Appendix V6-3D

Back River Project: Bathymetric Surveys of Lakes in the Goose and George Property Areas

Sabina
GOLD & SILVER CORP.

Appendix V6-3D. Back River Project: Bathymetric Surveys of Lakes in the Goose and George Property Areas

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Appendix V6-3D. Back River Project: Bathymetric Surveys of Lakes in the Goose and George Property Areas

1.1 SUMMARY

Bathymetric surveys of lakes in the Project area were conducted from 2010 to 2013 during open-water and ice-covered seasons. Surveys were conducted on lakes closest to potential infrastructure and activities as well as lakes identified as potential water sources for Project domestic and industrial uses.

1.2 METHODS

The bathymetric surveys were conducted as part of the baseline sampling program, and detailed in the following reports:

- *Back River Project: 2010 Lake Water and Sediment Quality Baseline Report* (Rescan 2011; Appendix V6-3A);
- *Back River Project: 2011 Freshwater Baseline Report* (Rescan 2012; Appendix V6-3B);
- *Back River Project: 2012 Freshwater Baseline Report* (Rescan 2013a; Appendix V6-3C); and
- *Back River Project: 2013 Freshwater Baseline Report* (Rescan 2013b).

Bathymetric surveys were also conducted on ice-covered lakes in 2013 using a ground-penetrating radar system (Appendix V6-3E).

Open-water bathymetric surveys from 2010 to 2013 consisted of two parts:

1. The collection of continuous depth measurements along perpendicular and perimeter transects on the lake and pond surfaces using a Differential Global Positioning System (DGPS) and a Garmin depth sounder; and
2. Establishing on-land benchmarks via DGPS surveys of the lake shorelines.

A Trimble PF Power DGPS was used for positioning during the depth survey, and a Garmin depth sounder and a Trimble TSC1 datalogger were used to collect and store the depth data in electronic files. The DGPS and sounder were mounted on the boat for surveys along the lake surfaces.

Depth surveys were carried out by navigating a course of regularly spaced transects across the width of each lake, followed by a longitudinal transect through the long axis of the lake (i.e., e-line). A hand-held GPS, pre-loaded with transect tracks, was used to maintain the correct course with the boat.

Bathymetric surveys conducted on ice-covered lakes in 2013 used a Ground-Penetrating RADAR (GPR) array. MALA's Ramac CUII was used with a 50 MHz rough-terrain antenna. Real-time positioning was attained using a Topcon HyperLite+GPS/Glonass unit. Positions were recorded at 1 Hz with a typical absolute horizontal accuracy of ± 1 metre. The GPR survey was conducted at a speed of approximately 15 km/hr and data were acquired at a frequency of approximately 10 readings per second, giving an

average horizontal resolution of approximately one GPR trace per 42 cm along survey lines. Data were later corrected for ice thickness (Appendix V6-3E).

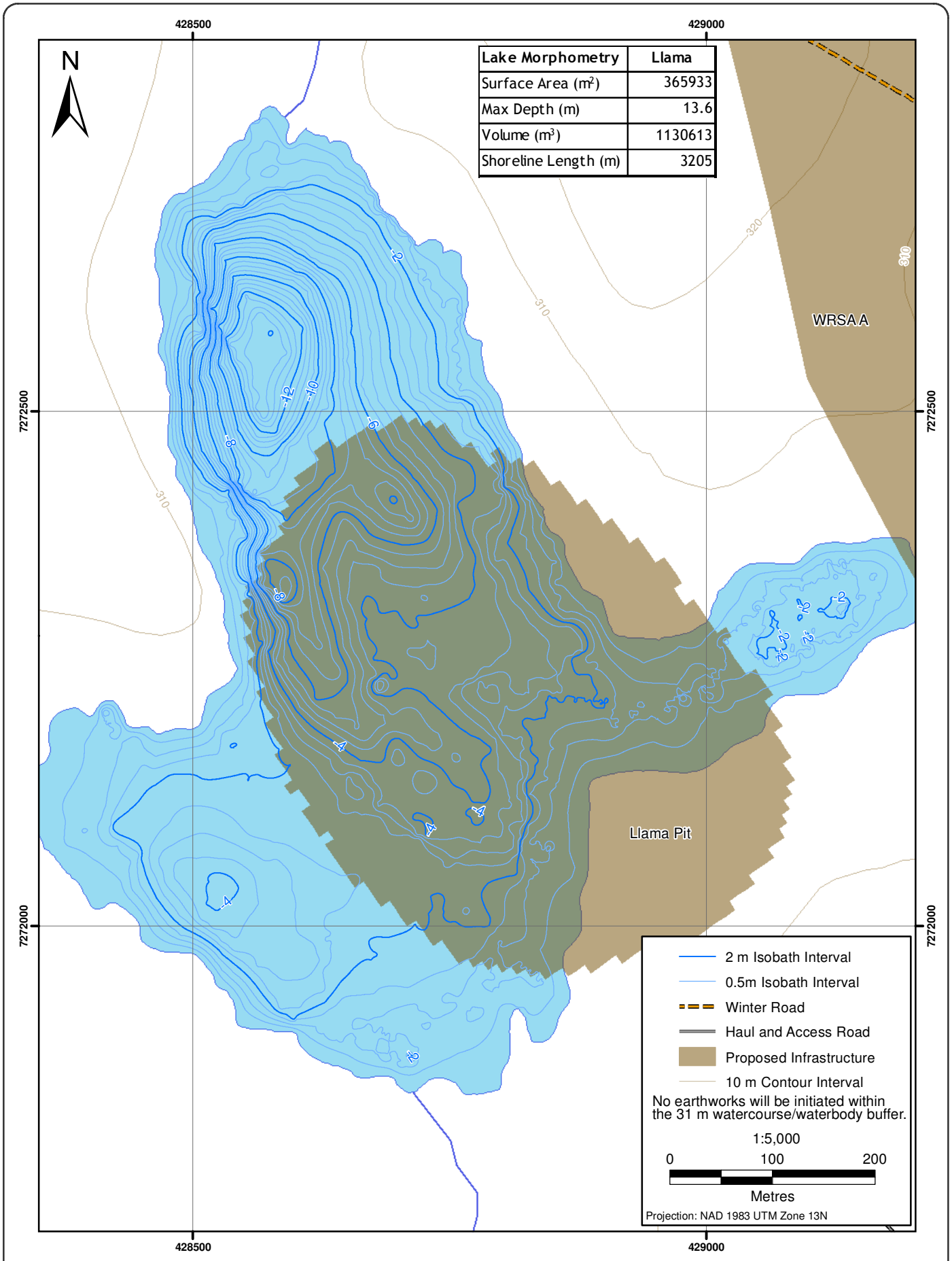
1.3 RESULTS

The bathymetry of 19 lakes in the Goose Property Area and 10 lakes in the George Property Area were surveyed between 2010 and 2013 (summarized in Table V6-3D-1). Smooth bathymetric contours were calculated using standard interpolation techniques and were used to create the bathymetric maps shown in Figures V6-3D-1 to V6-3D-27. For results of bathymetric surveys completed by EBA in winter on ice-covered lakes see Appendix V6-3E.

