

# **SURVEY OF LAKES IN CPAI ACTIVITY AREAS – 2013**

**Final Report**

**September 2013**



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**Prepared for:**

**ConocoPhillips Alaska, Inc.  
700 G Street  
Anchorage, AK**

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**TABLE OF CONTENTS**

INTRODUCTION..... 1

METHODS ..... 2

RESULTS AND DISCUSSION .....5

    Biological Observations .....5

    Water Chemistry Measurements .....5

    Evaluation of Fish Concerns .....5

LITERATURE CITED .....7

LAKE SUMMARIES .....2-1

## LIST OF TABLES

Table 1. Summary of lakes sampled during 2013 to support activities in CPAI projects. ....	8
Table 2. Catches of fish from lakes sampled during 2013 to support activities in CPAI projects. .....	9
Table 3. Water chemistry parameters measured in conjunction with lake sampling during 2013 to support activities in CPAI projects. ....	10
Table 4. Recommended maximum water volumes available for under-ice withdrawal from surveyed lakes during 2013 to support activities in CPAI projects. ....	11
Table 5. Estimated area available for removing ice aggregate, based on the area covered by water shallower than 4 feet, to support activities in CPAI projects. ....	12

## LIST OF FIGURES

Figure 1. Lakes surveyed in eastern NPRA during 2013 as potential water sources to support CPAI activities. ....	13
Figure 2. Lakes surveyed in the southwest Kuparuk area during 2013 as potential water sources to support the Sharktooth project. ....	14

## Index to Lake Summaries

<u>Lake</u>	<u>Page</u>
L9309 .....	2-2
L9341.....	2-7
M0353 .....	2-11
L9820.....	2-16
L9826 .....	2-19
L9832.....	2-24
M9915 .....	2-27
M9916.....	2-32
M9925 .....	2-37
M1301 .....	2-42
MB0401.....	2-47
R0062.....	2-52
R0070 .....	2-57
K108 .....	2-62
K109 .....	2-67
K212 .....	2-72

## INTRODUCTION

This 2013 lake survey sampled 16 lakes for potential use as water sources during winter in three areas of activity:

1. along the proposed CD5 road,
2. winter exploration in the CD7 region, and
3. winter exploration in the Sharktooth area. (Table 1).

Goals of this study were to conduct surveys of selected lakes to estimate the volume of water available for use, and to document fish presence and habitat use in lakes for lakes that may be used to support exploration activities.

Objectives of the survey were to:

- 1) obtain lake bathymetry and estimate water volumes for selected lakes,
- 2) identify fish species present in selected lakes within the project study area, and
- 3) measure water chemistry parameters to assess suitability of water for potential uses.

The selected lakes may be used as sources of freshwater during oil exploration and development for ice road and ice pad construction, as well as for short-term potable water supplies. Permitting decisions on water withdrawal will need to consider potential impacts to fish that depend on an adequate water supply for surviving winter. The inventory of fish and fish habitat provides information for assisting permitting decisions regarding water use and ice road routing.

## METHODS

The biological survey consisted of sampling with:

- gill nets for sensitive species,
- minnow traps,
- 20 ft beach seine, and
- visual survey (with dip net) for resistant species.

Lakes were sampled with short-duration gill net sets (typically 7 to 9 hours of total soak time). The gill nets are multimesh, 120 feet long, with six panels of variable mesh, mesh size ranging from 1 to 3.5 inches stretched mesh. These nets have been previously used to collect inventory-level data from lakes throughout the North Slope for similar surveys. Sets were kept to a short duration to minimize the chance for entangling waterfowl and to minimize fish mortality. Since the objective of the gill netting is to document presence/absence, the nets were placed in habitats expected to be used by fish for feeding or moving between feeding areas, and were pulled after fish were detected. Fish captured were measured and released. Duration of each set was recorded to allow calculation of catch rates. At some lakes, gill nets are not set if the lake is judged to be too shallow or remote from a stream system to support sensitive species. This decision is often based on results from a nearby lake with similar depth and connectivity characteristics. For this survey, gill nets were not set in 9 of the evaluated lakes (Table 2).

Minnow traps were used to identify smaller fish species that may not be detected by gill nets. Minnow traps baited with preserved salmon eggs were set in at the edge of surveyed lakes in areas expected to provide cover or feeding areas for ninespine stickleback. The traps were set and retrieved in concert with the gill net sampling.

When conditions were appropriate, a visual survey supplemented with dip net sampling was conducted. Ninespine stickleback are often observed in shallow water along the lake shore and because of their affinity for nearshore vegetation, they are vulnerable to hand-held dip nets. During the visual survey, frequent sweeps through vegetated areas are made with a small mesh dip net. The length of the visual/dip net survey was measured with a handheld GPS. If stickleback were observed, minnow traps and seines were not used.

Water chemistry parameters were measured to assess habitat conditions and provide information on the suitability of the water for domestic and industrial uses. Water chemistry measurements included surface measures of water temperature, specific conductance, dissolved oxygen, pH, and turbidity. Temperature, specific conductance and dissolved oxygen were *in situ* surface measurements taken along the edge of each lake with a YSI Model 30 meter. A sample was returned to the field office to measure pH and turbidity. PH was measured with an Oaktron Acorn Series pH5 meter. Turbidity was measured with a Lamotte 2020 turbidity meter. A water sample was sent to Pollen Environmental for laboratory determination of chloride, sodium, calcium, magnesium, and hardness (as CaCO<sub>3</sub>), except for 4 lakes where there were insufficient sample bottles

(Table 3).

Bathymetric data obtained during the survey allowed lake volume to be estimated. Location and depth were recorded on a Lowrance Model LCX-15MT integrated GPS/depth sounder. Location and depth were recorded at approximately 1-2 second intervals. The study design was to record at least eight depth transects on each lake. Lake volume was estimated by contour mapping of depth intervals. Contour maps were prepared by plotting the position and depth data obtained by GPS on GIS basemaps and plotting the contours in 1 ft intervals on maps of the surveyed lakes. One foot intervals were plotted for lakes where the maximum depth was 10 ft or less, two foot intervals were used on deeper lakes. The surface area of each contour was obtained, then the volume was estimated using the formula for truncated cones:

$$V = h/3*(A1+A2+(A1*A2) (1/2))$$

Where h = vertical depth of the stratum, A1 = area of the upper surface, and A2 = area of the lower surface of the stratum whose volume is to be determined. The volumes of individual strata are summed to obtain the volume of the desired depth intervals.

The amount allowed for winter water withdrawal when sensitive fish species are present is currently set at 15% of the volume of the lake deeper than 7 feet. When resistant fish species (i.e. ninespine stickleback and Alaska blackfish) are present, the current allocation allowed by Alaska Dept. of Natural Resources is 30% of the volume deeper than 5 feet. In 2007, Alaska Department of Natural Resources initiated a limit of 20% of the total lake volume if fish are not present. This amount may or may not be present at the time of withdrawal, depending on ice thickness at the time water is needed.

The area potentially available for ice aggregate was estimated by calculating the area of the lake shallower than 4 feet, assuming that the ice would grow to at least 4 feet prior to the need for aggregate. If the ice is shallower than 4 feet at the time of ice removal, then the area available will be less.

Estimating the gallons available as ice chips is as follows:

- 1) the area of the 4 foot contour is subtracted from the lake outline (0 ft contour) to provide the acreage less than 4 ft deep
- 2) the upper one foot of the acreage less than 4 ft deep is converted to cubic yards,
- 3) the cubic yards are reduced by 9% to account for ice expansion as the water freezes,
- 4) the remaining volume is multiplied by 202 gals per cubic yard to arrive at the final estimate of gallons available for use.

## **Lake Summaries**

This report uses lake numbering based on a researcher/year code. The lake number contains several pieces of information, including the code of the sampler and the year of sampling.



Sampler Code:

MC = McElderry and Craig (1981); fish sampling in 1979  
B = Bendoek fish sampling from 1977-1986  
L = Lobdell; water chemistry sampling in 1991-1999  
M = Moulton; fish sampling in 1995-2006  
MB = Michael Baker Jr., Inc. water chemistry sampling in 2002-2004  
N = Netsch et al. (1977) NPRA fish sampling in 1977  
R = Reanier depth sampling in 2000-2007

First Two Numerals:

Year of Initial Sampling  
(if Moulton sampled a lake previously sampled by McElderry and Craig, then the McElderry and Craig lake number is used)

Last Two Numerals:

Numbers from 1 to 99 used to identify the individual lake sampled within a given year

Information contained for each surveyed lake (if measured) includes:

1. A diagram of the lake bathymetry,
2. Other names utilized for the same lake,
3. Lake location, in latitude/longitude,
4. The USGS quadrangle sheet and the township and range in which the lake is situated
5. Surface area in acres, obtained from USGS digital maps,
6. Maximum depth in feet,
7. Presence or absence of an outlet,
8. Calculated total lake volume
9. Water volume under 4 feet of ice,
10. Water volume under 5 feet of ice
11. Water volume under 7 feet of ice
12. Acres of potential ice aggregate for road construction,
13. Gallons of water represented by the upper 1 foot of ice available for ice aggregate,
14. Maximum recommended under-ice water withdrawal,
15. Water chemistry measurements,
16. Catch record, including gear used, date sampled, species caught and size range,
17. Where appropriate data exist, the length frequency of dominant species is plotted,
18. Map of fish sampling locations,
19. Map of potential ice aggregate removal areas, and
20. Map showing measured depth transects.

## RESULTS AND DISCUSSION

### Biological Observations

**CD5 Area.** Fish species considered to be sensitive to effects associated with water withdrawal were assumed to be present in lake L9341 because the lake is connected to the Nigliq channel, affording easy access for sensitive species such as broad whitefish and least cisco (Table 2). Ninespine stickleback were detected at the remaining 2 lakes (Lake L9309 and Lake M0353).

**CD7 Area.** Arctic grayling were assumed to be present at lake L9826 because of its proximity to and seasonal connection with the Ublutuoch River. The remaining 9 lakes were all tundra lakes remote from streams and did not support sensitive fish (Table 2). Six of these lakes contained ninespine stickleback, however, fish were not detected at one (Lake MB0401) and two (Lake L9820, Lake L9832) were not sampled because they were too shallow (less than 4 ft deep).

**Sharktooth Area.** Three lakes surveyed to support Sharktooth exploration were tundra lakes southwest of the Kuparuk Operations Center. Fish were not detected at two lakes (Lake K108 and Lake K212), while ninespine stickleback were found at K109, the deepest of the three lakes (Table 2).

### Water Chemistry Measurements

Water chemistry parameters measured in the studied lakes are presented Table 3. Surface water temperature during the July 16-August 11 sampling in 2013 averaged 14.9°C, ranging from 12.9°C to 16.9°C. Specific conductance ranged from 79 to 555 microSiemens/cm. The highest specific conductance was measured at Lake R0062, which also had the highest concentrations of calcium, magnesium and chlorides, and the second highest level of sodium.

### Evaluation of Fish Concerns

Information from fish sampling and depth measurements was used to evaluate each lake regarding its potential to support fish. If fish were captured during gill net sampling, the lake was classified as fish-bearing. Gill net sets were relatively short, however, so the absence of catch does not necessarily mean a lake does not support fish. Lakes also were assessed for their proximity to fish-bearing streams and their depth. Lakes deeper than 7 feet are likely to retain unfrozen water during winter, thus have potential to overwinter fish. Deep lakes that are near fish-bearing streams and are likely to have a connection with the stream at some point during the year are classified as potential fish-bearing lakes, and will require additional sampling if further clarification of the designation is desired. Results of the evaluation are included in Table 4.

Lakes in which fish were verified as present are divided into lakes containing species sensitive to habitat changes likely to be associated with water withdrawal and those containing species more resistant to such changes. Species sensitive to impacts of water withdrawal (such as reduced

dissolved oxygen and increased dissolved solids) include lake trout, broad whitefish, least cisco and arctic grayling, while the more resistant species are Alaska blackfish and ninespine stickleback. Alaska blackfish are particularly resistant to low dissolved oxygen and are able to breathe atmospheric oxygen (Armstrong 1994). Residents of the Yukon Delta have reported observing Alaska blackfish oriented along cracks in the ice during winter to use oxygen in ponds that have gone anoxic. Ninespine stickleback can also withstand low dissolved oxygen (Lewis et al. 1972), although not the same extent as Alaska blackfish. Ninespine stickleback, however, can withstand higher levels of dissolved solids, and often frequent brackish nearshore waters during summer.

When sensitive fish are present, the amount of water available during winter is limited to 15% of the volume under 7 feet of ice. The water withdrawal criteria are relaxed when only resistant fish species are present because of the greater tolerance to lower dissolved oxygen and higher concentrations of dissolved solids. In this case, up to 30% of the water volume under 5 feet of ice is allowed for winter withdrawal.

In the CD5 area, the small size of the lakes and presence of fish constrained the available under-ice water to 2.326 million gallons from lakes L9309 and L9341. Lake L0353 was too shallow to provide useful under-ice water.

The ten lakes along the proposed ice road to the CD7 area contained 23.029 million gallons of permittable under-ice water, with the majority (18.509 million gallons) coming from MB0401. Other significant contributors were Lake M1301 (3.002 million gallons) and Lake M9915 (1.183 million gallons).

The three lakes surveyed to support Sharktooth activities show permittable under-ice water volumes totaling 55.448 million gallons because fish were not detected in two of the lakes (Lake K108 and Lake K212). The permittable volumes are deceptive, however, as there is less than 2 million gallons of water under 4 ft of ice in the two lakes combined (see lake packets in data appendix).

The area covered by water less than 4 feet deep, and therefore likely to be suitable for removing ice aggregate, was estimated for each lake (Table 5). Based on the above analysis, the surveyed lakes may provide up to 1,500 acres of ice chips from lakes surveyed for the exploration use, depending on the thickness of ice at the time of need. This area is equivalent to 445.1 million gallons of water in the top 1 foot of ice.

## LITERATURE CITED

- Armstrong, R.H. 1994. Alaska blackfish. ADF&G's Wildlife Notebook Series. Alaska Dept. Fish and Game. Juneau, AK.
- Lewis, D.B., M. Walkey, and H.J.G. Darnall. 1972. Some effects of low oxygen tensions on the distribution of the three-spined stickleback *Gasterosteus aculeatus* L. and the nine-spined stickleback *Pungitius pungitius* (L). J. Fish. Biol. 4: 103-108.

Table 1. Summary of lakes sampled during 2013 to support activities in CPAI projects.

Area	Lake Name	Latitude (NAD83)	Longitude	Umiat Meridian			Surface Area (acres)	Max. Depth (feet)	Lake Volume (mill. gals)	Volume under 5 ft of Ice (mill. gals)	Volume under 7 ft of Ice (mill. gals)
				Town	Range	Section					
<b>CD5</b>											
	L9309	N70.30789	W151.06704	11N	4E	14	4.6	10.7	10.52	3.825	1.588
	L9341	N70.30226	W151.05660	11N	4E	14,23	36.6	14.6	73.02	20.88	7.858
	M0353	N70.30536	W151.16958	11N	4E	1	18.5	4.7	16.67	0.000	0.000
<b>CD7</b>											
	L9820	N70.26528	W151.39721	11N	3E	33,34	321.3	<4	104.71	--	--
	L9826	N70.25860	W151.23729	11N	3E	31	7.3	12.1	14.02	4.420	1.723
	L9832	N70.25227	W151.34202	10N	3E	2,3	241.5	<4	79.70	--	--
				11N	3E	34					
	M9915	N70.20227	W151.76346	10N	1E	24	32.1	7.5	46.17	3.943	0.013
	M9916	N70.19612	W151.74319	10N	2E	19,30	46.0	6.5	41.15	0.036	0.000
	M9925	N70.24747	W151.48285	10N	3E	6	211.7	3.1	95.25	0.000	0.000
				10N	2E						
	M1301	N70.22510	W151.42890	10N	3E	8,16,17	192.9	6.9	198.75	10.01	0.000
	MB0401	N70.19418	W151.61024	10N	2E	22,27	76.7	8.7	92.54	17.98	2.932
	R0062	N70.17761	W151.61566	10N	2E	34	46.6	7.5	40.28	0.221	0.001
	R0070	N70.18723	W151.57044	10N	2E	26,35	116.0	5.3	114.51	0.000	0.000
<b>Sharktooth</b>											
	K108	N70.27703	W149.65792	10N	9E	2	191.3	4.6	189.00	0.000	0.000
				11N	9E	35					
	K109	N70.26336	W149.64304	11N	10E	29	193.8	7.2	234.43	5.898	0.005
	K212	N70.25187	W149.77424	11N	10E	32,33	86.3	6.1	79.40	0.046	0.000

8

Table 2. Catches of fish from lakes sampled during 2013 to support activities in CPAI projects.

Area	Lake Name	Sample Date	Gill Nets		Minnow Traps		Visual Survey	
			Set Duration (hours)	Fish Species <sup>1</sup>	Set Duration (hours)	Fish Species <sup>1</sup>	Distance (yards)	Fish Species <sup>1</sup>
<b>CD5</b>								
	L9309	Jul 16 13	6.3	none	5.9	NSSB	--	--
	L9341	Jul 16 13	sensitive species assumed present				--	--
	M0353	Jul 18 13	--	--	4.1	none	299	NSSB
	(fyke net)	Jul 19-22, 03	98.0	NSSB	--	--	--	--
<b>CD7</b>								
	L9820	Aug 11 13	--	--	--	--	--	--
	L9826	Aug 11 13	grayling assumed present				172	NSSB
	L9832	Aug 11 13	--	--	--	--	--	--
		Jul 19 99	5.2	none	--	--	--	--
	M9915	Jul 17 13	9.4	none	6.0	NSSB	129	none
		Jul 13 99	5.5	none	--	--	--	--
	M9916	Jul 17 13	--	--	4.7	NSSB	154	none
		Jul 13 99	6.3	none	--	--	--	--
	M9925	Aug 11 13	3.0	none	--	--	--	--
		Jul 18 99	6.4	none	--	--	--	--
	(fyke net)	Aug 3-6, 02	92.1	NSSB	--	--	--	--
	M1301	Aug 10 13	--	--	--	--	47	NSSB
	MB0401	Aug 09 13	--	--	5.6	none	158	none
	R0062	Aug 09 13	--	--	3.7	none	143	NSSB
	R0070	Aug 10 13	--	--	5.7	none	38	NSSB
<b>Sharktooth</b>								
	K108	Jul 19 13	9.5	none	13.6	none	892	none
	K109	Aug 08 13	--	--	7.8	none	87	NSSB
	K212	Jul 18 13	9.4	none	14.2	none	304	none

<sup>1</sup>NSSB = ninespine stickleback

Table 3. Water chemistry parameters measured in conjunction with lake sampling during 2013 to support activities in CPAI projects.

Area	Lake	Date	Water Temp (°C)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)
<b>CD5</b>											
	L9309	Jul 16 13	14.8	151	<0.5	7.17	8.4	4.9	12.0	27.8	41.1
	L9341	Jul 16 13	12.9	200	0.9	7.09	13.0	6.1	23.4	5.4	57.4
	M0353	Jul 18 13	15.4	252	<0.5	7.85	29.5	6.4	12.7	40.9	100.0
<b>CD7</b>											
	L9820	Aug 11 13	14.7	246	3.4	7.48	22.5	4.6	6.4	23.5	74.9
	L9826	Aug 11 13	15.0	239	2.9	7.51	13.5	2.8	4.0	12.8	45.2
	L9832	Aug 11 13	15.0	126	<0.5	7.31	24.6	4.4	5.7	13.4	79.4
	M9915	Jul 17 13	15.0	79	0.7	6.64	--	--	--	--	--
	M9916	Jul 17 13	16.9	195	<0.5	7.66	--	--	--	--	--
	M9925	Aug 11 13	14.6	405	2.3	7.85	38.3	6.6	10.7	41.6	123.0
	M1301	Aug 10 13	15.8	248	<0.5	7.60	24.6	3.5	7.2	18.2	76.0
	MB040	Aug 09 13	14.5	104	<0.5	7.11	9.5	2.3	4.9	12.1	33.1
	R0062	Aug 09 13	14.8	555	0.9	7.25	44.0	16.8	21.5	141.0	179.0
	R0070	Aug 10 13	13.7	299	1.6	7.41	28.6	6.8	10.9	55.2	99.6
<b>Sharktooth</b>											
	K108	Jul 19 13	15.0	231	0.7	7.72	--	--	--	--	--
	K109	Aug 08 13	14.6	195	<0.5	7.56	28.7	2.4	4.1	14.6	81.6
	K212	Jul 18 13	15.4	206	0.6	7.75	--	--	--	--	--

Table 4. Recommended maximum water volumes available for under-ice withdrawal from surveyed lakes during 2013 to support activities in CPAI projects.

(requested water based on 15% of winter volume deeper than 7 ft when sensitive species are present, 30% of winter volume deeper than 5 ft when resistant fish are likely to be present, 20% of total lake volume when no fish are present)

Area	Lake	Surface Area (acres)	Max. Depth (feet)	Calculated Volume (mill. gals)	20% of	30% of	15% of	Sensitive Fish Species Present <sup>1</sup>	Resistant Fish Species Present <sup>1</sup>	Recommended
					Total Lake Volume (mill. gals)	Water Under 5 ft of Ice (mill. gals)	Water Under 7 ft of Ice (mill. gals)			Maximum Under-Ice Withdrawal (mill. gals)
<b>CD5</b>										
	L9309	4.6	10.7	10.52	2.104	1.147	0.238	none	NSSB	1.147
	L9341	36.6	14.6	73.02	14.604	6.265	1.179	Yes	--	1.179
	M0353	18.5	4.7	16.67	3.333	0.000	0.000	none	NSSB	0.000
<b>CD7</b>										
	L9820	321.3	<4	104.71	--	--	--	--	--	0.000
	L9826	7.3	12.1	14.02	2.803	1.326	0.258	GRAY	NSSB	0.258
	L9832	241.5	<4	79.70	--	--	--	--	--	0.000
	M9915	32.1	7.5	46.17	9.235	1.183	0.002	none	NSSB	1.183
	M9916	46.0	6.5	41.15	8.229	0.011	0.000	none	NSSB	0.011
	M9925	211.7	3.1	95.25	19.050	0.000	0.000	none	NSSB	0.000
	M1301	192.9	6.9	198.75	39.751	3.002	0.000	none	NSSB	3.002
	MB0401	76.7	8.7	92.54	18.509	5.393	0.440	none	none	18.509
	R0062	46.6	7.5	40.28	8.056	0.066	0.000	none	NSSB	0.066
	R0070	116.0	5.3	114.51	22.902	0.000	0.000	none	NSSB	0.000
<b>Sharktooth</b>										
	K108	191.3	4.6	189.00	37.799	0.000	0.000	none	none	37.799
	K109	193.8	7.2	234.43	46.886	1.770	0.001	none	NSSB	1.770
	K212	86.3	6.1	79.40	15.879	0.014	0.000	none	none	15.879

<sup>1</sup> GRAY = arctic grayling, NSSB = ninespine sticklebacl



Table 5. Estimated area available for removing ice aggregate, based on the area covered by water shallower than 4 feet, to support activities in CPAI projects.

(ice thickness is typically 4 ft by early January)

<b>Area</b>	<b>Lake</b>	<b>Surface Area (acres)</b>	<b>Max. Depth (feet)</b>	<b>Acres covered by Water shallower than 4 feet</b>	<b>Gallons of Water As Chips (mill. gals)</b>
<b>CD5</b>					
	L9309	4.6	10.7	0.54	0.16
	L9341	36.6	14.6	7.79	2.31
	M0353	18.5	4.7	17.24	5.11
<b>CD7</b>					
	L9820	321.3	<4	321.35	95.30
	L9826	7.3	12.1	1.98	0.59
	L9832	241.5	<4	241.53	71.63
	M9915	32.1	7.5	10.44	3.10
	M9916	46.0	6.5	41.36	12.27
	M9925	211.7	3.1	211.74	62.79
	M1301	192.9	6.9	102.49	30.40
	MB0401	76.7	8.7	44.96	13.33
	R0062	46.6	7.5	40.64	12.05
	R0070	116.0	5.3	110.79	32.85
<b>Sharktooth</b>					
	K108	191.3	4.6	184.44	54.70
	K109	193.8	7.2	87.03	25.81
	K212	86.3	6.1	76.58	22.71

(gallons of water available as chips is the water content of the top 1 ft of ice)

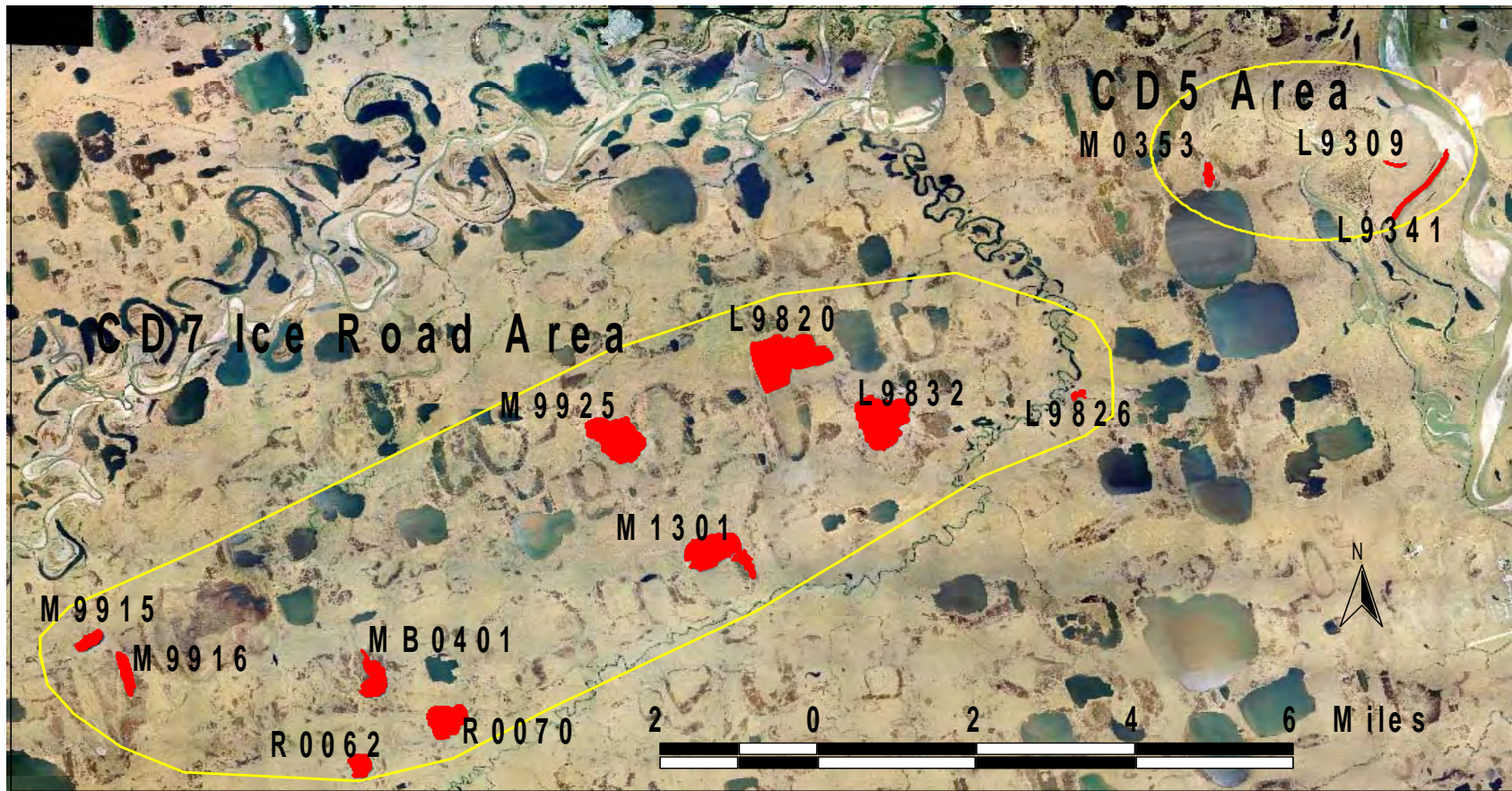


Figure 1. Lakes surveyed in eastern NPRA during 2013 as potential water sources to support CPAI activities.

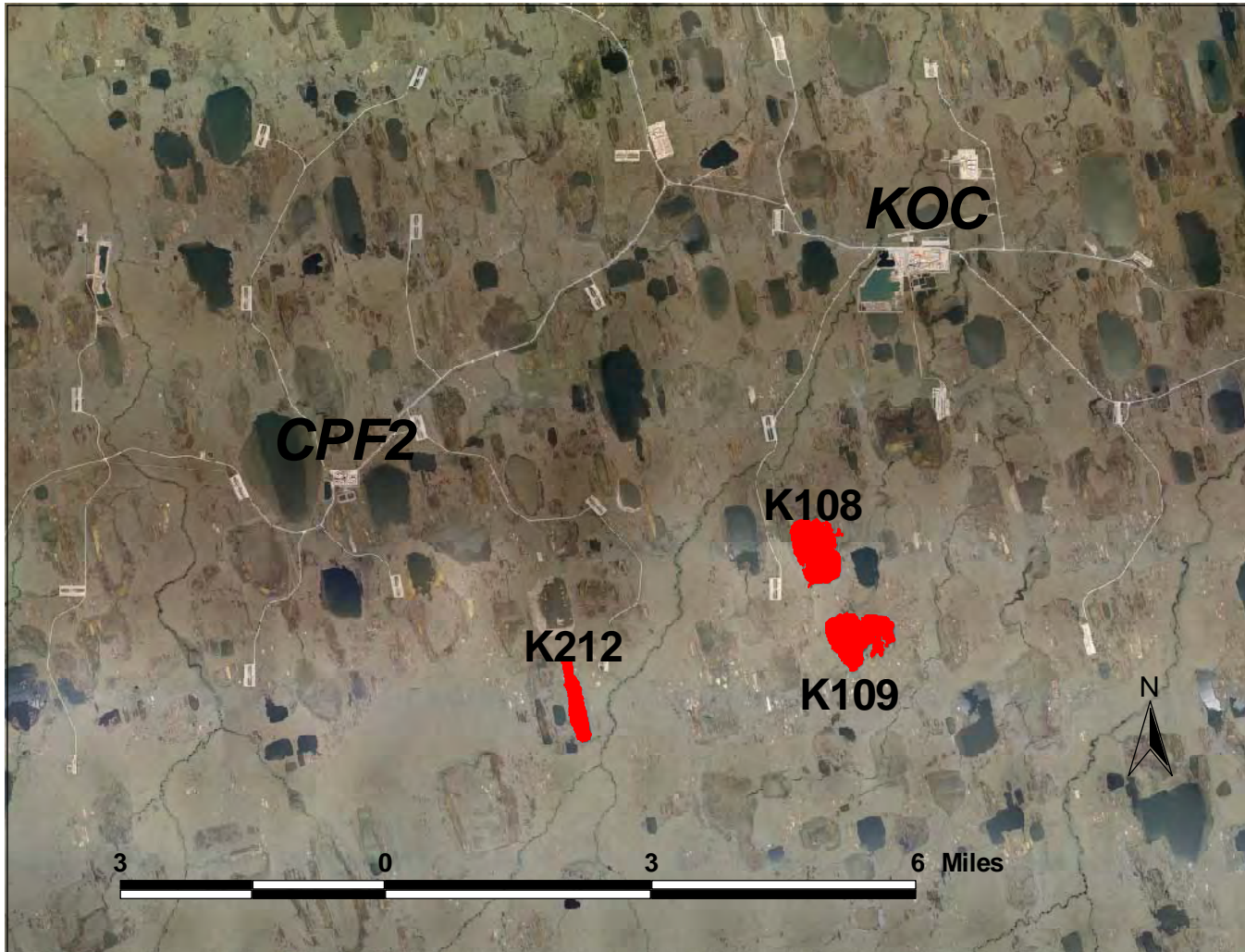
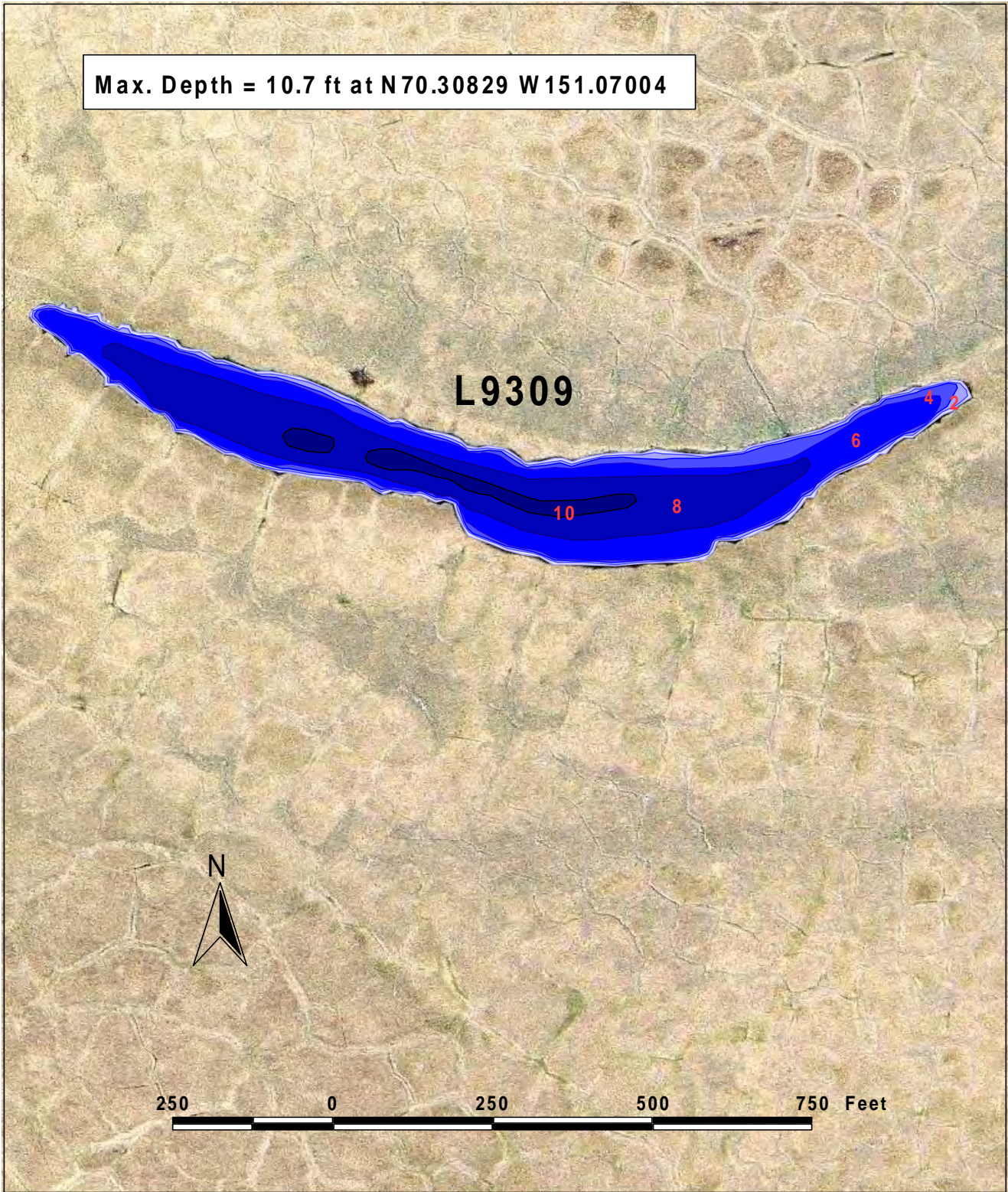


Figure 2. Lakes surveyed in the southwest Kuparuk area during 2013 as potential water sources to support the Sharktooth project.

