From:	Tyree Mullaney
To:	permits@mvlwb.com
Subject:	FW: MV2012F0007 Water Sources
Date:	Friday, December 28, 2012 1:41:22 PM
Attachments:	Hatfield Memo - Bathymetry report - 18Nov.pdf SNC Tote Roads to Water Sources.pdf

Please post to the registry MV2012F0007.

Tyree Mullaney
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Mackenzie Valley Land and Water Board
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-----Original Message-----
From: David Harpley [mailto:david@canadianzinc.com]
Sent: December-14-12 6:59 PM
To: Katherine.Cumming@pc.gc.ca; tyree@mvlwb.com
Cc: alan@canadianzinc.com; jmorse@mvlwb.com; Lorraine.Sawdon@dfo-mpo.gc.ca; permits@mvlwb.com
Subject: MV2012F0007 Water Sources

Tyree, Katherine,

Please find attached a report on water sources which defines volumes for water supply according to the DFO protocol, and drawings from SNC showing proposed tote roads to access them. Katherine, you have seen the report before, but not the road drawings.

--

David Harpley
VP Environment & Permitting Affairs
Tel. 604 594 3855 (home office) 604 688 2001 (office)

MEMO

Date: November 19, 2012 HCP Ref No.: CZN1856

From: John Wilcockson and Martin Davies

To: David Harpley, CZN

Subject: Prairie Creek Mine – Bathymetry of lakes possibly suitable for winter water withdrawal.

1.0 BACKGROUND/RATIONALE

The purpose of this memo is to present the results of bathymetric data collected from nine lakes located along or in close proximity to the Prairie Creek Mine access road right-of-way (Figure 1). The lakes assessed are located approximately 63 to 141 km from the mine site along the road. The purpose of the bathymetry data is (1) to identify lakes that are suitable for winter water withdrawal, and (2) calculate the volume of water that can be withdrawn with minimal impacts on aquatic biota.

The water withdrawn will be used for road construction and maintenance seasonally. Based on an estimated requirement of 250 m^3/km from Km 39 (Cat Camp) to Km 140, the estimated total water requirement is 25,250 m^3. Water is not expected to be required for road bed construction from the Mine to Km 39 because the bed is of all season quality, and the road bed to Km 140 will be built from the east using water from the Liard River.

Water withdrawal from lakes in the NWT is governed by the DFO guideline *Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut* (the "Protocol"; DFO 2010). A key factor is the depth of the lake relative to the predicted thickness of ice. The Protocol does not apply to lakes that are anticipated to have less than 1.5 m of water under ice in winter. The intent is to provide sufficient water such that overwintering fish will have sufficient oxygen to sustain them through winter. The Protocol indicates that an ice thickness of 1 m should be assumed for the Dehcho Region, therefore candidate lakes would need to have a maximum depth greater than 2.5 m.

The Protocol also provides guidance on collecting and calculating lake volumes. The maximum volume of water that can be withdrawn from any given waterbody is 10% of the available (under ice) water volume.

Based on the DFO Protocol, lake volumes were calculated for each of the nine prospective lakes, and maximum allowable volumes of withdrawal computed. In addition, bathymetric maps of each lake are provided, as well as maps showing lake hydraulic connectivity.

2.0 METHODOLOGY

Bathymetric mapping was conducted from July 5 to July 8, 2012 on nine lakes proposed for winter water withdrawal. The DFO Protocol also provides guidance on mapping methods and was used as the basis for completing the assessment.

Bathymetry data were collected using a Lowrance HDS-7 generation two (Tulsa, Oklahoma). This equipment consists of:

- A Lowrance HDS sonar with a split beam 83/200 KHz transducer (a 200KHz frequency was used for all bathymetric mapping);
- A computer to control the sounder and record data; and
- An internal Lowrance 16-channel GPS+WAAS differential GPS to geo-code data as they were collected.

Bathymetry data were collected continuously along transects. These followed longitudinal and zig-zag patterns on each of the lakes and provided greater resolution (and improved lake volume estimates) than the minimum three transect model outlined in the DFO Protocol.

The shoreline of each lake was characterized and mapped using either 5 to 10 m SPOT (Système Pour l'Observation de la Terre, Toulouse, France) or Google Earth satellite imagery (Mountain View, California). Lake shoreline polygons were collected from either pre-traced 1:50,000 NTDB polygons or hand-traced geo-referenced Google Earth imagery. Shoreline files were imported into the bathymetric mapping software and converted to 0 m depth contour shoreline files. Thus, the shoreline was incorporated in the estimate of volume for each lake.

Digital data files obtained during the fieldwork were processed with DrDepth software (Perlin 2012) to create echograms, ".dxf" files and shape files containing contours of depth, latitude, and longitude for each sounding. In order to produce a fully rendered contour map, DrDepth requires extensive data collection along multiple transects, which is beyond the scope of this investigation (as well as beyond the requirements of the Protocol; DFO 2010). To overcome this, data gaps were "filled-in" using extrapolated-transects, calculated as average latitude, longitude and depth between surveyed transects. A conservative approach was taken, such that extrapolation uncertainty was addressed by assuming water was slightly shallower than the average depth of the adjacent transects.

ArcGIS 9.3 software was then used to post-process each map, convert the files to NAD 83 and interpolate the depth scale into a regular colour pattern scale (i.e., "depth contours"). Lake volume estimates and average depth were also calculated using DrDepth.

3.0 RESULTS

Table 1 provides the results of the bathymetry study. Figures 2 to 10 provide bathymetric maps for each of the waterbodies. Satellite images showing hydraulic connectivity of each lake are provided in Attachement 1.

Of the nine lakes, only one did not satisfy the requirements of the Protocol. The lake at Km 95 had a maximum recorded depth of 1.7 m. Assuming a maximum expected ice thickness of 1.0 m (as per the Protocol), only 0.7 m of water is available below the ice in winter. Consequently, according to the Protocol, lake Km 95 is not suitable for water withdrawal. However, the protocol is intended to protect aquatic biota, and assumes such biota are present. As this was suspected not to be the case at lake Km 95, an ecological assessment was performed by Hatfield (2012) on July 6 and 7th. This indicated that the lake may be suitable for winter water withdrawal because the lake:

1. Does not provide good habitat for fish and no surface connectivity to other waterbodies was found;
2. Rendered no fish after use of several fishing methods (i.e., electro-fishing, gill netting, minnow trapping and angling). Furthermore, there was no surface disruption of the lake indicative of feeding fish, nor were fish seen in underwater video footage.
3. Is not unique in the area;
4. Does not appear to provide habitat for beaver, muskrat or nesting migratory waterfowl; and,
5. Ecological impacts of water withdrawal on resident amphibians and invertebrates should not be significant.

Therefore, we propose that the minimum 1.5 m water depth under ice and 10% withdrawal limit in the Protocol be waived for lake Km 95.

Please refer to the Hatfield memo attached in Attachment 2 for more information on the Ecological Reconnaissance performed at lake Km 95.

Table 1 Summary of Bathymetric information for each of the lakes potentially suitable for winter water withdrawal.

Lake Name	Location (UTM)	Imagery	Surface Area (m^2)	Total Lake Volume (m^3)	Under Ice Volume (m^3)	Calculated 10% Withdrawal Volume
Mosquito Lake	445750E/6825750N	2006 SPOT	450,500	1,092,000	670,567	33,528
Km 70	448500/E6819000N	2006 SPOT	217,700	1,248,000	1,049,490	52,475
Km 95	465100E/6812850N	2006 SPOT	15,230	13,999	2,333	NA
Km 100-OR2	470570E/6813770N	2007 SPOT	19,260	18,830	3,000	256
Km 100-OR4	470450E/6815900N	2007 SPOT	107,800	145,300	48,965	2,448
Km 115	474200E/6801200N	2007 SPOT	95,720	190,400	115,466	5,773
Km 121	477000E/6799400N	2007 SPOT	252,400	291,600	81,809	4,090
Km 139	487250E/6787500N	2006 SPOT	393,900	371,200	107,642	5,382
Km 141	486250E/6784500N	2006 SPOT	186,200	486,000	336,061	16,803
Total						120,755

4.0 REFERENCES

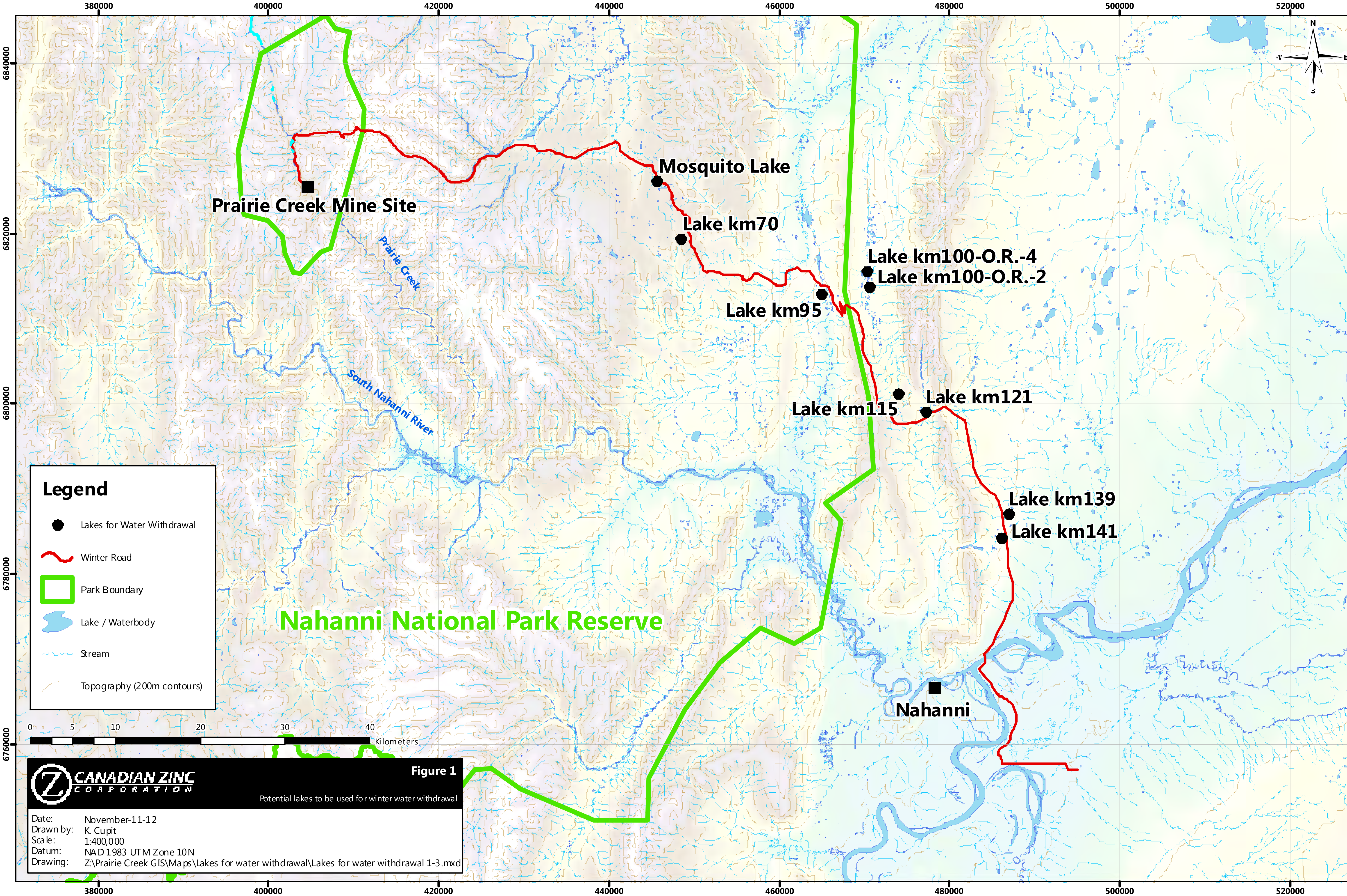
[DFO] Department of Fisheries and Oceans. 2010. DFO Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut. Document current as of June 21, 2010.

ESRI. 2008. ArcGIS 9.3, Redlands, California

[Hatfield] Hatfield Consultants. 2012. Prairie Creek Mine – Ecological Reconnaissance of the Lake at km 95. Memo written by John Wilcockson (Hatfield) for David Harpley (CZN), November 9, 2012.

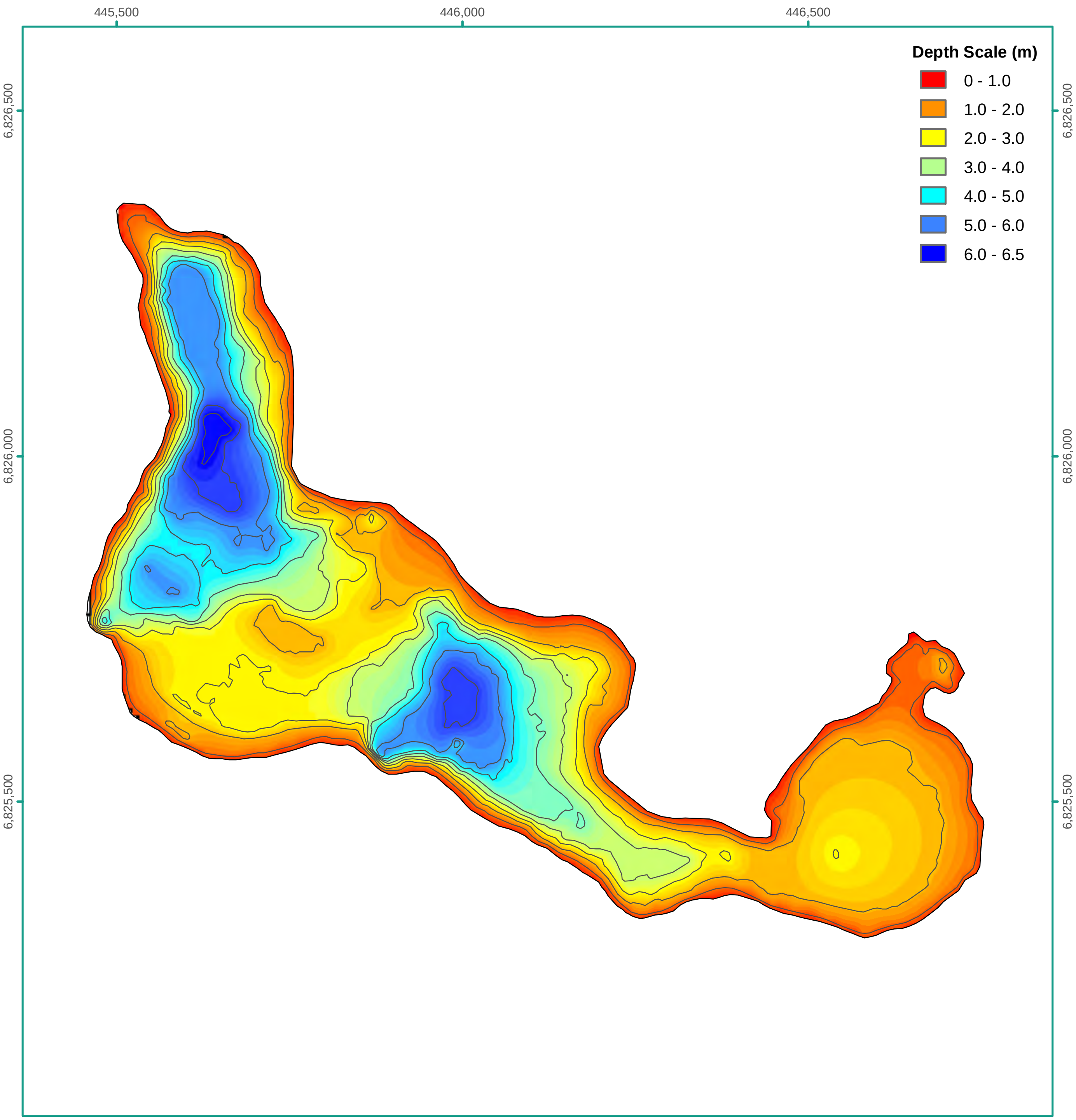
Pelin, P. 2012. DrDepth, Sea bottom mapping software, Goteborg Sweden. http://www.drdepth.se/index.php?l=gb