Table V6-3D-1. Summary of Bathymetry Data Collected in the George and Goose Property Areas, Back River Project, 2010 to 2013

Lake	Year Bathymetry Completed	Lake	Year Bathymetry Completed
George Property		***Goose Property (cont'd)***	
Lytle Lake	2012	Reference Lake B	2010
Occurrence Lake	2012	Goose Lake	2011
Sleigh Lake	2012	Round Pond[1]	2011
George Lake	2012	Pond NE of Round Pond[2]	2011
Reference Lake C	2012	Del Lake	2012
Mosquito	2013	Big Lake	2012
Bob	2013	Fox Lake	2012
Komatic	2013	Rabbit Lake	2012
Reference Q	2013	Giraffe Lake	2012
McCoy	2013	Rascal	2013
Goose Property		Wasp	2013
Llama Lake	2010	Pond A	2013
Umwelt Lake	2010	Propeller[3]	2013
Mam Lake	2010	Leaf[4]	2013
Chair Lake	2010	Wolf[4]	2013

Notes:
[1] Round Pond is also known as Pond 1.
[2] Pond NE of Round Pond is also known as Pond 2.
[3] Bathymetry was conducted on Propeller Lake in the open-water season using the standard methods and by GPR (Rescan 2013b and Appendix V6-3E).
[4] Under-ice bathymetry conducted using GPR (Appendix V6-3E).



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Bathymetry of Llama Lake, Back River Project, 2010

Figure V6-3D-1

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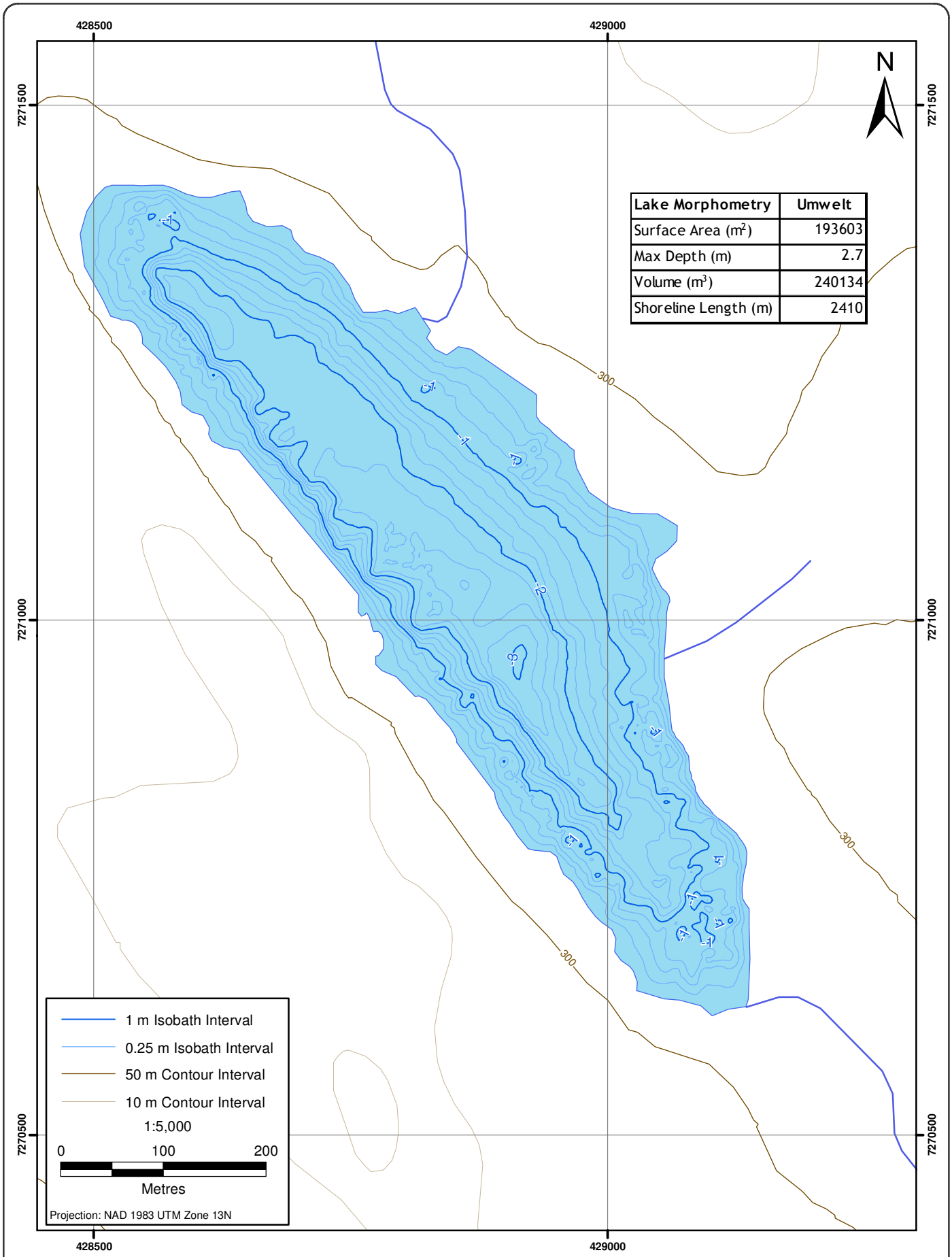