## **Lake Summaries**



Depth contours at Lake L9309 based on transects surveyed on July 16, 2013.  
(depth in 2 ft intervals)

**Lake L9309**

**Other Names:** None Known  
**Location:** 70.30789°N 151.06704°W  
**USGS Quad Sheet:** Harrison Bay B-2: T11N R4E Sec. 14  
**Habitat:** Perched Lake (infrequent flooding)  
**Area:** 4.6 acres  
**Maximum Depth:** 10.7 feet  
**Active Outlet:** No  
**Total Lake Volume:** 10.5 million gallons (July 16, 2013 data)  
**Volume Under 4 ft of ice:** 5.10 million gallons  
**Volume Under 5 ft of ice:** 3.82 million gallons  
**Volume Under 7 ft of ice:** 1.59 million gallons

**Potential Aggregate:** 0.54 acres (water depth 4 ft or less)  
 0.160 million gallons

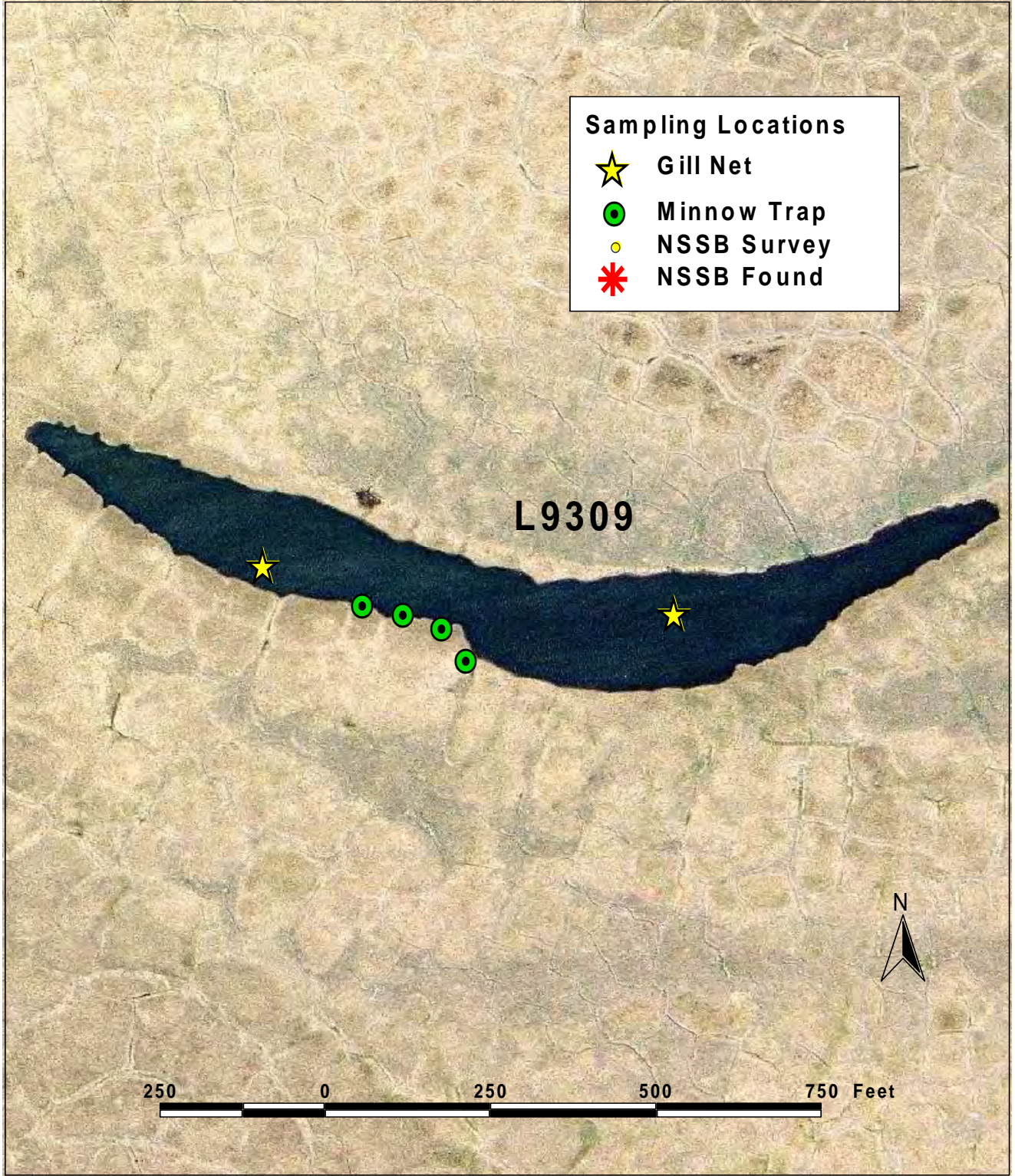
**Maximum Recommended Winter Removal:** **1.147 million gallons**  
 (30% of water volume under 5 feet of ice)  
 (does not include volume associated with ice aggregate)

**Water Chemistry:**

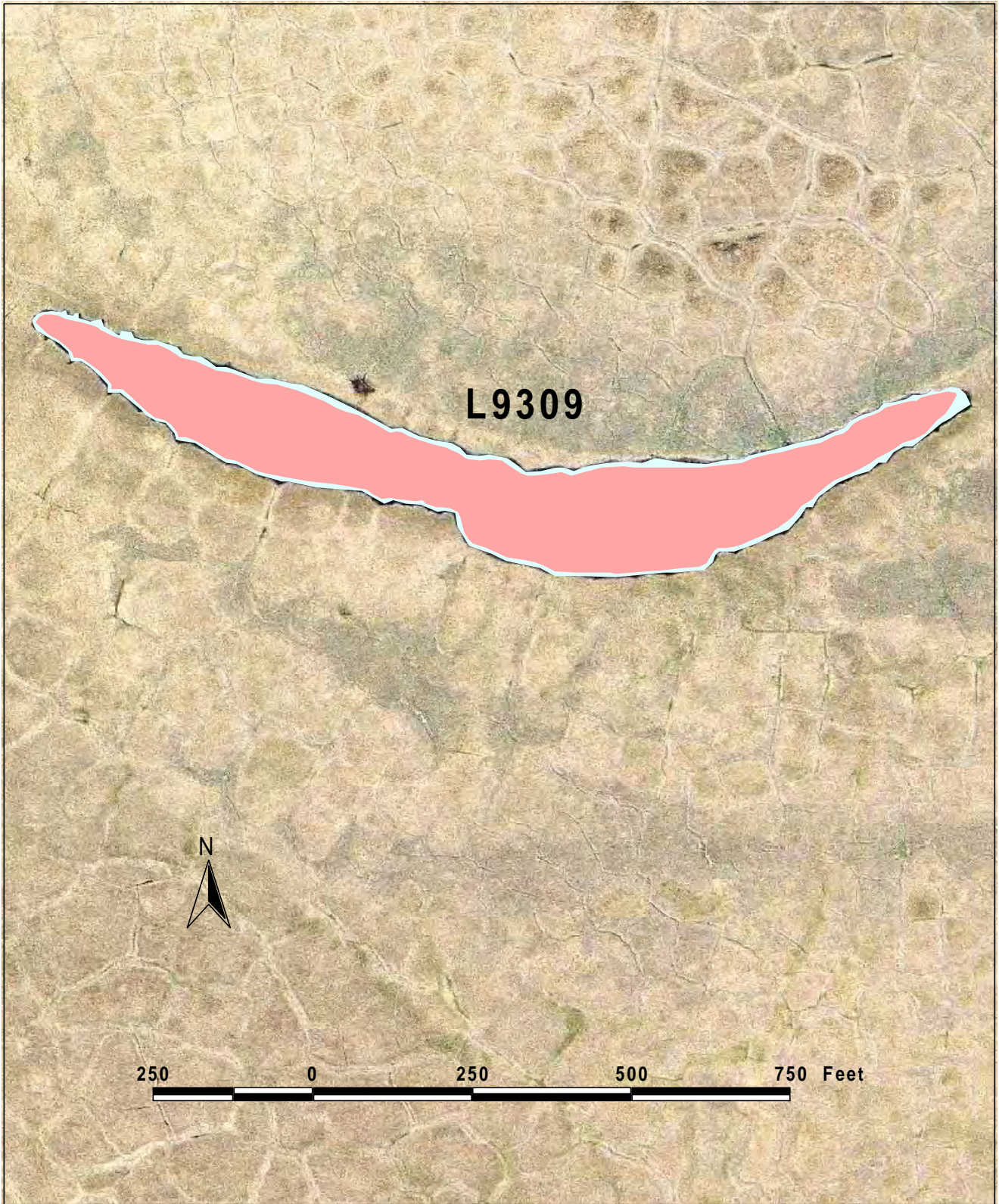
Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2013	8.4	4.9	12.0	27.8	41.1	151	<0.5	7.17	L. Moulton

**Catch Record:**

Gear	Date	Effort (hours)	Species	Number Caught
Gill net	Jul 16 13	6.3	none	0
Minnow Traps	Jul 16 13	5.9	Ninespine stickleback	2

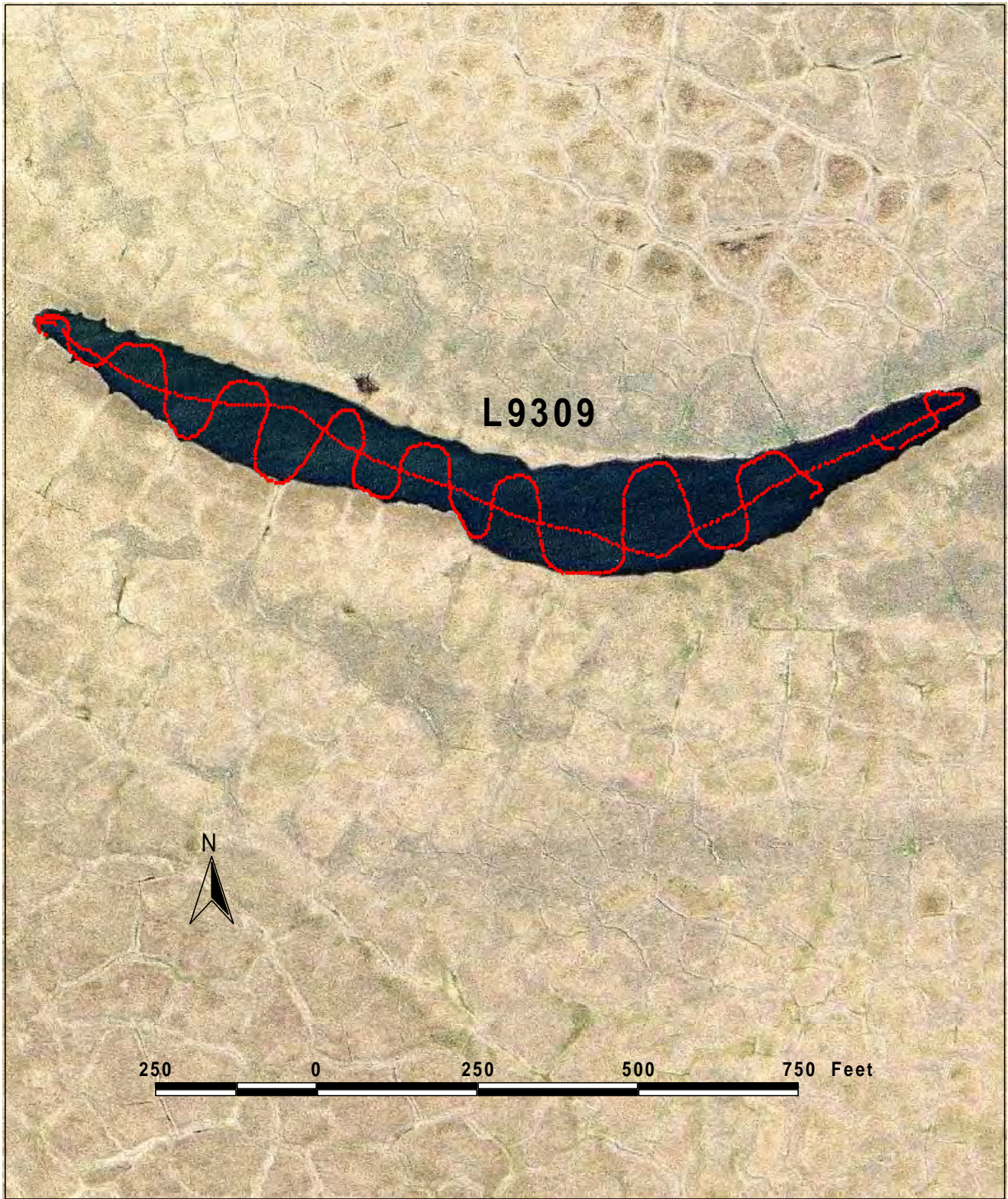


Location of fish sampling effort at Lake L9309 on July 16, 2013.

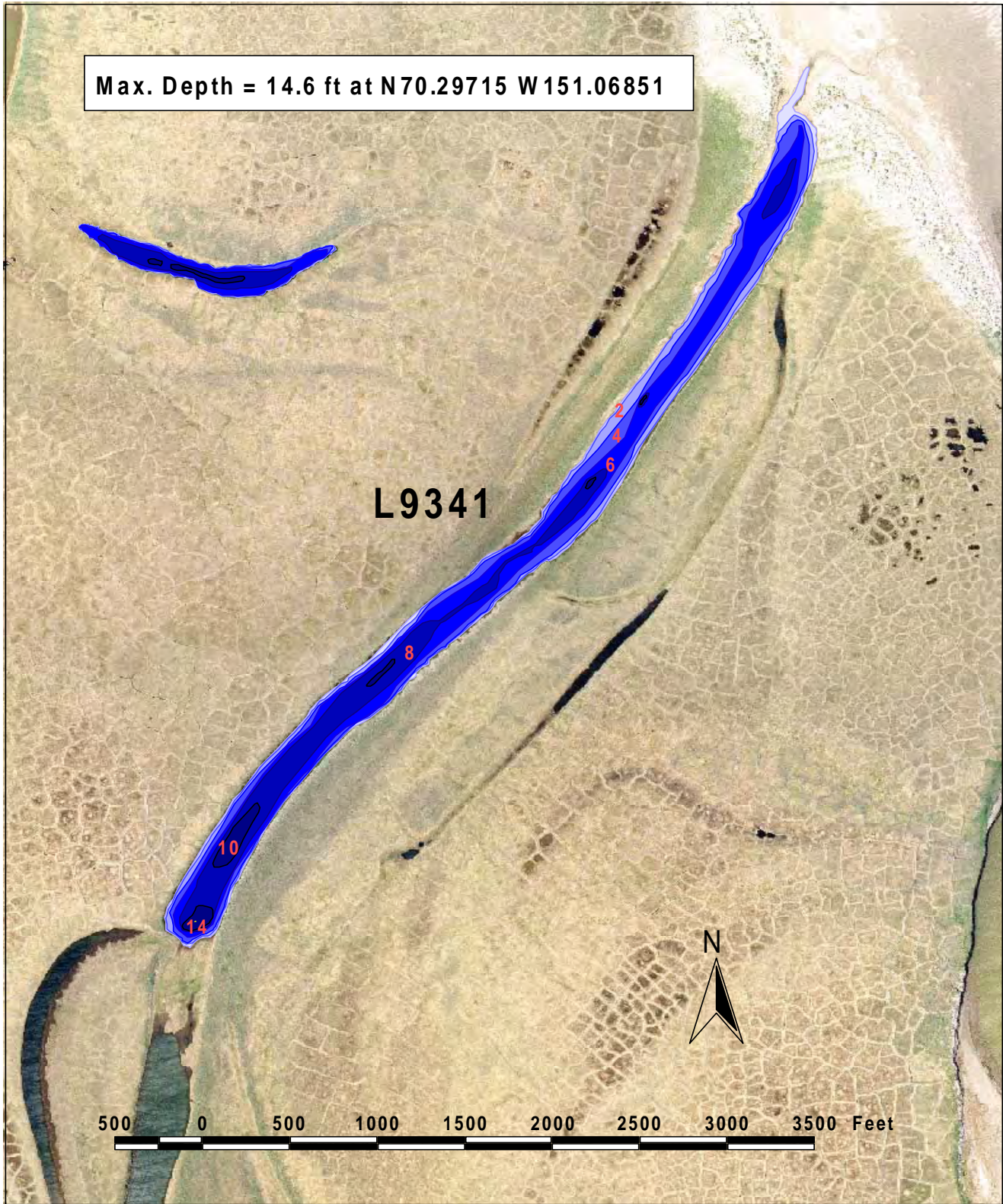


Regions of Lake L9309 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on July 16, 2013.





Depth transects surveyed at Lake L9309 on July 16, 2013.



Depth contours at Lake L9341 based on transects surveyed on July 16, 2013.  
(depth in 2 ft intervals)

**Lake L9341**

**Other Names:** None Known  
**Location:** 70.30226°N 151.05660°W  
**USGS Quad Sheet:** Harrison Bay B-2: T11N R4E Sec. 14,23  
**Habitat:** Oxbow Lake (frequent flooding)  
**Area:** 36.6 acres  
**Maximum Depth:** 14.6 feet  
**Active Outlet:** No  
**Total Lake Volume:** 73.0 million gallons (July 16, 2013 data)  
**Volume Under 4 ft of ice:** 29.6 million gallons  
**Volume Under 5 ft of ice:** 20.9 million gallons  
**Volume Under 7 ft of ice:** 7.9 million gallons

**Potential Aggregate:** 7.8 acres (water depth 4 ft or less)  
 2.311 million gallons

**Maximum Recommended Winter Removal:** **1.179 million gallons**  
 (15% of water volume under 7 feet of ice)  
 (does not include volume associated with ice aggregate)

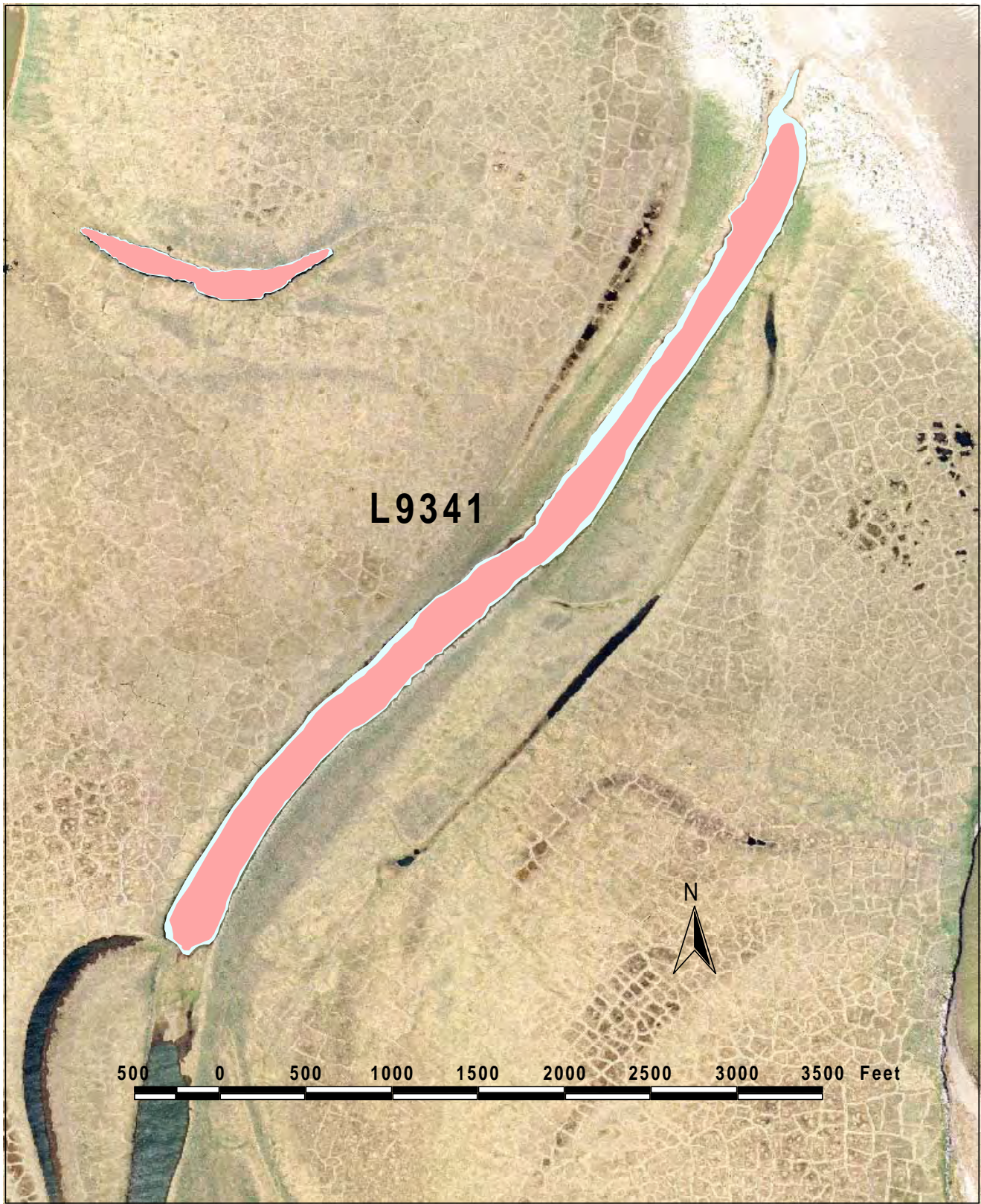
**Water Chemistry:**

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2013	13.0	6.1	23.4	5.4	57.4	199.5	0.9	7.1	L. Moulton

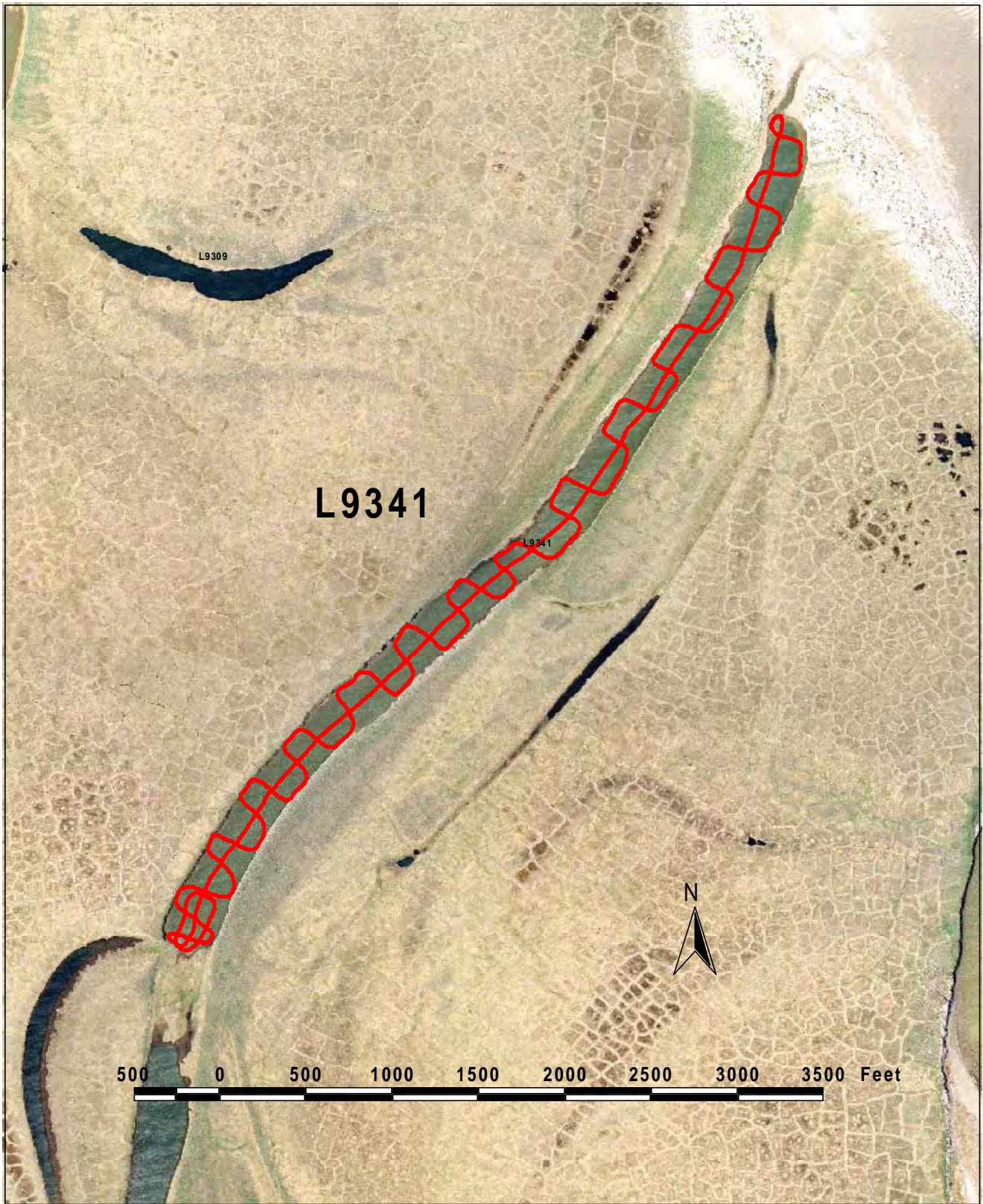
**Catch Record:**

Gear	Date	Effort (hours)	Species	Number Caught
	Jul 16 13			

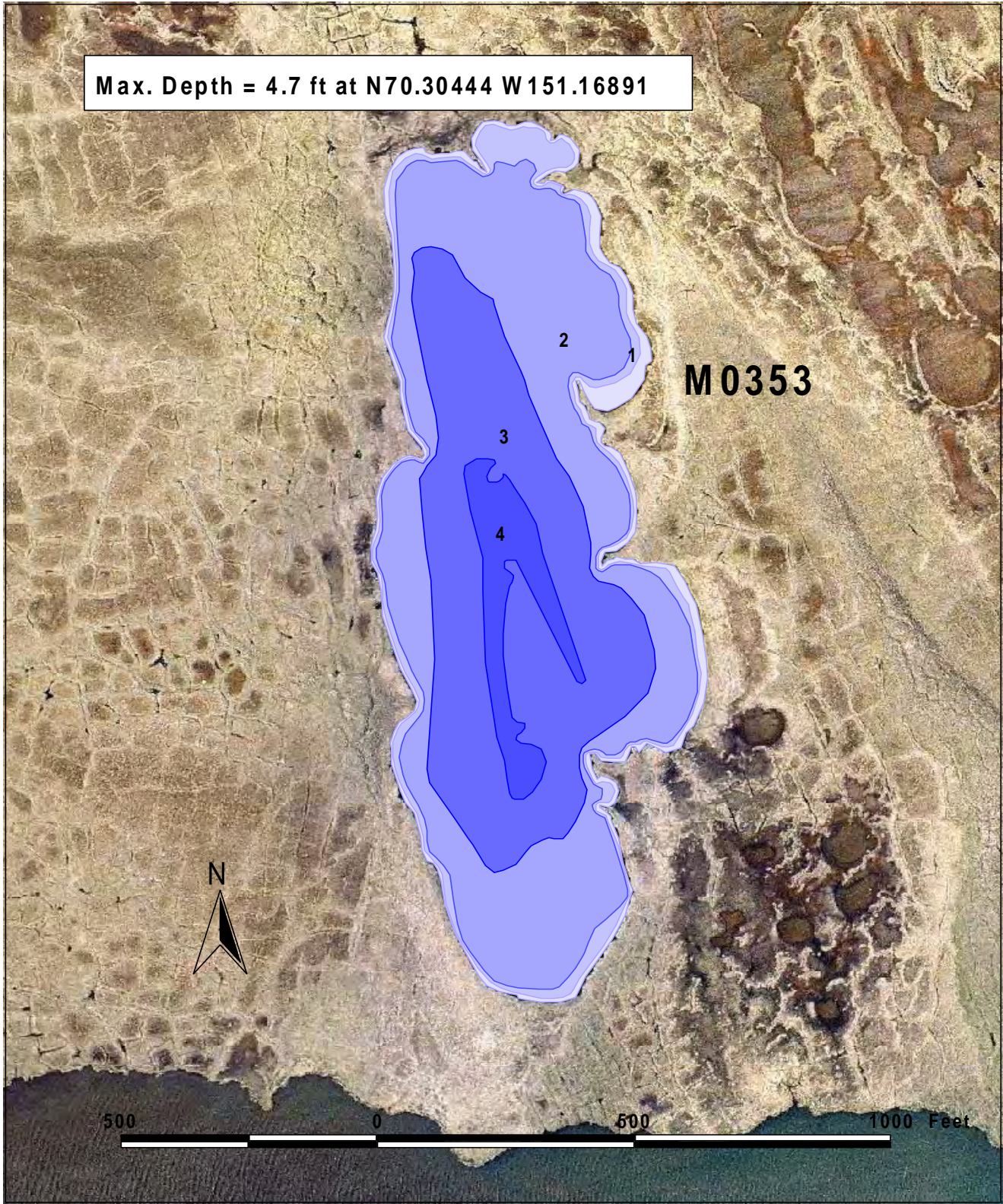
Gear not set, sensitive species assumed present, activew connection to river



Regions of Lake L9341 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on July 16, 2013.



Depth transects surveyed at Lake L9341 on July 16, 2013.