FIGURES



Mosquito Lake
Prairie Creek Mine Site
Lake km70
Lake km100-O.R.-4
Lake km100-O.R.-2
Lake km95
Prairie Creek
South Nahanni River
Lake km115
Lake km121
Lake km139
Lake km141
Nahanni National Park Reserve
Nahanni
Legend
Lakes for Water Withdrawal
Winter Road
Park Boundary
Lake / Waterbody
Stream
Topography (200m contours)
0 5 10 20 30 40 Kilometers
380000 400000 420000 440000 460000 480000 500000 520000
6840000 6820000 6800000 6780000 6760000
N
CANADIAN ZINC CORPORATION
Figure 1
Potential lakes to be used for winter water withdrawal
Date: November-11-12
Drawn by: K. Cupit
Scale: 1:400,000
Datum: NAD 1983 UTM Zone 10N
Drawing: Z:\Prairie Creek GIS\Maps\Lakes for water withdrawal\Lakes for water withdrawal 1-3.mxd

Figure 2 Bathymetry of Mosquito Lake, July 2012



Statistics

Mapped Area = 450,500m^2
Mapped Volume = 1,092,000 m^3
Average Depth = 2.4 m
Maximum Depth = 6.6 m
Contour intervals in meters.

0 65 130 260 m

Scale: 1:8,500

Projection: NAD 1983 UTM Zone 10N

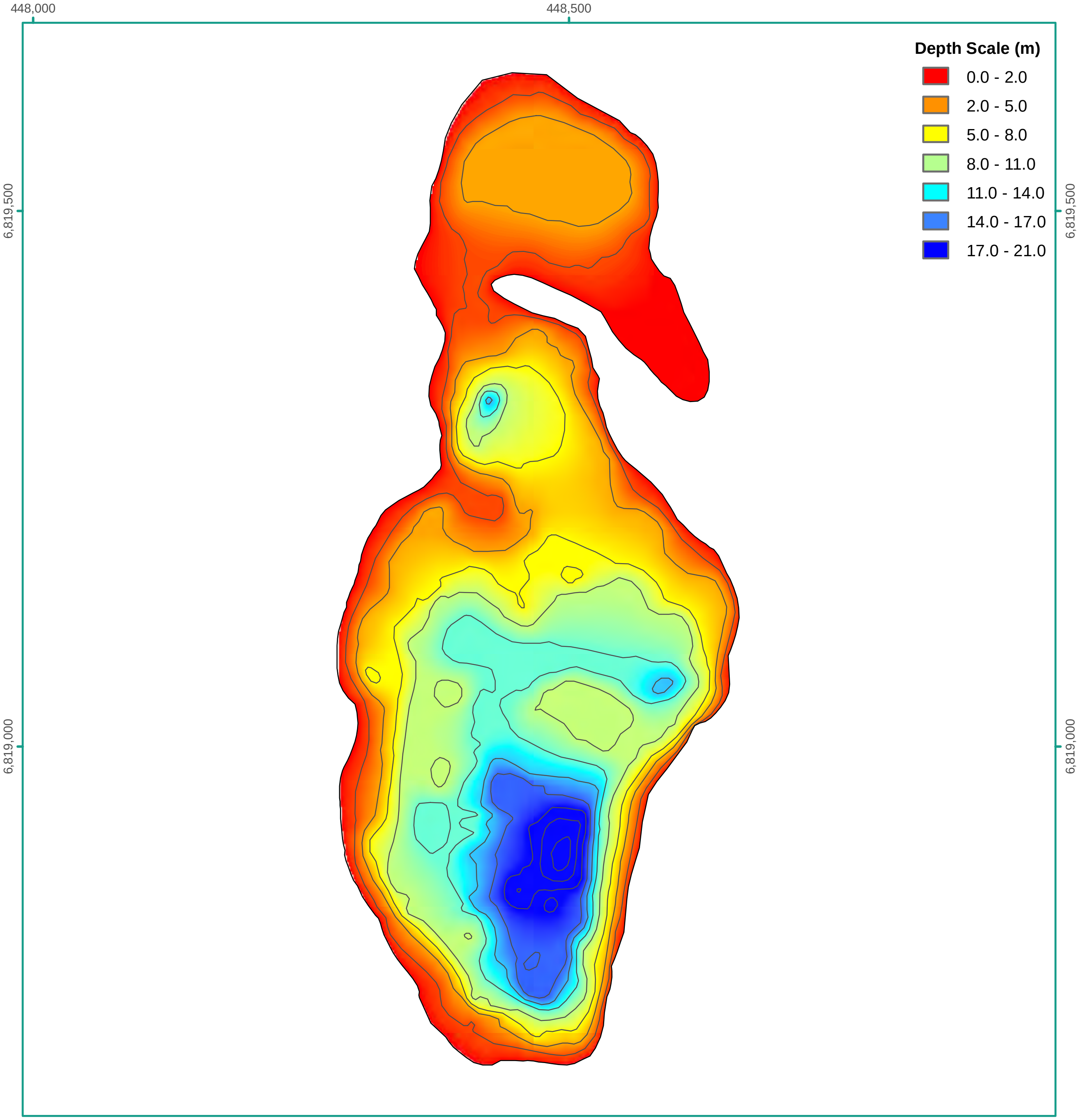
N

Data Sources:
Bathymetry information created using Dr. Depth software.

Hatfield CONSULTANTS

K:\Data\Project\CZN1856\GIS_MXD\Bathymetry\CZN1856_Mosq_Lk_20121102.mxd

Figure 3 Bathymetry of lake at 70 km, July 2012



Statistics

Mapped Area = 217,700m^2
Mapped Volume = 1,248,000 m^3
Average Depth = 5.7 m
Maximum Depth = 21.0 m
Contour intervals in meters.

0 40 80 160 m

Scale: 1:5,500

Projection: NAD 1983 UTM Zone 10N

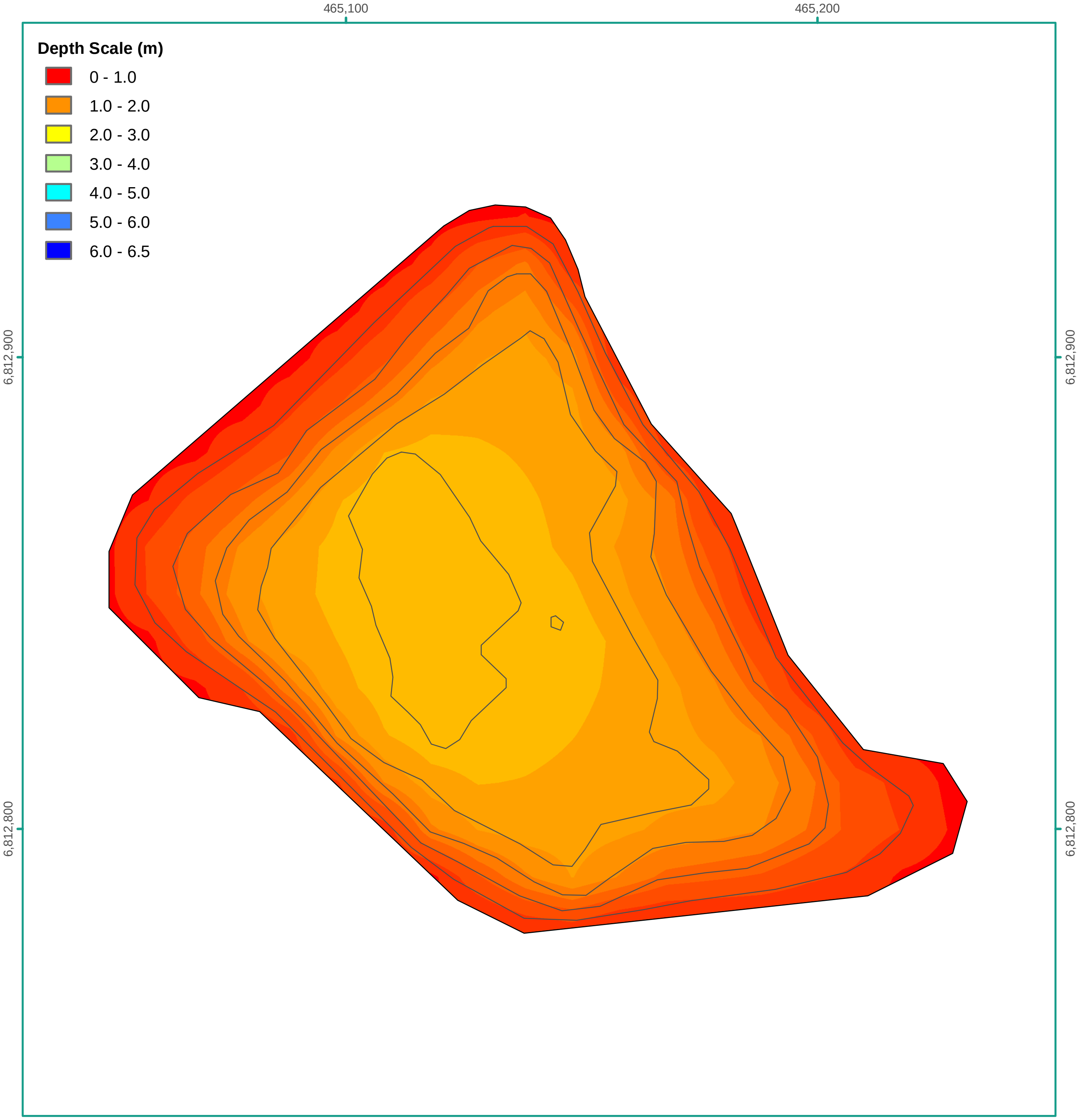
N

Data Sources:
Bathymetry information created using Dr. Depth software.

Hatfield CONSULTANTS

K:\Data\Project\CZN1856\GIS_MXD\Bathymetry\CZN1856_Lake70_20121102.mxd

Figure 4 Bathymetry of lake at 95 km, July 2012.



Statistics

Mapped Area = 15,230m^2
Mapped Volume = 13,990 m^3
Average Depth = 0.9 m
Maximum Depth = 1.7 m
Contour intervals in meters.

0 10 20 40
m

Scale: 1:1,250

Projection: NAD 1983 UTM Zone 10N

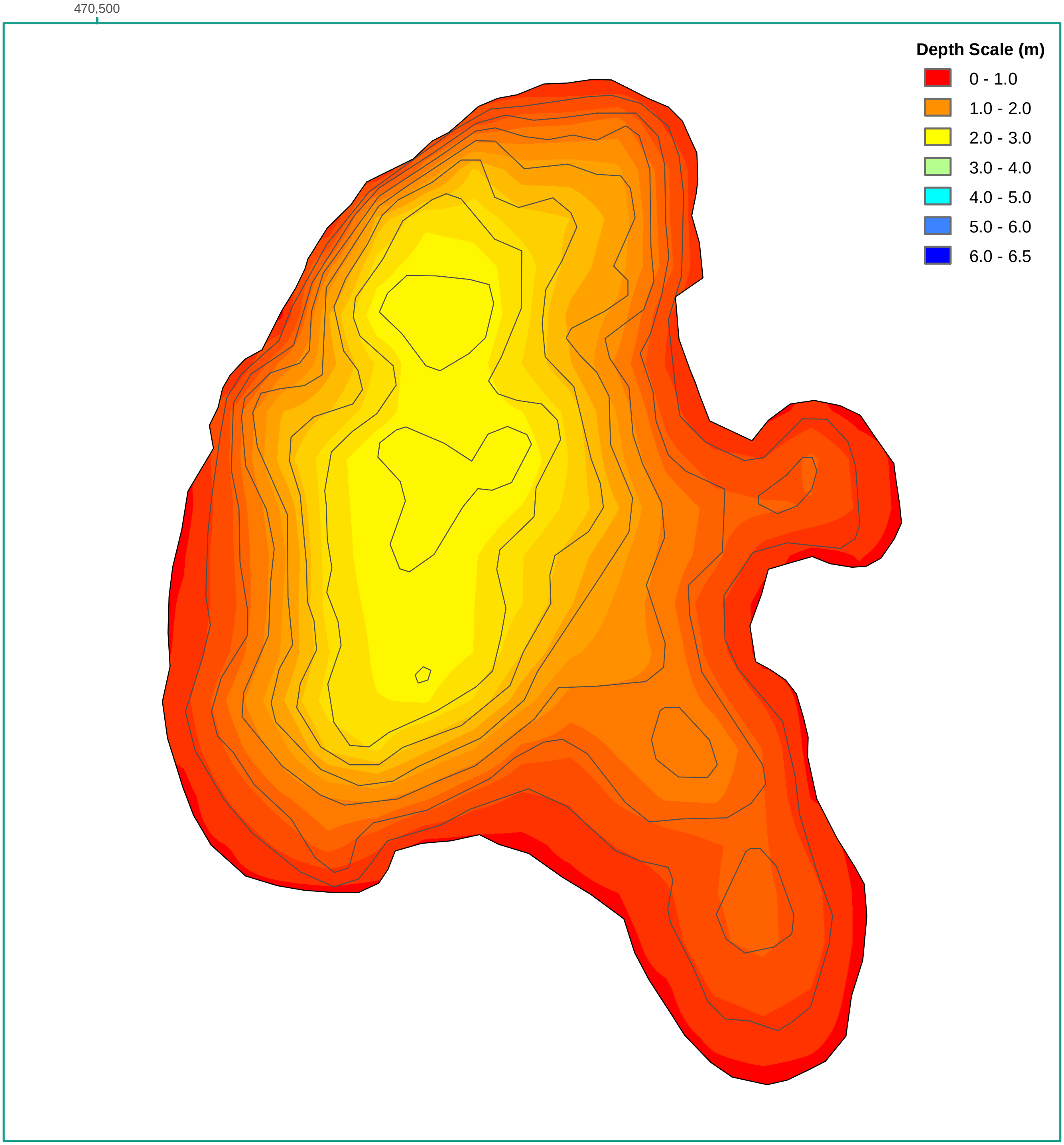
N

Data Sources:
Bathymetry information created using Dr. Depth software.