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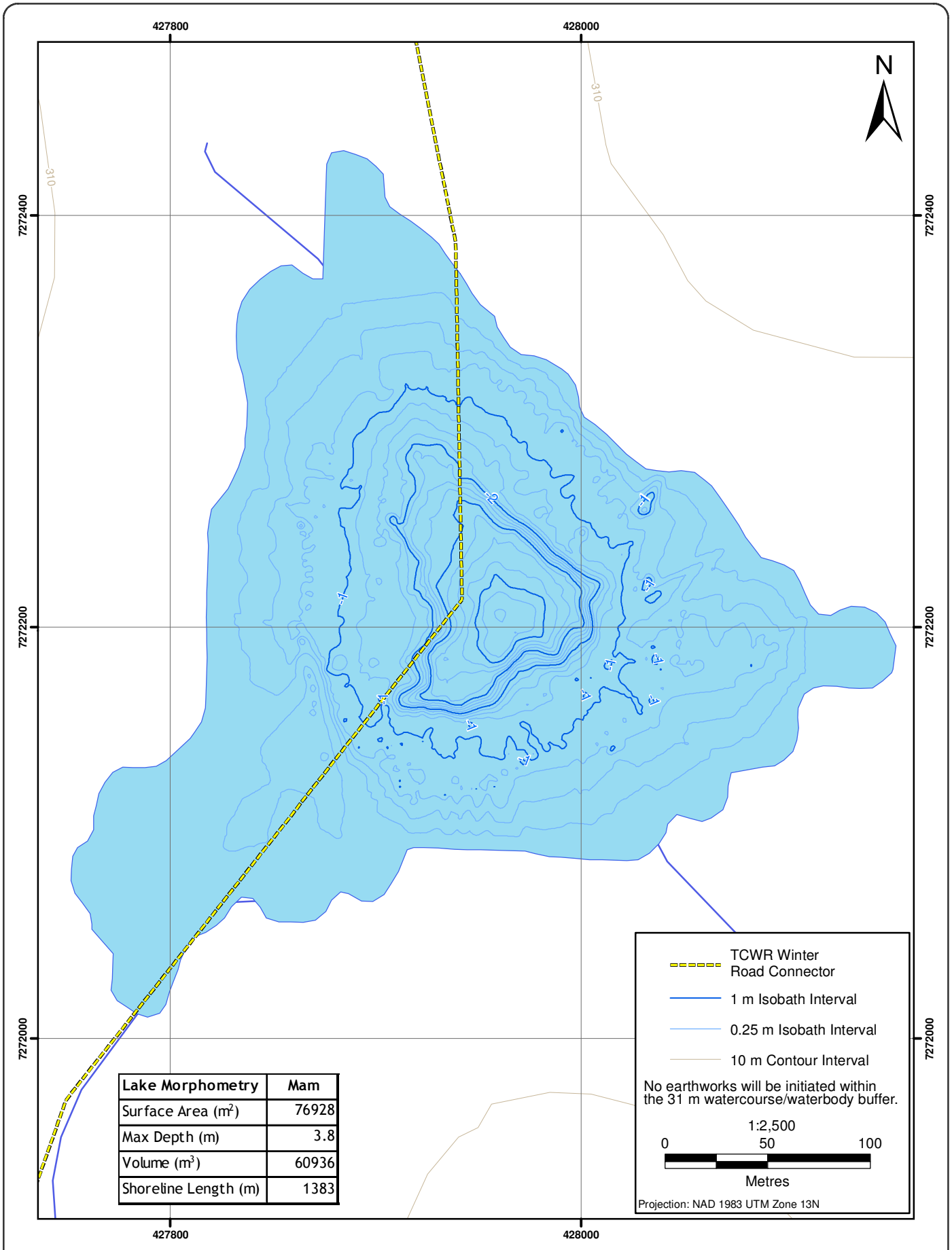
Bathymetry of Umwelt Lake, Back River Project, 2010

Figure V6-3D-2

Rescan an ERM company



Lake Morphometry	Mam
Surface Area (m^2)	76928
Max Depth (m)	3.8
Volume (m^3)	60936
Shoreline Length (m)	1383

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Bathymetry of Mam Lake, Back River Project, 2010

Figure V6-3D-3

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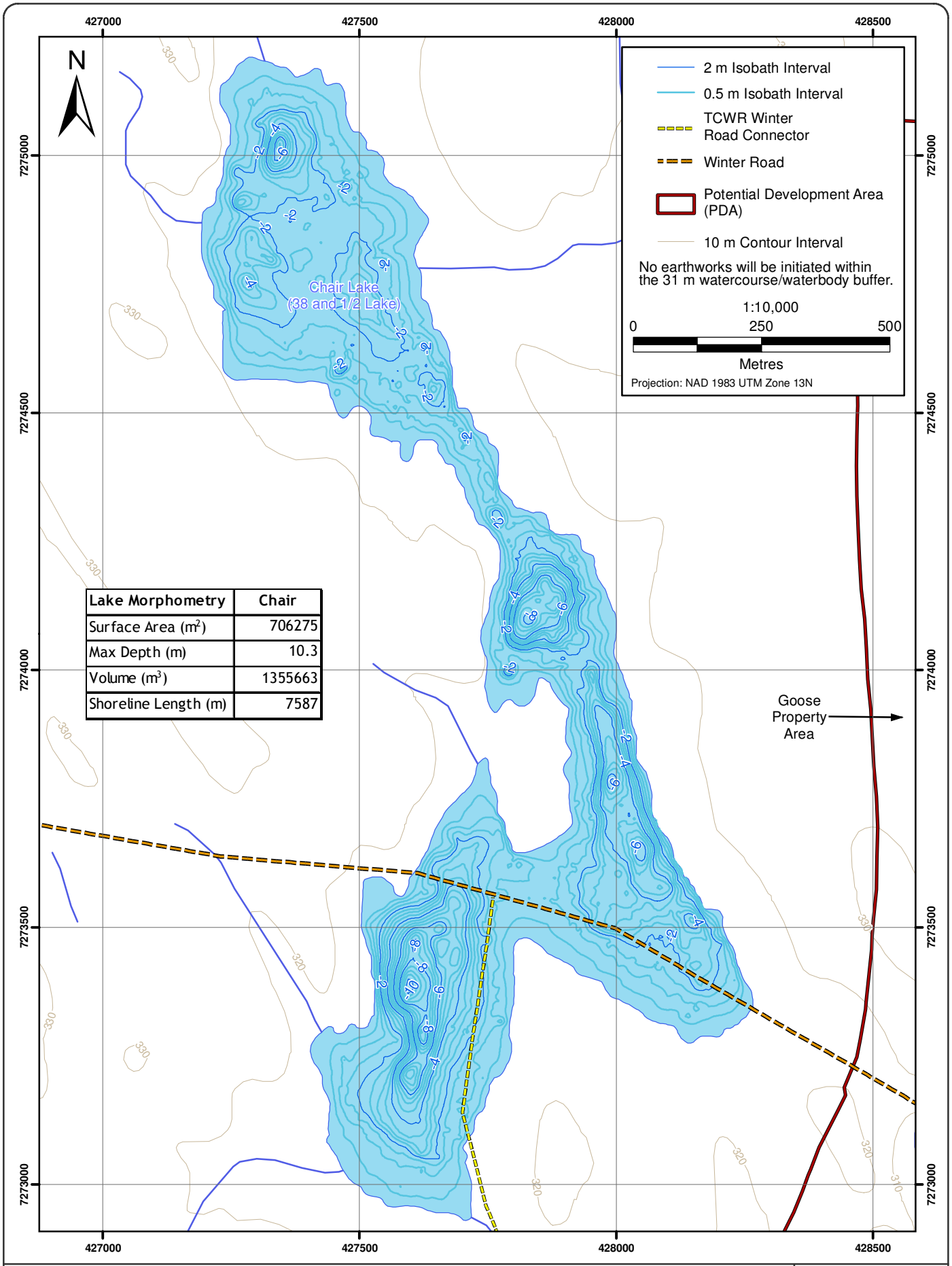

Lake Morphometry	Chair
Surface Area (m^2)	706275
Max Depth (m)	10.3
Volume (m^3)	1355663
Shoreline Length (m)	7587