Depth contours at Lake M0353 based on transects surveyed on July 17, 2013.  
(depth in 1 ft intervals)

**Lake M0353**

**Other Names:** None Known  
**Location:** 70.30536°N 151.16958°W  
**USGS Quad Sheet:** Harrison Bay B-2: T11N R4E Sec. 1  
**Habitat:** Tundra lake  
**Area:** 18.5 acres  
**Maximum Depth:** 4.7 feet  
**Active Outlet:** No  
**Total Lake Volume:** 16.7 million gallons (July 18, 2013 data)  
**Volume Under 4 ft of ice:** 0.14 million gallons  
**Volume Under 5 ft of ice:** 0.0 million gallons  
**Volume Under 7 ft of ice:** 0.0 million gallons

**Potential Aggregate:** 17.2 acres (water depth 4 ft or less)  
 5.113 million gallons

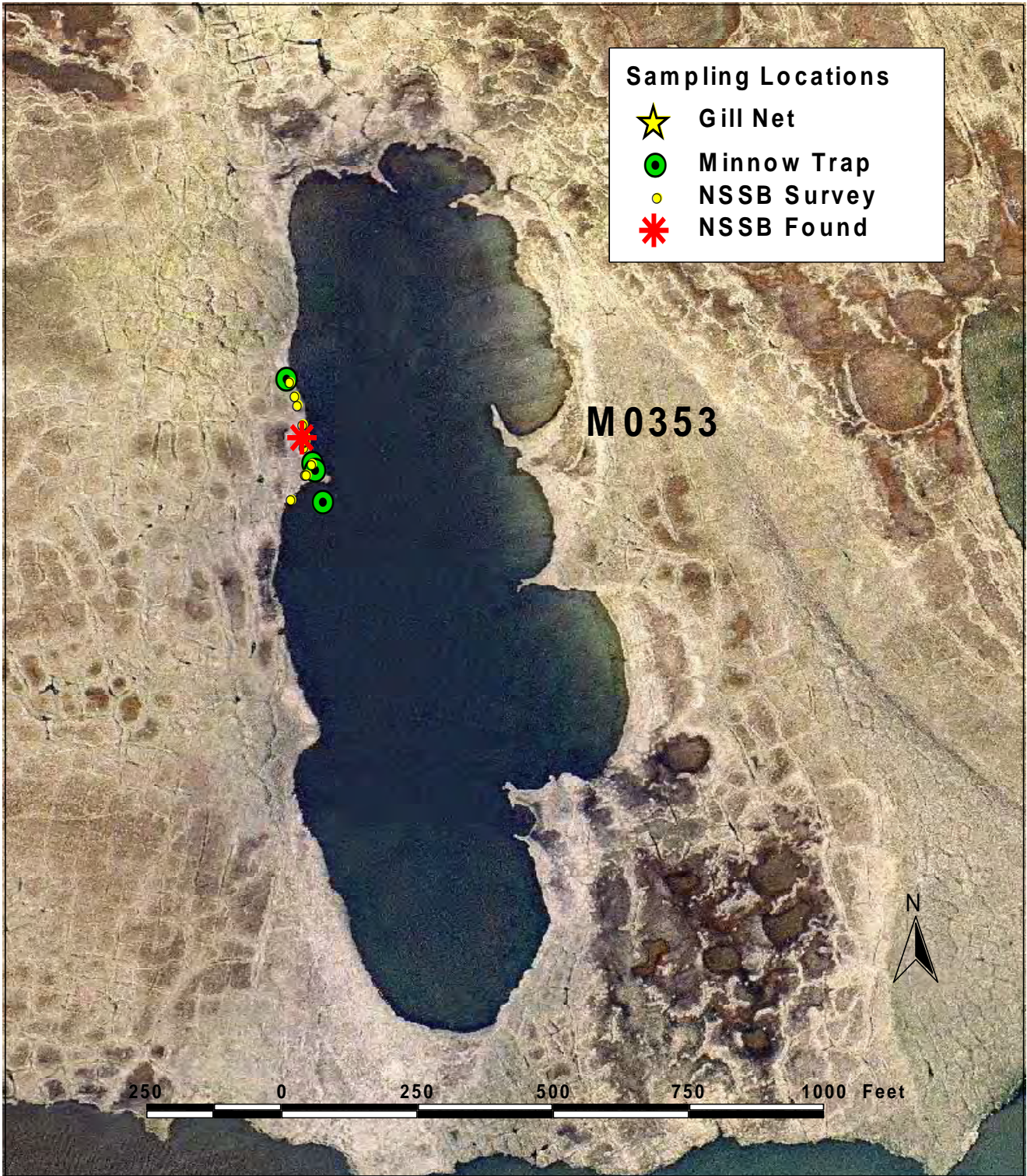
**Maximum Recommended Winter Removal:** **0.000 million gallons**  
 (30% of water volume under 5 feet of ice)  
 (does not include volume associated with ice aggregate)

**Water Chemistry:**

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
Jul 19 03	--	--	--	--	--	217	0.7	8.21	L. Moulton
Jul 20 03	--	--	--	--	--	216	1.0	8.27	L. Moulton
Jul 21 03	--	--	--	--	--	218	0.9	8.51	L. Moulton
Jul 22 03	--	--	--	--	--	221	0.8	8.45	L. Moulton
2013	29.5	6.4	12.7	40.9	100.0	252	<0.5	7.85	L. Moulton

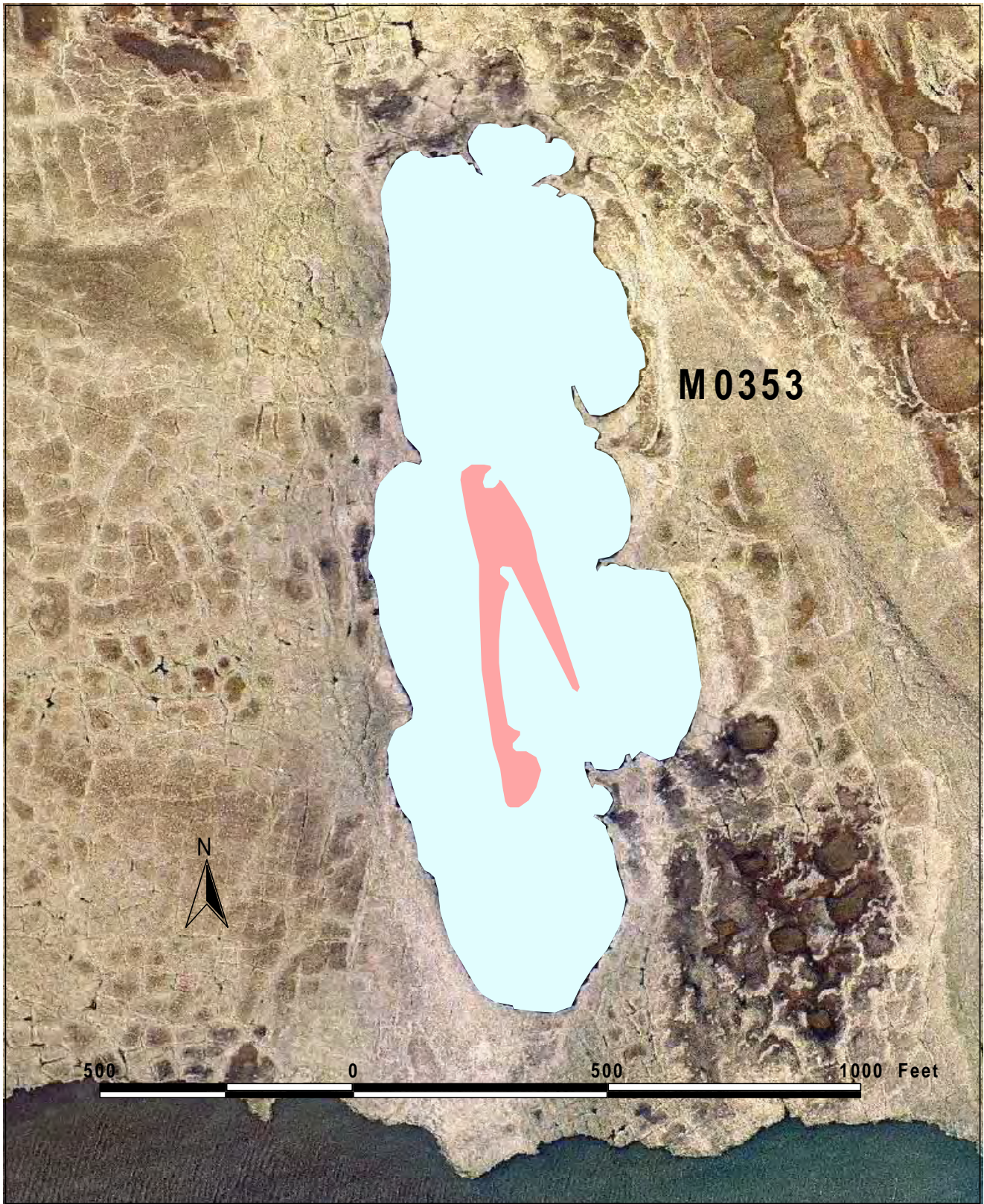
**Catch Record:**

Gear	Date	Effort (hours)	Species	Number Caught
Fyke Net	Jul 19-22, 2003	98.0	Ninespine stickleback	938
Minnow Traps	Jul 18 13	4.1	none	0
Visual +Dipnet	Jul 18 13	299 yds	Ninespine stickleback	1

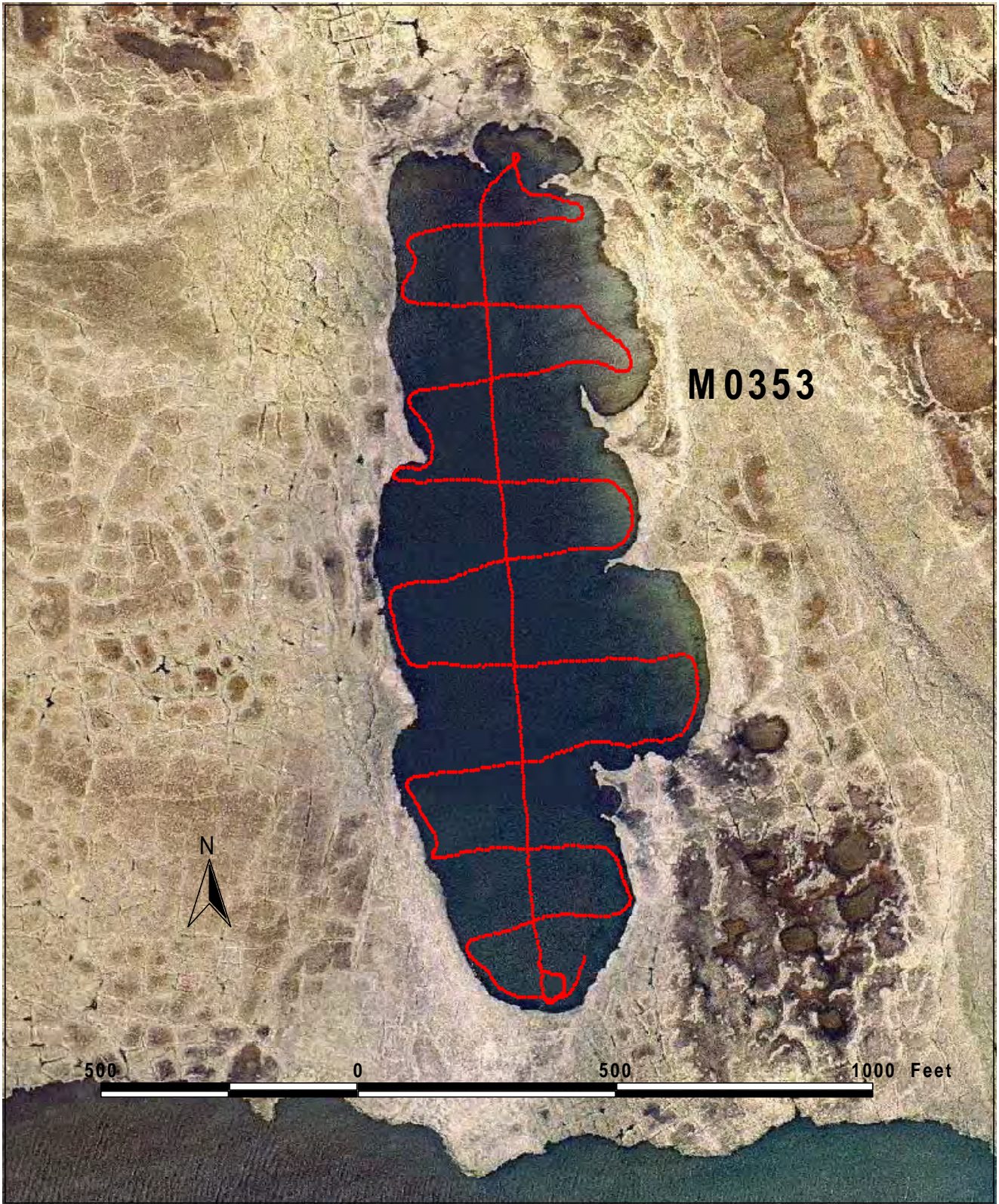


Location of fish sampling effort at Lake M0353 on July 18, 2013.





Regions of Lake M0353 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on July 18, 2013.



Depth transects surveyed at Lake M0353 on July 18, 2013.



Lake L9820 was too shallow to transect on August 11, 2013.

**Lake L9820**

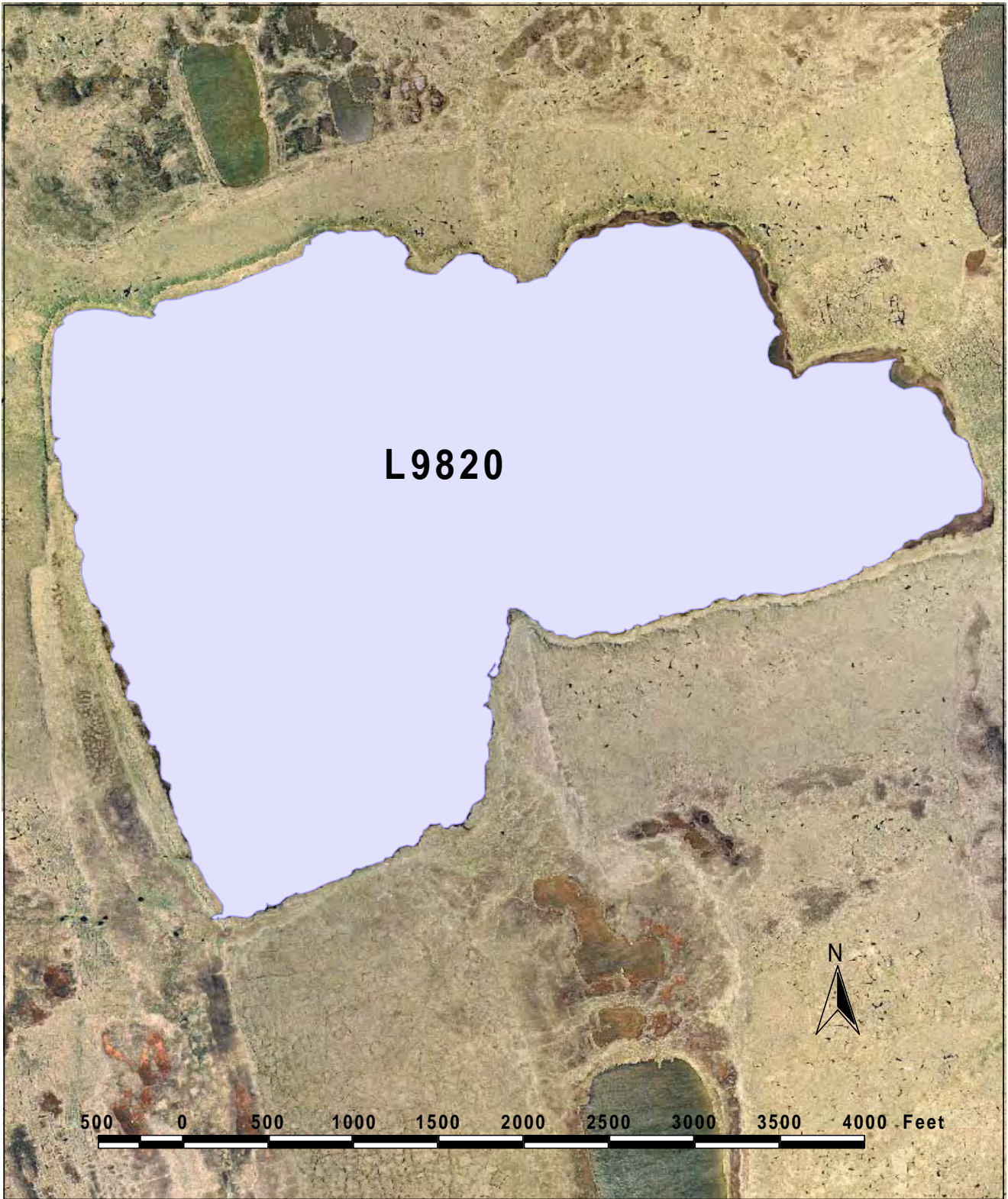
**Other Names:** None Known  
**Location:** 70.26528°N 151.39721°W  
**USGS Quad Sheet:** Harrison Bay B-3: T11N R3E Sec. 33,34  
**Habitat:** Tundra Lake  
**Area:** 321 acres  
**Maximum Depth:** 3.0 feet  
**Active Outlet:** Yes  
**Total Lake Volume:** 104.71 million gallons (1998 data)  
**Volume Under 4 ft of ice:** 0.00 million gallons (also visited August 11, 2013)  
**Volume Under 5 ft of ice:** 0.00 million gallons  
**Volume Under 7 ft of ice:** 0.00 million gallons  
  
**Potential Ice Aggregate:** 321.3 acres (water depth 4 ft or less)  
 95.3 million gallons  
  
**Maximum Recommended Winter Removal:** 0.000 million gallons  
 (too shallow)

**Water Chemistry:**

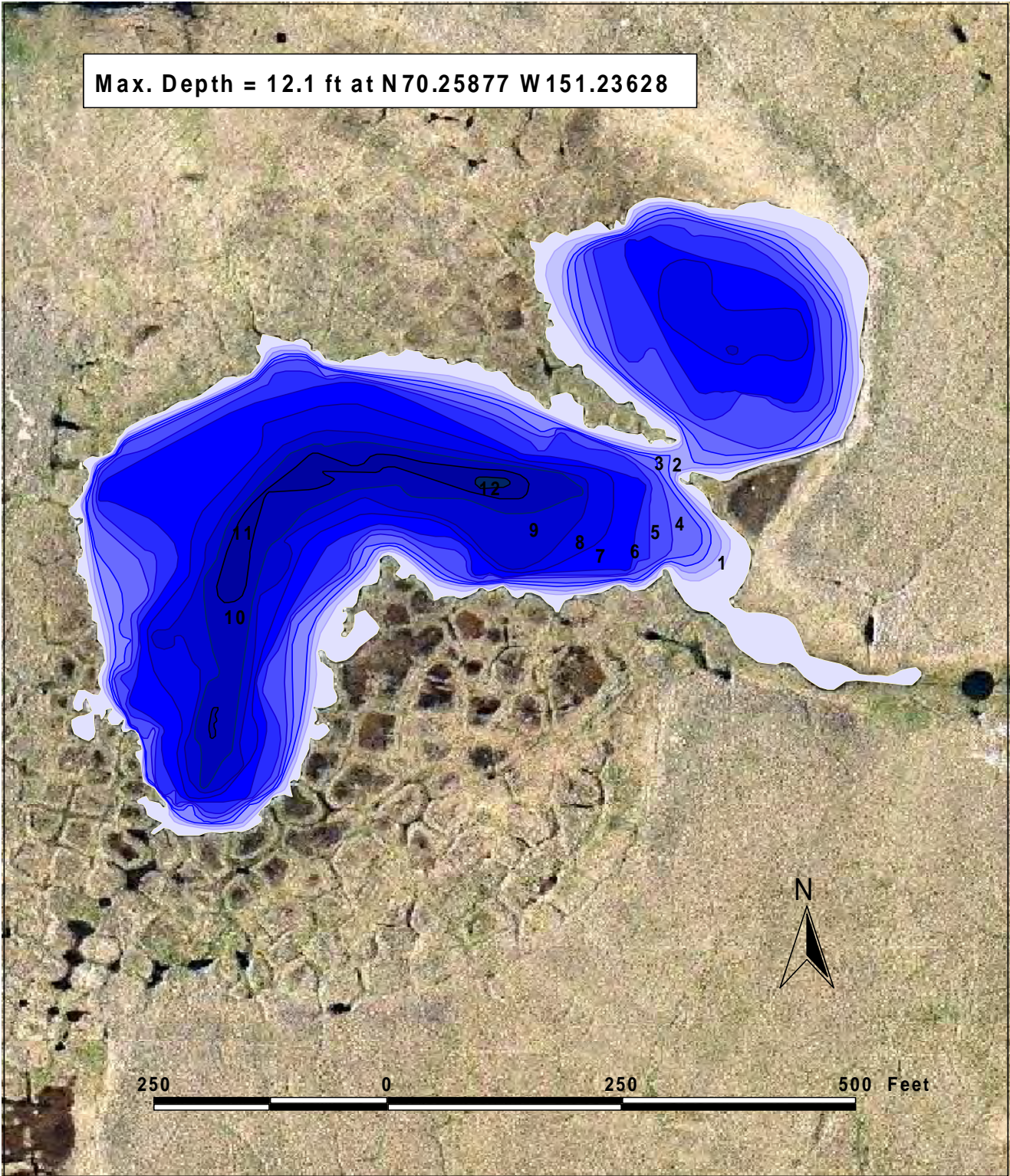
Date of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2013	22.5	4.6	6.4	23.5	74.9	246	3.36	7.48	L. Moulton

**Catch Record:**

Gear	Date	Effort (hours)	Species	Number Caught
not sampled on August 11, 2013, too shallow				



Lake L9820 was less than 4 feet deep (light blue) and likely to be available for ice chips, when surveyed on August 11, 2013.



Depth contours at Lake L9826 based on transects surveyed on August 11, 2013.  
(depth in 1 ft intervals)

**Lake L9826**

**Other Names:** None known  
**Location:** 70.25860°N 151.23729°W  
**USGS Quad Sheet:** Harrison Bay B-3: T11N R3E Sec. 31  
**Habitat:** Drainage Lake  
**Area:** 7.3 acres  
**Maximum Depth:** 12.1 feet  
**Active Outlet:** Yes  
**Total Lake Volume:** 14.0 million gallons (Aug 11, 2013 data)  
**Volume Under 4 ft of ice:** 6.08 million gallons  
**Volume Under 5 ft of ice:** 4.42 million gallons  
**Volume Under 7 ft of ice:** 1.72 million gallons

**Potential Aggregate:** 7.79 acres (water depth 4 ft or less)  
 2.311 million gallons

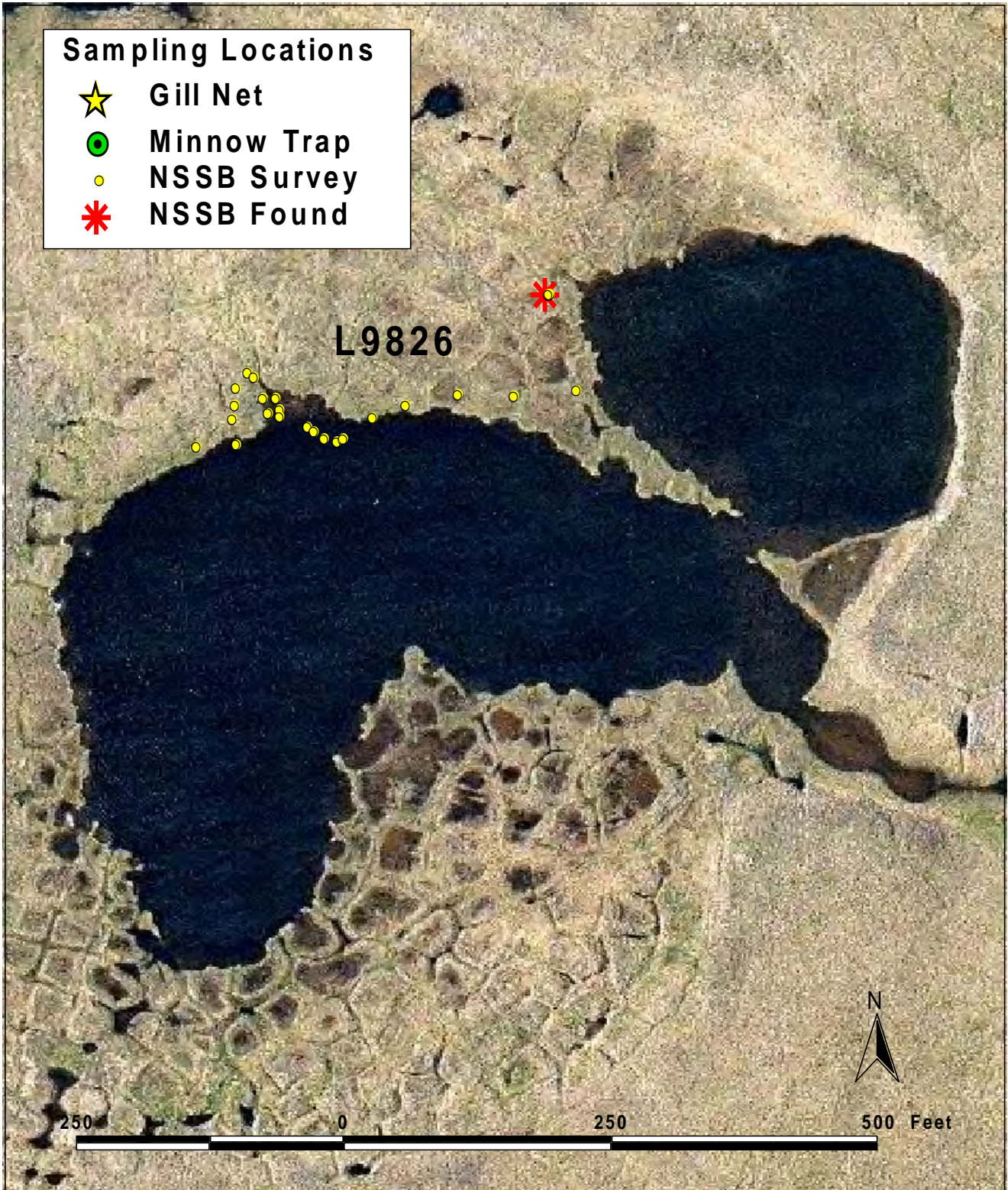
**Maximum Recommended Winter Removal:** **0.258 million gallons**  
 (Potential grayling habitat, 15% of water water volume under 7 ft of ice)  
 (does not include volume associated with ice aggregate)

**Water Chemistry:**

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Total Dissolved Solids (mg/l)	pH	Source
1998	13.5	3.2	3.9	15.2	46.8	--	74	--	J. Lobdell
2013	13.5	2.8	4.0	12.8	45.2	239	--	7.51	L. Moulton

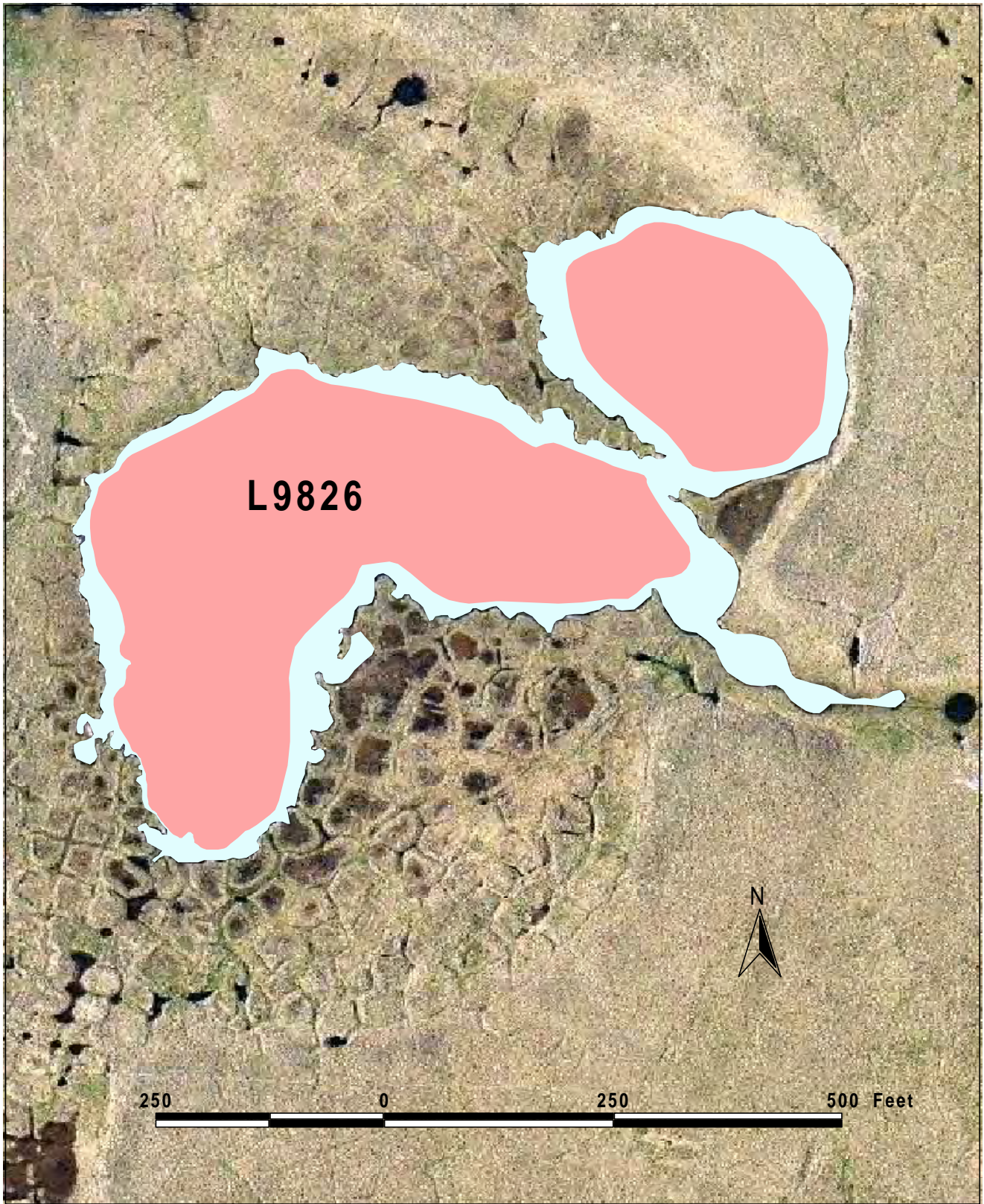
**Catch Record:**

Gear	Date	Effort (hours)	Species	Number Caught
Gill nets not set, Arctic grayling assumed present				
Visual +Dipnet	Aug 11 13	172 yds	Ninespine stickleback	1

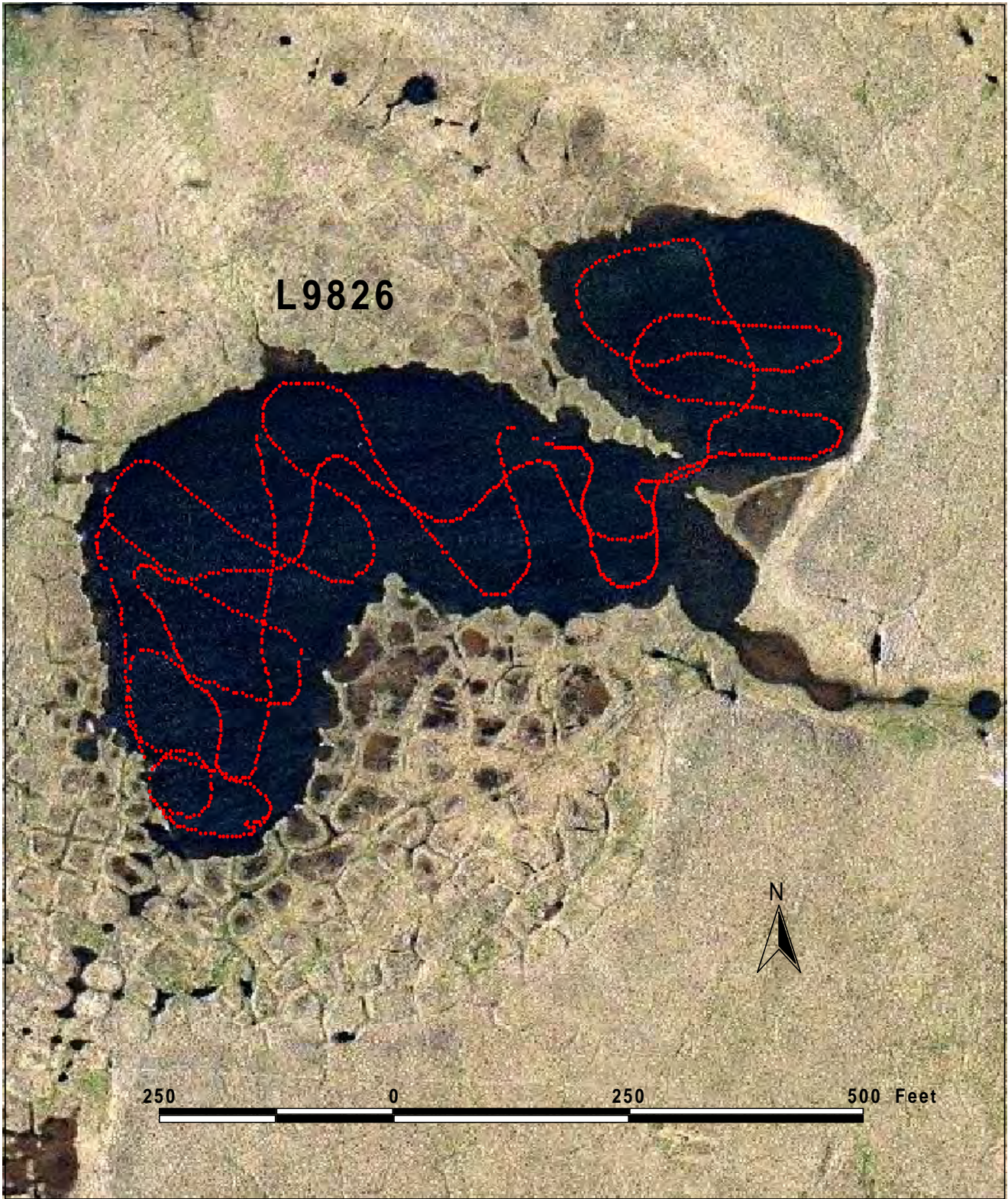


Location of fish sampling effort at Lake L9826 on August 11, 2013.