Hatfield CONSULTANTS

K:\Data\Project\CZN1856\GIS_MXD\Bathymetry\CZN1856_Lake95_20121102.mxd

Figure 5 Bathymetry of lake at 100 km (2km north of road), July 2012.



Statistics

Mapped Area =19,260 m^2
Mapped Volume = 18,830 m^3
Average Depth = 1.0 m
Maximum Depth = 2.3 m
Contour intervals in meters.

0 10 20 40 m

Scale: 1:1,250

Projection: NAD 1983 UTM Zone 10N

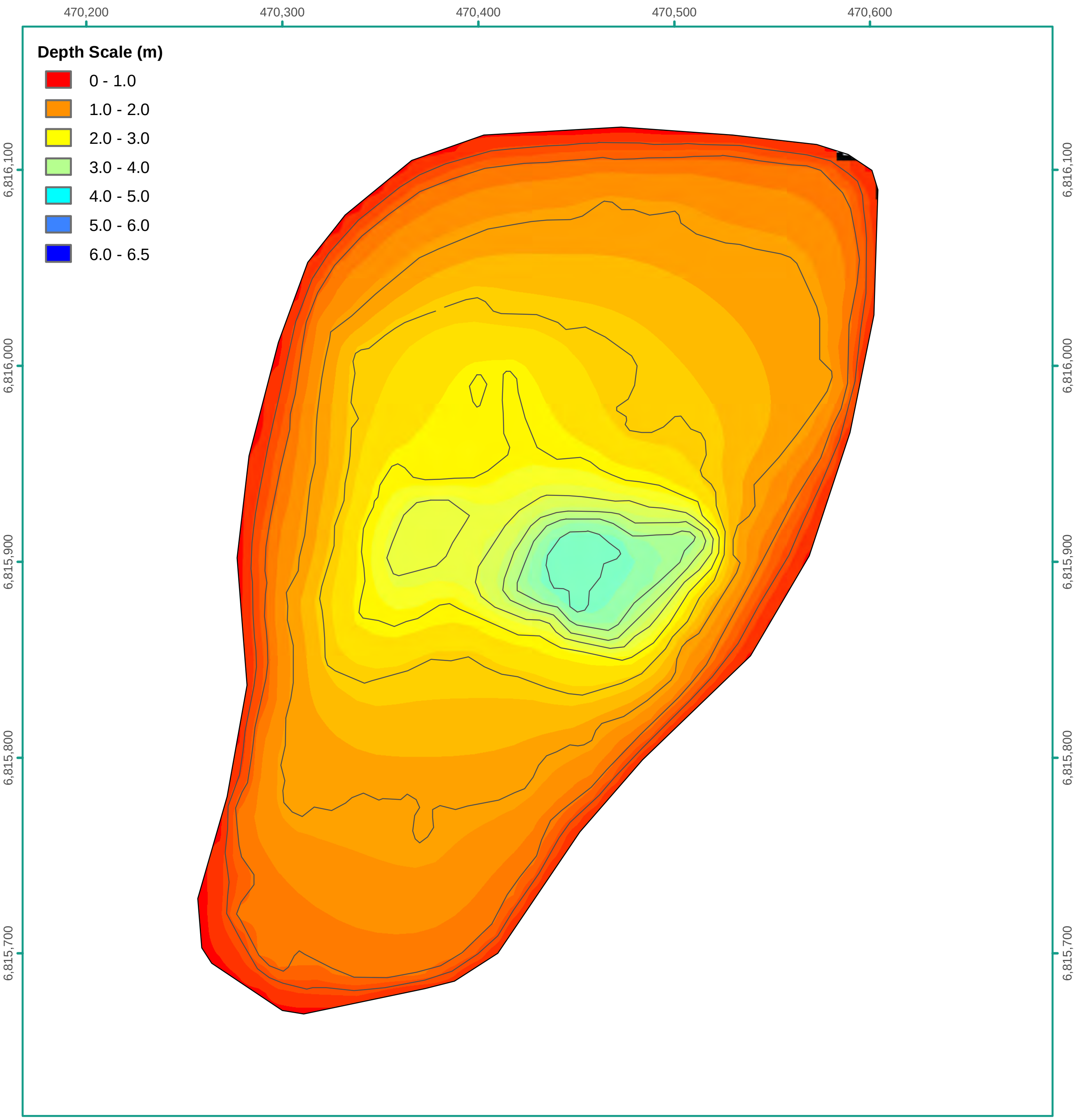
N

Data Sources:
Bathymetry information created using Dr. Depth software.

Hatfield CONSULTANTS

K:\Data\Project\CZN1856\GIS_MXD\Bathymetry\CZN1856_Lake100_OR_20121102.mxd

Figure 6 Bathymetry of lake at 100 km (4km north of road), July 2012.



Statistics

Mapped Area = 107,800 m^2
Mapped Volume = 145,300 m^3
Average Depth = 1.3 m
Maximum Depth = 3.7 m
Contour intervals in meters.

0 20 40 80 m

Scale: 1:3,000

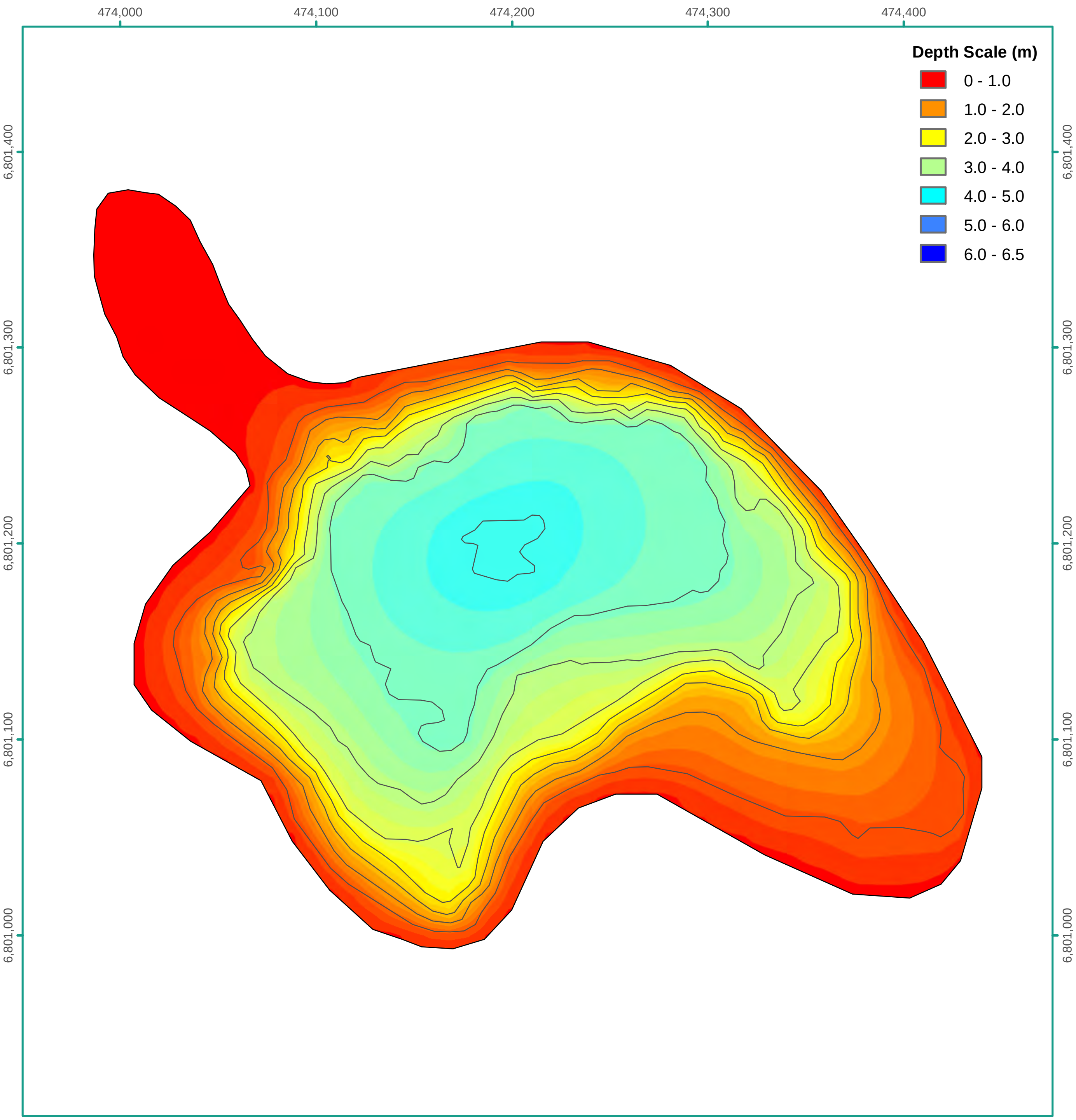
Projection: NAD 1983 UTM Zone 10N

N

Data Sources:
Bathymetry information created using Dr. Depth software.

Hatfield CONSULTANTS

Figure 7 Bathymetry of lake at 115 km, July 2012.



Statistics

Mapped Area = 95,720m^2
Mapped Volume = 190,400 m^3
Average Depth = 2.0 m
Maximum Depth = 4.1 m
Contour intervals in meters.

0 20 40 80 m

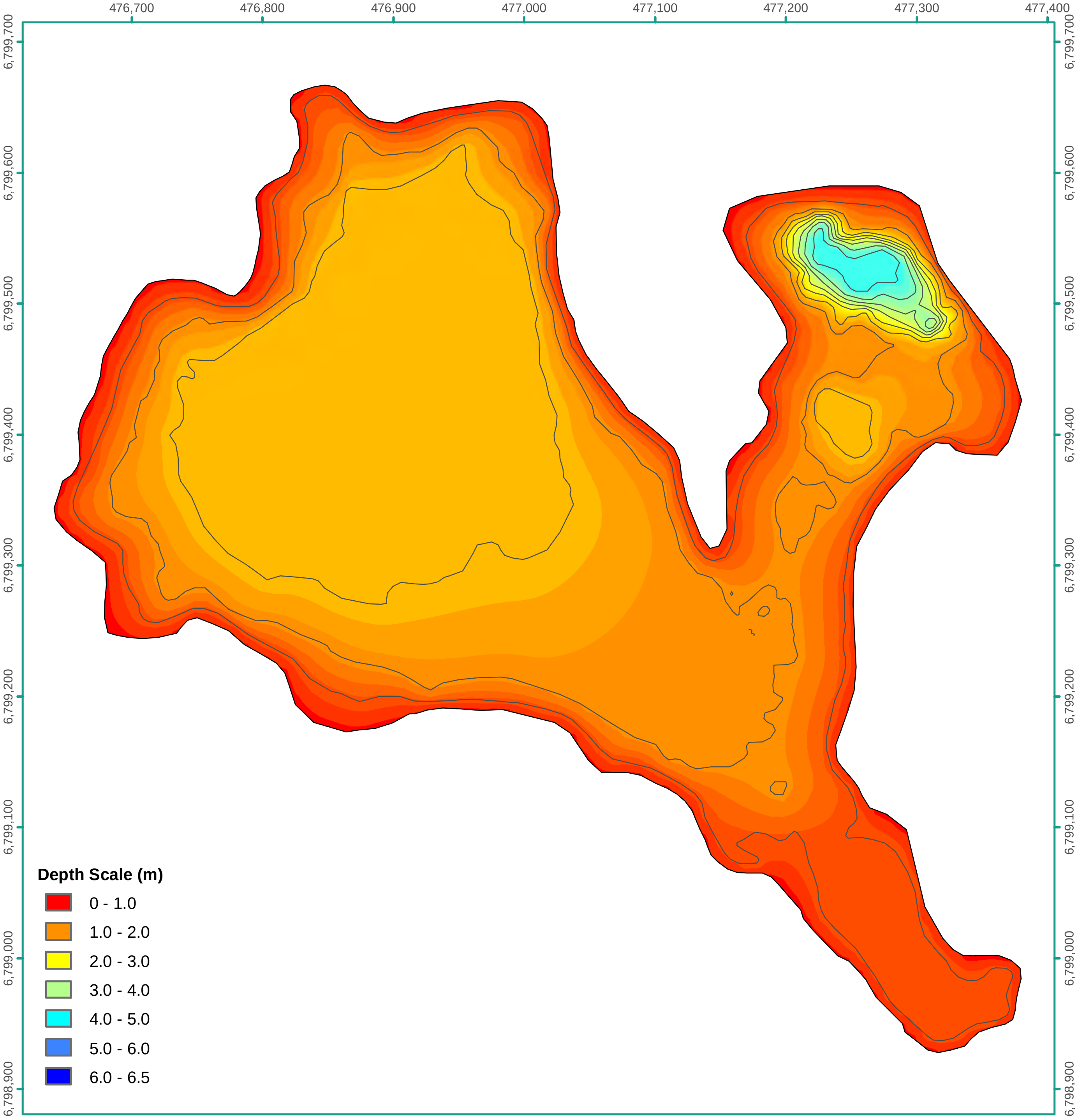
Scale: 1:3,000

Projection: NAD 1983 UTM Zone 10N

N

Data Sources:
Bathymetry information created using Dr. Depth software.

Figure 8 Bathymetry of lake at 121 km, July 2012.



Statistics

Mapped Area = 252,400m^2
Mapped Volume = 291,600 m^3
Average Depth = 1.2 m
Maximum Depth = 4.3 m
Contour intervals in meters.

