040	34		2240	3		3440	44				
1060	13		2260	11		3460	18				
1080	26		2280	20		3480	20				
1100	57		2300	6		3500	20				
1120	20		2320	7		3520	18				
1140	16		2340	12		3540	19				
1160	14		2360	8		3560	36				
1180	9		2380	5		3580	27	Lake/Tundra			

**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-RAFTB  
 Survey Purpose: Snow Depth and Water Content Date: 1/9/2007 Time: 10:00

Location Description:	Did "L" shape near Raft B, started at North and went West 25 x 25 ft for 1ft increments				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather Observations:	Overcast
Latitude:	N70°19.995'	Longitude:	W150°56.918'	Datum:	NAD83
Elevation:	100' aproximately	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 <sup>2</sup>			Dan White and Sally Rothwell	

Snow Course Depths, in cm.

	1	2	3	4	5
1	8	9.5	9	11	10.5
2	8.5	9	11	11	10
3	9	10	13	11.25	9.5
4	10	9.5	12	12	8.5
5	10	8.5	11	12.75	8.5
6	11	7.75	11	12	8
7	11	7	10.25	11.5	7
8	11.5	6.5	10	10.5	7
9	11	7	10	10.75	7
10	10	7.75	10.5	10	6

(cm)  
 Average snow depth = 9.7  
 Maximum snow depth = 13.0  
 Minimum snow depth = 6.0  
 Standard variation = 1.7

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
SWE1	10.16	78.0	362.7	0.22
SWE2	9.652	57.0	344.6	0.17
SWE3	9.5	99.0	339.2	0.29
SWE4	10	77.0	357.0	0.22
SWE5	7	53.0	249.9	0.21

Average Density = 0.22 gr/cm<sup>3</sup>  
 Average Snow Water Equivalent (SWE) = 2.1 cm H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.84 inches H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.07 feet H<sub>2</sub>O

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-LAKE  
 Survey Purpose: Snow Depth and Water Content Date: 1/9/2006 Time: 10:00

Location Description:	On lake surface, near raft mid-point. 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:		Overcast
Latitude:	N70°19.995'	Longitude:	W150°56.918'	Datum:	NAD83
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 <sup>2</sup>			Mike Lilly	

Snow Course Depths, in cm.

	1	2	3	4	5
1	11	8	9	11	8
2	10	10	8	14	7
3	11	12	9	20	7
4	9	14	7	17	9
5	11	14	11	12	7
6	8	14	11	11	8
7	10	12	11	11	15
8	13	12	9	11	10
9	12	8	9	9	9
10	10	9	11	8	9

(cm)  
 Average snow depth = 10.5  
 Maximum snow depth = 20.0  
 Minimum snow depth = 7.0  
 Standard variation = 2.6

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
SWE1	9	66	321.3	0.21
SWE2	11	89	392.7	0.23
SWE3	9	65	321.3	0.20
SWE4	9	83	321.3	0.26
SWE5	10	89	357.0	0.25

Average Density = 0.23 gr/cm<sup>3</sup>  
 Average Snow Water Equivalent (SWE) = 2.4 cm H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.95 inches H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.08 feet H<sub>2</sub>O

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-BELFORD  
 Survey Purpose: Snow Depth and Water Content Date: 1/9/2007 Time: 14:30:00 AM

Location Description:	Did "L" shape, started at lake between belford gauge and snow sensor. 25 x 25 meters at 1 meter increments. Went North, then West.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates		Weather Observations:		overcast
Latitude:	N 70°19.9444'	Longitude:	W 150° 57.047'	Datum:	NAD83
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 <sup>2</sup>			Jeff Derry, Chad Cormack	

Snow Course Depths, in cm.

	1	2	3	4	5
1	14	34	14	33	35.5
2	16	25	23	17	24
3	14	20	27	23	28
4	21	18	26	19	44
5	30	26	24	18	40.5
6	28	32.5	17	25	36
7	26	31	13	32.5	22
8	29	23	16.5	36	19
9	29	28	21	40	22
10	29	18.5	17	34	37

(cm)  
 Average snow depth = 25.5  
 Maximum snow depth = 44.0  
 Minimum snow depth = 13.0  
 Standard variation = 7.8

**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-SNO1  
 Survey Purpose: Snow Depth and Water Content Date: 1/9/2007 Time: 2:00:00 PM

Location Description:	Did "L" shape, started at orange pole at southerly end of lake on tundra, went 25 m to orange pole, turned, and 25m to other pole.				
Survey objective:	Snow depths and snow-water content for lake recharge estimates			Weather Observations:	overcast
Latitude:	N 70°19.9444'	Longitude:	W 150° 57.047'	Datum:	NAD83
Elevation:	100' approximately	Elevation Datum:	BPMSL	Reference Markers:	Site marked with GPS
Drainage Basin:	L9312	Slope Direction:	flat	Vegetation Type:	snow depth on ice surface
Slope Angle:	Flat	Access Notes:		Other:	1 meter increments
Snow Depth Probe Type:	T-handle snow depth probe,			Snow-Survey Team Names Sally Rothwell and Matthew Whitman	
Snow Tube Type:	Adirondak, 6.74 cm diameter cutter, area = 35.7 cm <sup>2</sup>				

Snow Course Depths, in cm.