Regions of Lake L9826 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on August 3, 2013.



Depth transects surveyed at Lake L9826 on August 11, 2013.



Lake L9832 was too shallow to transect on August 11, 2013.

**Lake L9832**

**Other Names:** None known  
**Location:** 70.25227°N 151.34202°W  
**USGS Quad Sheet:** Harrison Bay B-3: T10N R3E Sec. 2,3; T11N R3E Sec. 34  
**Habitat:** Tundra lake  
**Area:** 241.5 acres  
**Maximum Depth:** 3.0 feet  
**Active Outlet:**  
**Total Lake Volume:** 79.70 million gallons (1999 data)  
**Volume Under 4 ft of ice:** 0 million gallons (also visited August 11, 2013)  
**Volume Under 5 ft of ice:** 0 million gallons  
**Volume Under 7 ft of ice:** 0 million gallons

**Potential Aggregate:** 241.5 acres (water depth 4 ft or less)  
 71.63 million gallons

**Maximum Recommended Winter Removal:** 0.000 million gallons  
 (too shallow)

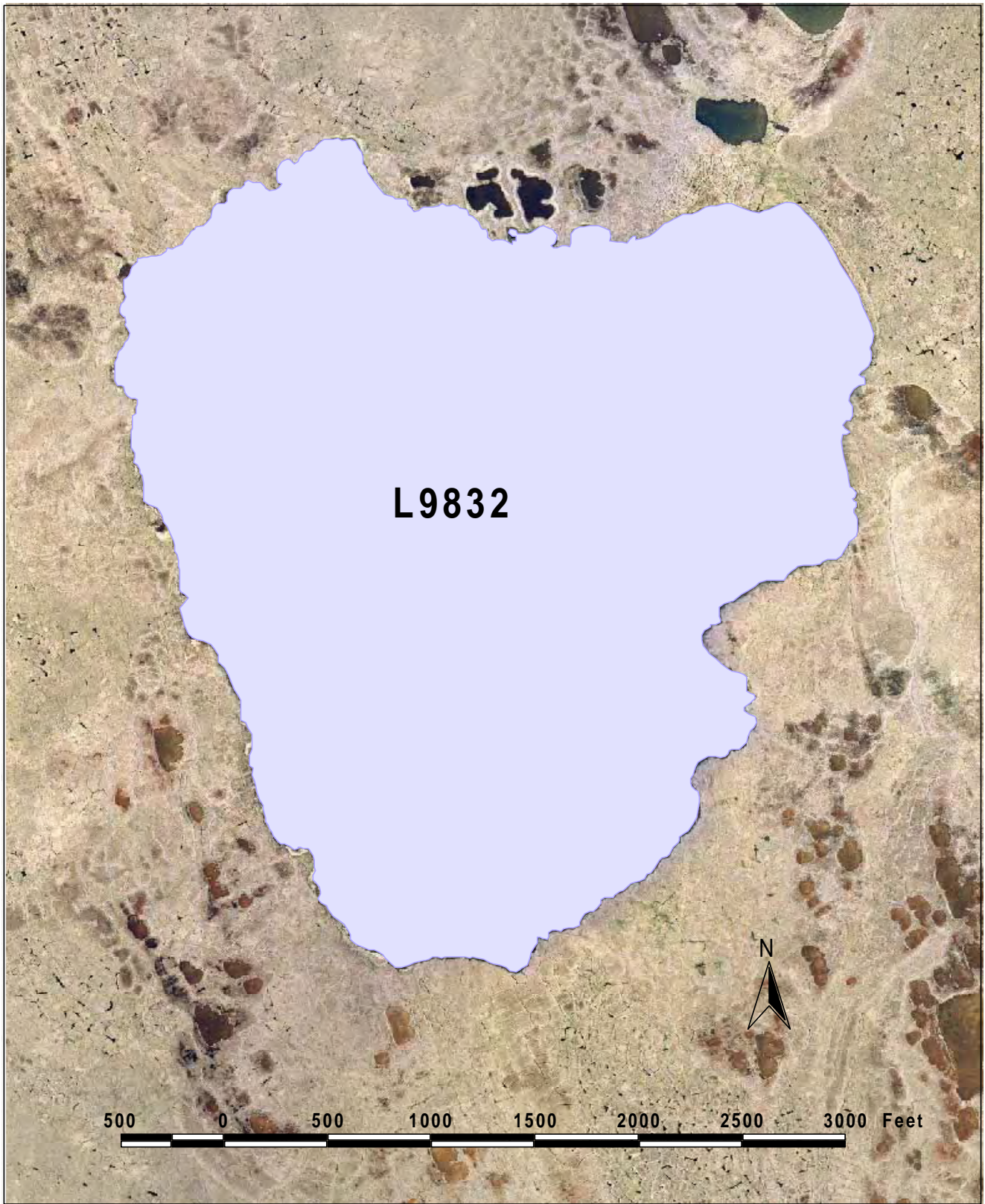
**Water Chemistry:**

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
1999	--	--	--	--	--	203	--	7.98	L. Moulton
2013	24.6	4.4	5.7	13.4	79.4	126	<0.5	7.31	L. Moulton

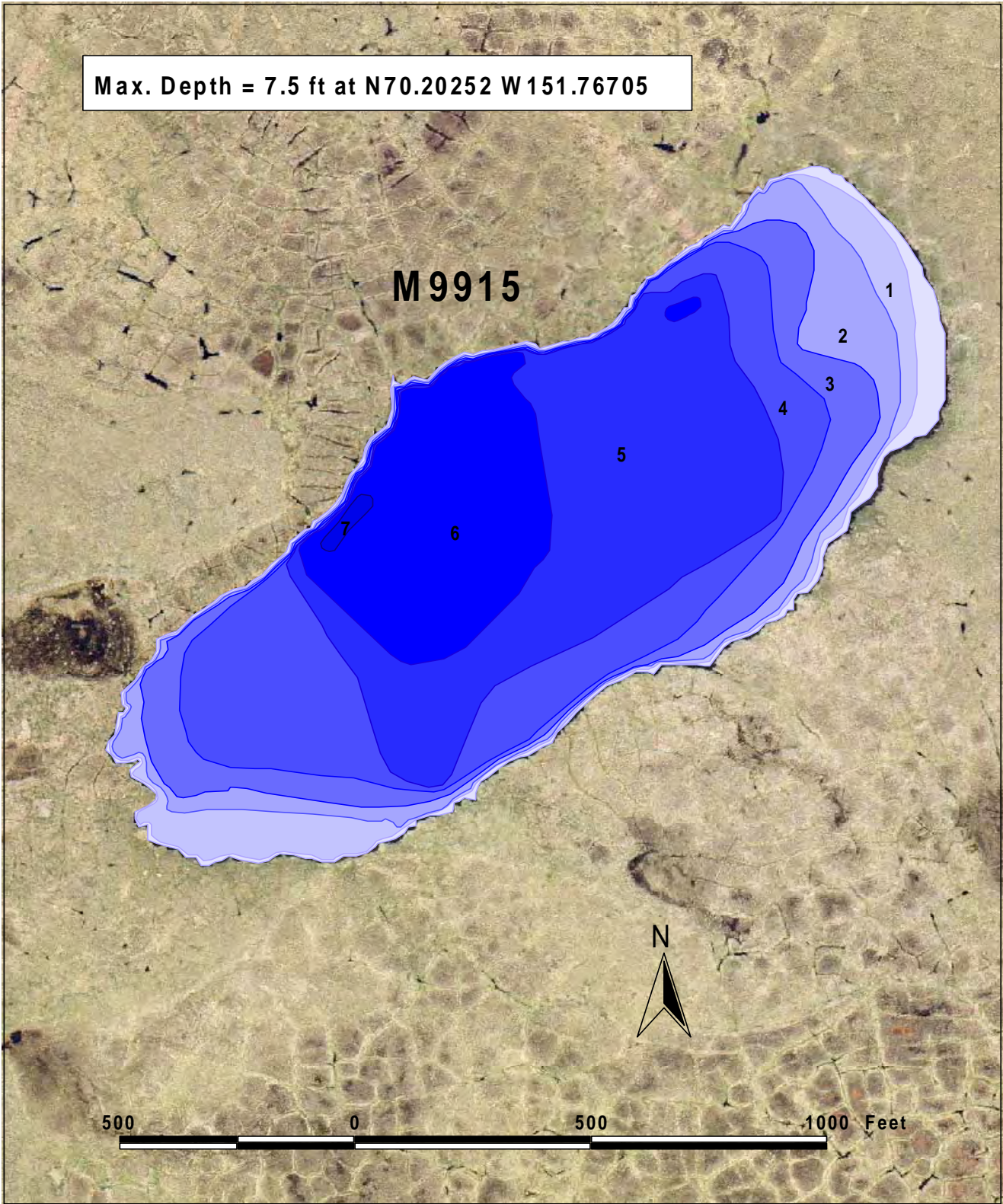
**Catch Record:**

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 19 99	5.17	None	0

not sampled on August 11, 2013, too shallow



Lake L9832 was less than 4 feet deep (light blue) and likely to be available for ice chips, when surveyed on August 11, 2013.



Depth contours at Lake M9915 based on transects surveyed on July 17, 2013.  
(depth in 1 ft intervals)

**Lake M9915**

**Other Names:** None Known  
**Location:** 70.20227°N 151.76346°W  
**USGS Quad Sheet:** Harrison Bay A-3: T10N R1E Sec. 24  
**Habitat:** Tundra lake  
**Area:** 32.1 acres  
**Maximum Depth:** 7.5 feet  
**Active Outlet:** No  
**Total Lake Volume:** 46.17 million gallons (July 17, 2013 data)  
**Volume Under 4 ft of ice:** 9.88 million gallons  
**Volume Under 5 ft of ice:** 3.94 million gallons  
**Volume Under 7 ft of ice:** 0.01 million gallons

**Potential Ice Aggregate:** 10.4 acres (water depth 4 ft or less)  
 3.097 million gallons

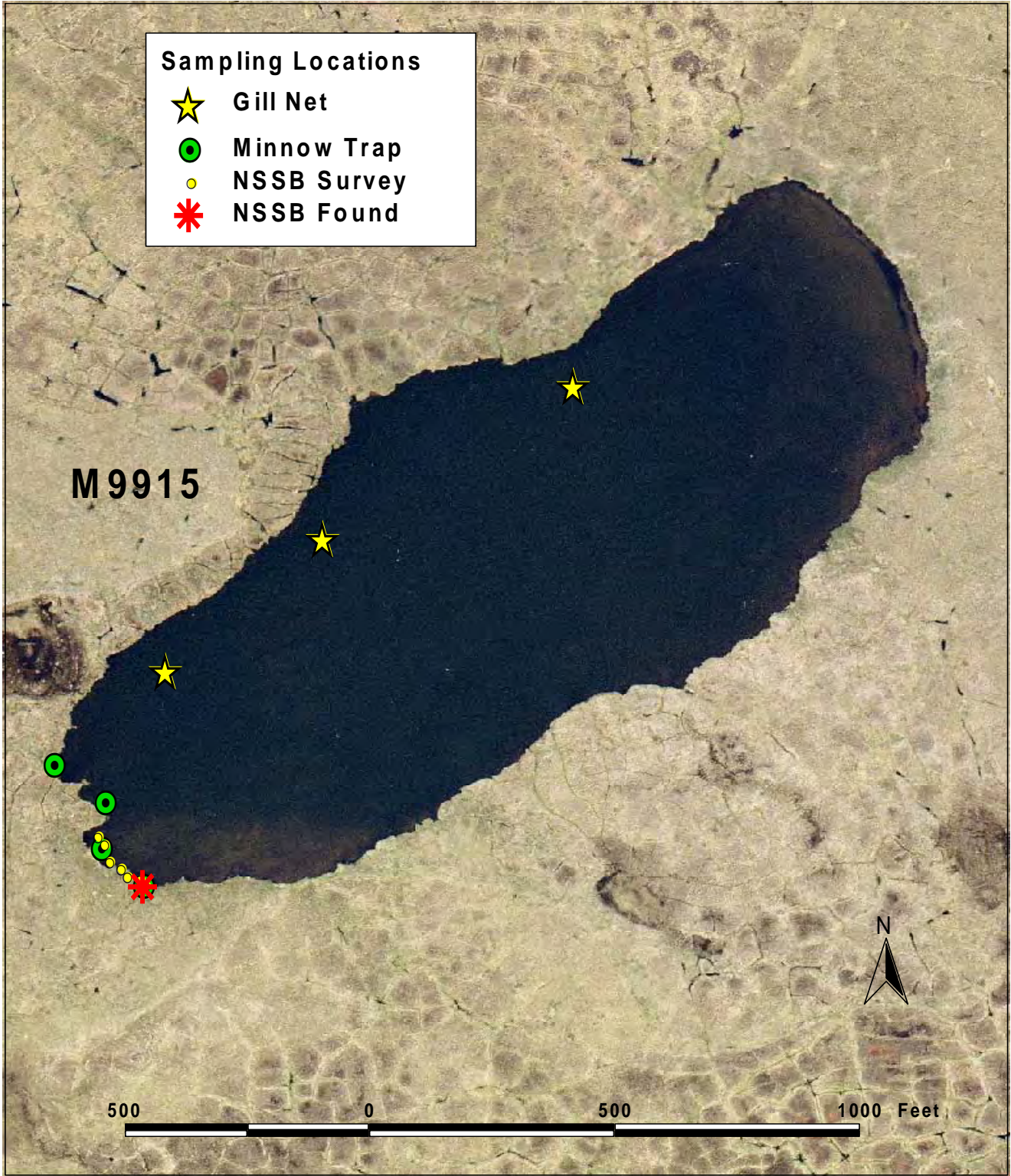
**Maximum Recommended Winter Removal:** **1.183 million gallons**  
 (30% of water volume under 5 feet of ice)  
 (does not include volume associated with ice aggregate)

**Water Chemistry:**

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Total Dissolved Solids (mg/l)	pH	Source
1999	8.97	2.3	4.1	14.1	32.8	89	61	7.58	L. Moulton
2013	--	--	--	--	--	79	--	6.64	L. Moulton

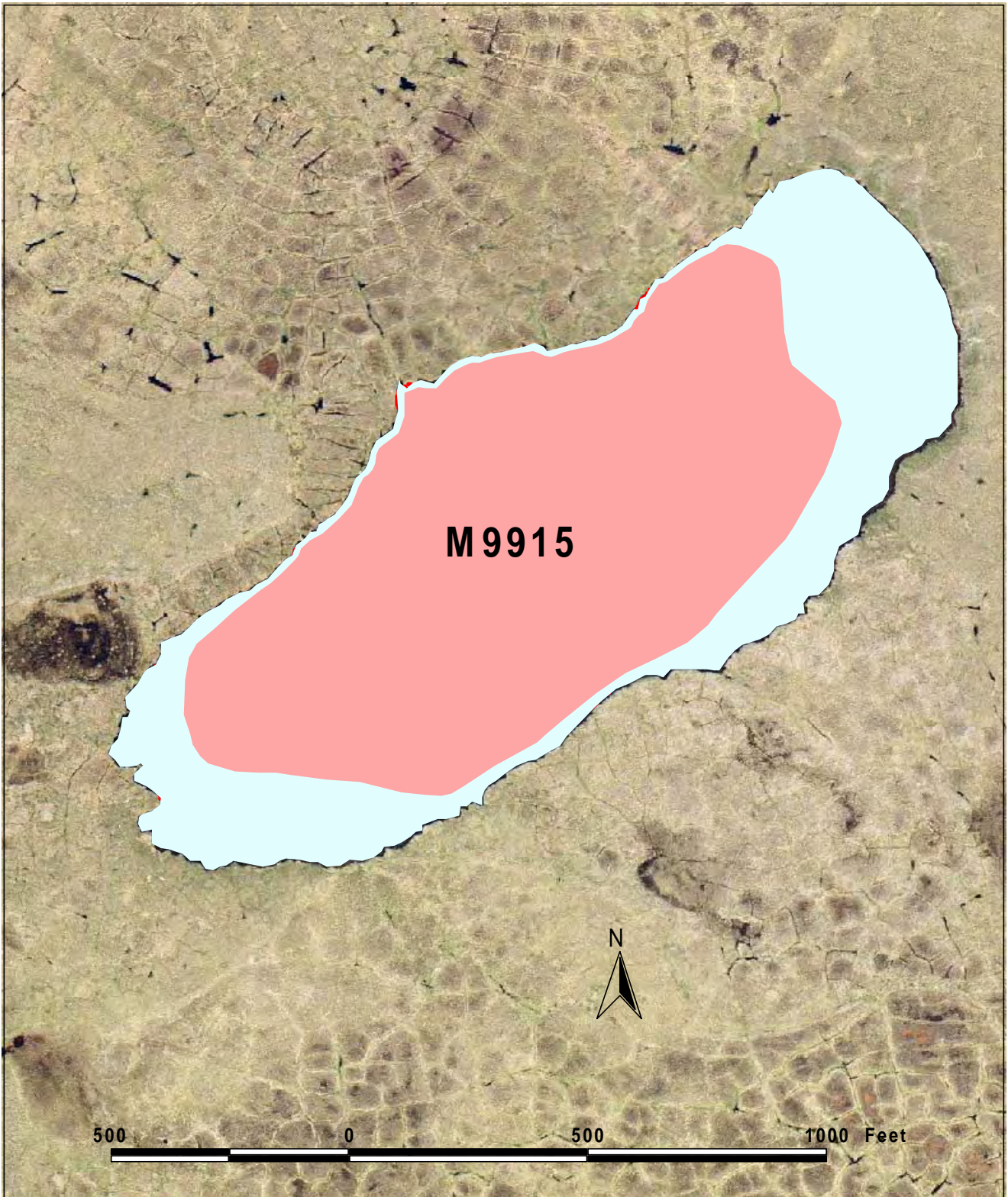
**Catch Record:**

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 13 99	5.5	none	0
	Jul 17 13	9.4	none	0
Minnow Traps	Jul 17 13	6.0	Ninespine stickleback	1
Visual +Dipnet	Jul 17 13	129 yds	none	0

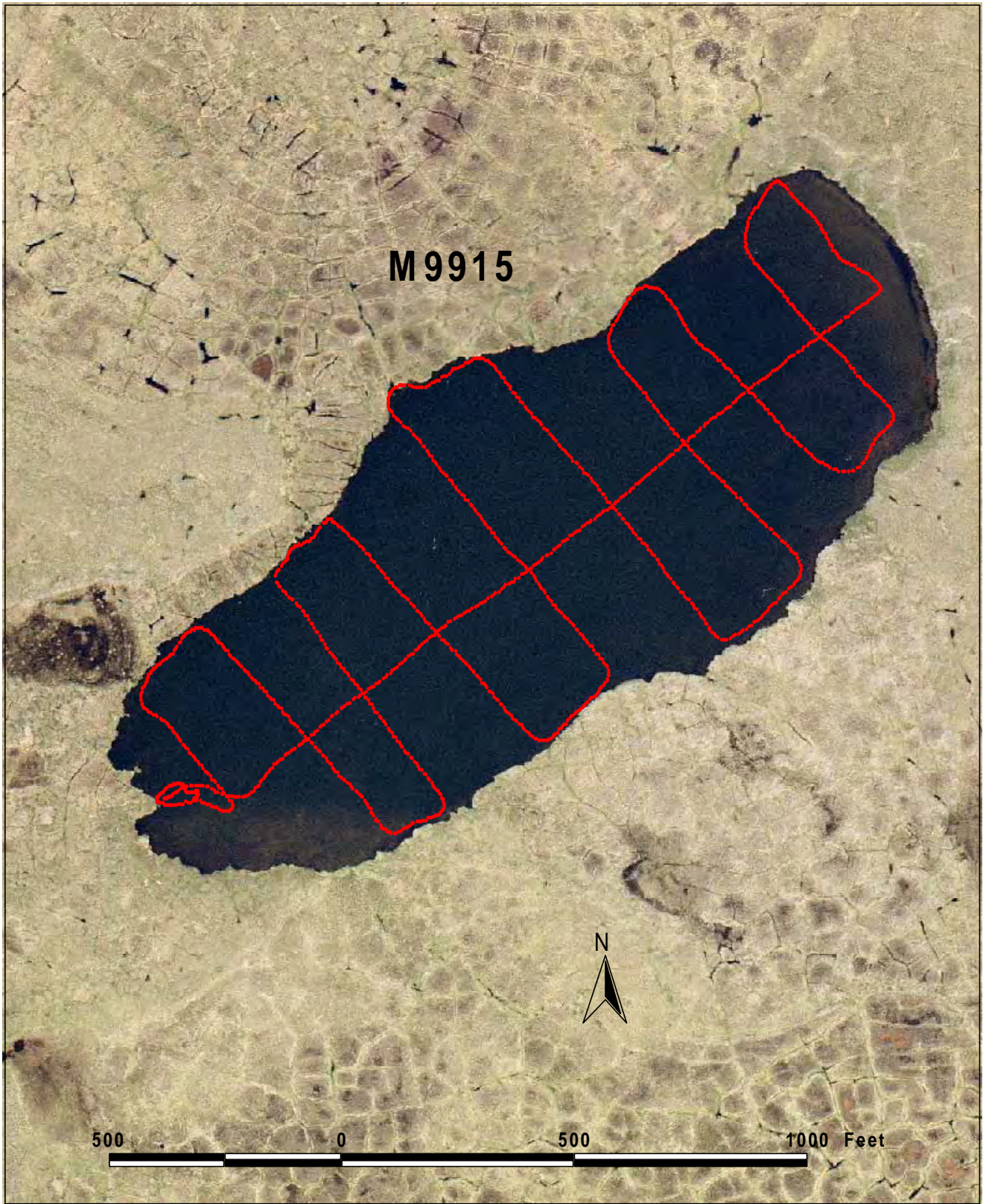


Location of fish sampling effort at Lake M9915 on July 17, 2013.

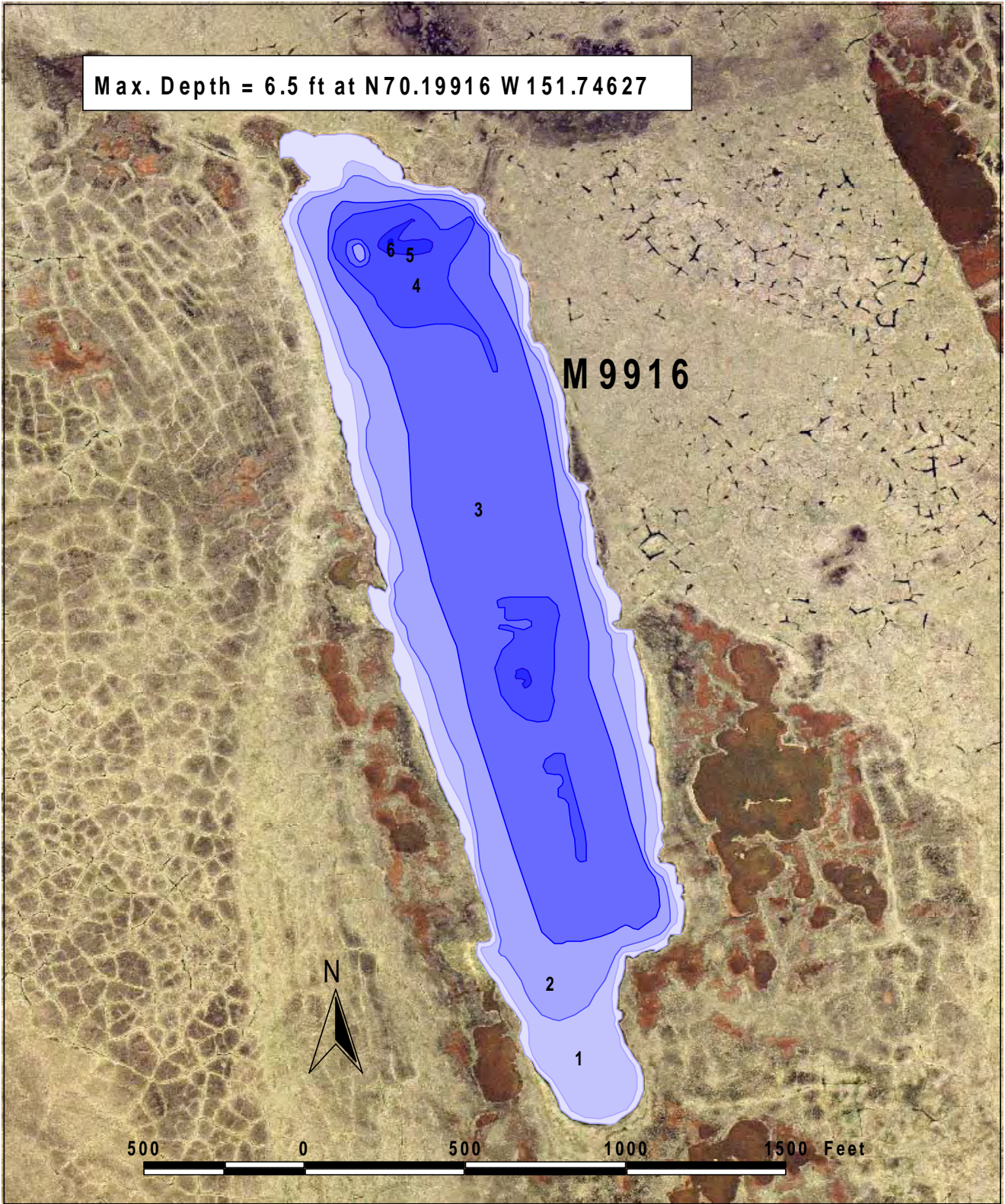




Regions of Lake M9915 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on July 17, 2013.



Depth transects surveyed at Lake M9915 on July 17, 2013.



Depth contours at Lake M9916 based on transects surveyed on July 17, 2013.  
(depth in 1 ft intervals)

**Lake M9916**

**Other Names:** None Known  
**Location:** 70.19612°N 151.74319°W  
**USGS Quad Sheet:** Harrison Bay A-3: T10N R2E Sec. 19,30  
**Habitat:** Tundra lake  
**Area:** 46.0 acres  
**Maximum Depth:** 6.5 feet  
**Active Outlet:**  
**Total Lake Volume:** 41.15 million gallons (July 17, 2013 data)  
**Volume Under 4 ft of ice:** 0.69 million gallons  
**Volume Under 5 ft of ice:** 0.04 million gallons  
**Volume Under 7 ft of ice:** 0.00 million gallons

**Potential Ice Aggregate:** 41.4 acres (water depth 4 ft or less)  
 12.27 million gallons

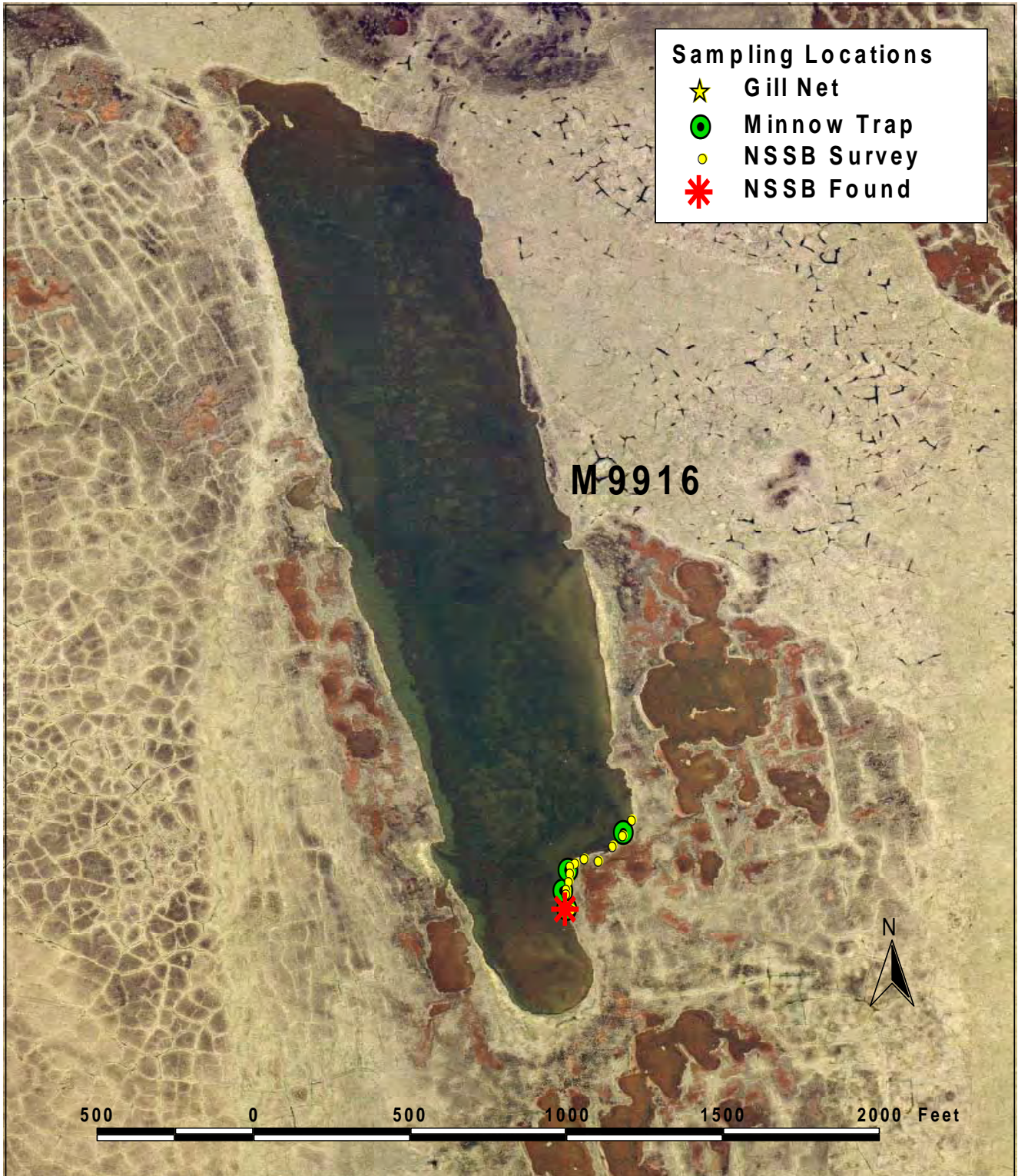
**Maximum Recommended Winter Removal:** **0.011 million gallons**  
 (30% of water volume under 5 feet of ice)  
 (does not include volume associated with ice aggregate)