0 35 70 140 m

Scale: 1:4,500

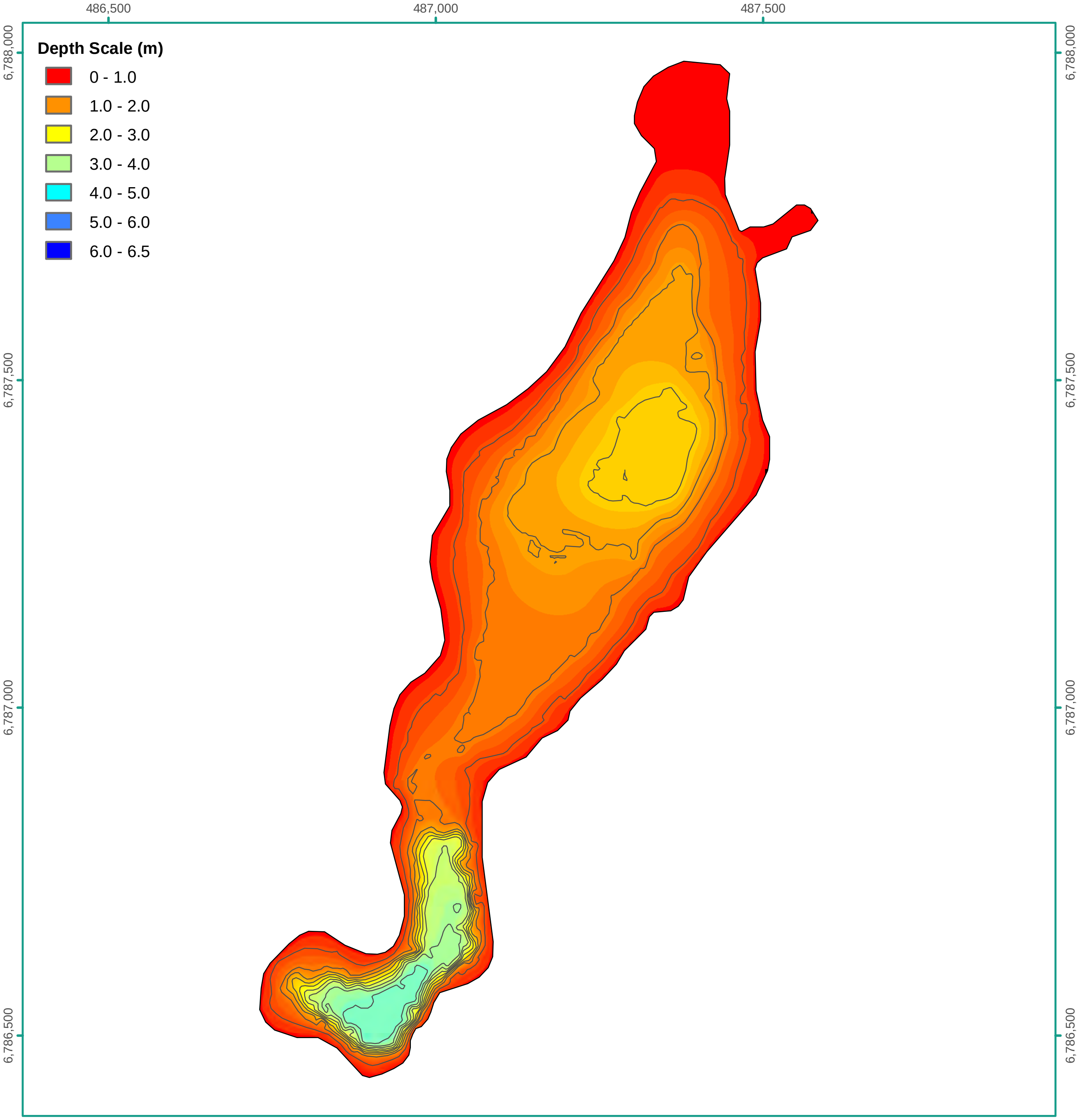
Projection: NAD 1983 UTM Zone 10N

N

Data Sources:
Bathymetry information created using Dr. Depth software.

Hatfield CONSULTANTS

Figure 9 Bathymetry of lake at 139 km, July 2012.



Statistics

Mapped Area = 393,900m^2
Mapped Volume = 371,200 m^3
Average Depth = 1.2 m
Maximum Depth = 4.3 m
Contour intervals in meters.

0 70 140 280 m

Scale: 1:9,000

Projection: NAD 1983 UTM Zone 10N

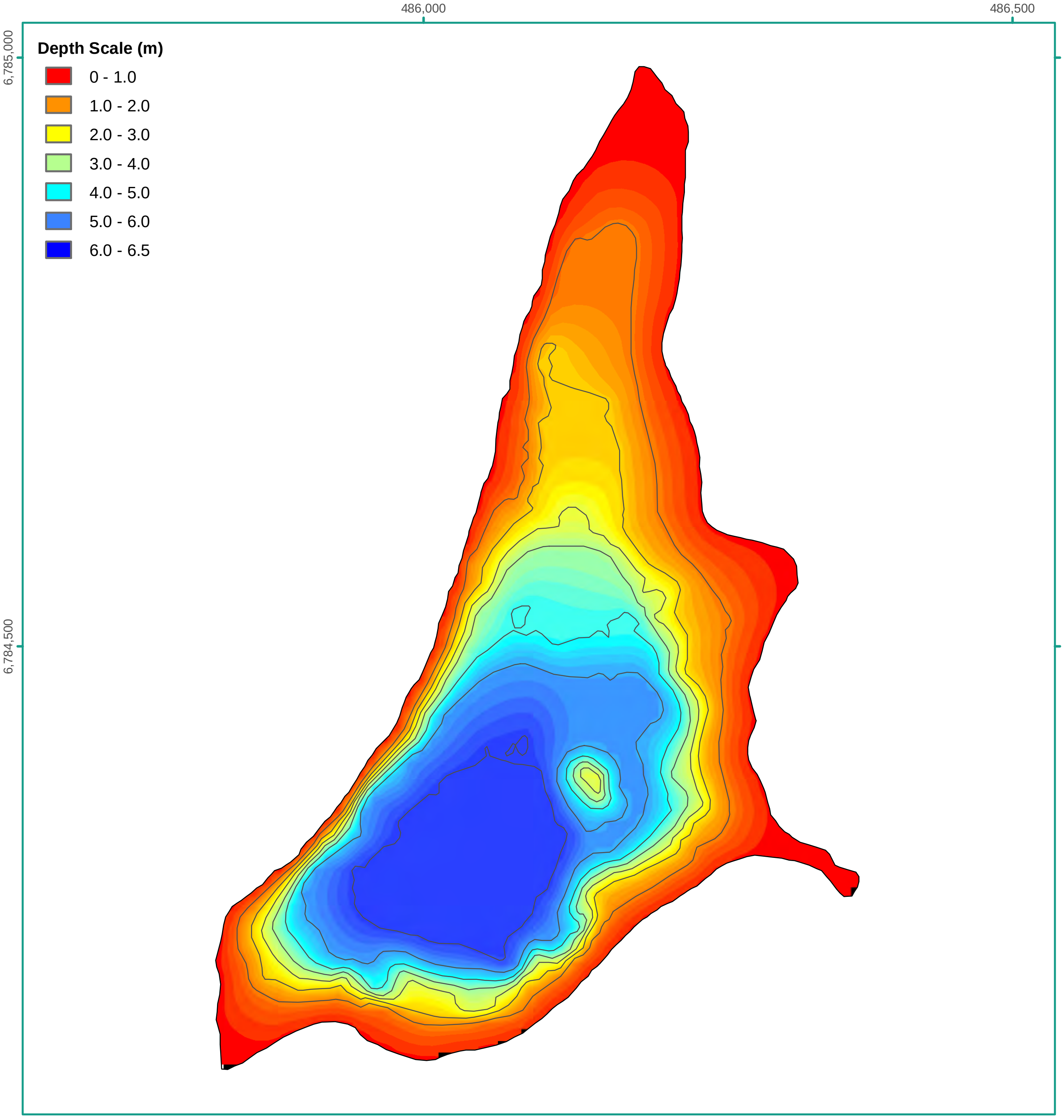
N

Data Sources:
Bathymetry information created using Dr. Depth software.

Hatfield CONSULTANTS

K:\Data\Project\CZN1856\GIS_MXD\Bathymetry\CZN1856_Lake139_20121102.mxd

Figure 10 Bathymetry of lake at 141 km, July 2012.



Statistics

Mapped Area = 186,200m^2
Mapped Volume = 486,000 m^3
Average Depth = 2.6 m
Maximum Depth = 6.0 m
Contour intervals in meters.

0 40 80 160 m

Scale: 1:5,000

Projection: NAD 1983 UTM Zone 10N

N

Data Sources:
Bathymetry information created using Dr. Depth software.

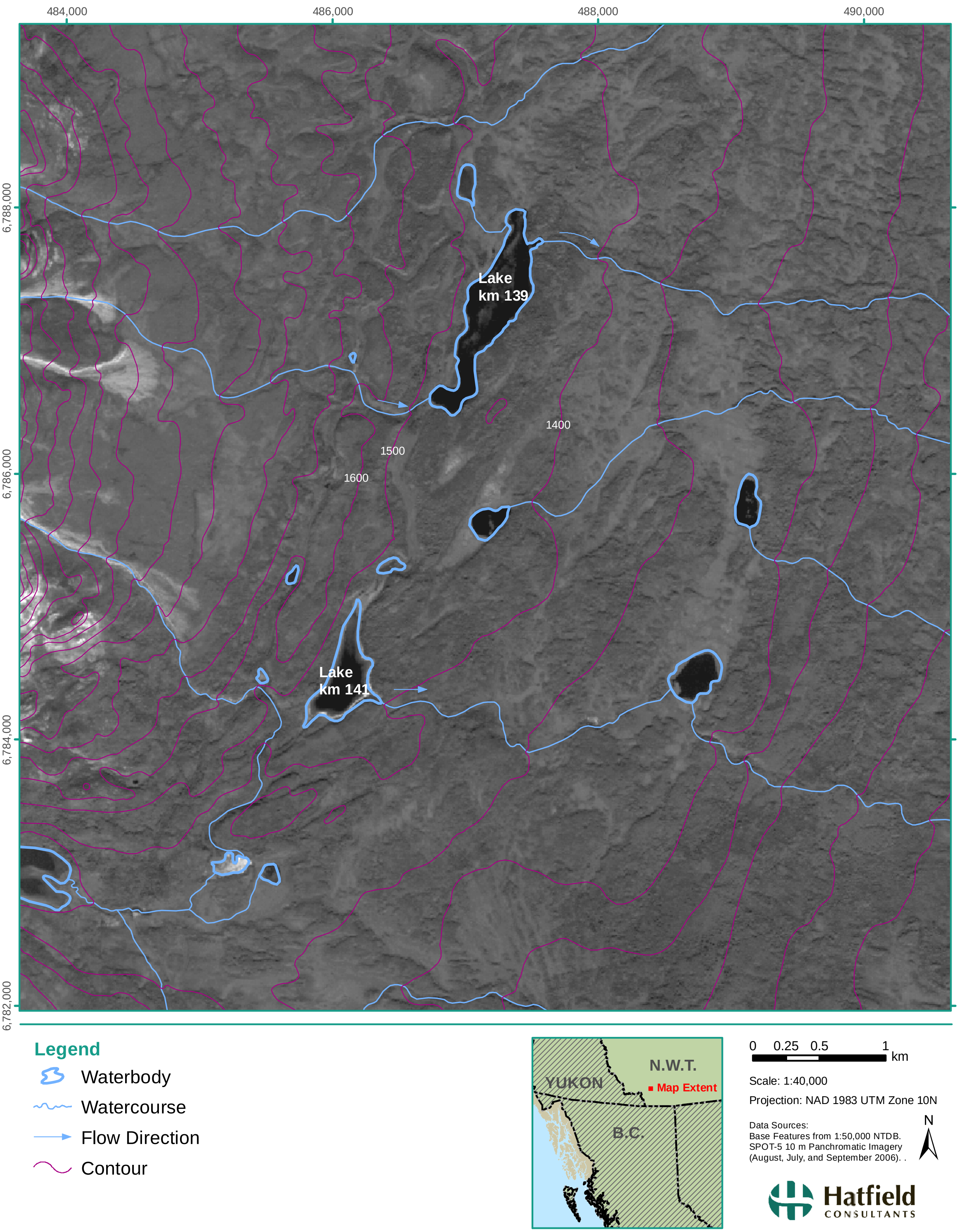
Hatfield CONSULTANTS

ATTACHMENTS

Attachment 1

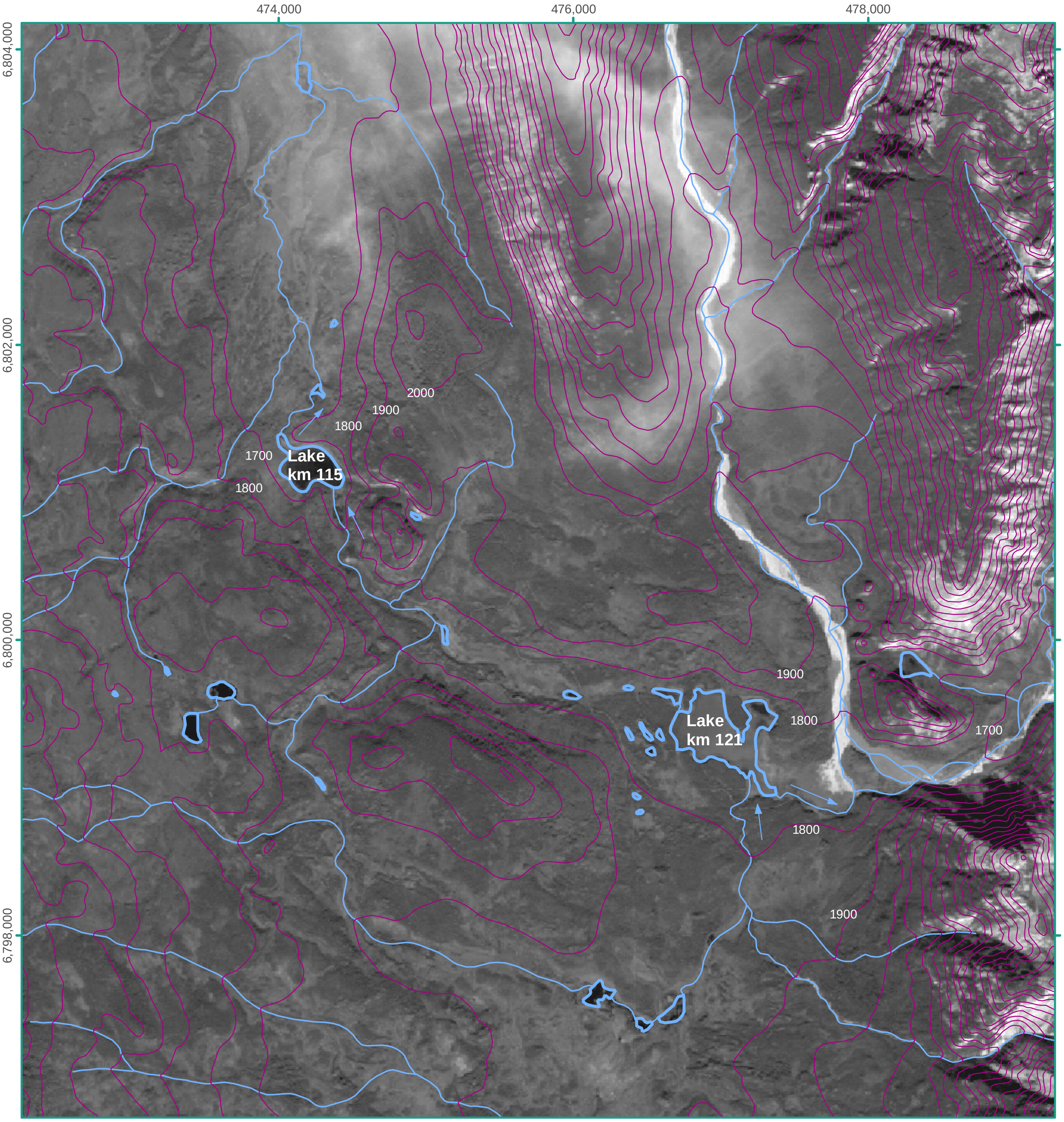
Satellite Images Showing Lake Connectivity

Attachment 1-1 Map showing hydraulic connectivity of lakes at km 139 and km 141.