Figure V6-3D-4

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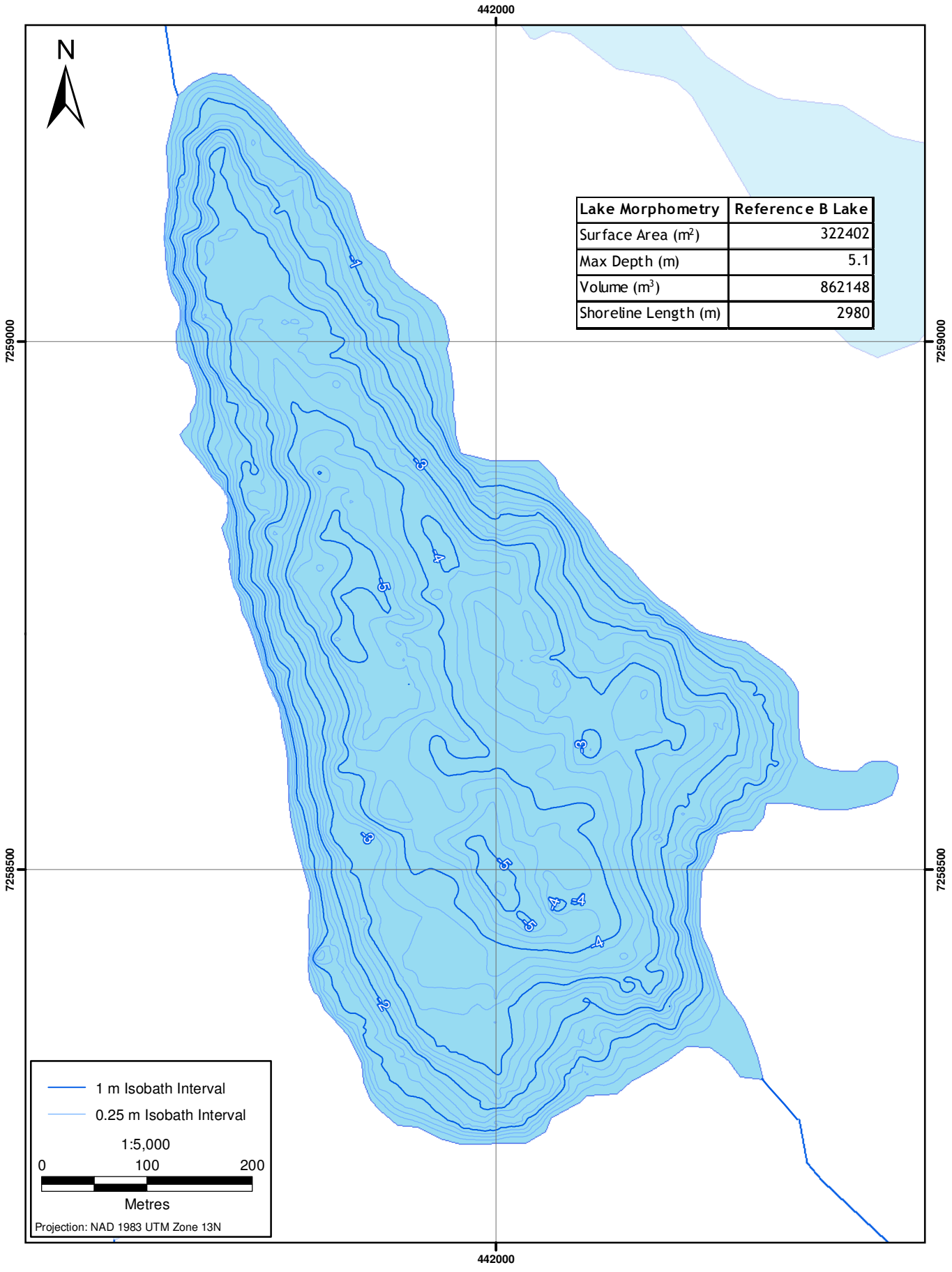
Bathymetry of Chair Lake, Back River Project, 2010

Rescan an ERM company



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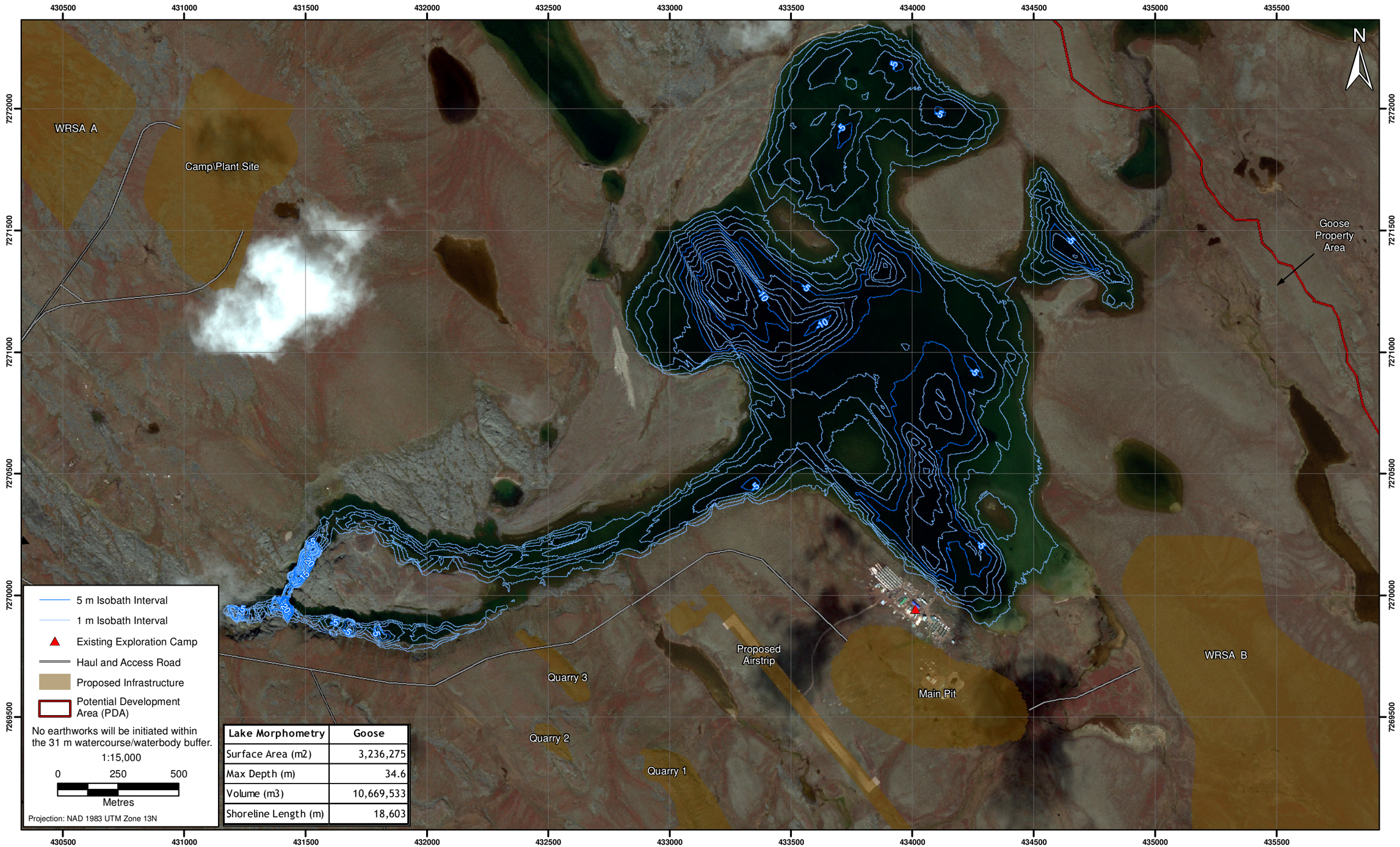
Bathymetry of Reference B Lake, Back River Project, 2010