**Water Chemistry:**

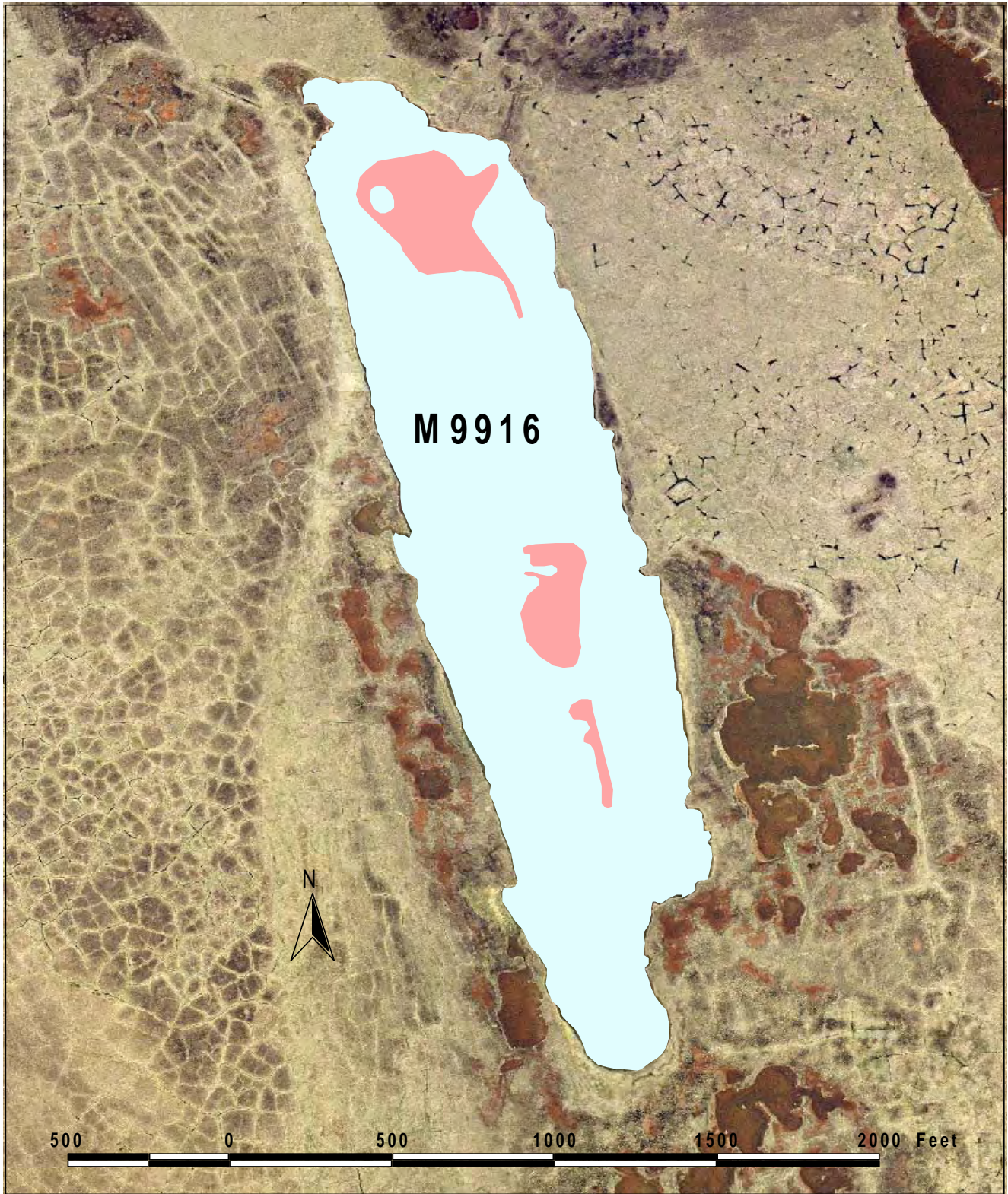
Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Total Dissolved Solids (mg/l)	pH	Source
1999	15.4	3.8	8	17.5	55	147	120	9.00	L. Moulton
2013	--	--	--	--	--	195	--	7.66	L. Moulton

**Catch Record:**

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 13 99	6.3	None	0
Minnow Traps	Jul 17 13	4.7	Ninespine sticklebac	1
Visual +Dipnet	Jul 17 13	154 yds	none	0



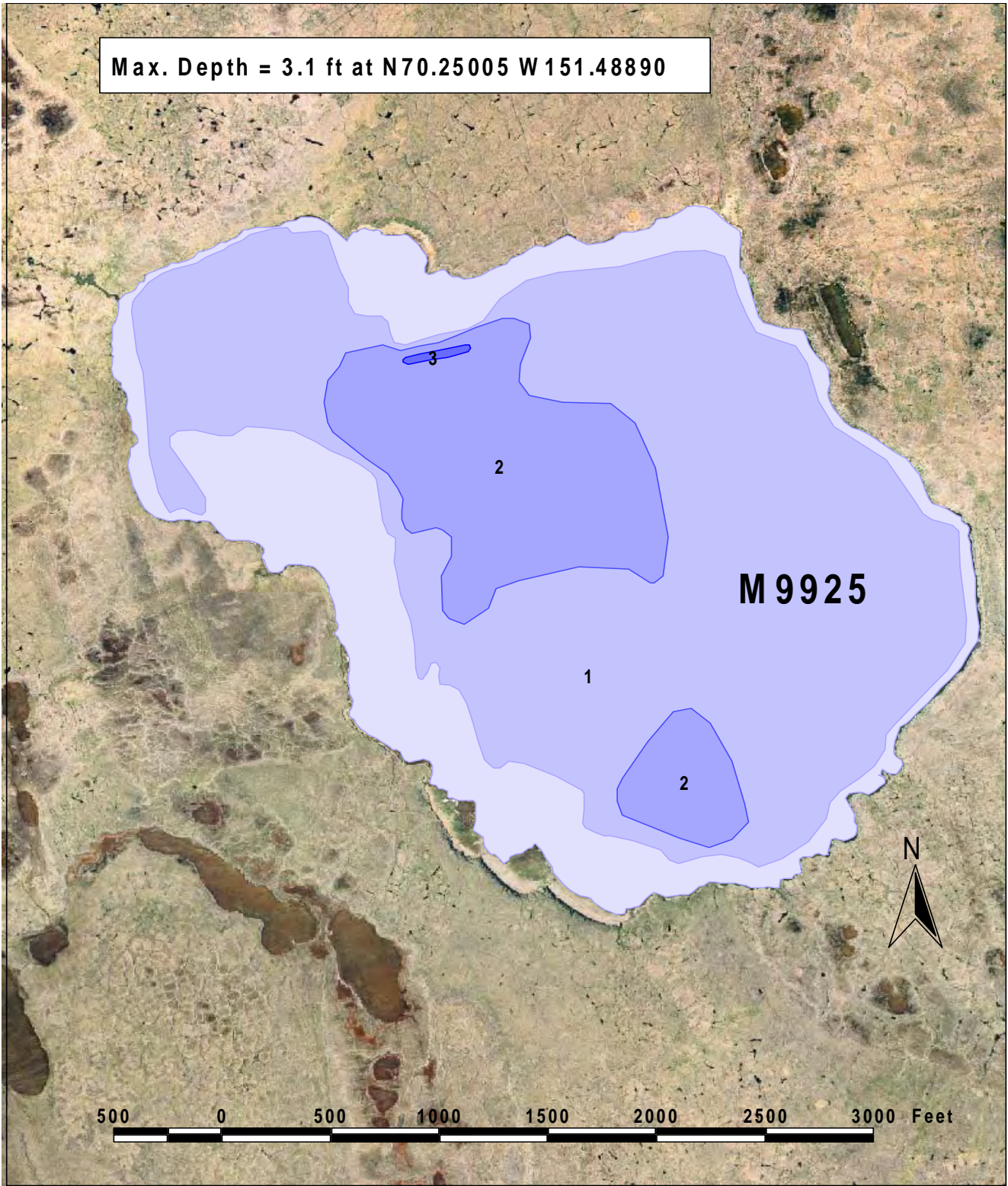
Location of fish sampling effort at Lake M9916 on July 17, 2013.



Regions of Lake M9916 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on July 17, 2013.



Depth transects surveyed at Lake M9916 on July 17, 2013.



Depth contours at Lake M9925 based on transects surveyed on August 11, 2013.  
(depth in 1 ft intervals)



**Lake M9925**

**Other Names:** None Known  
**Location:** 70.24747°N 151.48285°W  
**USGS Quad Sheet:** Harrison Bay A-3/B-3: T10N R3E Sec. 6; T10N R2E Sec. 1  
**Habitat:** Tundra lake  
**Area:** 212 acres  
**Maximum Depth:** 3.9 feet  
**Active Outlet:** No  
**Total Lake Volume:** 95.3 million gallons (August 11, 2013 data)  
**Volume Under 4 ft of ice:** 0.0 million gallons  
**Volume Under 5 ft of ice:** 0.0 million gallons  
**Volume Under 7 ft of ice:** 0.0 million gallons

**Potential Aggregate:** 211.7 acres (water depth 4 ft or less)  
 62.79 million gallons

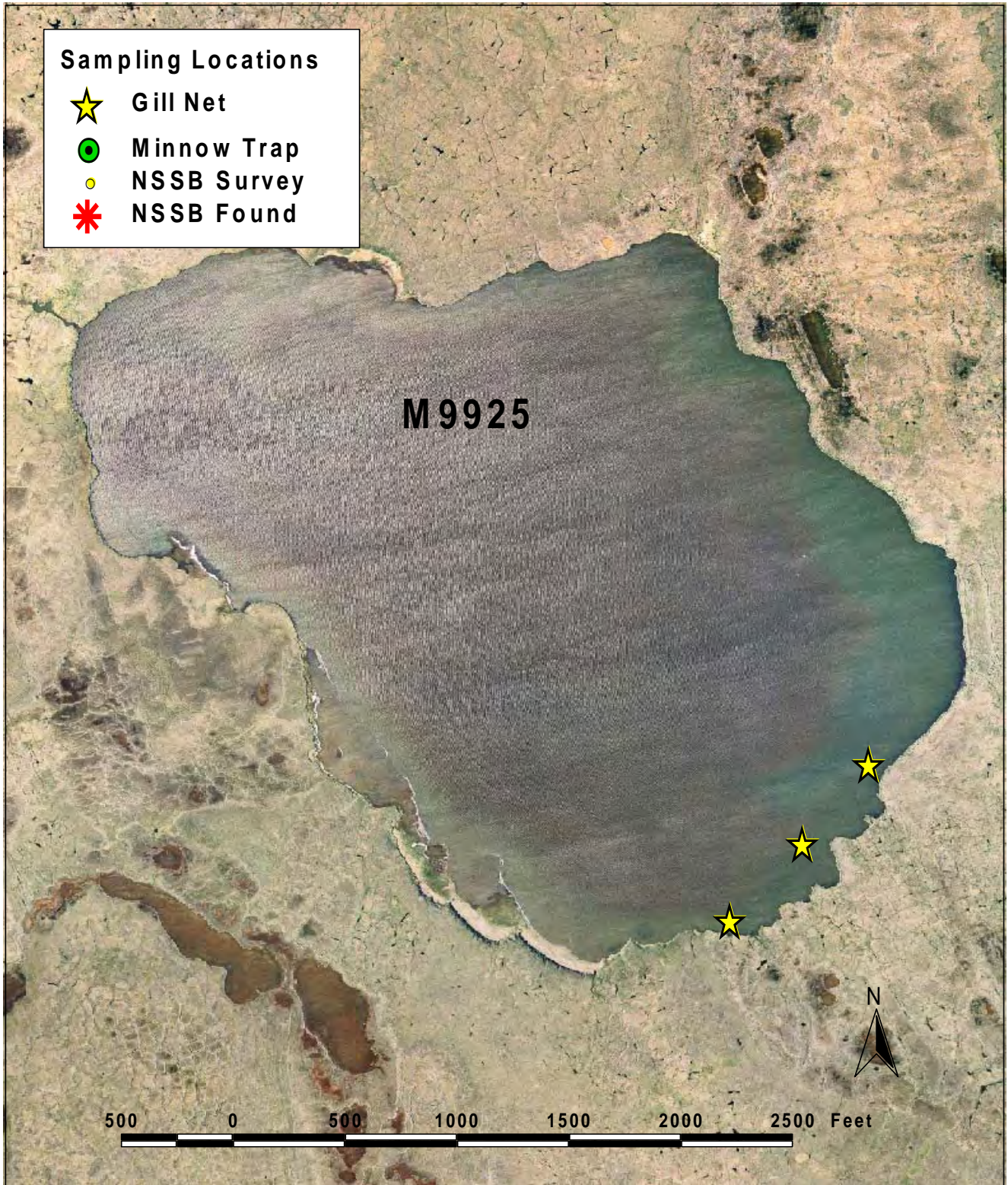
**Maximum Recommended Winter Removal:** **0.000 million gallons**  
 (30% of water volume under 5 feet of ice)  
 (does not include volume associated with ice aggregate)

**Water Chemistry:**

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
1999	40.2	6.2	11.1	37.8	122	276	--	8.12	L. Moulton
Aug 03 02	--	--	--	--	--	312	6.2	8.28	L. Moulton
Aug 04 02	--	--	--	--	--	316	11.8	8.14	L. Moulton
Aug 06 02	--	--	--	--	--	308	7.8	7.86	L. Moulton
2013	38.3	6.6	10.7	41.6	123.0	405	2.32	7.85	L. Moulton

**Catch Record:**

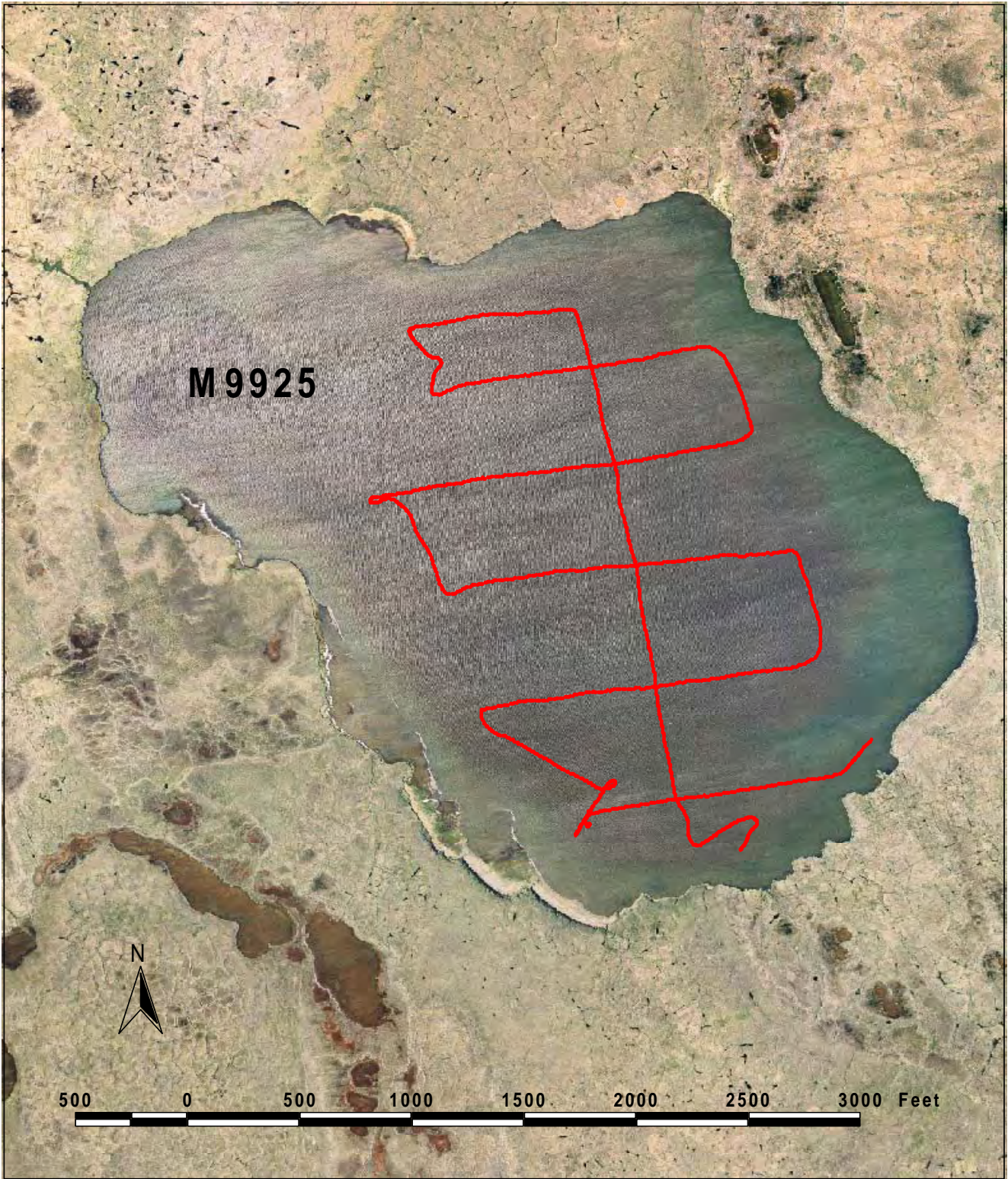
Gear	Date	Effort (hours)	Species	Number Caught
Gill net	Jul 18 99	6.4	none	0
	Aug 11 13	3.0	none	0
Fyke Net	Aug 3-6, 02	92.1	Ninespine stickleback	2,243



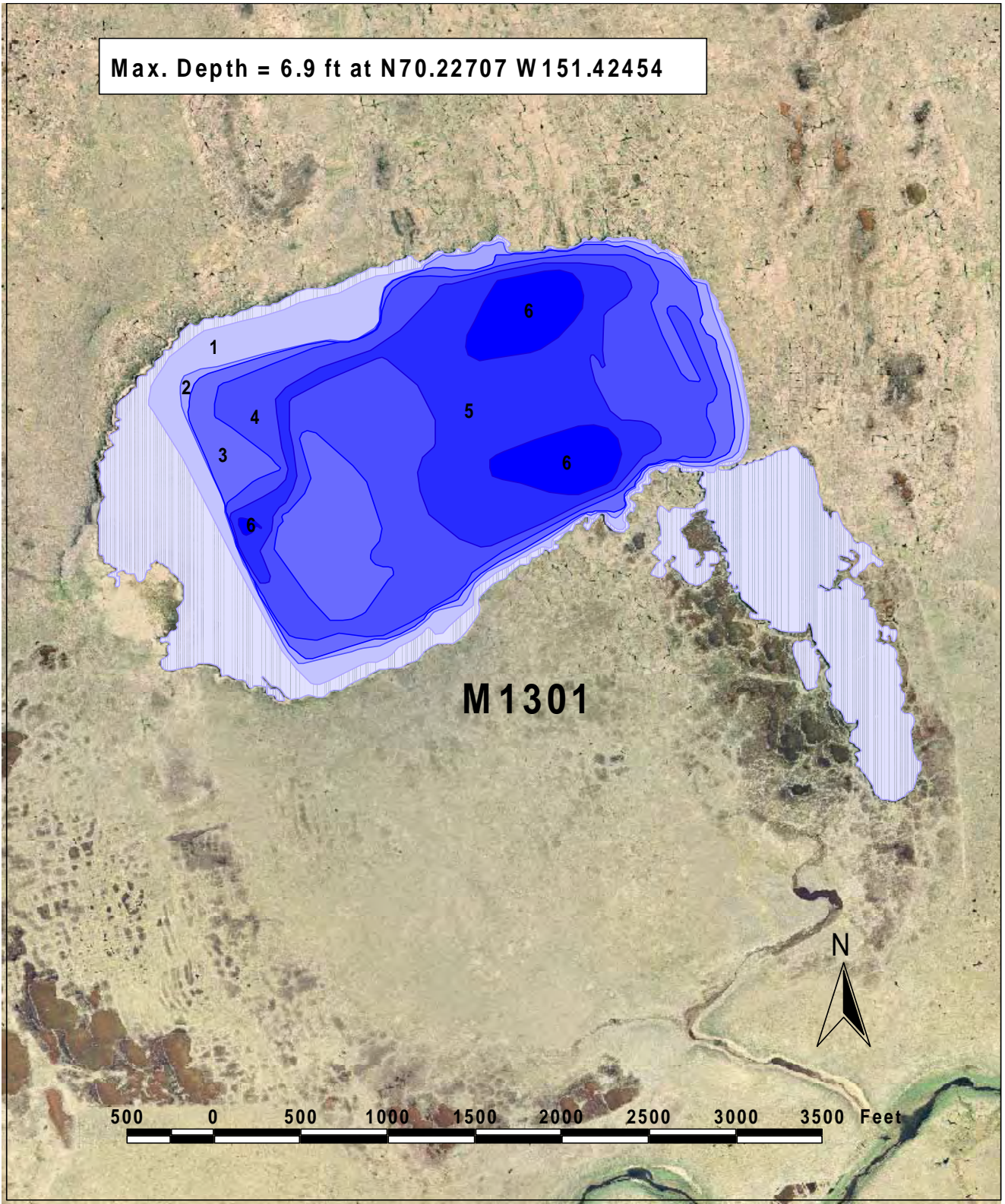
Location of fish sampling effort at Lake M9925 on August 11, 2013.



Lake M9925 was less than 4 feet deep (light blue) and likely to be available for ice chips, when surveyed on August 11, 2013.



Depth transects surveyed at Lake M9925 on August 11, 2013.



Depth contours at Lake M1301 based on transects surveyed on August 10, 2013.  
(depth in 1 ft intervals)

**Lake M1301**

**Other Names:** None Known  
**Location:** 70.22510°N 151.42890°W  
**USGS Quad Sheet:** Harrison Bay A-3: T10N R3E Sec. 8,16,17  
**Habitat:** Tundra lake  
**Area:** 193 acres  
**Maximum Depth:** 6.9 feet  
**Active Outlet:** No  
**Total Lake Volume:** 198.8 million gallons (August 10, 2013 data)  
**Volume Under 4 ft of ice:** 31.8 million gallons  
**Volume Under 5 ft of ice:** 10.0 million gallons  
**Volume Under 7 ft of ice:** 0.0 million gallons

**Potential Aggregate:** 102.5 acres (water depth 4 ft or less)  
 30.40 million gallons

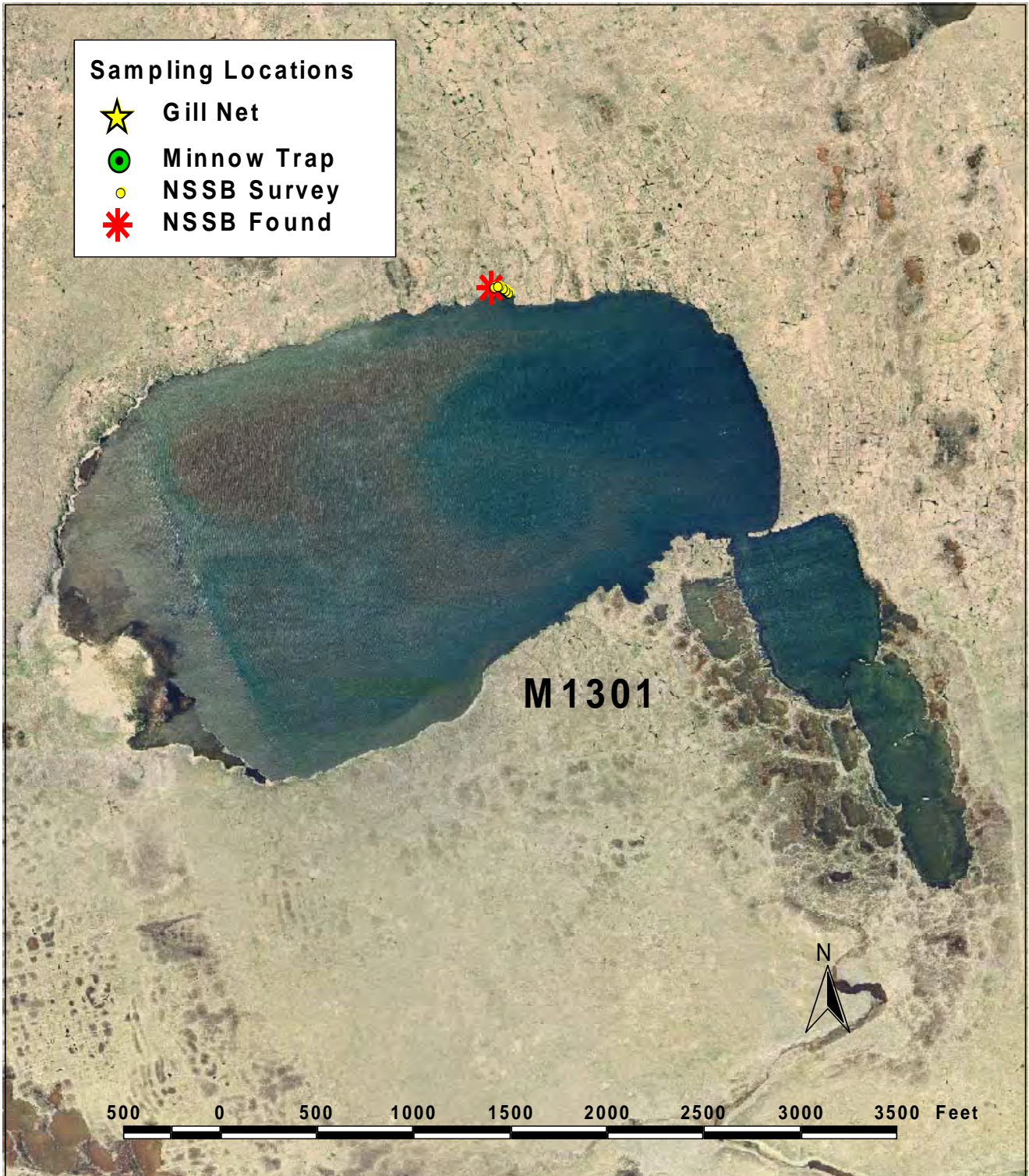
**Maximum Recommended Winter Removal:** **3.002 million gallons**  
 (30% of water volume under 5 feet of ice)  
 (does not include volume associated with ice aggregate)

**Water Chemistry:**

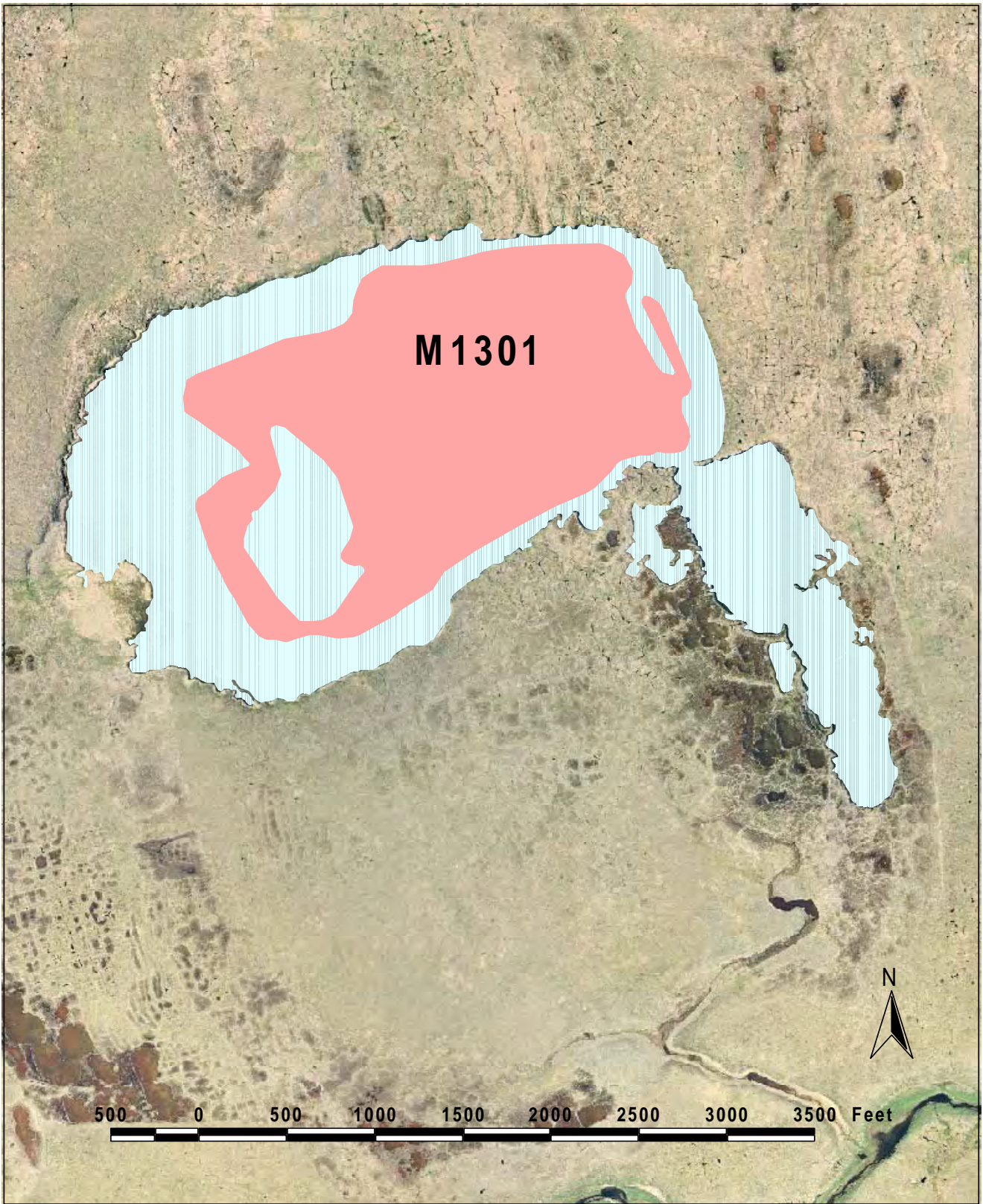
Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2013	24.6	3.5	7.2	18.2	76.0	248	<0.5	7.6	L. Moulton

**Catch Record:**

Gear	Date	Effort (yards)	Species	Number Caught
Visual +Dipnet	Aug 10 13	47 yd	Ninespine stickleback	1

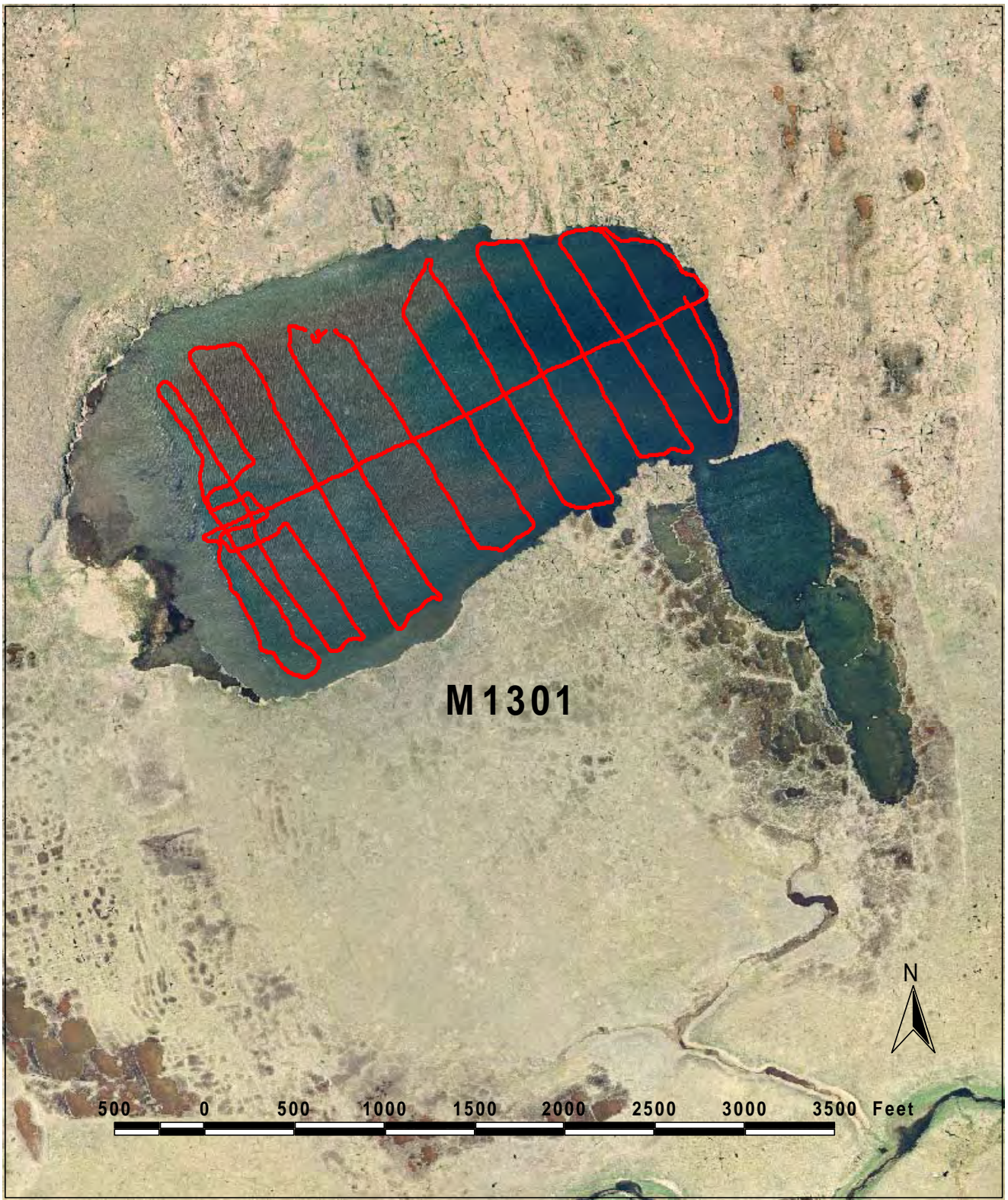


Location of fish sampling effort at Lake M1301 on August 10, 2013.