K:\Data\Project\CZN1856\GIS_MXD\Lakes\CZN1856_LakesA_20121119.mxd

Attachment 1-2 Map showing hydraulic connectivity of lakes at km 115 and km 121.



Legend

Waterbody

Watercourse

Flow Direction

Contour

0 0.25 0.5 1 km

Scale: 1:40,000

Projection: NAD 1983 UTM Zone 10N

Data Sources:
Base Features from 1:50,000 NTDB.
SPOT-5 10 m Panchromatic Imagery
(August, July, and September 2006).

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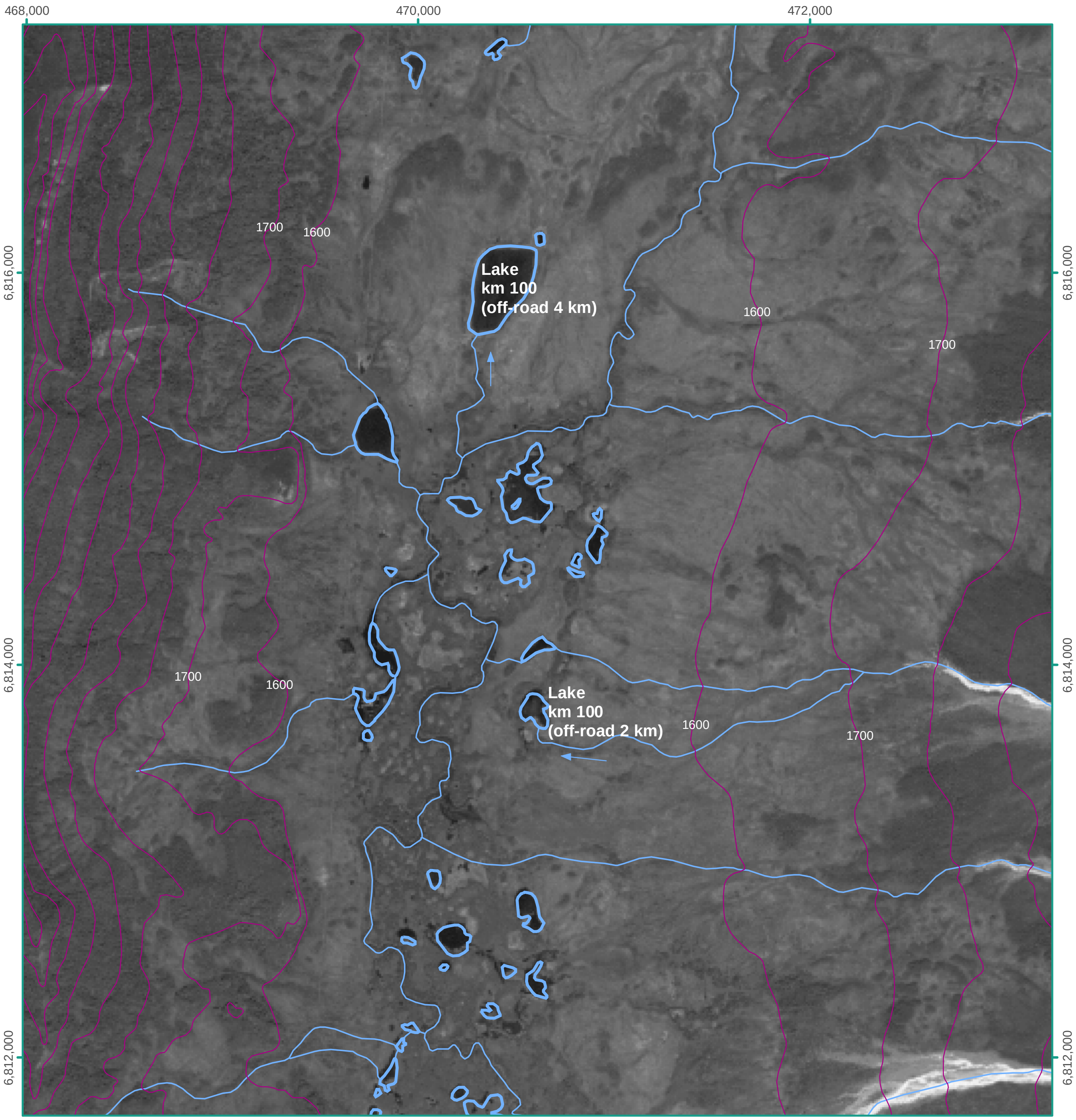
Attachment 1-3 Map showing hydraulic connectivity of lakes at km 100 (OR2) and km 100 (OR4).



Legend

- Waterbody
- Watercourse
- Flow Direction
- Contour

0 0.2 0.4 0.8 km

Scale: 1:30,000

Projection: NAD 1983 UTM Zone 10N

Data Sources:
Base Features from 1:50,000 NTDB.
SPOT-5 10 m Panchromatic Imagery
(August, July, and September 2006).

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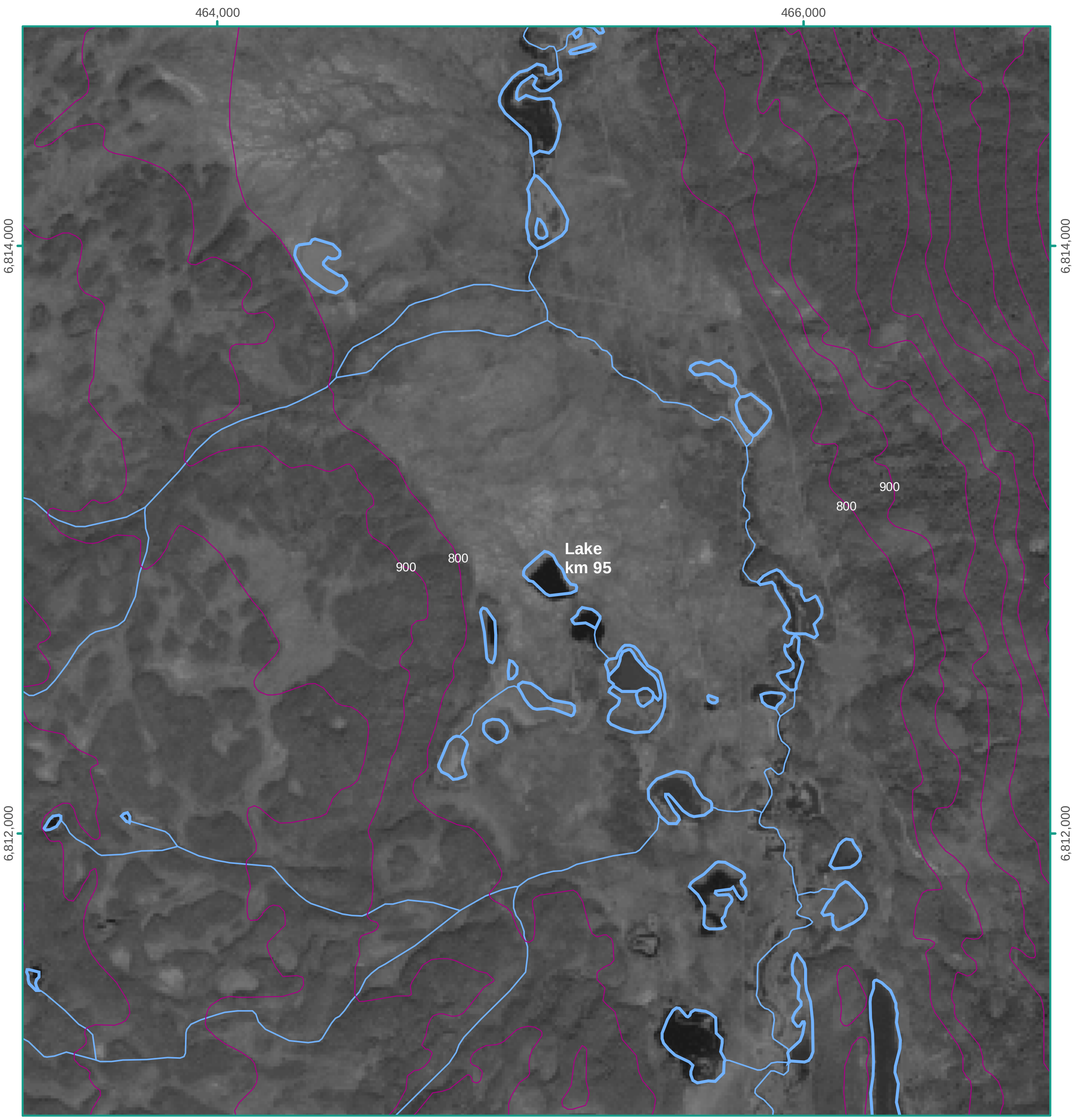
Attachment 1-4 Map showing hydraulic connectivity of lakes at km 95.



Legend

- Waterbody
- Watercourse
- Flow Direction
- Contour

0 0.15 0.3 0.6 km

Scale: 1:20,000

Projection: NAD 1983 UTM Zone 10N

Data Sources:
Base Features from 1:50,000 NTDB.
SPOT-5 10 m Panchromatic Imagery
(August, July, and September 2006).

N

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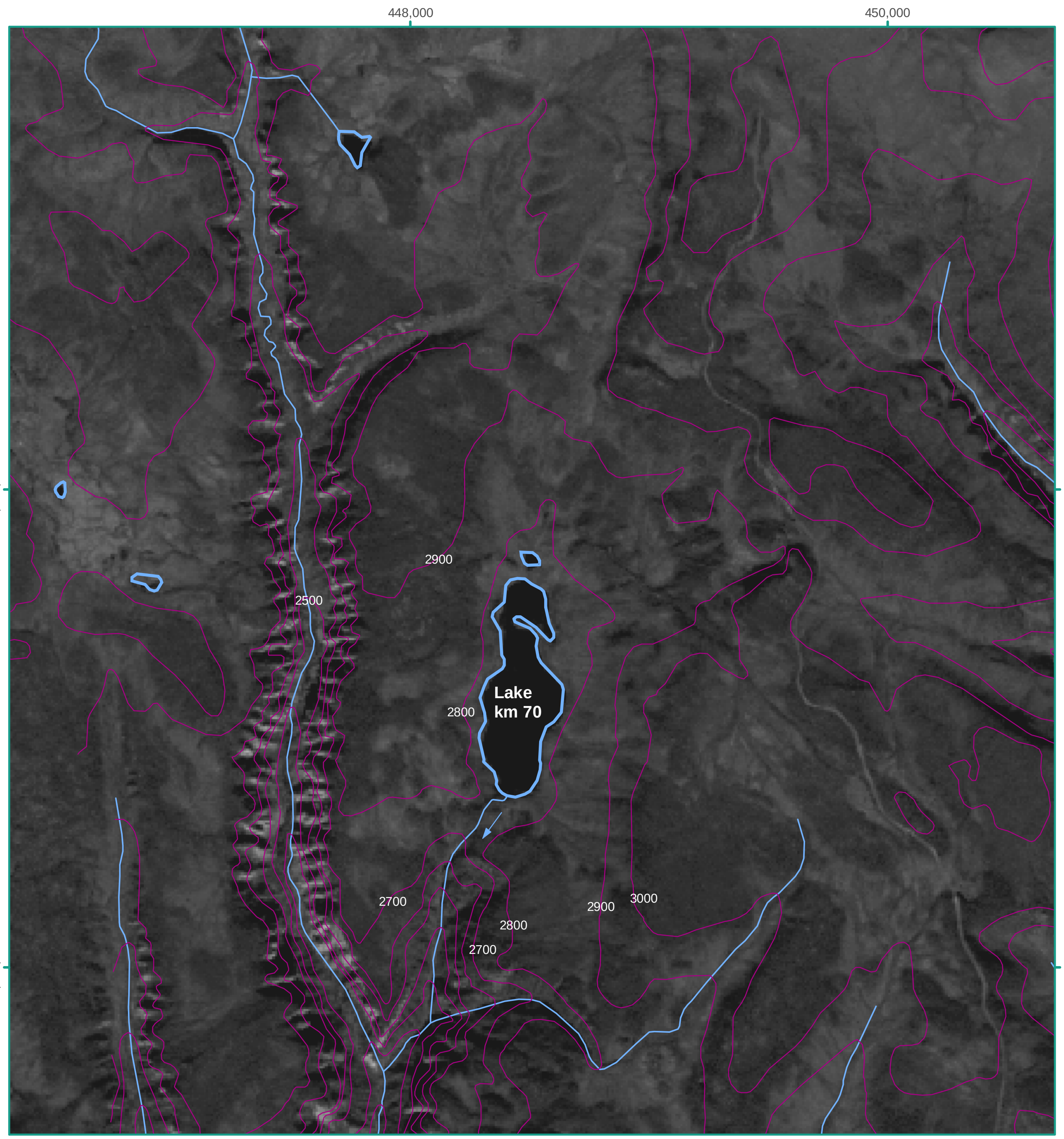
K:\Data\Project\CZN1856\GIS_MXD\Lakes\CZN1856_LakesD_20121119.mxd

Attachment 1-5 Map showing hydraulic connectivity of lakes at km 70.