Figure V6-3D-5

Rescan an ERM company



Lake Morphometry	Goose
Surface Area (m2)	3,236,275
Max Depth (m)	34.6
Volume (m3)	10,669,533
Shoreline Length (m)	18,603

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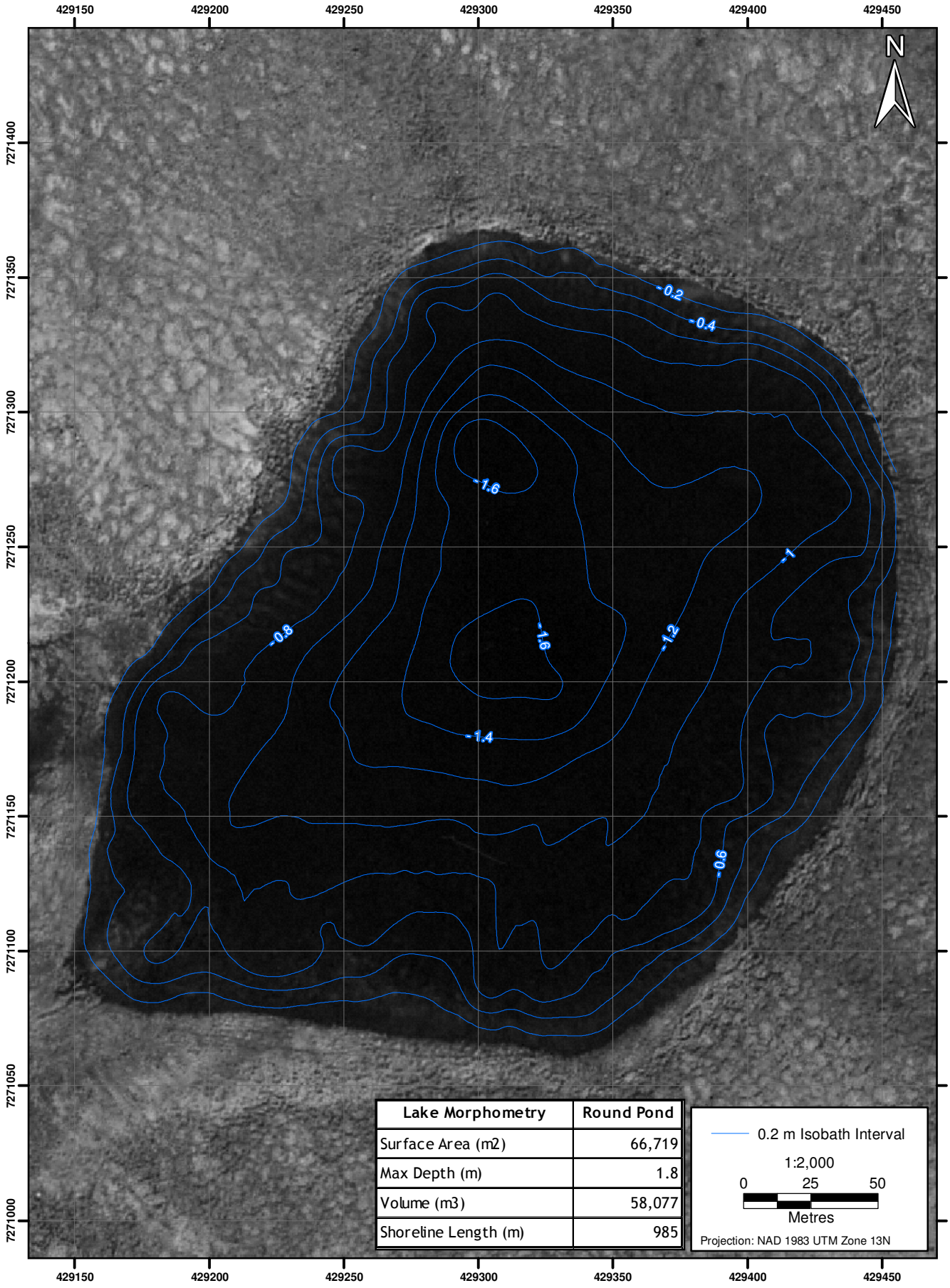
Figure V6-3D-6

Bathymetry of Goose Lake, Back River Project, 2011



Lake Morphometry	Round Pond
Surface Area (m2)	66,719
Max Depth (m)	1.8
Volume (m3)	58,077
Shoreline Length (m)	985

0.2 m Isobath Interval

1:2,000

0 25 50

Metres

Projection: NAD 1983 UTM Zone 13N

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Bathymetry of Round Pond (Pond 1), Back River Project, 2011

Figure V6-3D-7

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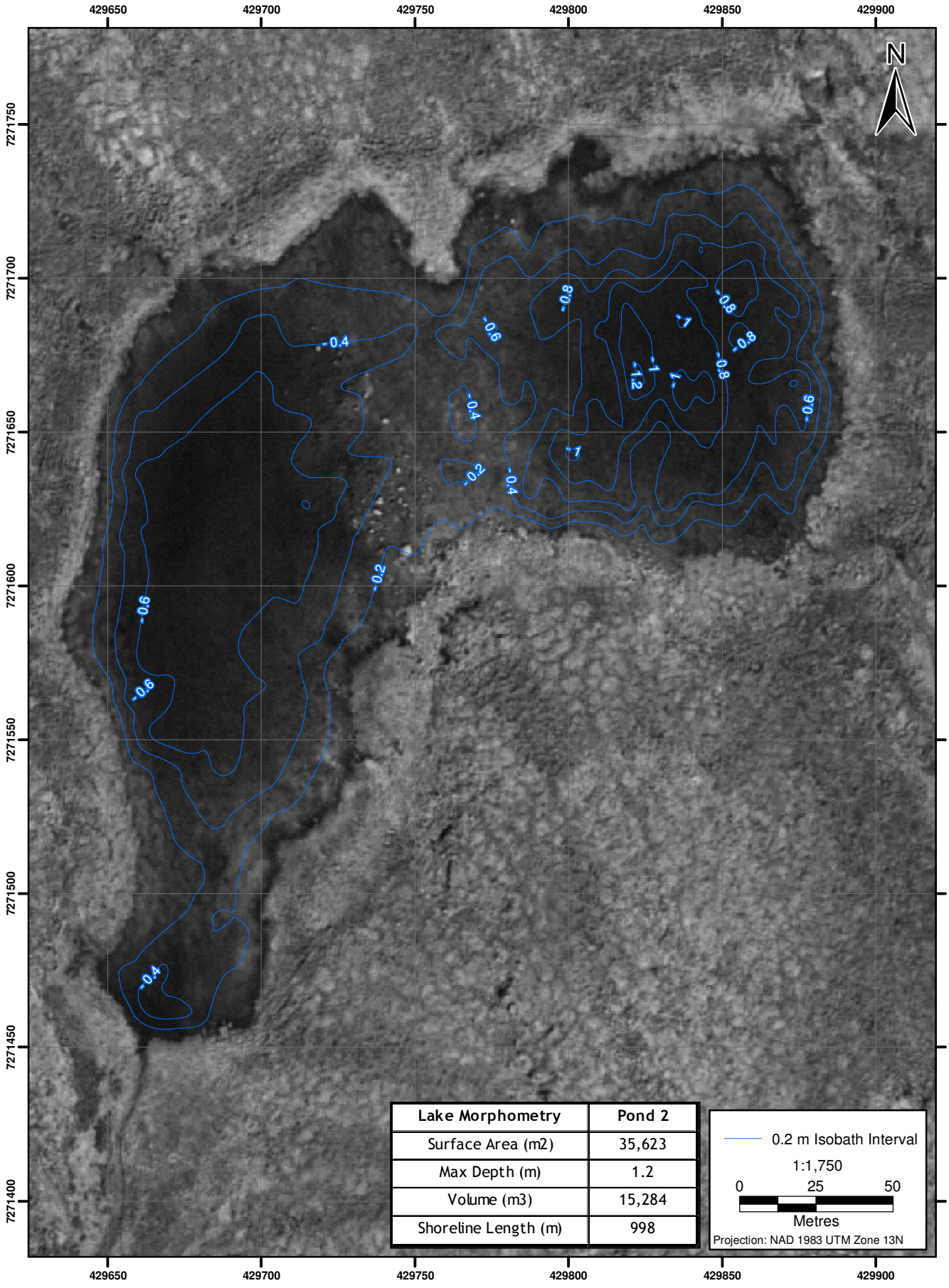