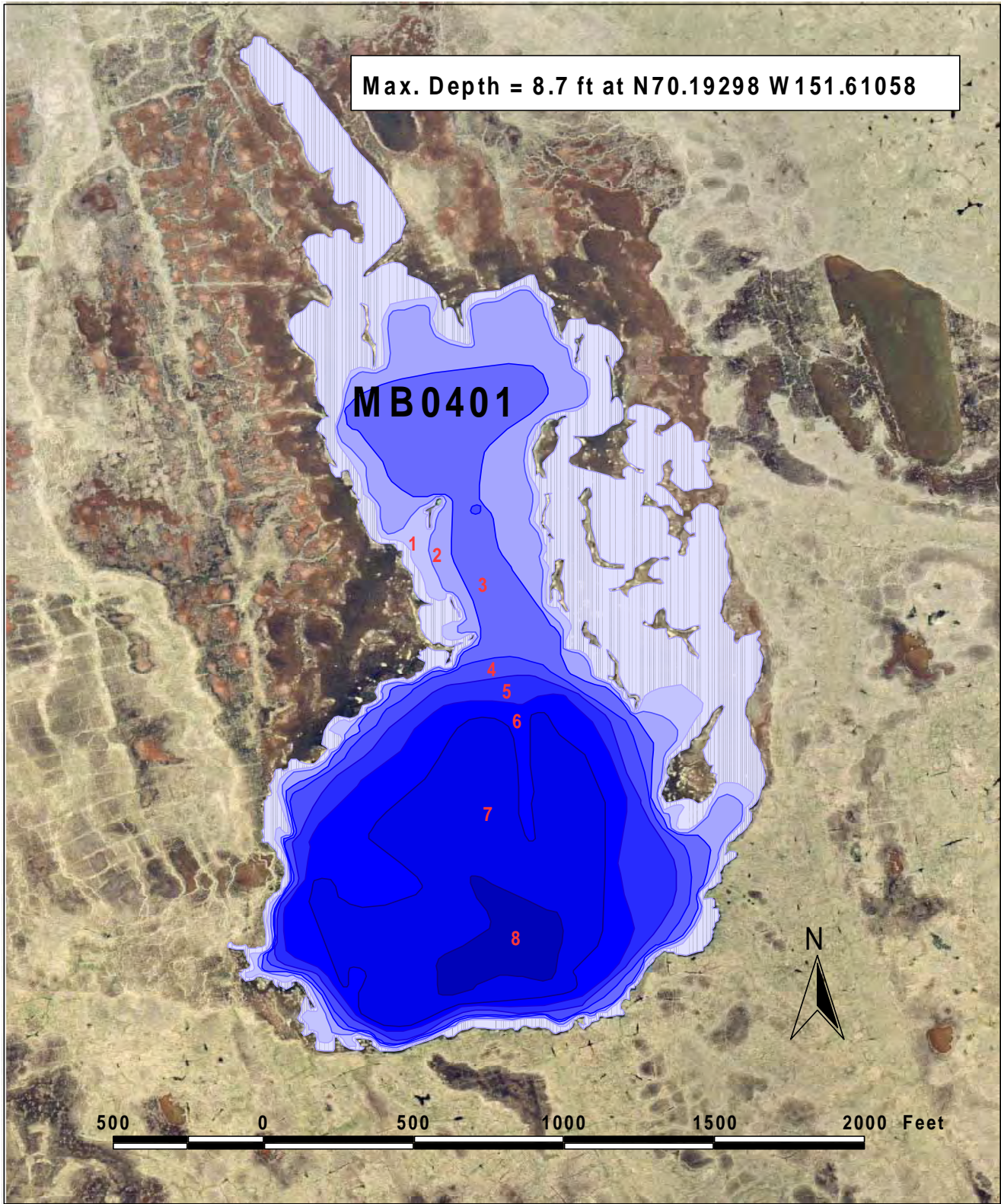


Regions of Lake M1301 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on August 10, 2013.





Depth transects surveyed at Lake M1301 on August 10, 2013.



Depth contours at Lake MB0401 based on transects surveyed on August 9, 2013.  
(depth in 1 ft intervals)

**Lake MB0401**

**Other Names:** None Known  
**Location:** 70.19418°N 151.61024°W  
**USGS Quad Sheet:** Harrison Bay A-3: T10N R2E Sec. 22,27  
**Habitat:** Tundra lake  
**Area:** 76.7 acres  
**Maximum Depth:** 8.7 feet  
**Active Outlet:** No  
**Total Lake Volume:** 92.5 million gallons (August 9, 2013 data)  
**Volume Under 4 ft of ice:** 27.8 million gallons  
**Volume Under 5 ft of ice:** 18.0 million gallons  
**Volume Under 7 ft of ice:** 2.9 million gallons

**Potential Aggregate:** 45.0 acres (water depth 4 ft or less)  
 13.33 million gallons

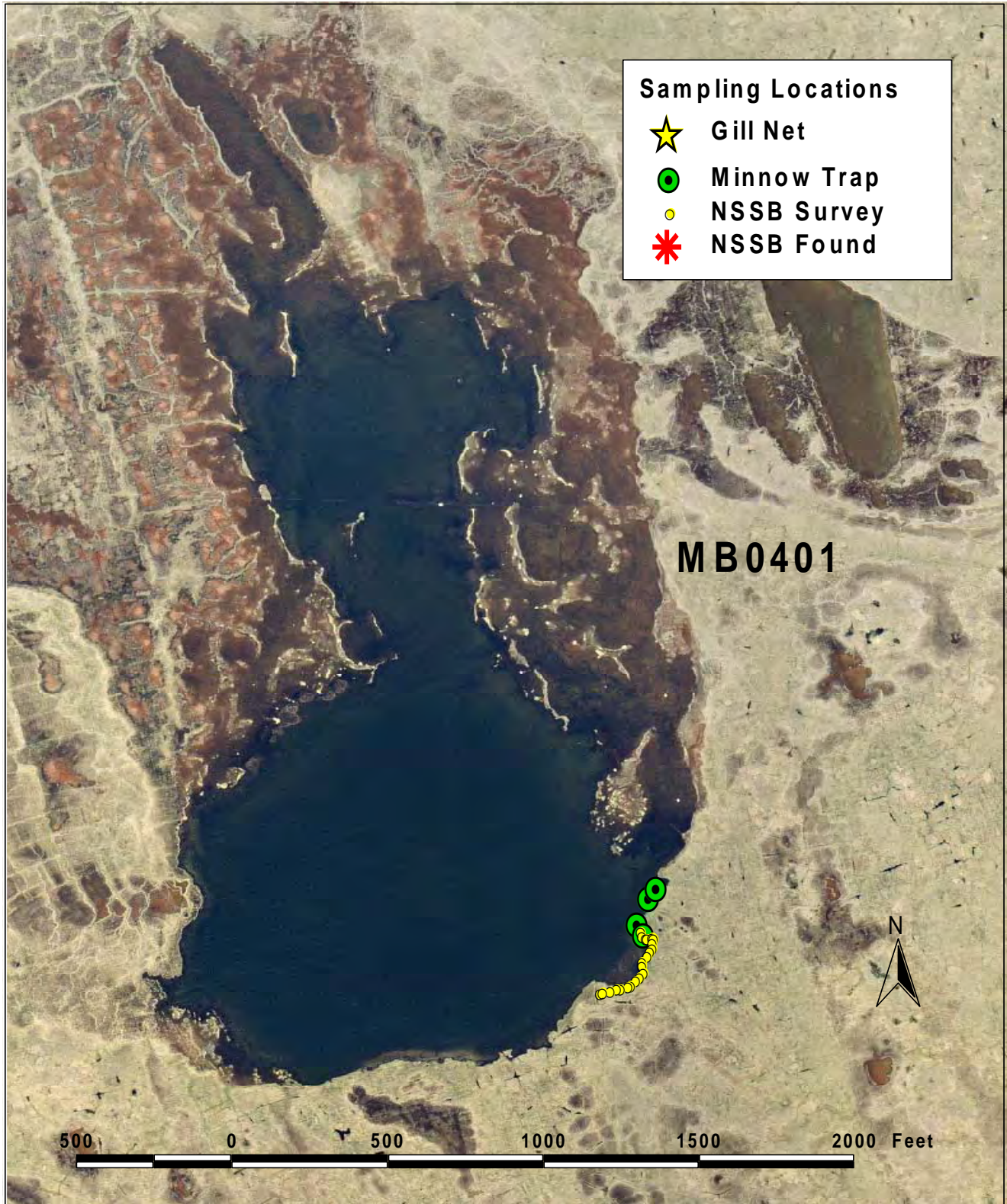
**Maximum Recommended Winter Removal:** **18.509 million gallons**  
 (20% of water volume)

**Water Chemistry:**

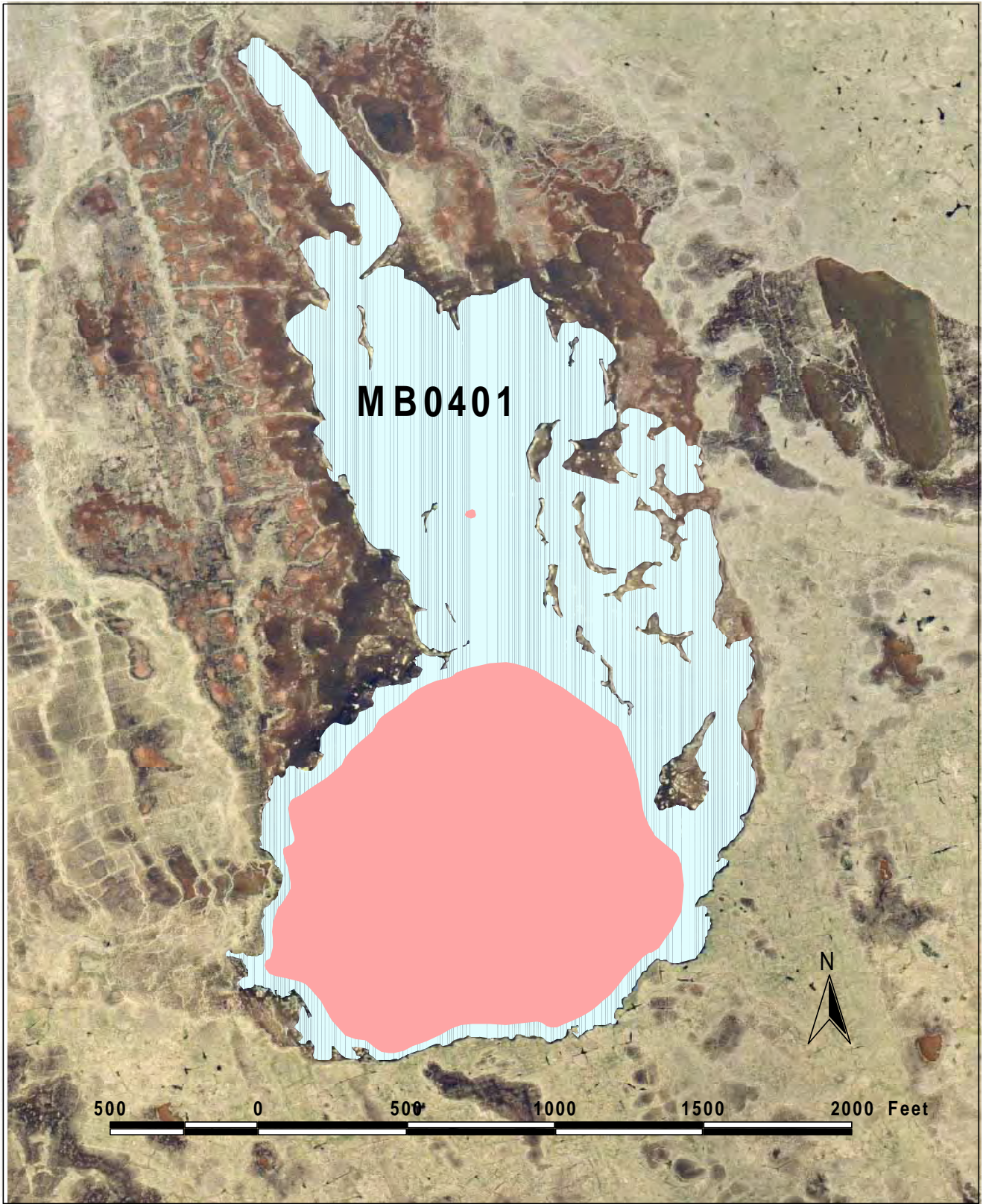
Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2013	9.5	2.3	4.9	12.1	33.1	104	<0.5	7.11	L. Moulton

**Catch Record:**

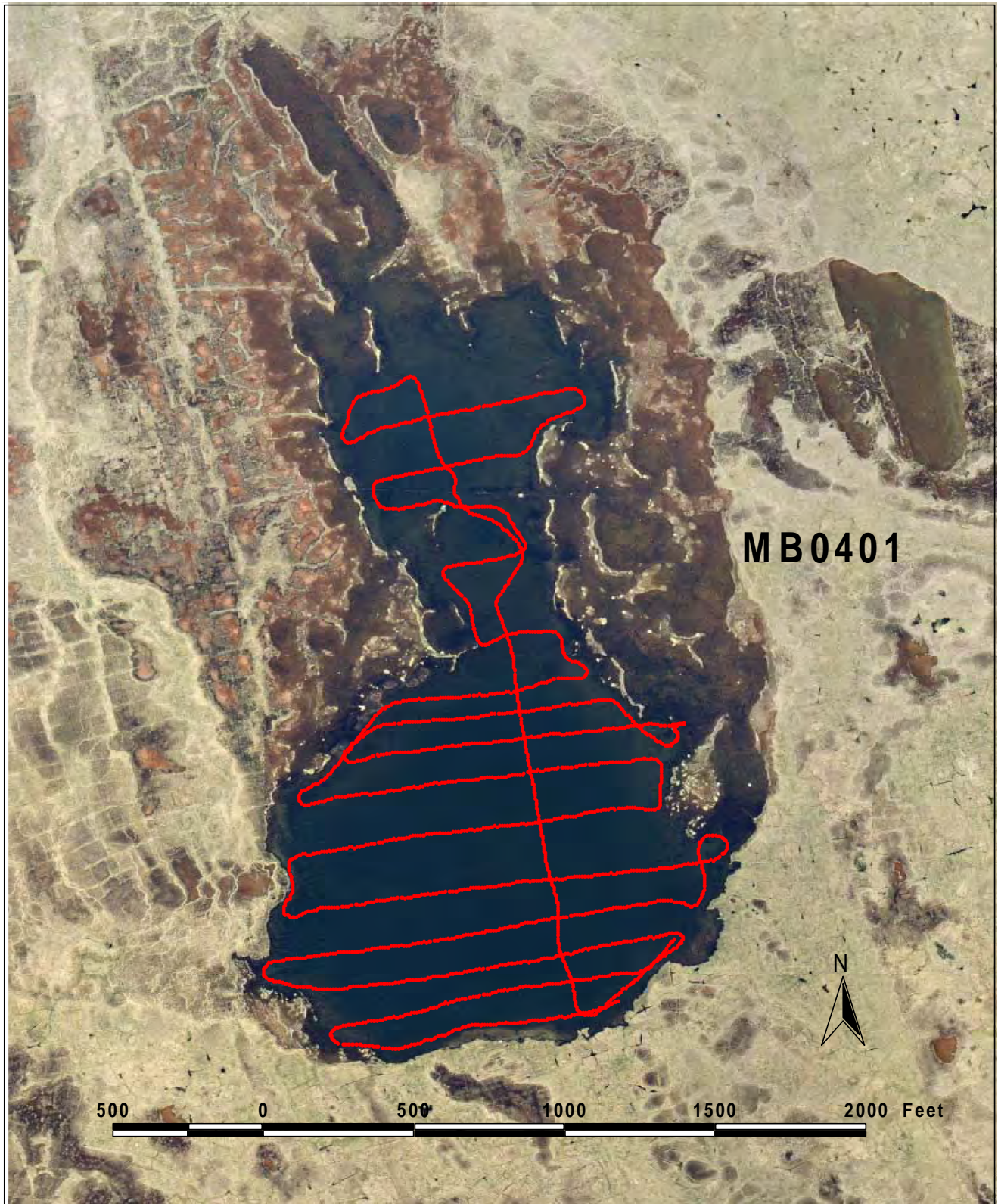
Gear	Date	Effort (hours)	Species	Number Caught
Minnow Traps	Aug 9 13	5.6	none	0
Visual +Dipnet	Aug 9 13	158 yds	none	0



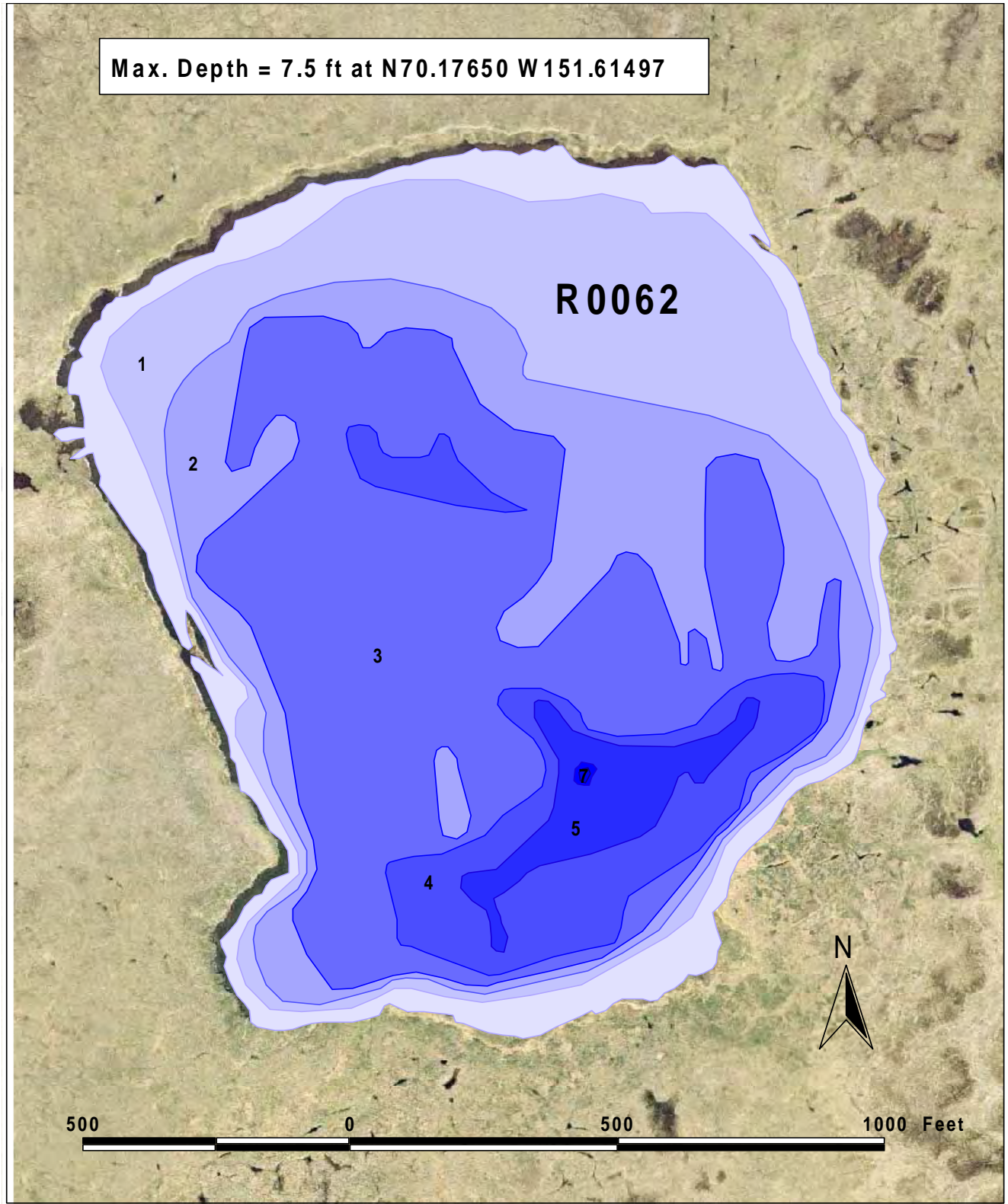
Location of fish sampling effort at Lake MB0401 on August 9, 2013.



Regions of Lake MB0401 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on August 9, 2013.



Depth transects surveyed at Lake MB0401 on August 9, 2013.



Depth contours at Lake R0062 based on transects surveyed on August 9, 2013.  
(depth in 1 ft intervals)

**Lake R0062**

**Other Names:** None Known  
**Location:** 70.17761°N 151.61566°W  
**USGS Quad Sheet:** Harrison Bay A-3: T10N R2E Sec. 34  
**Habitat:** Tundra lake  
**Area:** 46.6 acres  
**Maximum Depth:** 7.5 feet  
**Active Outlet:** No  
**Total Lake Volume:** 40.3 million gallons (August 9, 2013 data)  
**Volume Under 4 ft of ice:** 1.40 million gallons  
**Volume Under 5 ft of ice:** 0.22 million gallons  
**Volume Under 7 ft of ice:** 0.00 million gallons

**Potential Aggregate:** 40.6 acres (water depth 4 ft or less)  
 12.05 million gallons

**Maximum Recommended Winter Removal:** **0.066 million gallons**  
 (30% of water volume under 5 feet of ice)  
 (does not include volume associated with ice aggregate)

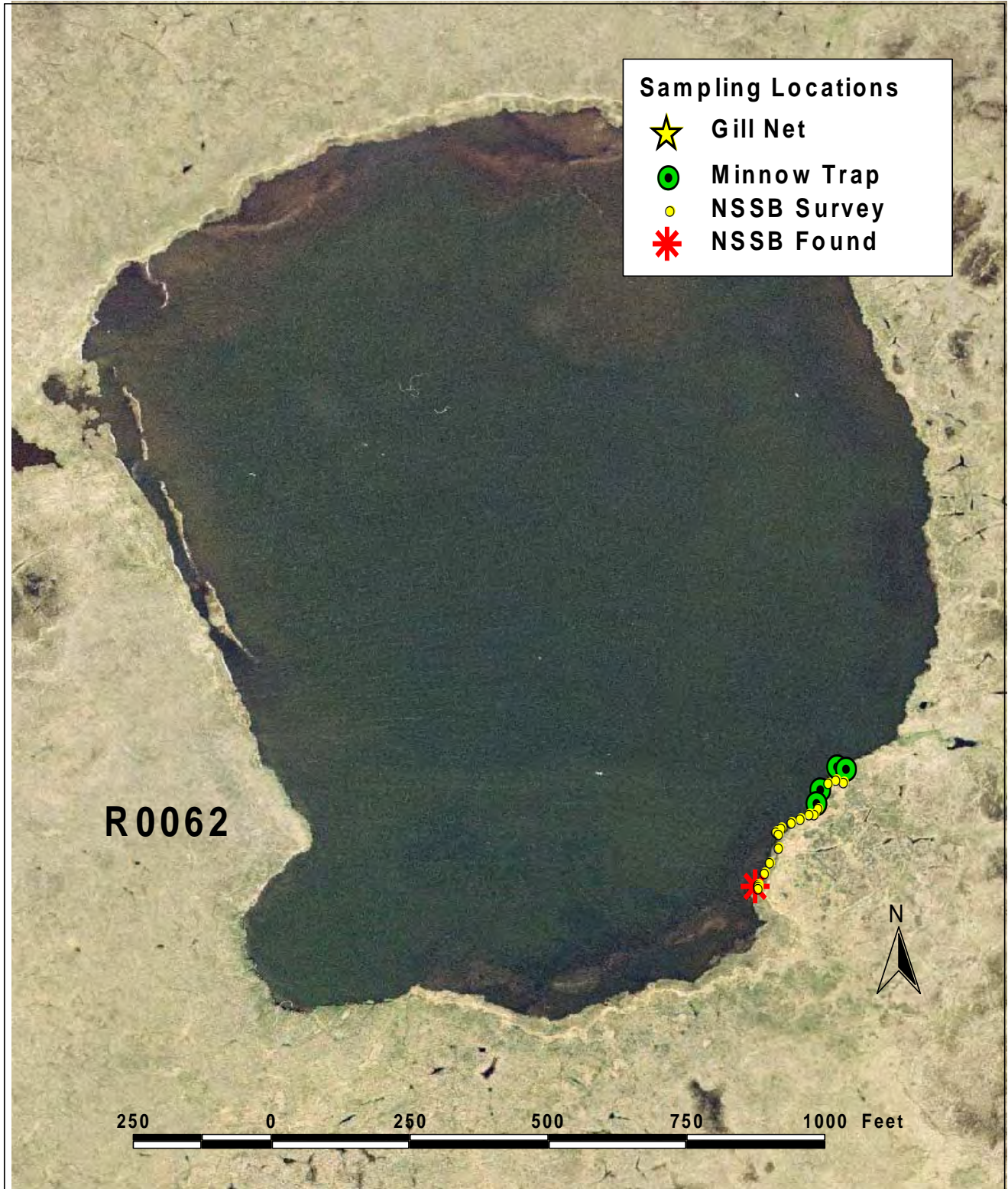
**Water Chemistry:**

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2013	44.0	16.8	21.5	141.0	179.0	555	0.93	7.25	L. Moulton

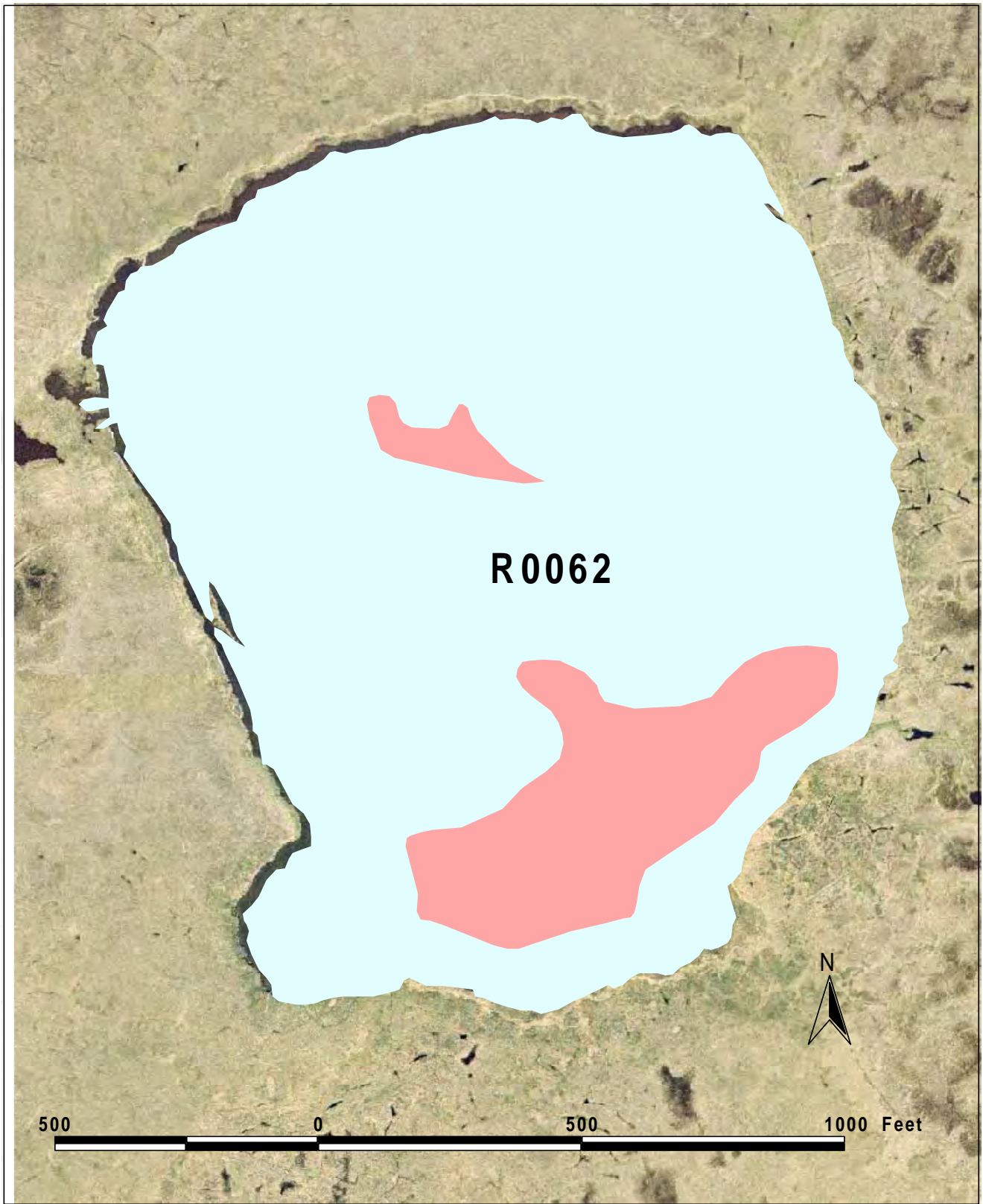
**Catch Record:**

Gear	Date	Effort (hours)	Species	Number Caught
Minnow Traps	Aug 9 13	3.7	none	0
Visual +Dipnet	Aug 9 13	143 yds	Ninespine stickleback	1

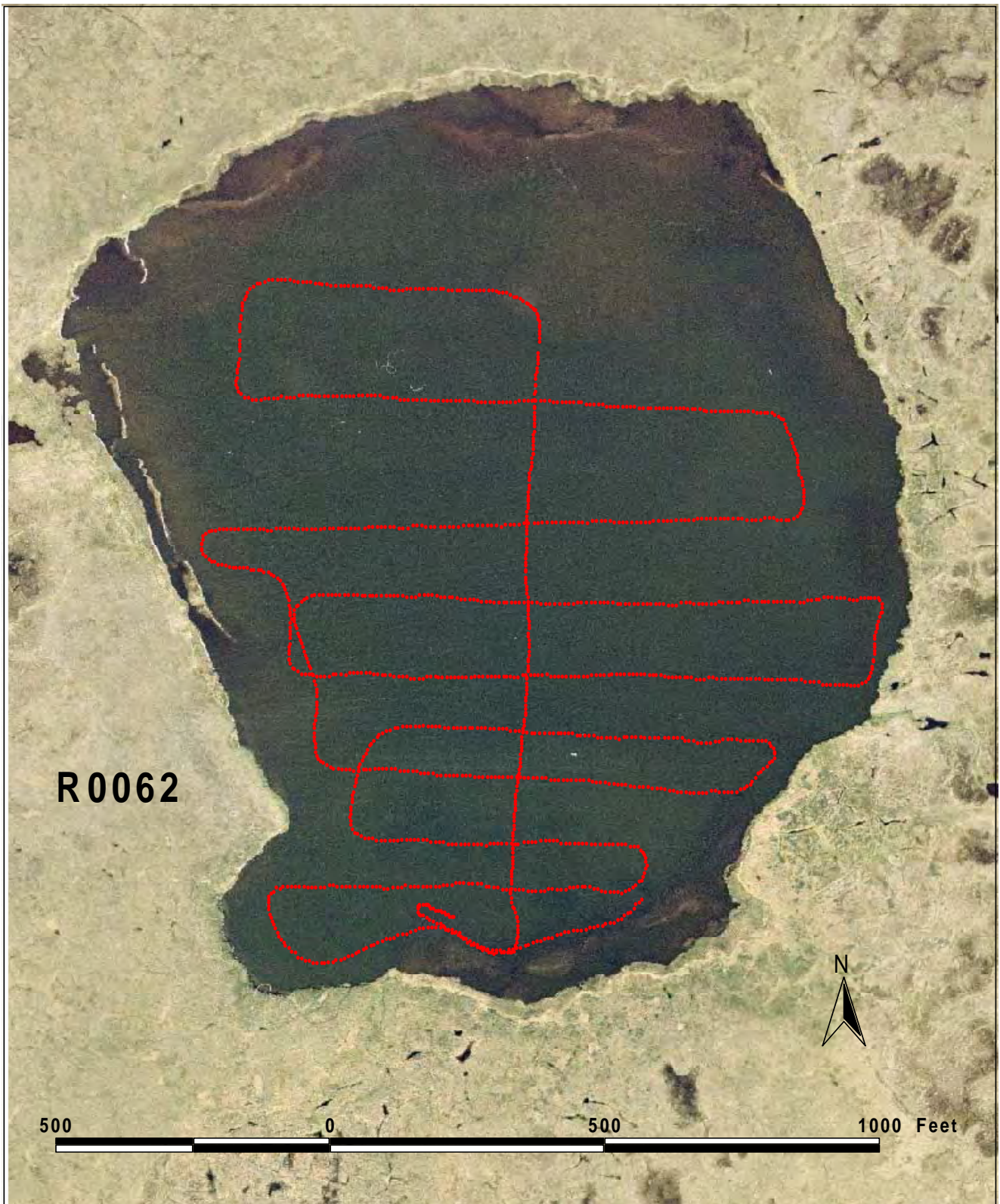




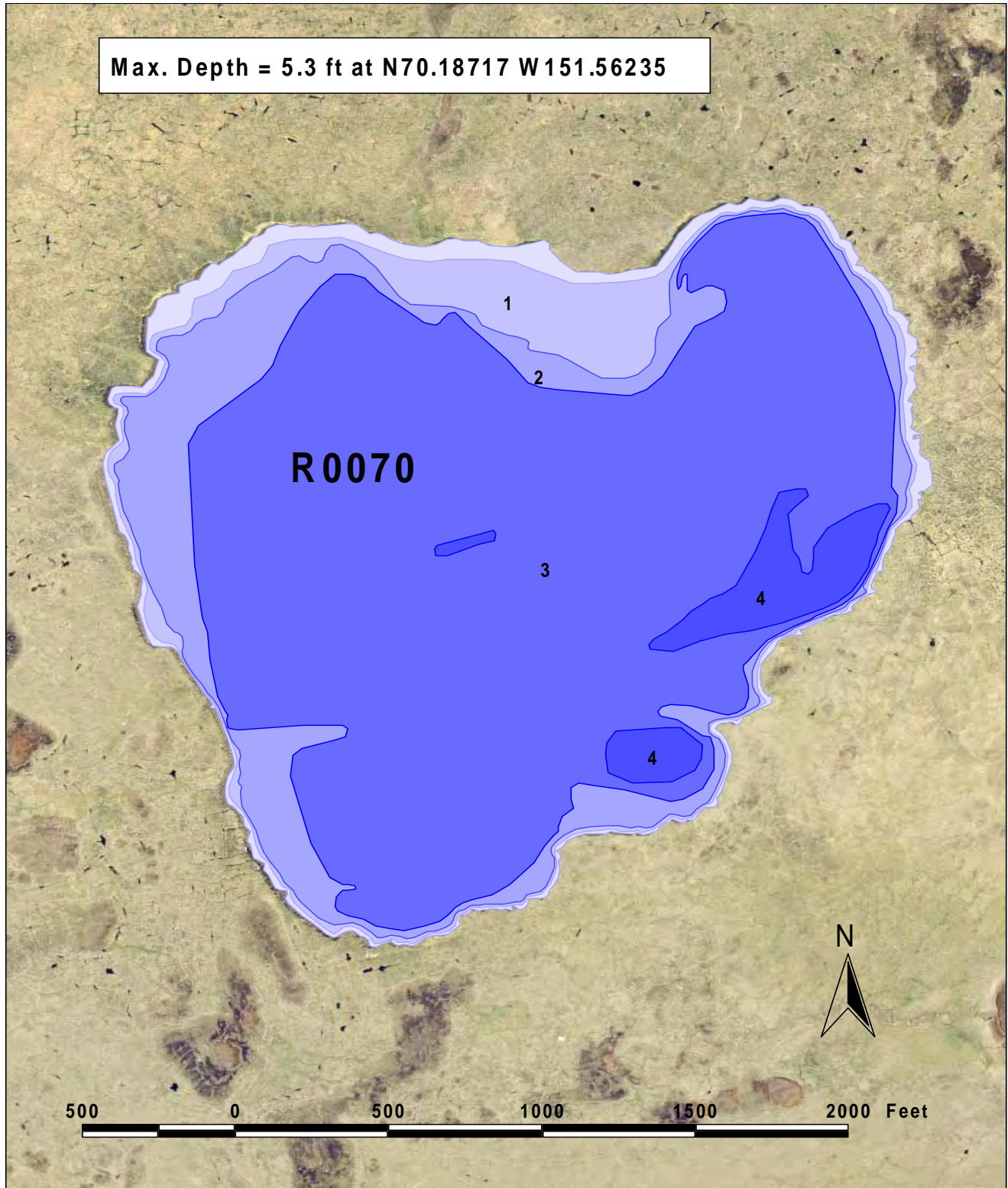
Location of fish sampling effort at Lake R0062 on August 9, 2013.