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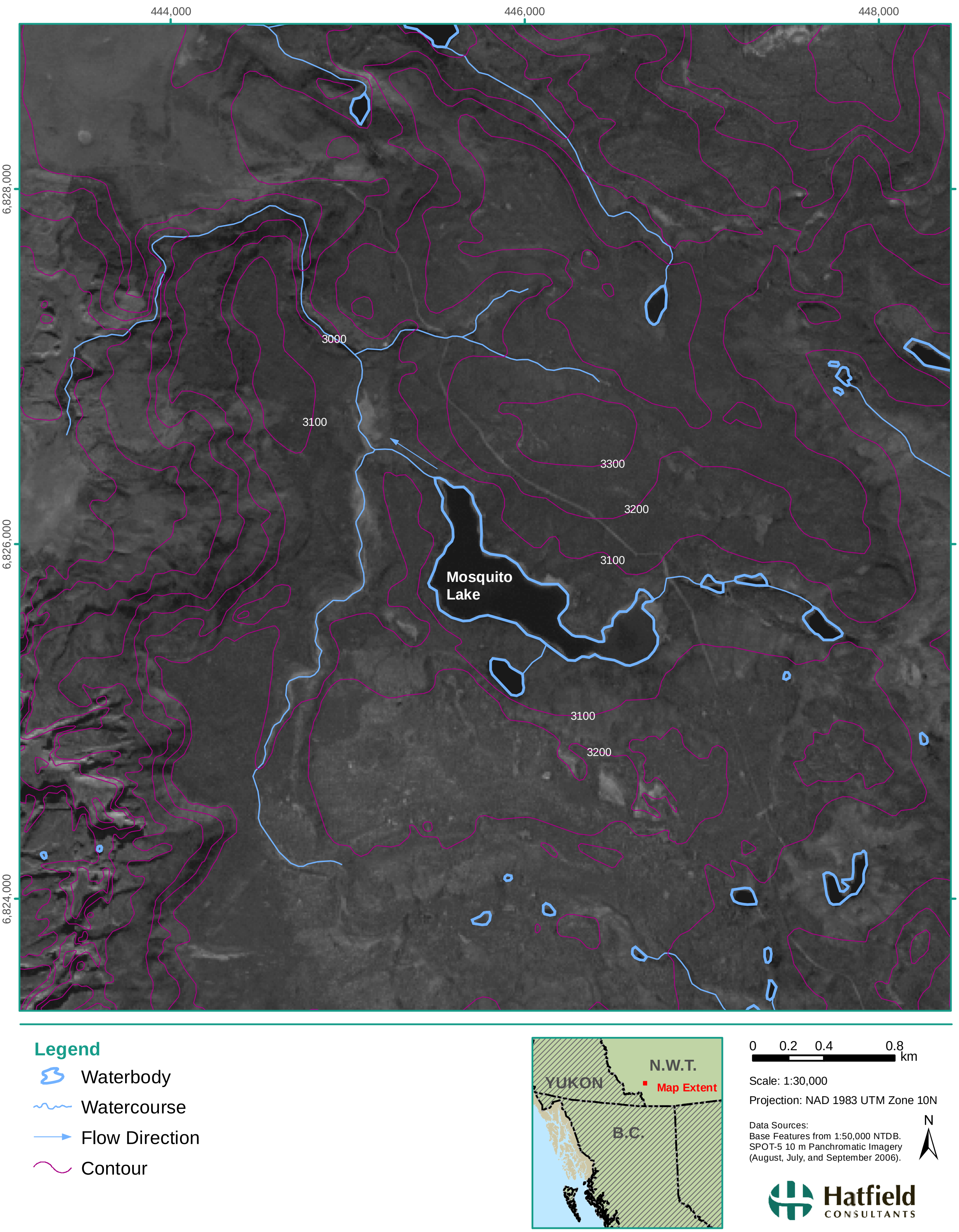
Attachment 1-6 Map showing hydraulic connectivity of lakes at Mosquito Lake.



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Attachment 2

Ecological Reconnaissance of the Lake at Km 95

Hatfield
CONSULTANTS

MEMO

Date: November 19, 2012 HCP Ref No.: CZN1856

From: John Wilcockson and Martin Davies

To: David Harpley, CZN

Subject: Prairie Creek Mine – Ecological Reconnaissance of Lake Km 95.

1.0 BACKGROUND/RATIONALE

This memo describes the physical and biological attributes of a small lake at Km 95 along the access road from the Prairie Creek Mine site. Canadian Zinc Corp (CZN), the owner of the Mine, wishes to withdraw water from this lake during winter months for road construction and maintenance. Because the lake is quite shallow (i.e., less than 2 m), the depth of unfrozen water during winter is not sufficient to support water withdrawal according to the DFO protocol for winter water withdrawal. However, we believe the lake is suitable for winter withdrawal because the following criteria apply:

- The lake does not appear to contain fish;
- The potential for significant ecological impacts is low; and
- The lake does not appear to be unique in the area, or to have significant regional ecological value.

2.0 METHODOLOGY

The lake at Km 95 was visited on the afternoon of July 6th to collect bathymetric data, and again on the morning of July 7th to collect biological information. The bathymetric study is outlined in a separate memo (Hatfield 2012). On July 7th, John Wilcockson (Hatfield) and Jason Matt (CZN) attempted to document fish presence at the lake. The following methodologies were carried out:

- Minnow traps – eight minnow traps containing canned cat food were deployed throughout the lake. All but one of the minnow traps were deployed along the edges of the lake. Please refer to field data sheet provided in Appendix A1. Total soak time of the minnow traps was 4 hours (0930-1245, July 7).
- Gill nets – a single floating multi-panelled gill net was deployed from east to west across the lake. The net had five panels ranging from 0.75 cm to 2 cm. Total soak time of the gill net was 3 hours (1000 to 1300, July 7);

- Electrofishing – electrofishing was conducted along the edge of the lake in two areas, the west shore and the south shore. Electrofishing settings were as follows: voltage – 400v, duty cycle – 50%, frequency - 70 Hz, duration - 239 seconds (1200 – 1250, July 7);

- Angling – angling was carried out from a boat with two rods, one using a Red Devil lure, the other having a Five of Diamonds lure. Angling was conducted for 45 minutes (1035-1120, July 7).

- Underwater video – Underwater video was recorded using a Contour Roam underwater high definition video camera attached to a PVC pole. The purpose of the video was to look for fish near the shore, including the undercut bank at the south end of the lake. Video was recorded between 11:20 and 11:30, July 7.

3.0 PHYSICAL DESCRIPTION

The lake is shallow, having a maximum recorded depth of 1.7m. The riparian zone of the lake at the time of the visit consisted of grasses that were partially submerged and in some cases floating. Small bushes and trees were generally located more than 5 m from the shore. Along the southern shore of the lake, bushes and small trees grow along the water's edge.

Bottom substrates consist of a thick humic material. Water at the time of the site reconnaissance was clear, but had a pronounced brownish tint. Other *in-situ* water quality variables recorded were as follows:

- Dissolved Oxygen 6.5 mg/L (average of July 6 and 7)
- Conductivity 129 µS (July 6)
- Temperature 23.9 °C (July 6)
- pH 8.05 (July 6)

No entrance or exit channels for water were observed during reconnaissance by boat around the entire perimeter of the lake.

4.0 BIOLOGICAL DESCRIPTION

Based on visual observations made during the site reconnaissance, the lake appears to be inhabited primarily by predacious diving beetle larvae, water boatmen, leaches and tadpoles. Given these species would be good dietary items for fish, the abundance of these species is consistent with fish being absent from the lake. The absence of identifiable flow either in or out of this lake indicates that these organisms do not contribute to food availability for fish in neighbouring waterbodies.

Attempts at fishing, using several methods, did not indicate any fish. Nor were there any surface disturbances of the lakes surface observed that might indicate fish activity. Nor were any fish observed using polarized sunglasses while working around the edges of the lake.

Many tadpoles were observed during electrofishing, and a single adult frog was observed at the site. Based on a comparison to photos provided in Fornier (2000), it appears that the adult was a wood frog (*Lithobates sylvaticus*). This is consistent with a factsheet from Parks Canada which indicates that wood frogs have the widest distribution of all amphibians in the north. It was not possible to identify the tad poles at the site and it is also not possible to state unequivocally that no other amphibian species are located at the site. However, data collected to date in Nahanni

Park indicate that there are very few amphibians (Parks Canada 2012, Jowett and Hartling 2003). Therefore, it would seem plausible that the tadpoles present were representative of one species.

The only other amphibian confirmed to live within the Nahanni Park is the Western (Boreal) Toad, which has been observed as close as Fort Liard (Parks Canada 2000, 2012, Fournier 2000). Another species which may inhabit the park, but is not confirmed, is the Boreal Chorus Frog. In addition, the leopard frog has been observed elsewhere in southern North West Territories (and may be moving north due to global warming) and therefore could be found within the Park. With the exception of the leopard frog, all species hibernate on land and therefore should not be impacted by water withdrawal during winter (Fournier 2012).

No birds were observed on the lake at the time of the site reconnaissance, nor was there any sign of waterfowl nesting. There were also no beaver lodges or dams on the lake, nor obvious beaver or muskrat runs in grass growing at the edge of the lake.

5.0 CONCLUDING REMARKS

The results of the site reconnaissance at lake Km 95 indicate the following:

- The potential for significant ecological impacts associated with winter water withdrawal is low; and
- The lake does not appear to be unique in the area, nor does it appear to have significant regional ecological value.

Consequently, despite being shallow, we believe this lake is suitable for winter water withdrawal, and the minimum 1.5 m water depth under ice and 10% withdrawal limit in the Protocol should be waived. If this lake is used as a source of water and a large proportion of the free water is removed, seepage from adjacent areas is expected to provide sufficient water in spring for amphibians to reproduce.

6.0 REFERENCES

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http://www.pc.gc.ca/pn-np/nt/nahanni/natcul/natcul1a.aspx#rep

APPENDICES

Appendix A1

Field Datasheet

Lake Survey Data Sheet - CZN 1856

Hatfield CONSULTANTS LTD

Site Name: Km 95 **Date:** 6 July, 2012 (Fri)

Sampled By: JW Dave Harpley Jason Matt ~~7 Jul~~ 6 July ~~8 Jul~~ 7 July **Time:** Ar 1620 Dep 1720

Site UTM: WP26 10V0465088 6812893 **Weather:** Sunny ~~clou~~ w/ some clouds

Access: Helicopter / Boat

Recorded by: John W

In Situ Parameters- Equipment **Serial No.**

Calibration Record? Y / N

Dissolved Oxygen:	6.2 mg/L (~~7~~ 6 July); 6.8 (~~8~~ 7 July)	Conductivity:	129 µS	pH:	8.05
Dissolved Oxygen:	NR %	Temperature:	23.9 °C	Turbidity (NTU):	NR

Equipment/Serial No.:

Water Description: Clear but pronounced brown color
secchi disk, ~

Substrate Description: Bottom hard to see fairly deep at edges, floating clumps of ~~g~~ vegitation, easy to step in + sink to waist at edge - peaty.

Task related information

	Start		End
Reconnaissance	NR		NR
Minnow traps	930	7 Jul	~~945~~ 1330
Gill nets	1000	7 Jul	1300
Boat recon	NR		NR
Seining	NR		NR
Electrofishing	1200	7 Jul	1250
Angling	1035	7 Jul	1120
Bathymetry	1645		1655
Other video	1120	7 Jul	1130

Lake Dimensions	~100m across
Maximum depth	~~1.7~~ 1.8
Angling Lure type	Red Devil Five of diamonds.
Electrofishing Setting	~J5
voltage	400
pulse	Duty cycle 50
frequency	~~8~~ 70
duration	1307 - 1546 sec

Description of fish observed (including method of capture/observation)

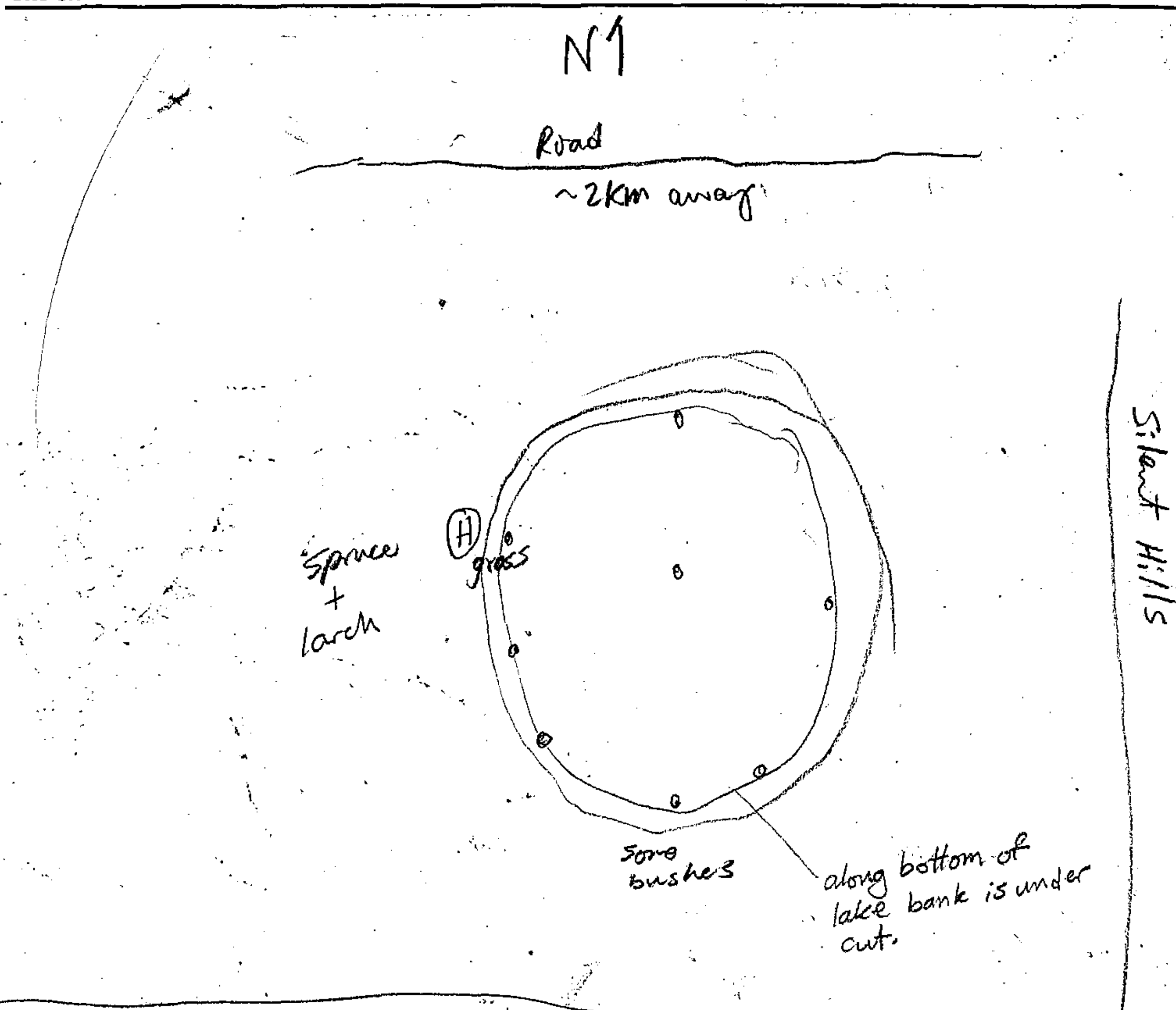
No fish observed @ surface or below using polarized glasses

one dead tad pole, many insects seen swimming from surface down as we approached.

Took underwater video from 1655 - 1705 took more footage second day using slower boat cruising speed.