Figure V6-3D-8

Bathymetry of Pond NE of Round Pond (Pond 2), Back River Project, 2011

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Rescan an ERM company

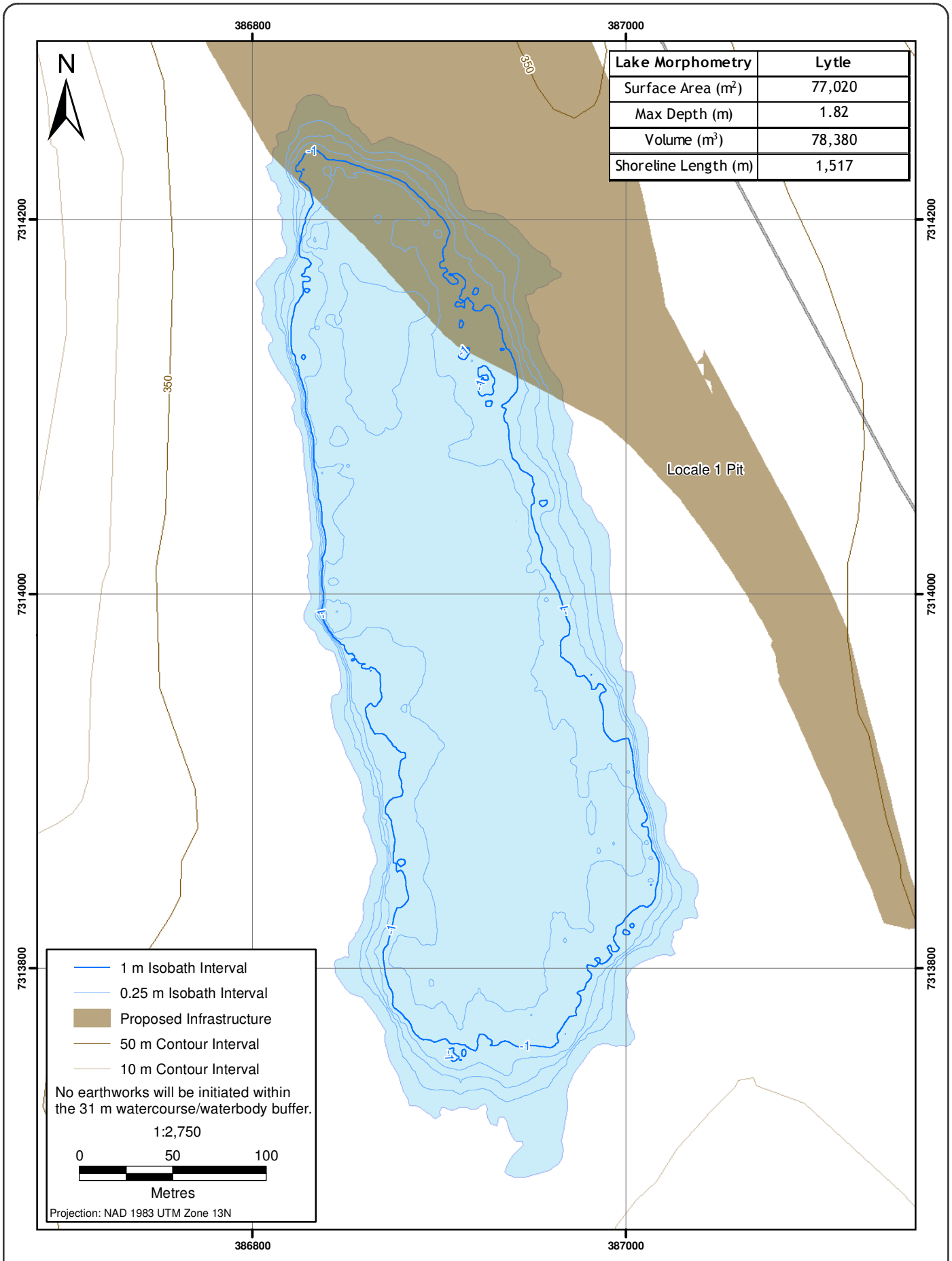

Figure V6-3D-9

Bathymetry of Lytle Lake, Back River Project, 2012

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Rescan an ERM company