Regions of Lake R0062 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on August 9, 2013.



Depth transects surveyed at Lake R0062 on August 9, 2013.



Depth contours at Lake R0070 based on transects surveyed on August 10, 2013.  
(depth in 1 ft intervals)

**Lake R0070**

**Other Names:** None Known  
**Location:** 70.18723°N 151.57044°W  
**USGS Quad Sheet:** Harrison Bay A-3: T10N R2E Sec. 26,35  
**Habitat:** Tundra lake  
**Area:** 116 acres  
**Maximum Depth:** 5.3 feet  
**Active Outlet:** No  
**Total Lake Volume:** 114.5 million gallons (August 10, 2013 data)  
**Volume Under 4 ft of ice:** 0.6 million gallons  
**Volume Under 5 ft of ice:** 0.0 million gallons  
**Volume Under 7 ft of ice:** 0.0 million gallons

**Potential Aggregate:** 110.8 acres (water depth 4 ft or less)  
 32.85 million gallons

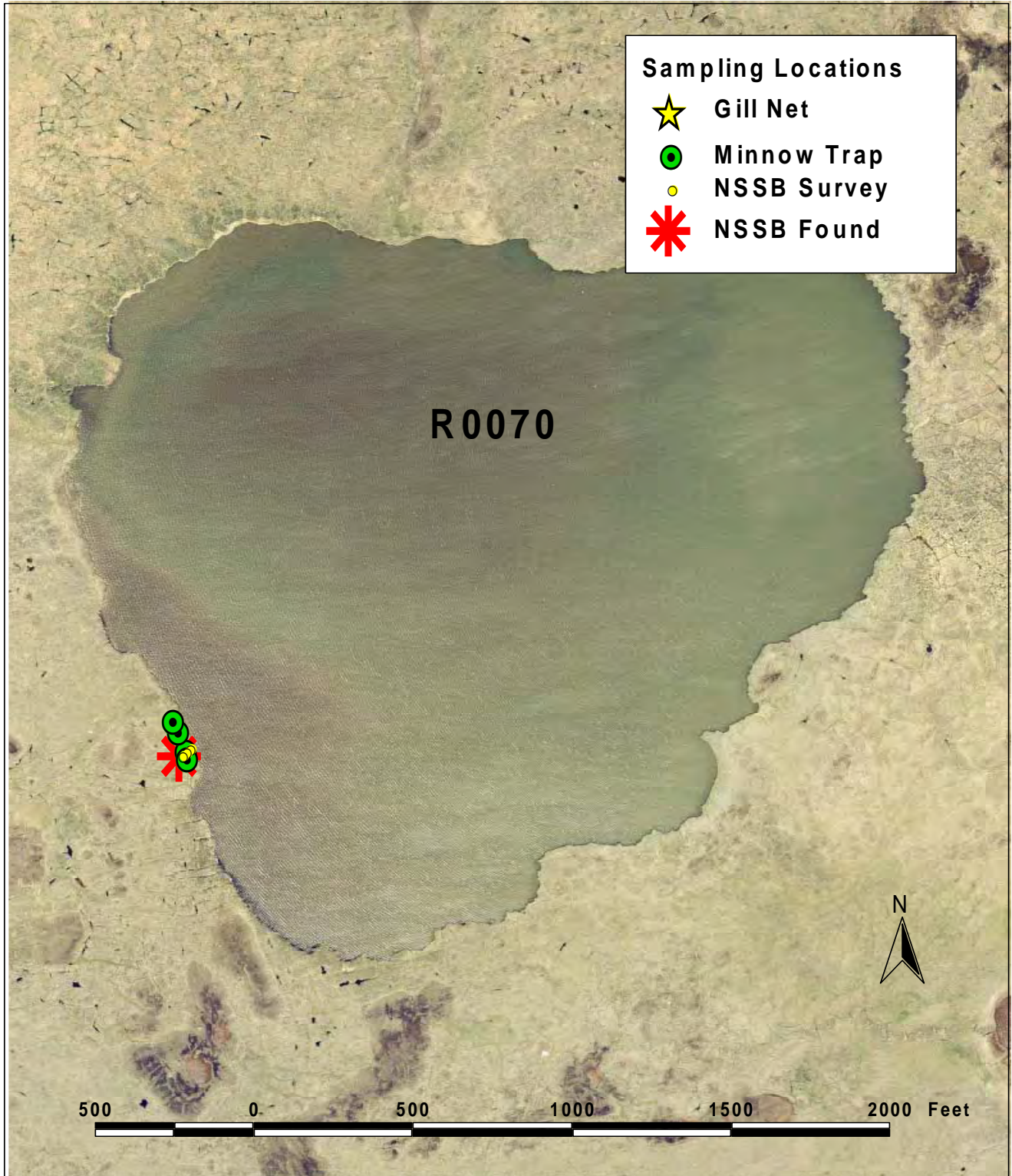
**Maximum Recommended Winter Removal:** **0.000 million gallons**  
 (30% of water volume under 5 feet of ice)  
 (does not include volume associated with ice aggregate)

**Water Chemistry:**

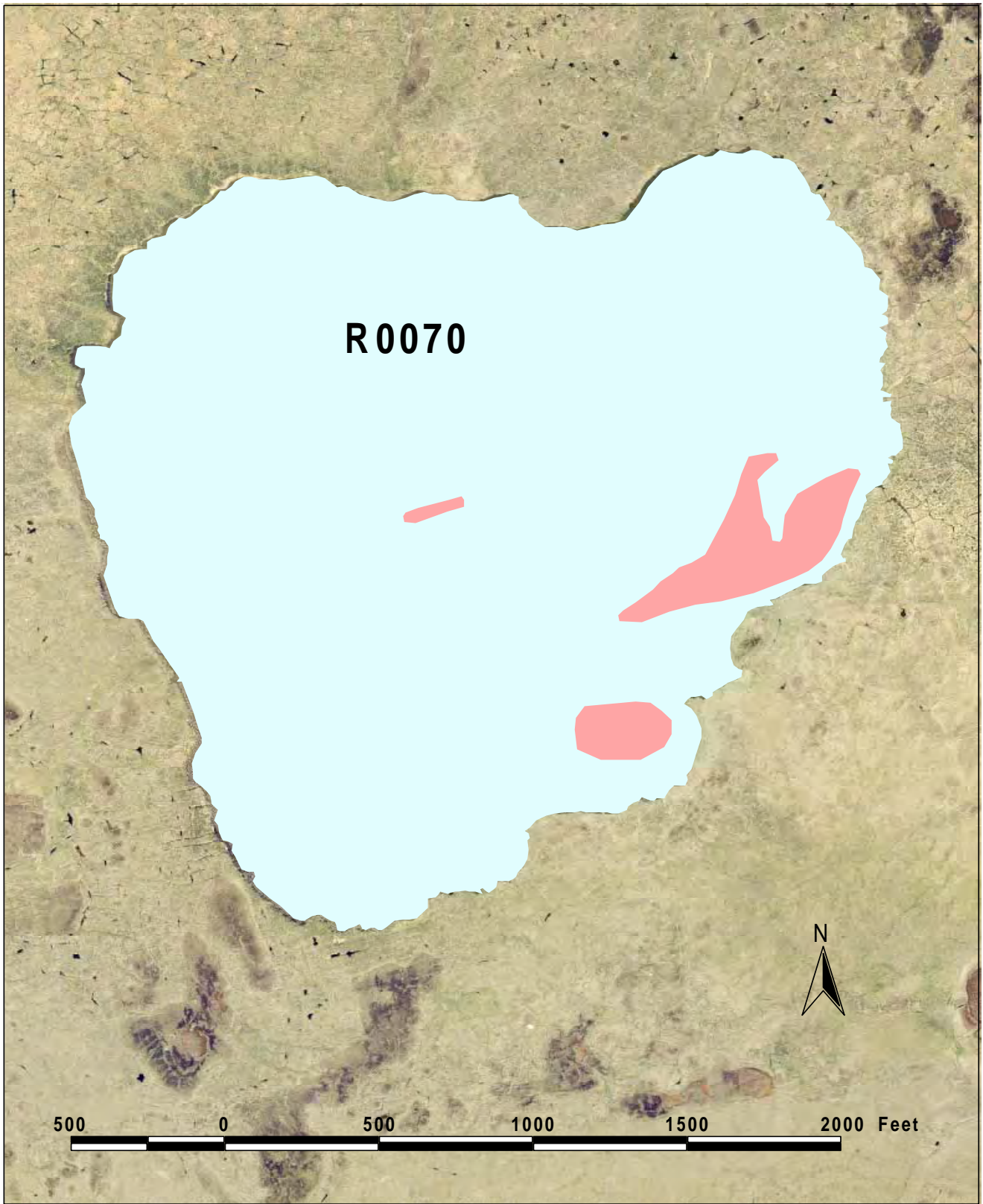
Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2013	28.6	6.8	10.9	55.2	99.6	299	1.58	7.41	L. Moulton

**Catch Record:**

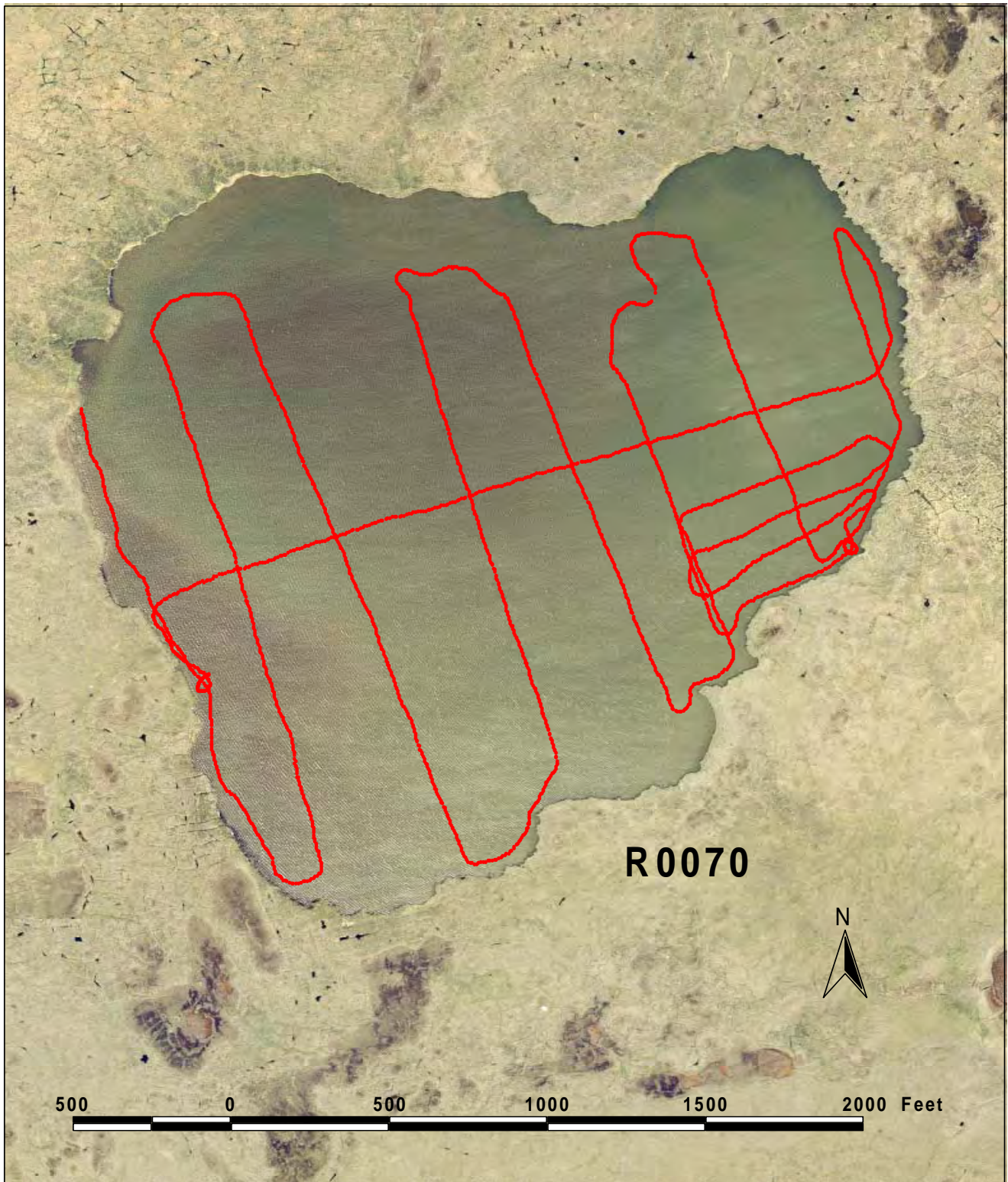
Gear	Date	Effort (hours)	Species	Number Caught
Minnow Traps	Aug 10 13	5.7	none	0
Visual +Dipnet	Aug 10 13	38 yds	Ninespine stickleback	1



Location of fish sampling effort at Lake R0070 on August 10, 2013.

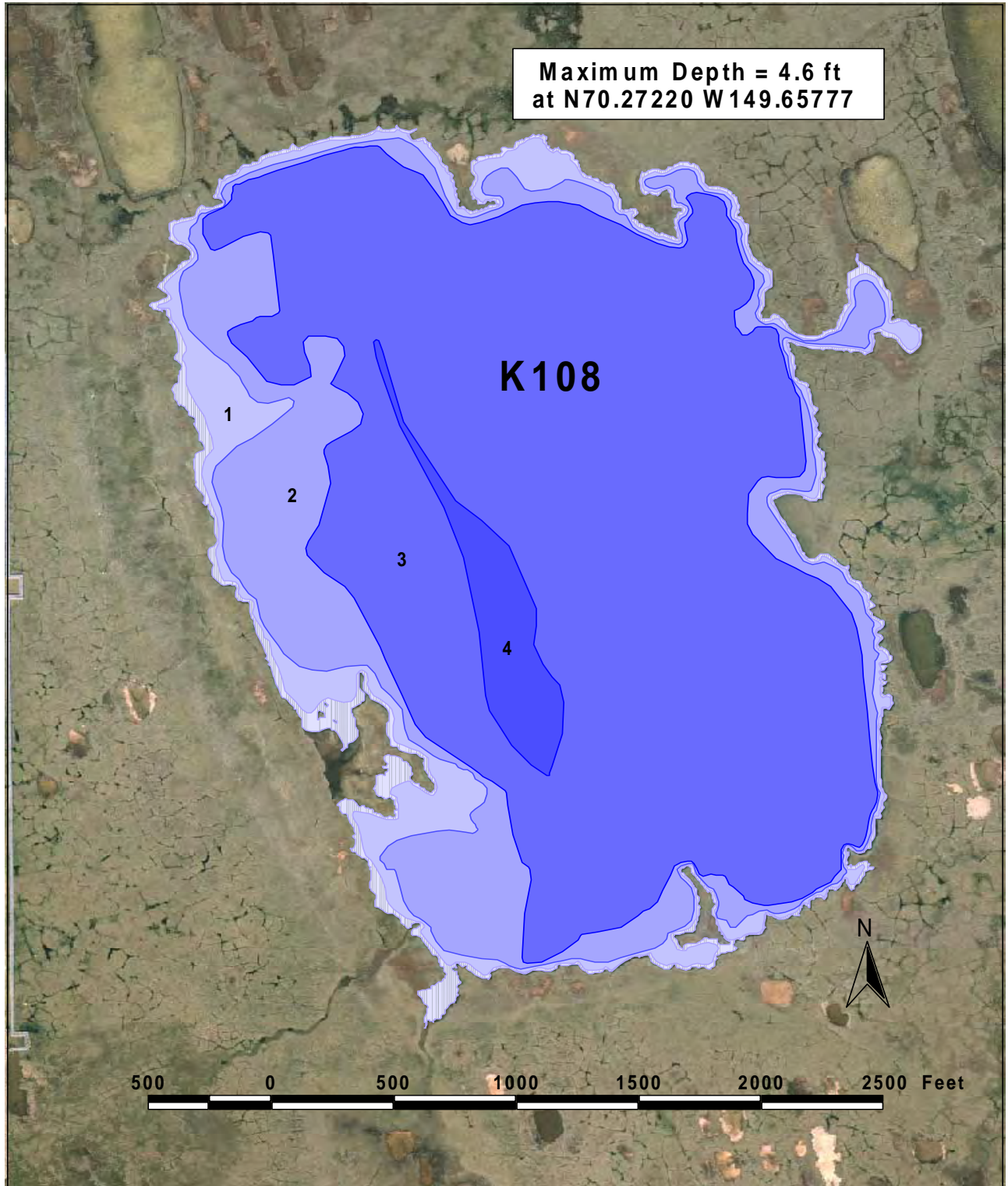


Regions of Lake R0070 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on August 10, 2013.



Depth transects surveyed at Lake R0070 on August 10, 2013.





Depth contours at Lake K108 based on transects surveyed on July 19, 2013.  
(depth in 1 ft intervals)

**Lake K108**

**Other Names:** None Known  
**Location:** 70.27703°N 149.65792°W  
**USGS Quad Sheet:** Beechey Pt. B-5: T10N R9E Sec. 2, T11N R9E Sec. 35  
**Habitat:** Tundra lake  
**Area:** 191 acres  
**Maximum Depth:** 4.6 feet  
**Active Outlet:** No  
**Total Lake Volume:** 189.0 million gallons (July 19, 2013 data)  
**Volume Under 4 ft of ice:** 0.742 million gallons  
**Volume Under 5 ft of ice:** 0.0 million gallons  
**Volume Under 7 ft of ice:** 0.0 million gallons  
  
**Potential Aggregate:** 184.4 acres (water depth 4 ft or less)  
 54.70 million gallons

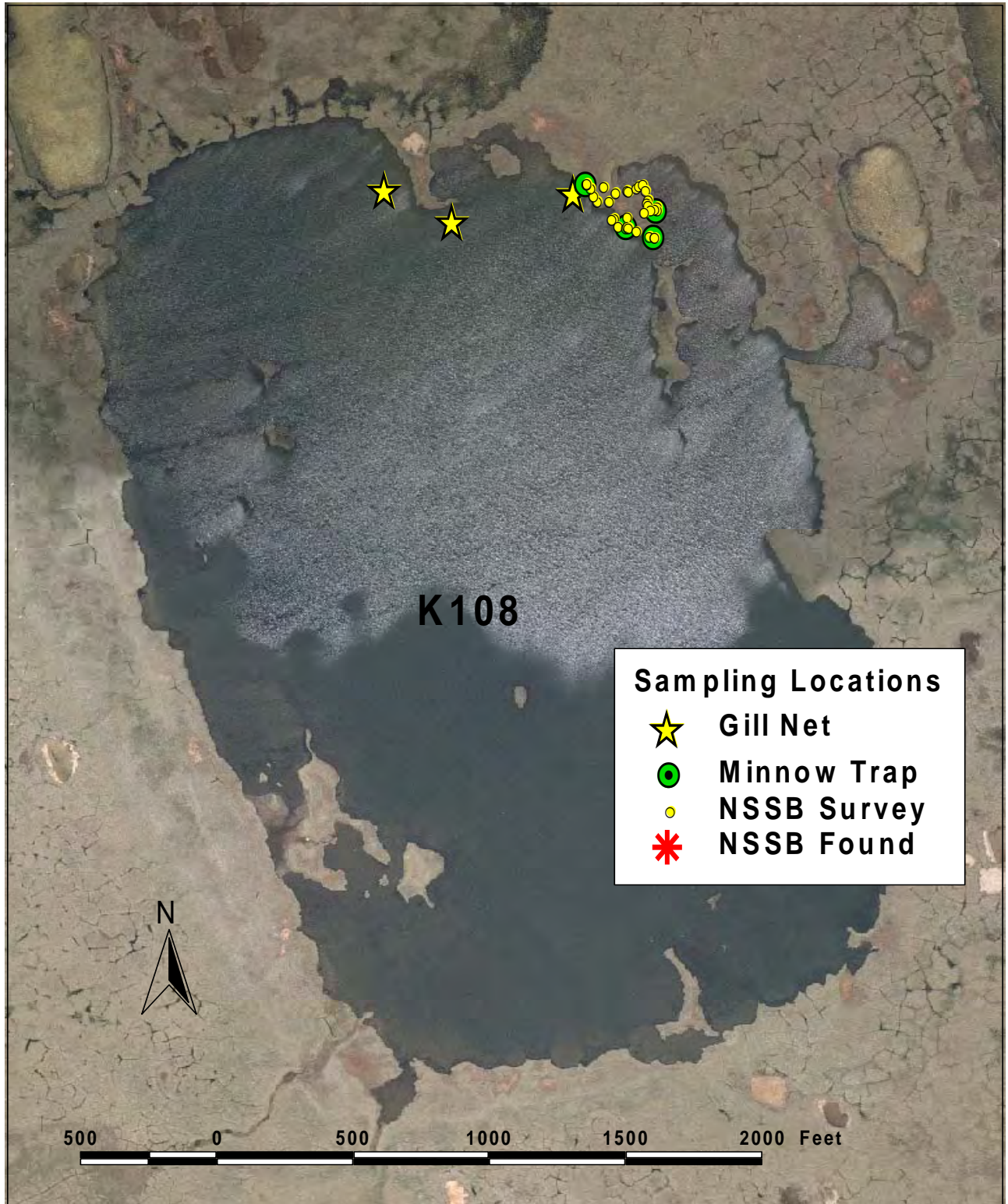
**Maximum Recommended Winter Removal:** **37.80 million gallons**  
 (20% of water volume)

**Water Chemistry:**

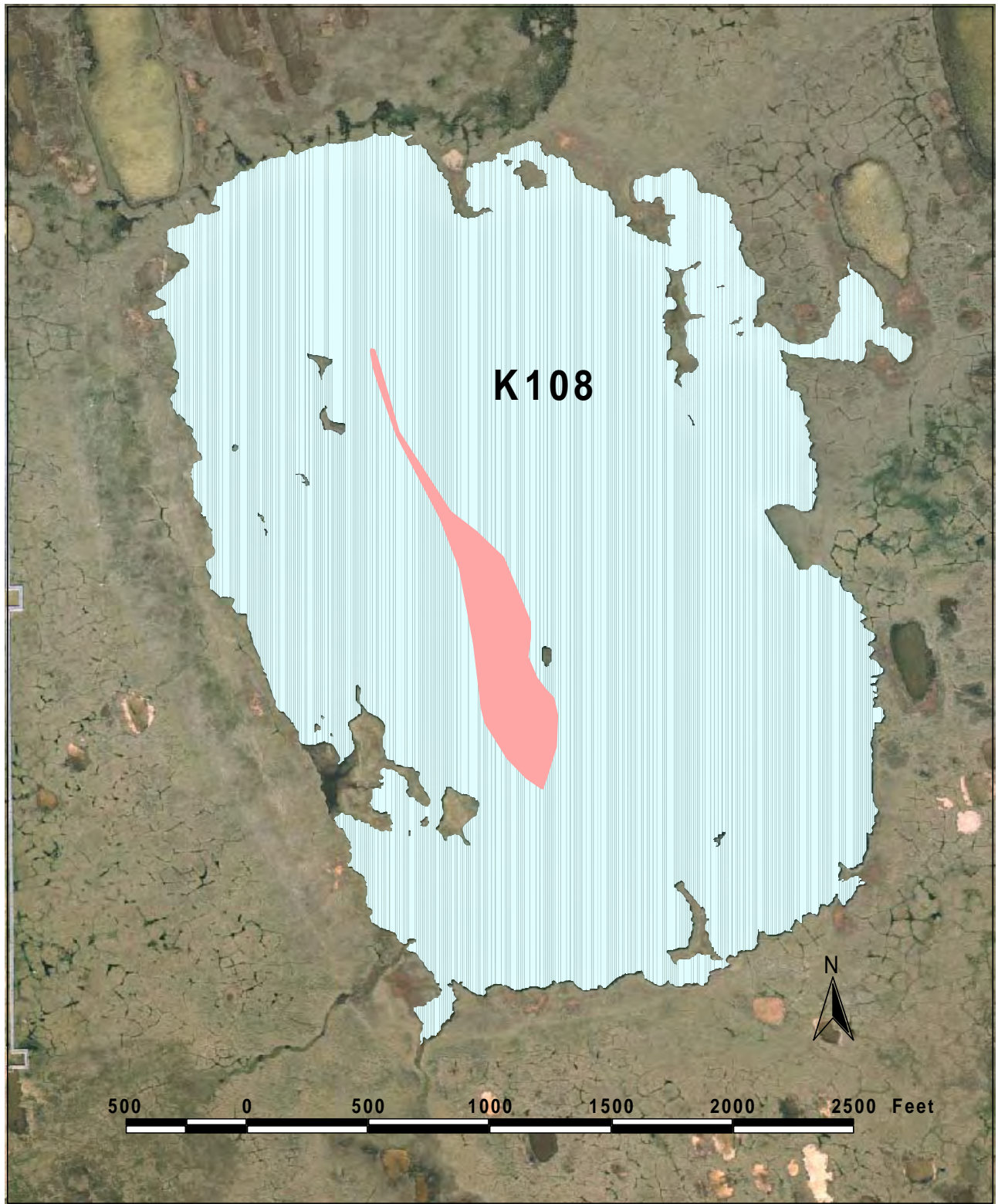
Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2013	--	--	--	--	--	231	0.7	7.72	L. Moulton

**Catch Record:**

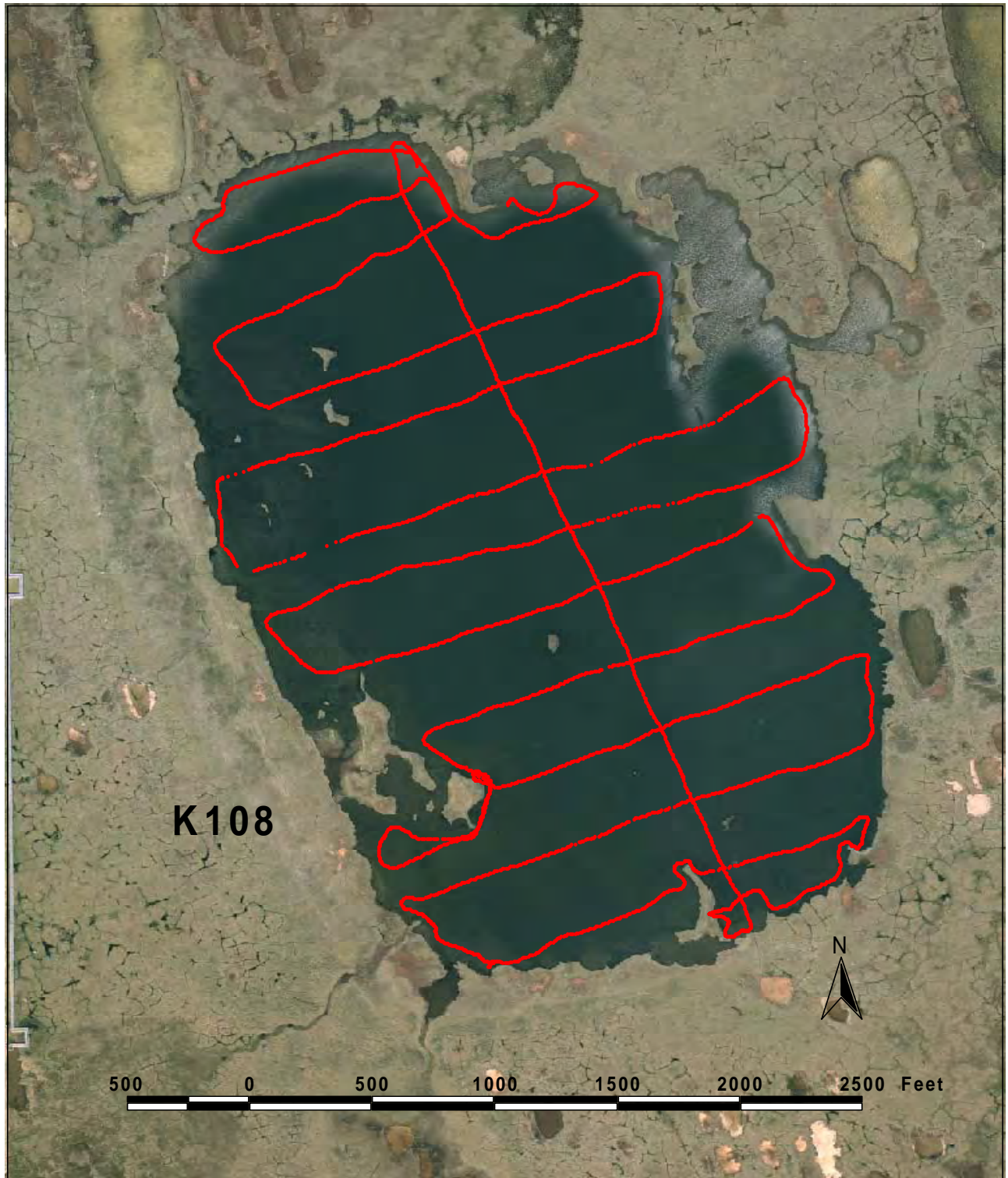
Gear	Date	Effort (hours)	Species	Number Caught
Gill net	Jul 19 13	9.5	none	0
Minnow Traps	Jul 19 13	13.6	none	0
Visual +Dipnet	Jul 19 13	892 yds	none	0



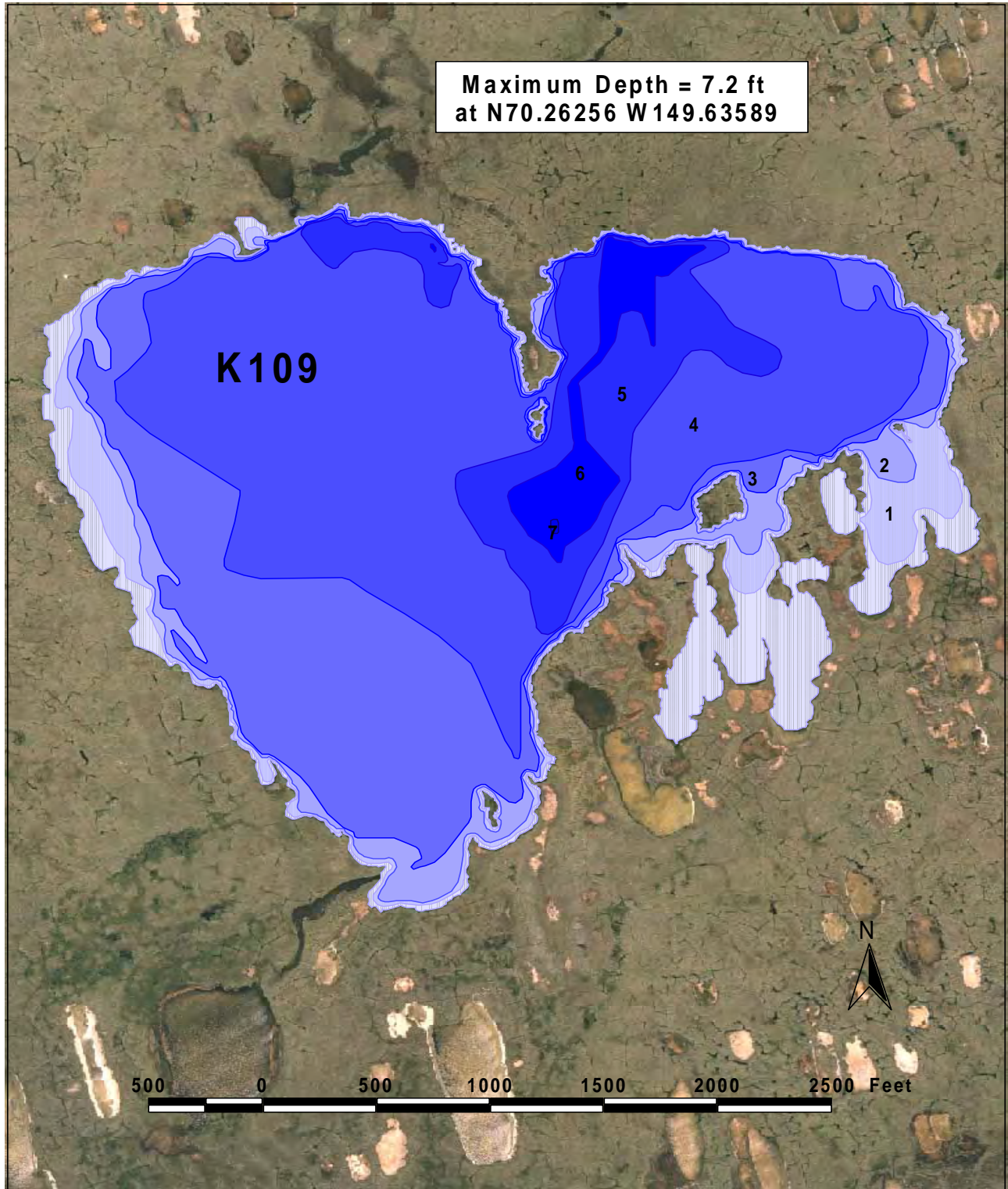
Location of fish sampling effort at Lake K108 on July 19, 2013.