NR = not required

Site sketch



Sat, 7 Jul (day 2) fishing
Arr ~ 915 Dep ~ 1515
~~[illegible]~~ Deployed fishing traps / nets, angled, electrofished, underwater video slow.
Abundant insect life + tadpoles
no sign of fish. Observed orsewed, predatious beetle larvae, leeches, dragon flies + damsel flies.

no apparent channel in or out

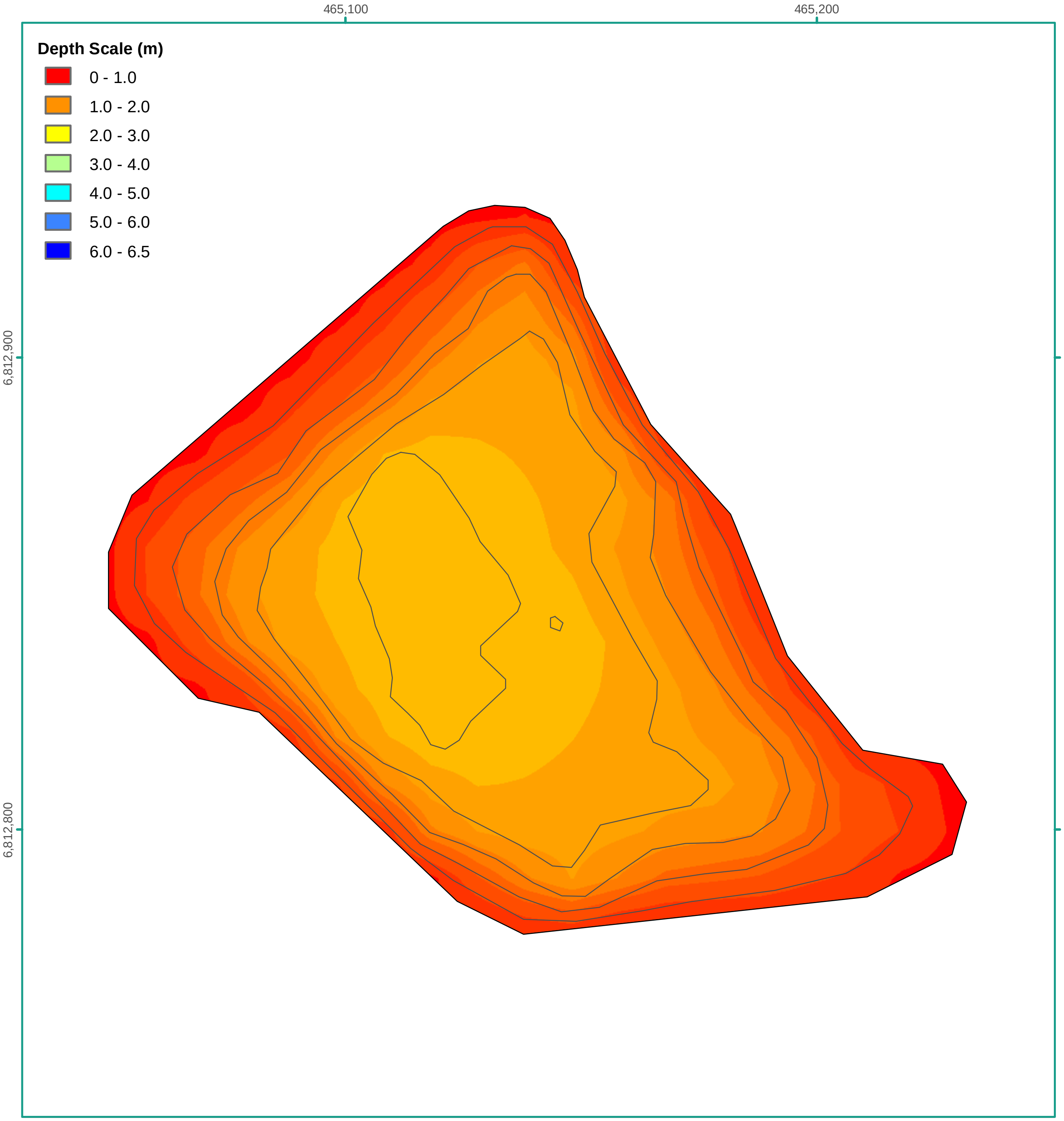
Checklist (have the location of the following items been shown?)

- ☐ Littoral Zone
- ☐ Riparian type
- ☐ Minnow traps
- ☐ Gill nets
- ☐ Electrofishing
- ☐ Perimeter survey
- ☐ Signs of fur bearing animals
- ☐ Signs of water fowl
- ☐ Signs of other aquatic species
- ☐ North
- ☐ Relative position of road
- ☐ Connectivity (water in & out)
- ☐ Macrophytes
- ☐
- ☐
- ☐

Appendix A2

Bathymetric Map of the Lake at km 95

Figure A2 Bathymetry of lake at 95 km, July 2012.



Statistics

Mapped Area = 15,230m^2
Mapped Volume = 13,990 m^3
Average Depth = 0.9 m
Maximum Depth = 1.7 m
Contour intervals in meters.

0 10 20 40 m

Scale: 1:1,250

Projection: NAD 1983 UTM Zone 10N

Data Sources:
Bathymetry information created using Dr. Depth software.

Hatfield CONSULTANTS

K:\Data\Project\CZN1856\GIS_MXD\Bathymetry\CZN1856__Memo_Lake95_20121119.mxd

Appendix A3

Photographs

Photo A3.1 Lake at km 95 as seen from the air, looking south west.

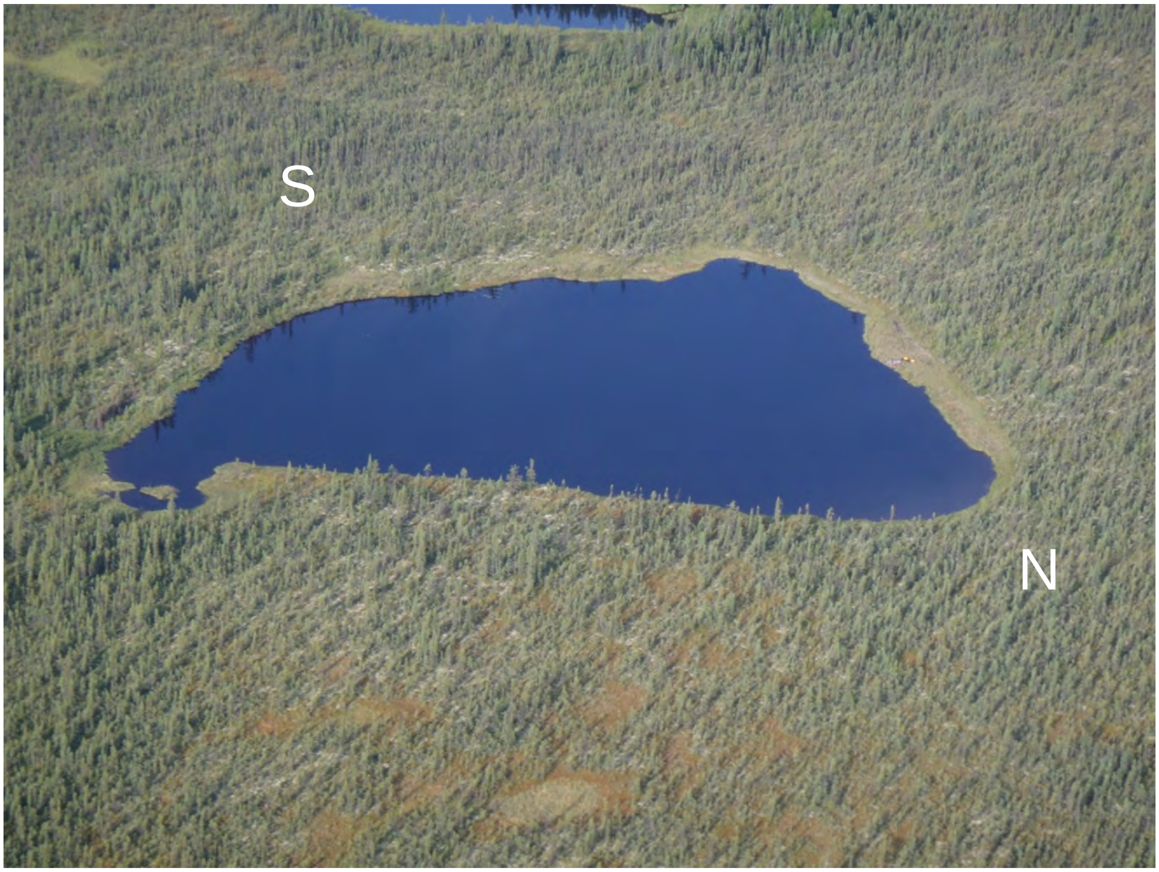
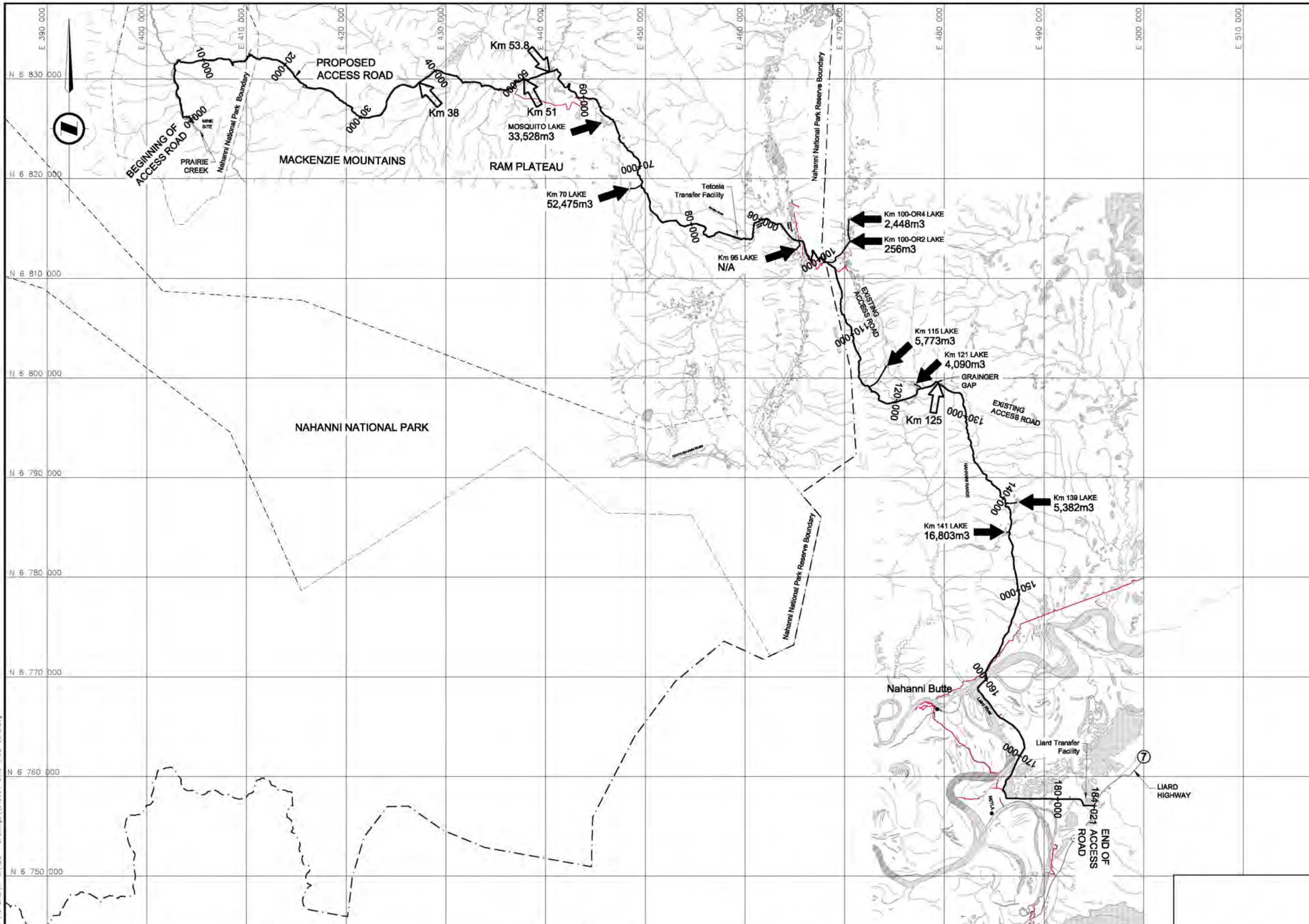


Photo A3.2 Lake at km 95, looking at the south side.

Photo A3.3 Southern shoreline of lake at km 95.

Photo A3.4 First photograph of frog observed at the lake at km 95.

Photo A3.5 Second photograph of frog observed at the lake at km 95.



NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. FOR TOTE ROADS SEE DWGS. 610984-5110-41DD-0018 610984-5110-41DD-0019.

LEGEND:

- PROPOSED ACCESS ROAD
- TRAIL
- TOTE ROAD
- WATERCOURSES
- WETLAND
- LAKE WATER DRAWOFF
- AGGREGATE SOURCE

WATER DRAWOFF TABLE

LAKE NAME	TOTE ROAD (km)	WATER (m3)
MOSQUITO	EXISTING	33,528
Km 70	1.13	52,475
Km 95	0.97	NA
Km 100-0R2	3.50	256
Km 100-0R4	2.0	2,448
Km 115	2.60	5,773
Km 121	0.54	4,090
Km 139	1.0	5,382
Km 141	0.26	16,803
TOTAL	12.0	120,755

HARFIELD CONSULTANTS MEMO HCP REF. No. CZN1856 PRAIRIE CREEK MINE-BATHYMETRY OF LAKES POSSIBLY SUITABLE FOR WINTER WATER WITHDRAWAL. DATED: NOVEMBER 19, 2012

0 1:200000 20000

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SNC·LAVALIN

PROFESSIONAL ENGINEER | NAME | NO.

DWG. NO.	REFERENCES
610984-5110-4100-0019	LAKE WATER DRAWOFF PLAN TOTE ROADS SHEET 2 OF 2
610984-5110-4100-0018	LAKE WATER DRAWOFF PLAN TOTE ROADS SHEET 1 OF 2

NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL.	CLIENT ENG.	CLIENT AREA
01	12/12/13	ISSUED FOR PERMIT	ESL	LH	JAC		
00	12/12/12	ISSUED FOR SUBMISSION	ESL	JAC	JAC		

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APPROVED LEAD ENG.	Jos A. CAVE	JAC	12/12/04
CLIENT APPROVED AREA LEAD			
APPROVED ENG. MAN.			