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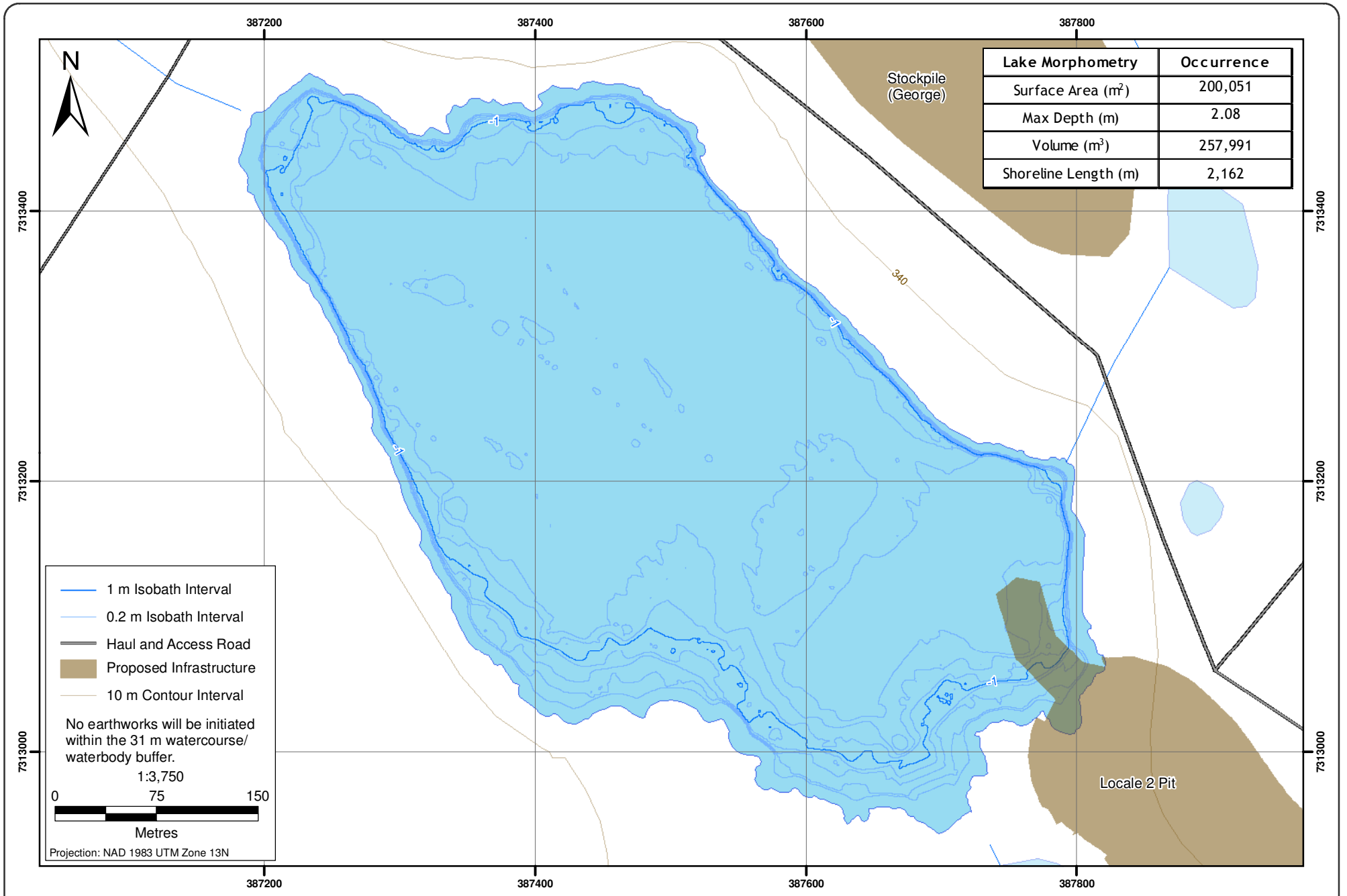

Figure V6-3D-10

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Bathymetry of Occurrence Lake, Back River Project, 2012

Figure V6-3D-10

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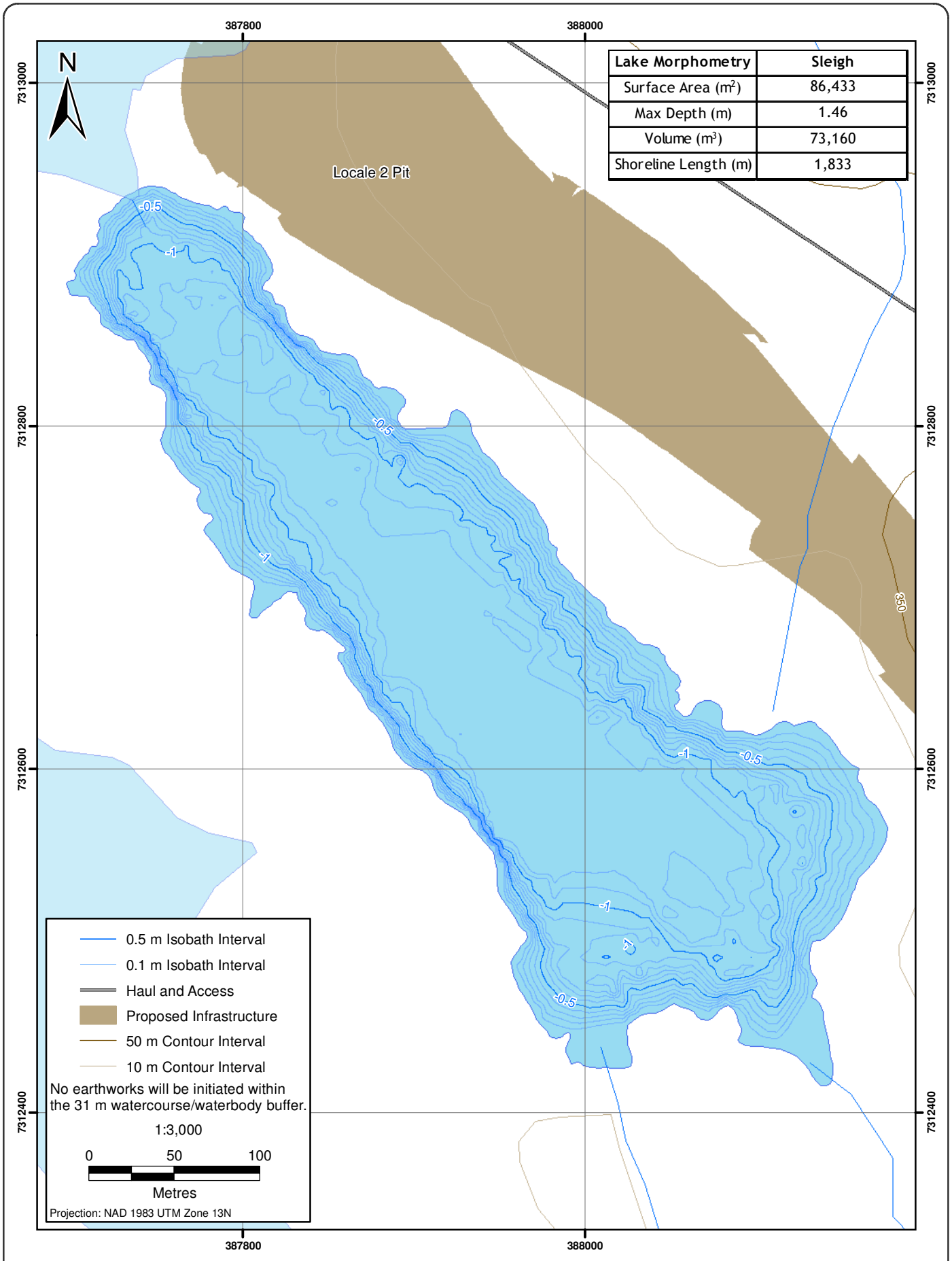

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Bathymetry of Sleigh Lake, Back River Project, 2012