	1	2	3	4	5
1	36	20	22	15	20
2	36	25	26	20	29
3	34	23	22	17	42
4	33.0	22	21	20	27
5	33.5	20	20	22	30
6	33	18	20	22	31
7	14	26	47	25	24
8	23	25	23	25	35
9	42	26	23	21	21
10	35	21	22	22	22

(cm)  
 Average snow depth = 25.6  
 Maximum snow depth = 47.0  
 Minimum snow depth = 14.0  
 Standard variation = 7.2

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
SWE1	21	211.0	749.7	0.28
SWE2	11	85.0	392.7	0.22
SWE3	23	164.0	821.1	0.20
SWE4	14	61.0	499.8	0.12
SWE5	29	393.0	1035.3	0.38

Average Density = 0.24 gr/cm<sup>3</sup>  
 Average Snow Water Equivalent (SWE) = 6.1 cm H<sub>2</sub>O  
 Average Snow Water Equivalent = 2.42 inches H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.20 feet H<sub>2</sub>O

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  
 Survey Purpose: Snow Depth and Water Content Date: 1/10/2007 Time: 13:00

Location Description:	East side of lake done on tundra. 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, visibility unrestricted. Minus 29F @ 10 mph	
Latitude:	N 70° 16.832	Longitude:	W 148° 53.856	Datum:	NAD83 Alaska
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 <sup>2</sup>			Sally Rothwell and Matthew Whitman	

Snow Course Depths, in cm.

	1	2	3	4	5
1	25	28	28	28	30
2	26	26	25	27	29
3	23	33	35	30	29
4	26	31	34	27	25
5	20	33	30	26	36
6	30	18	32	22	35
7	26	28	29	30	29
8	28	35	27	27	31
9	27	33	25	34	32
10	23	31	27	27	39

(cm)  
 Average snow depth = 28.7  
 Maximum snow depth = 39.0  
 Minimum snow depth = 18.0  
 Standard variation = 4.2

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
SWE1	15	91	535.5	0.17
SWE2	19	211	678.3	0.31
SWE3	18	119	642.6	0.19
SWE4	35	213	1249.5	0.17
SWE5	17	92	606.9	0.15

Average Density = 0.20 gr/cm<sup>3</sup>  
 Average Snow Water Equivalent (SWE) = 5.7 cm H<sub>2</sub>O  
 Average Snow Water Equivalent = 2.23 inches H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.19 feet H<sub>2</sub>O

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  
 Survey Purpose: Snow Depth and Water Content Date: 1/10/2007 Time: 12:30

Location Description:	Conducted on lake. L-shaped, 25 m by 25 m. Measurements took every 1 meter.				
Survey objective:	Snow depths and snow-water content for comparison with lake snow survey	Weather Observations:	Unrestricted		
Latitude:	N 70° 16.832	Longitude:	W 148° 53.856	Datum:	NAD83 Alaska
Elevation:		Elevation Datum:		Reference Markers:	Lathe # 1 on lake
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 <sup>2</sup>			Matt Whitman, Sally Rothwell	

Snow Course Depths, in cm.

	1	2	3	4	5
1	7	10	10	14	14
2	15	9	9	12	13
3	14	8	9	10	12
4	12	9	8	8	11
5	12	11	9	11	9
6	11	10	15	10	9
7	10	10	13	12	10
8	13	10	14	14	10
9	14	9	15	14	11
10	11	9	15	15	nr

(cm)  
 Average snow depth = 11.2  
 Maximum snow depth = 15.0  
 Minimum snow depth = 7.0  
 Standard variation = 2.3

Snow Sample Depths and Weights

Bag #	Depth (cm)	Weight (gr)	Volume (cm <sup>3</sup> )	Density (gr/cm <sup>3</sup> )
DW3-1	10	72.0	357.0	0.20
DW3-2	10	90.0	357.0	0.25
DW3-3	8	60.0	285.6	0.21
DW3-4	11	74.0	392.7	0.19
DW3-5	14	137.0	499.8	0.27

Average Density = 0.23  
 Average Snow Water Equivalent (SWE) = 2.5 cm H<sub>2</sub>O  
 Average Snow Water Equivalent = 1.00 inches H<sub>2</sub>O  
 Average Snow Water Equivalent = 0.08 feet H<sub>2</sub>O

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