Regions of Lake K108 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on July 19, 2013.



Depth transects surveyed at Lake K108 on July 19, 2013.



Depth contours at Lake K109 based on transects surveyed on August 8, 2013.  
(depth in 1 ft intervals)

**Lake K109**

**Other Names:** None Known  
**Location:** 70.26336°N 149.64304°W  
**USGS Quad Sheet:** Beechey Pt. B-5: T11N R10E Sec. 29  
**Habitat:** Tundra lake  
**Area:** 194 acres  
**Maximum Depth:** 7.2 feet  
**Active Outlet:** No  
**Total Lake Volume:** 234.4 million gallons (August 8, 2013 data)  
**Volume Under 4 ft of ice:** 26.2 million gallons  
**Volume Under 5 ft of ice:** 5.9 million gallons  
**Volume Under 7 ft of ice:** 0.0 million gallons

**Potential Aggregate:** 87.0 acres (water depth 4 ft or less)  
 25.81 million gallons

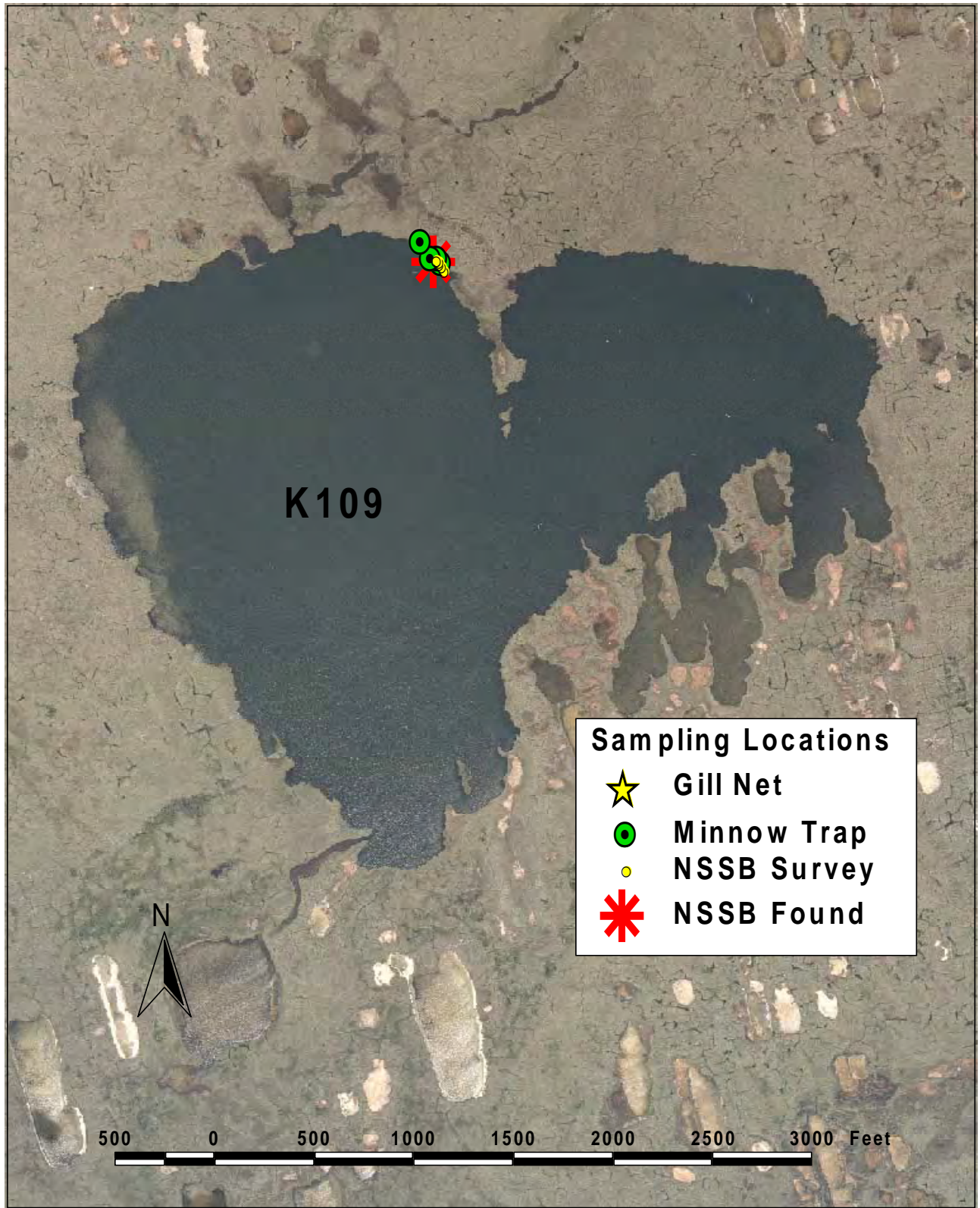
**Maximum Recommended Winter Removal:** **1.770 million gallons**  
 (30% of water volume under 5 feet of ice)  
 (does not include volume associated with ice aggregate)

**Water Chemistry:**

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2013	28.7	2.4	4.1	14.6	81.6	195	<0.5	7.56	L. Moulton

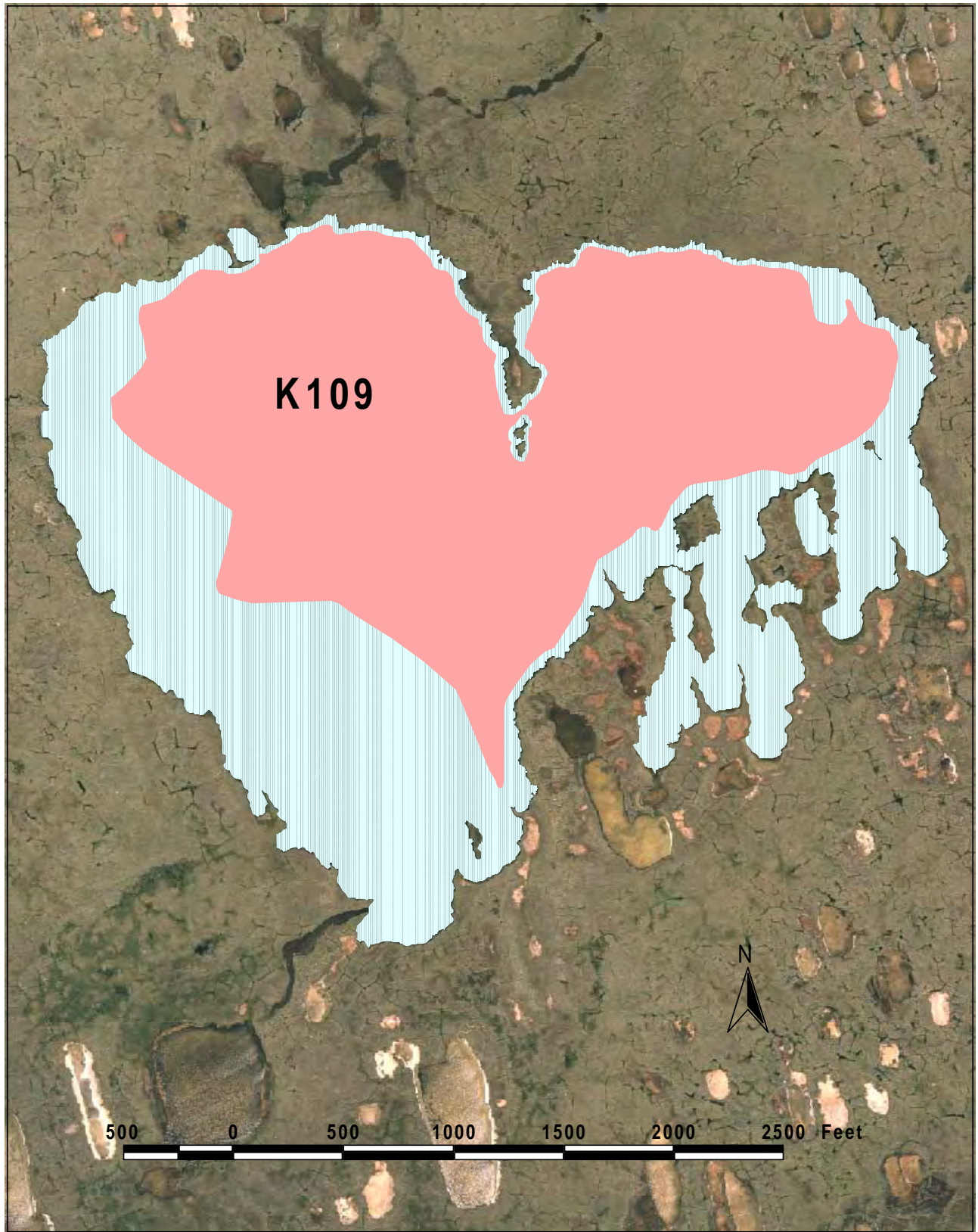
**Catch Record:**

Gear	Date	Effort (hours)	Species	Number Caught
Minnow Traps	Aug 8 13	7.8	none	0
Visual +Dipnet	Aug 8 13	87	Ninespine stickleback	1

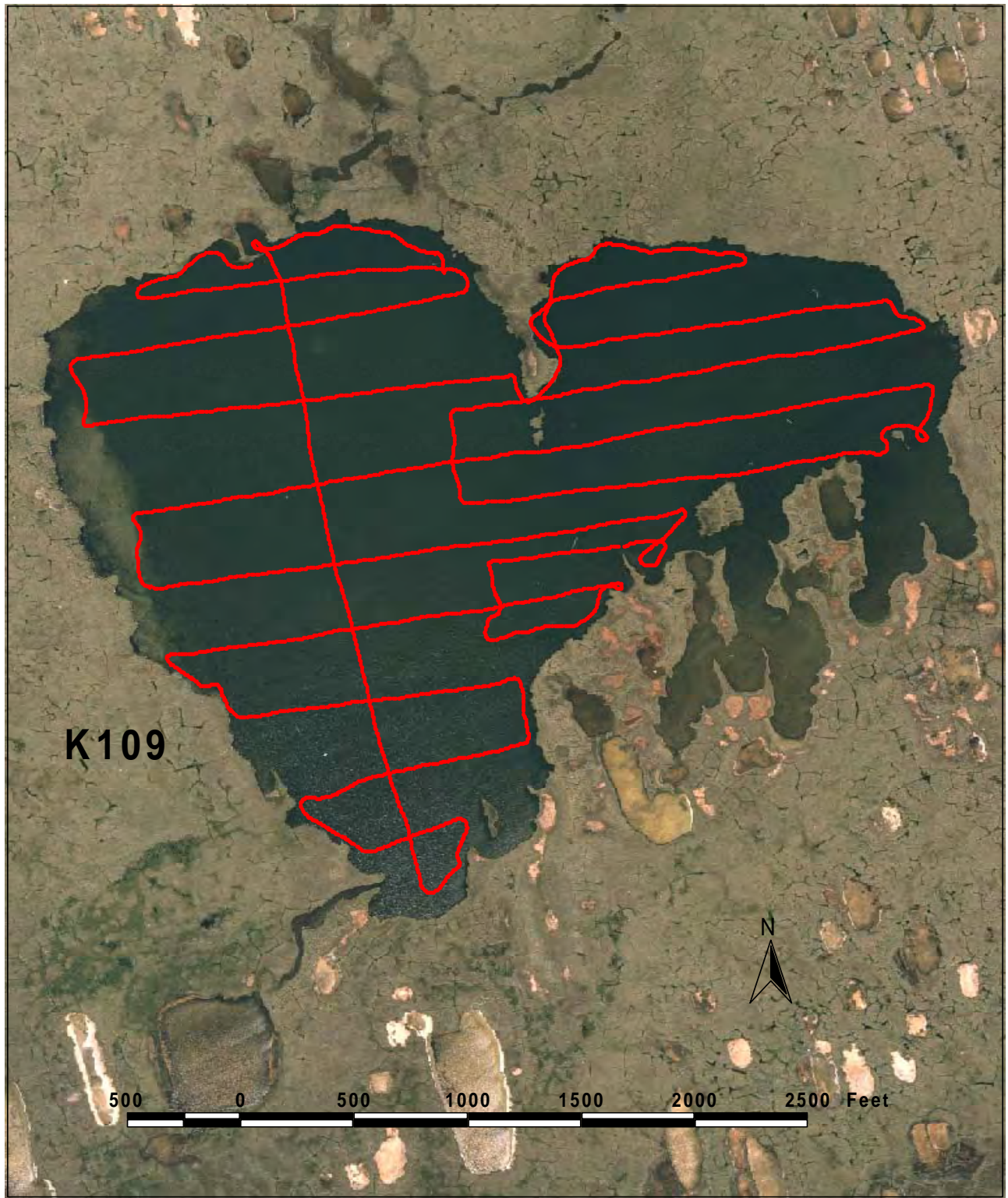


Location of fish sampling effort at Lake K109 on August 8, 2013.

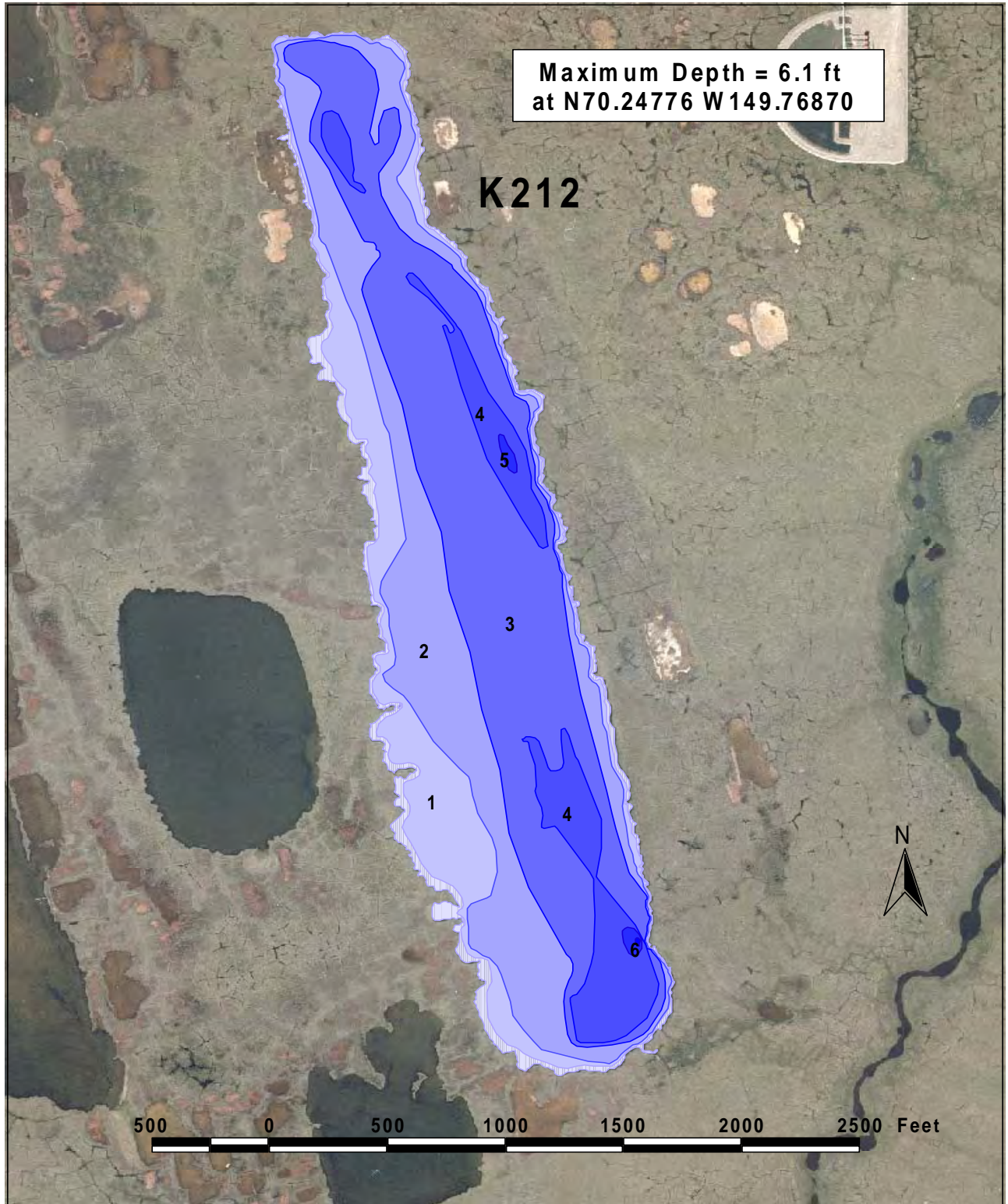




Regions of Lake K109 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on August 8, 2013.



Depth transects surveyed at Lake K109 on August 8, 2013.



Depth contours at Lake K212 based on transects surveyed on July 18, 2013.  
(depth in 1 ft intervals)

**Lake K212**

**Other Names:** None Known  
**Location:** 70.25187°N 149.77424°W  
**USGS Quad Sheet:** Beechey Pt. B-5: T11N R10E Sec. 32.33  
**Habitat:** Tundra lake  
**Area:** 86.3 acres  
**Maximum Depth:** 6.1 feet  
**Active Outlet:** No  
**Total Lake Volume:** 79.4 million gallons (July 18, 2013 data)  
**Volume Under 4 ft of ice:** 1.338 million gallons  
**Volume Under 5 ft of ice:** 0.046 million gallons  
**Volume Under 7 ft of ice:** 0.0 million gallons

**Potential Aggregate:** 76.6 acres (water depth 4 ft or less)  
 22.71 million gallons

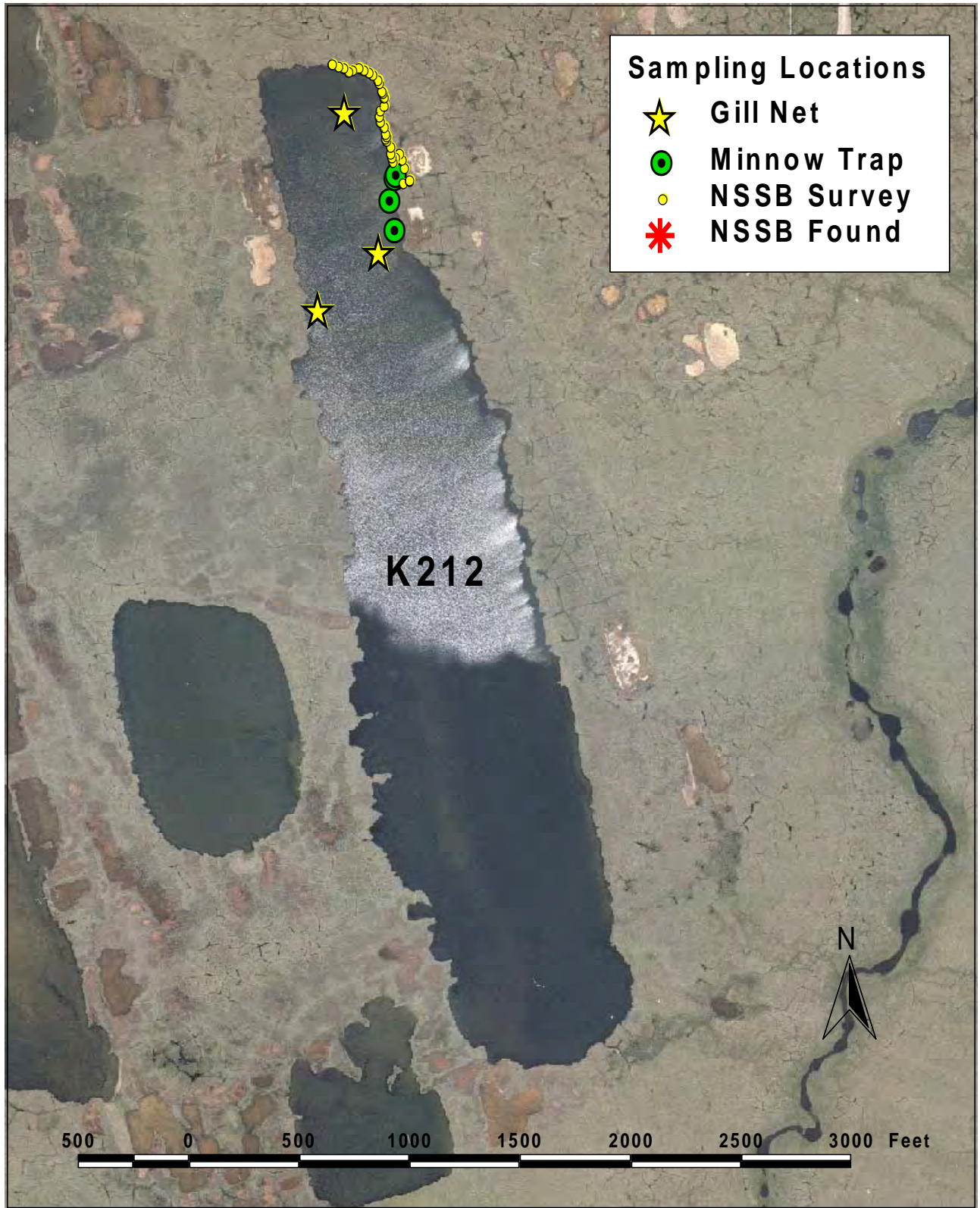
**Maximum Recommended Winter Removal:** **15.88 million gallons**  
 (20% of water water volume)

**Water Chemistry:**

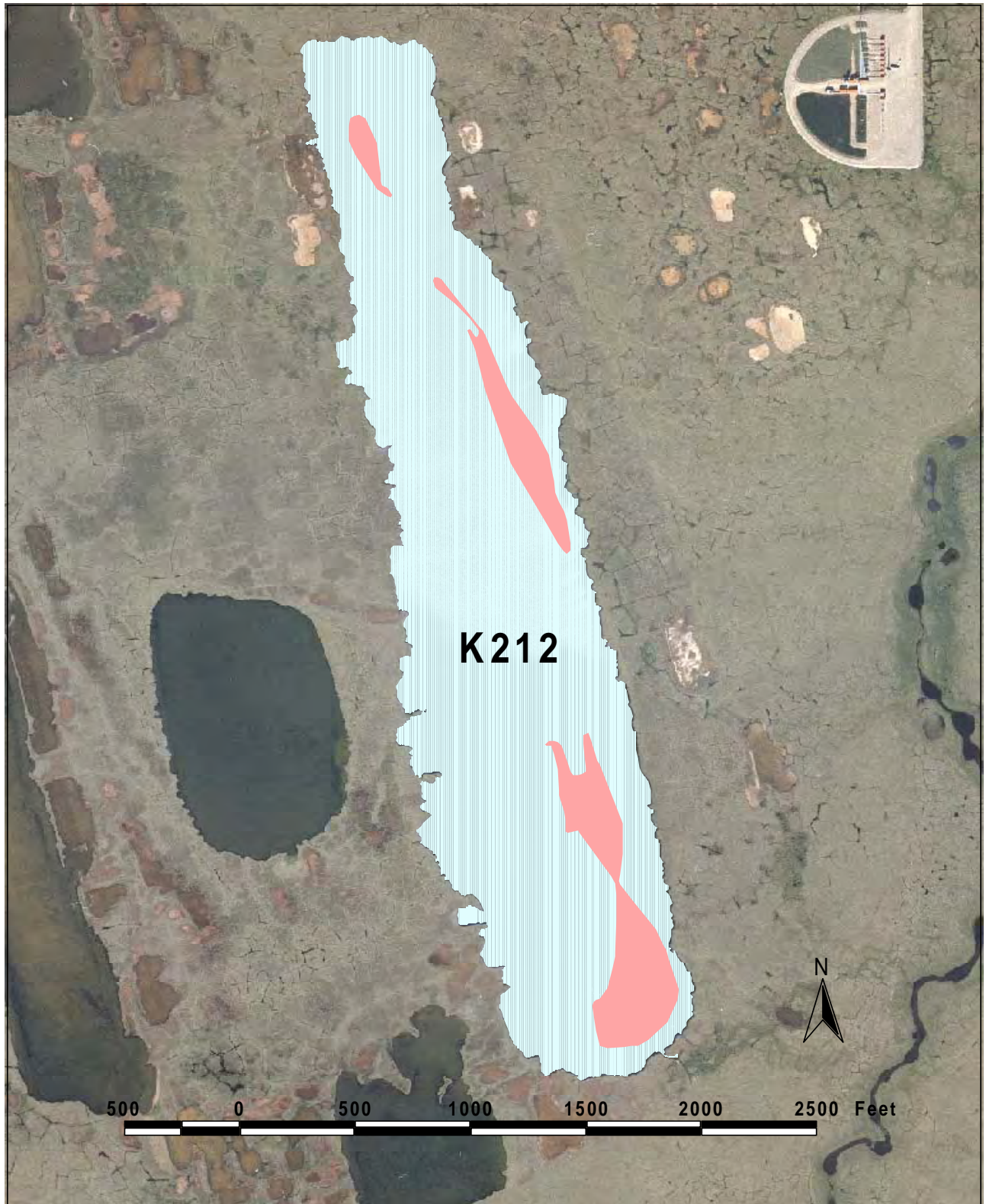
Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2013	--	--	--	--	--	206	0.6	7.75	L. Moulton

**Catch Record:**

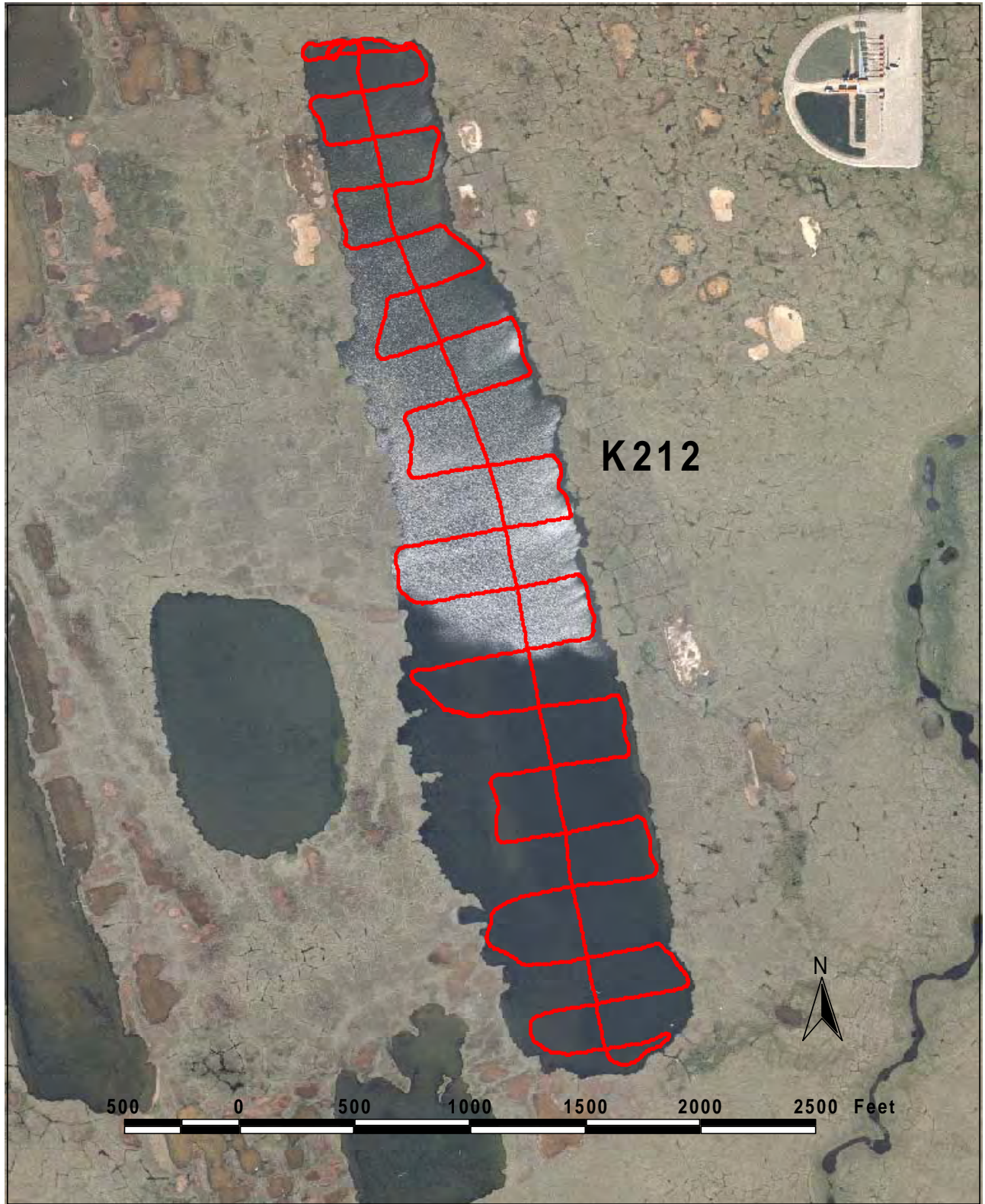
Gear	Date	Effort (hours)	Species	Number Caught
Gill net	Jul 18 13	9.4	none	0
Minnow Traps	Jul 18 13	14.2	none	0
Visual +Dipnet	Jul 18 13	304 yds	none	0



Location of fish sampling effort at Lake K212 on July 18, 2013.



Regions of Lake K212 less than 4 feet deep (light blue) and likely to be available for ice chips, based on transects surveyed on July 18, 2013.



Depth transects surveyed at Lake K212 on July 18, 2013.