SCALE AS SHOWN

TITLE

PRAIRIE CREEK MINE PROJECT
PROJECT ACCESS ROAD

AGGREGATE SOURCE AND WATER DRAWOFF PLAN

PROJECT NO.	AREA	DISCPL.	DOC.	DRAWING NUMBER	REVISION NUMBER
610984	5110	41	DD	0015	01

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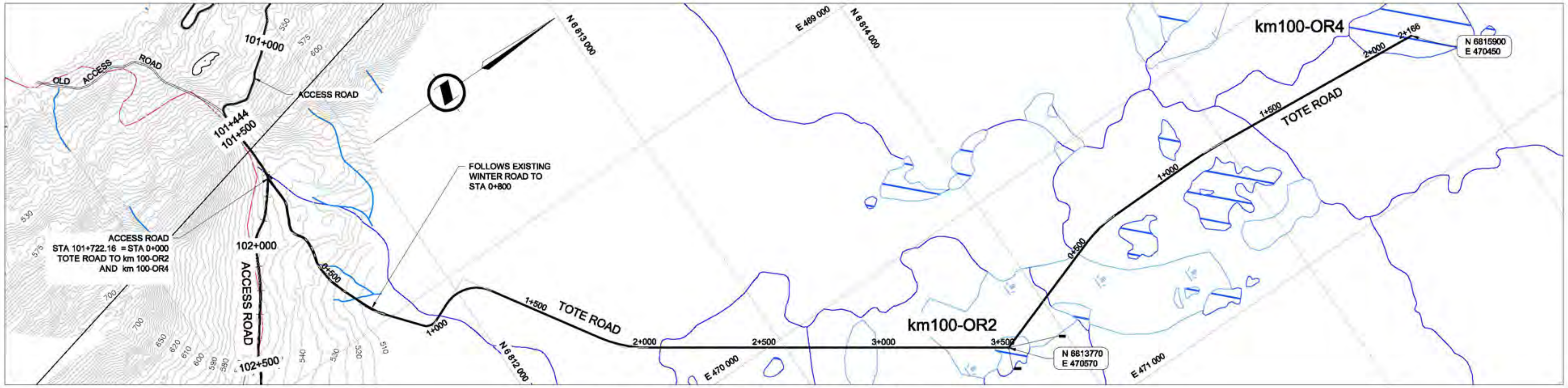
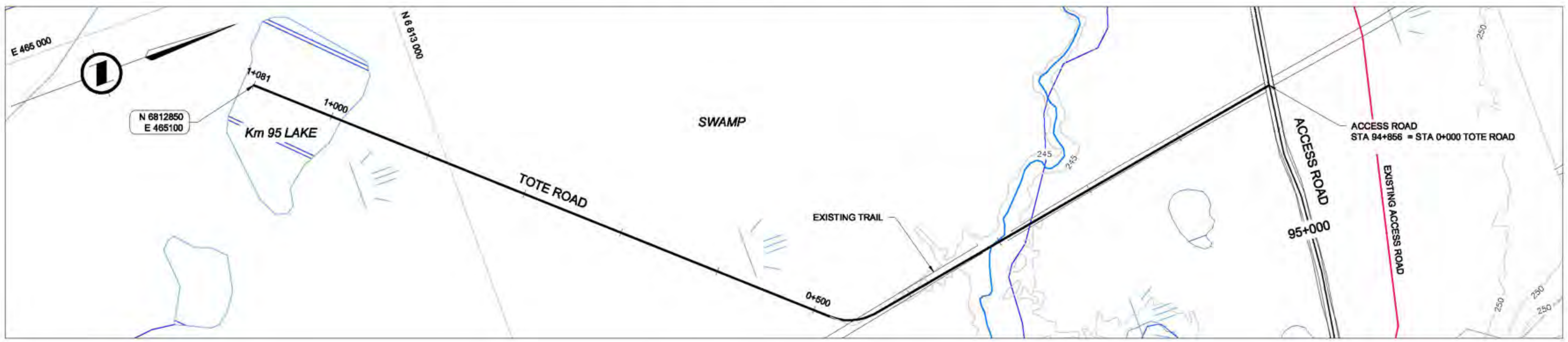


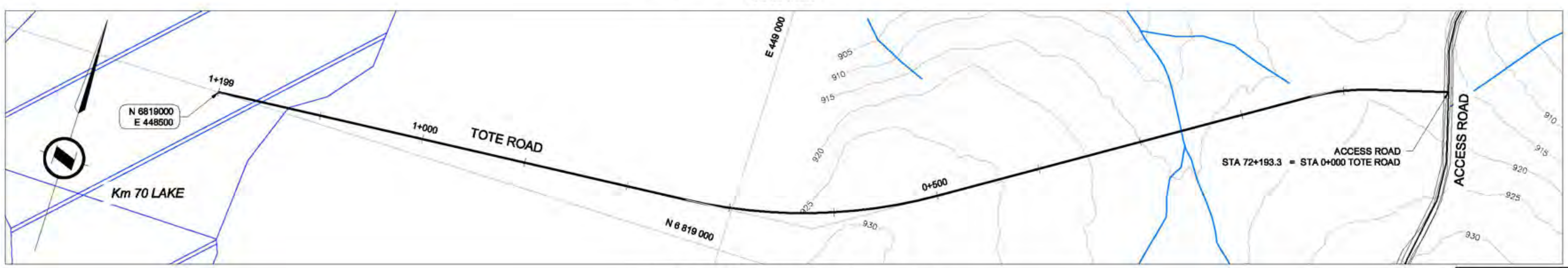
TOTE ROAD TO km 100-OR2 & OR4 LAKE PLAN

SCALE 1: 10000



TOTE ROAD TO km 95 LAKE PLAN

SCALE 1: 2500



TOTE ROAD TO km 70 LAKE PLAN

SCALE 1: 2500

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. TOPOGRAPHICAL DATA OBTAINED FROM LIDAR SURVEY INFORMATION BY McELHANNEY SURVEYING & ENGINEERING LTD.
3. CONTOURS AT 1.0m ELEVATION INTERVAL.
4. TOTE ROAD WIDTH IS 5m WIDE UNLESS NOTED OTHERWISE.
5. FOR PLAN SEE DWG 610984-5110-41DD-0015 AGGREGATE SOURCE AND WATER DRAWOFF.

0 1:2500 100m

0 1:10000 500

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CLIENT APPROVED AREA LEAD			
APPROVED ENG. MAN.			

TITLE
PRAIRIE CREEK MINE PROJECT
PROJECT ACCESS ROAD
LAKE WATER DRAWOFF
TOTE ROADS
SHEET 1 OF 2

PROJECT NO.	AREA	DISCPL.	DOC.	DRAWING NUMBER	REVISION NUMBER
610984	5110	41	DD	0018	01

DWG. NO.	REFERENCES
610984-5110-4100-0019	LAKE WATER DRAWOFF PLAN TOTE ROADS SHEET 2 OF 2
610984-5110-4100-0015	AGGREGATE SOURCE AND WATER DRAWOFF PLAN

NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL. ENG.	CLIENT AREA
01	12/12/14	ISSUED FOR PERMIT	ESL	LH	JAC	
00	12/12/12	ISSUED FOR SUBMISSION	ESL	RU	JAC	

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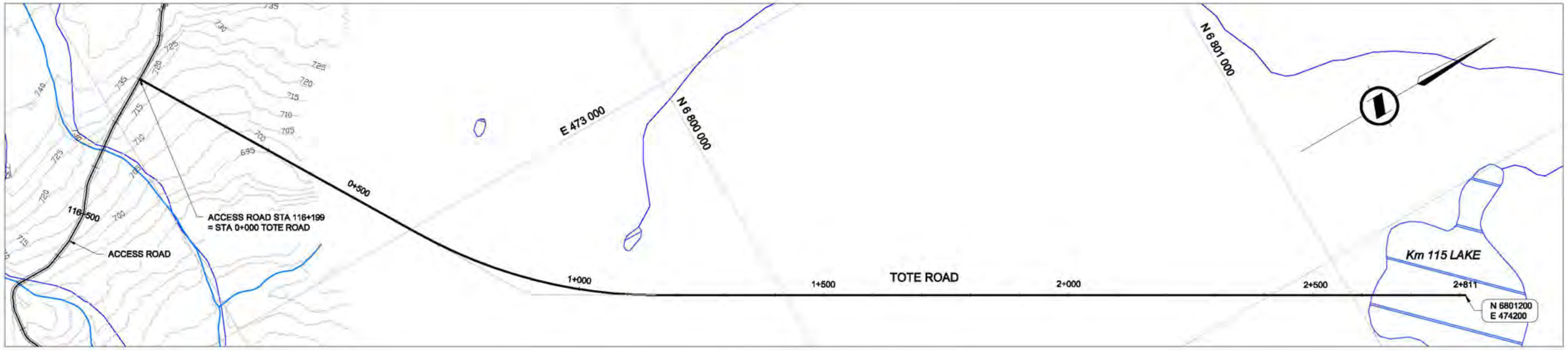
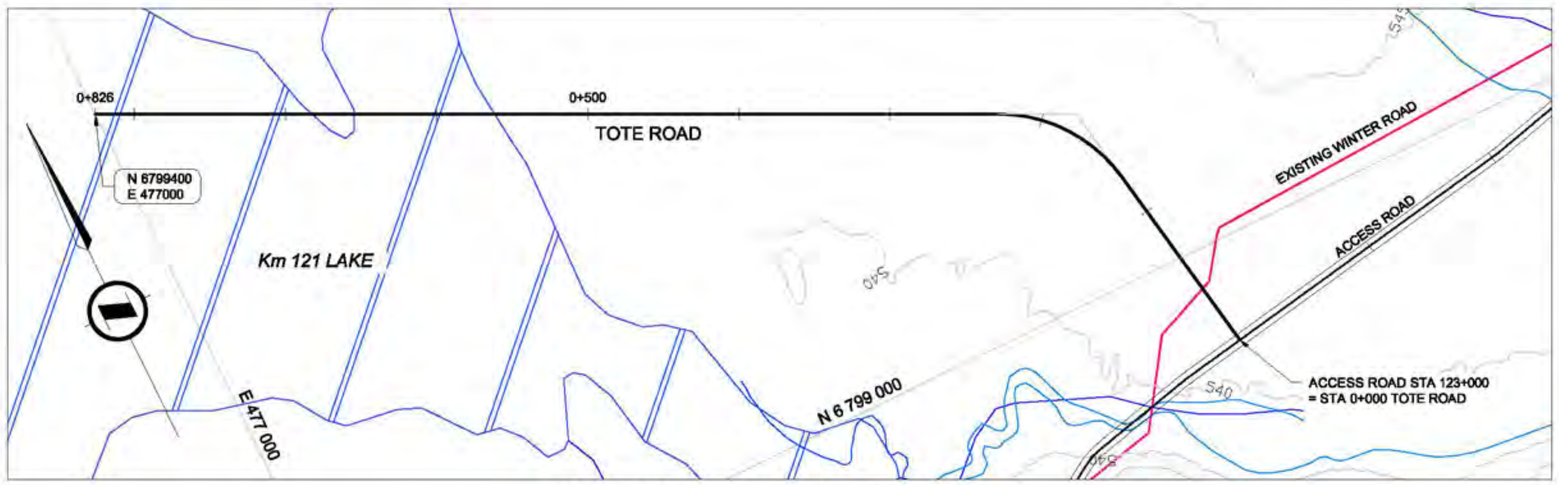


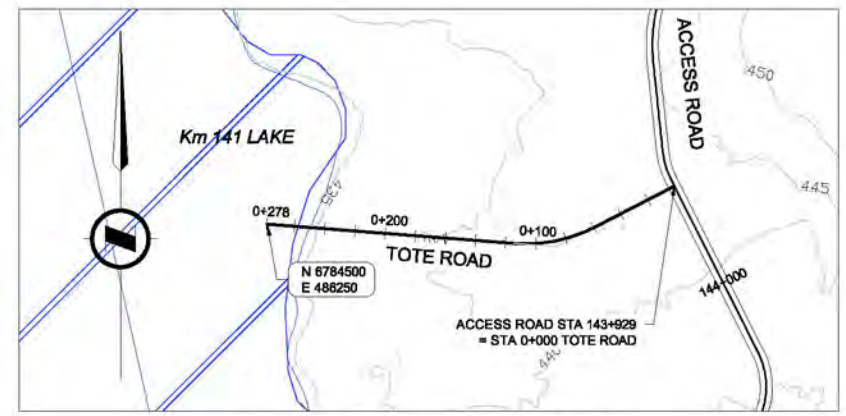
TOTE ROAD TO km 115 LAKE PLAN

SCALE 1: 5000



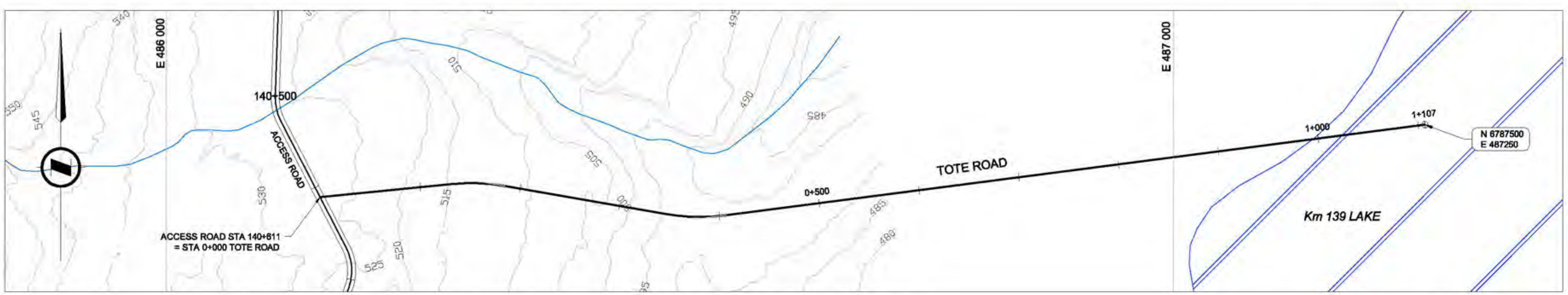
TOTE ROAD TO km 121 LAKE PLAN

SCALE 1: 2500



TOTE ROAD TO km 141 LAKE PLAN

SCALE 1: 2500



TOTE ROAD TO km 139 LAKE PLAN

SCALE 1: 2500

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. TOPOGRAPHICAL DATA OBTAINED FROM LIDAR SURVEY INFORMATION BY McELHANNEY SURVEYING & ENGINEERING LTD.
3. CONTOURS AT 1.0m ELEVATION INTERVAL.
4. TOTE ROAD WIDTH IS 5m WIDE UNLESS NOTED OTHERWISE.
5. FOR PLAN SEE DWG 610984-5110-41DD-0015 AGGREGATE SOURCE AND WATER DRAWOFF.

DWG. NO.	REFERENCES
610984-5110-4100-0018	LAKE WATER DRAWOFF PLAN TOTE ROADS SHEET 1 OF 2
610984-5110-4100-0015	AGGREGATE SOURCE AND WATER DRAWOFF PLAN

NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL.	CLIENT ENG.	CLIENT AREA
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00	12/12/12	ISSUED FOR SUBMISSSION	ESL	RU	JAC		

0 1:2500 100m

0 1:5000 250

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APPROVED LEAD ENG.	Jos A. CAVE	JAC	12/12/06
APPROVED AREA LEAD			
APPROVED ENG. MAN.			
SCALE			

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CLIENT DWG. NO.

SNC·LAVALIN

PROFESSIONAL ENGINEER | NAME | NO.

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PROJECT ACCESS ROAD
LAKE WATER DRAWOFF
TOTE ROADS
SHEET 2 OF 2

PROJECT NO.	AREA	DISCPL.	DOC.	DRAWING NUMBER	REVISION NUMBER
610984	5110	41	DD	0019	01

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