Figure V6-3D-11

Rescan an ERM company

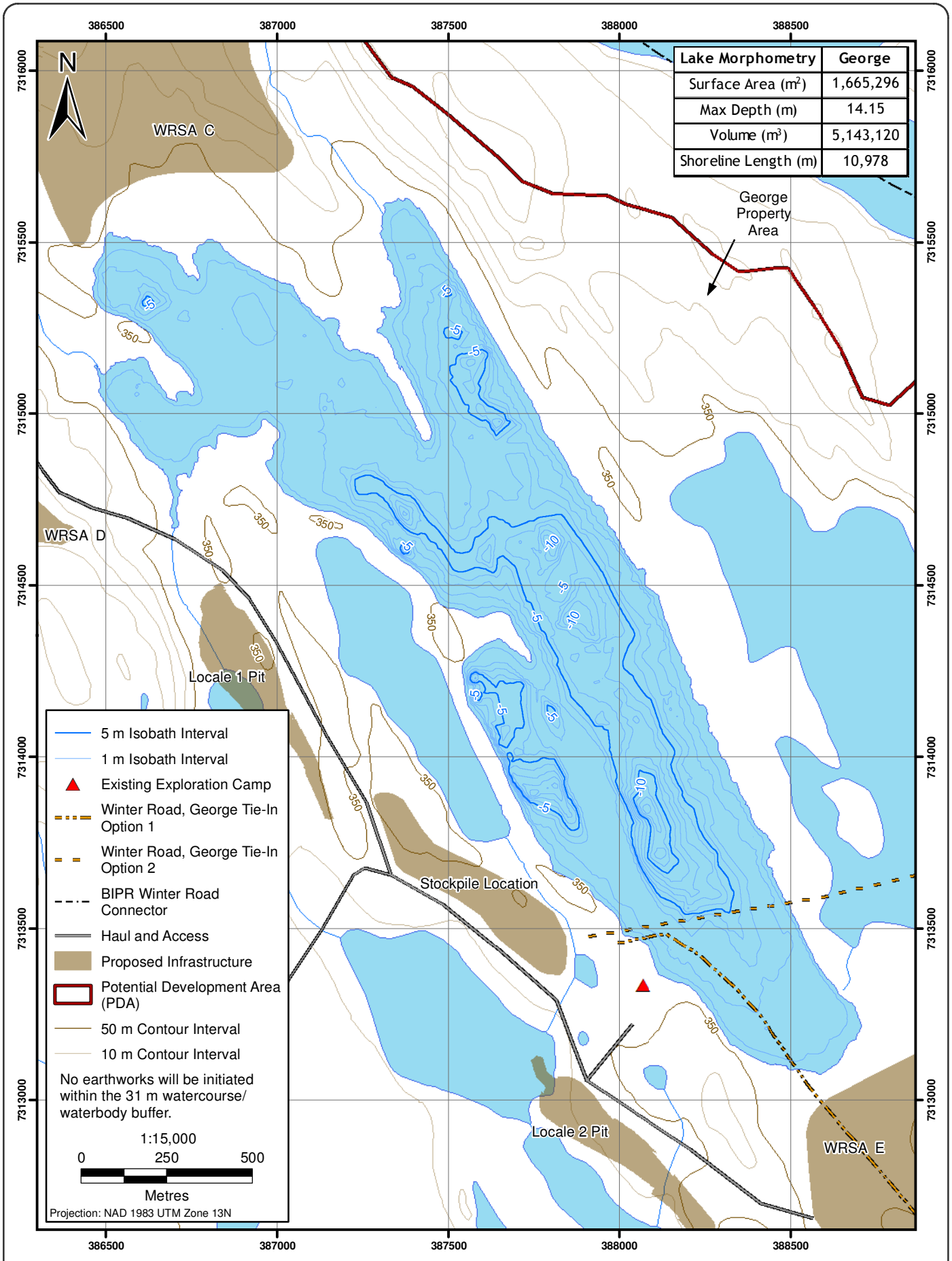

Figure V6-3D-12

Bathymetry of George Lake, Back River Project, 2012

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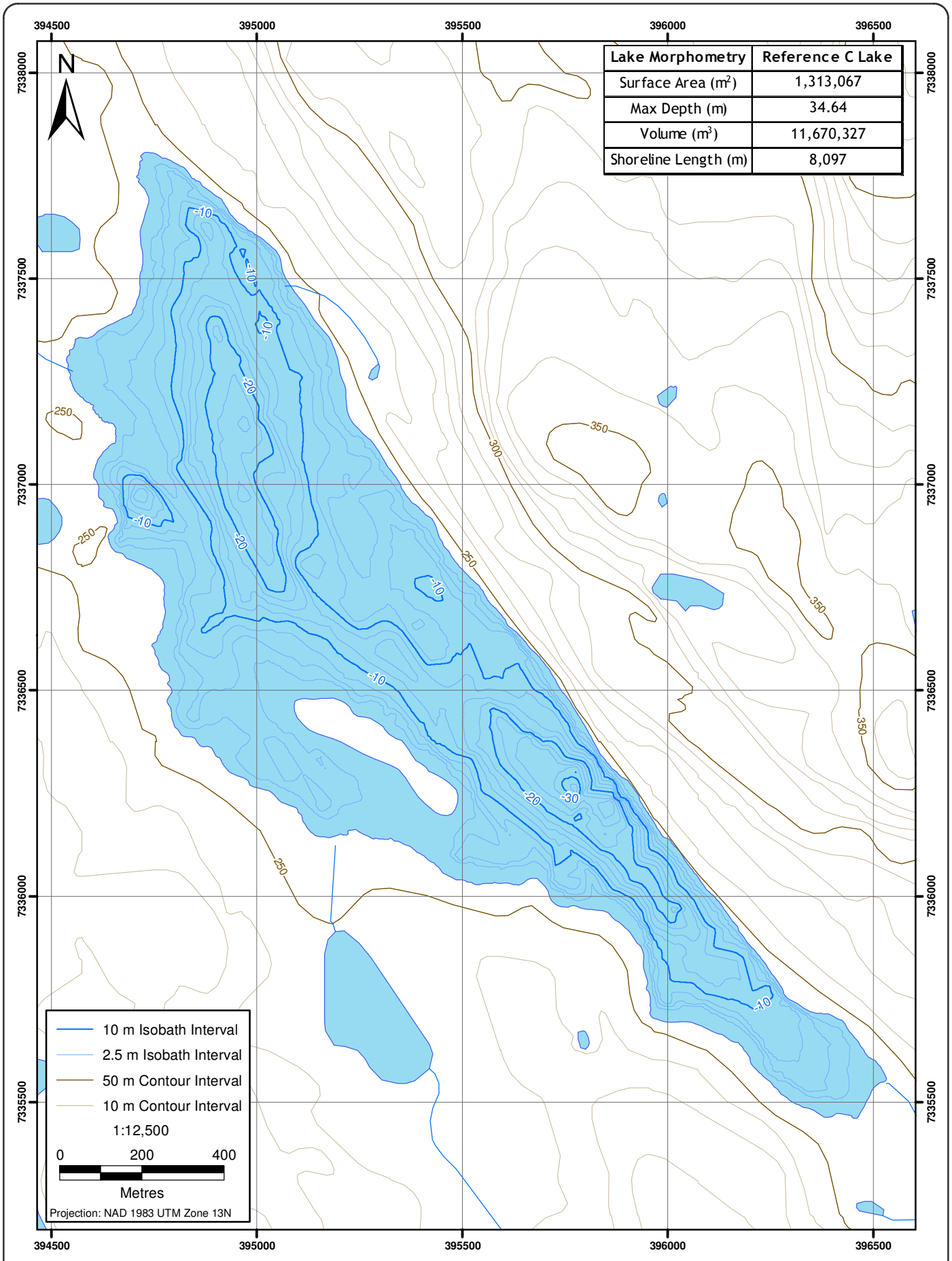

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Bathymetry of Reference C Lake, Back River Project, 2012

Figure V6-3D-13

Rescan an ERM company

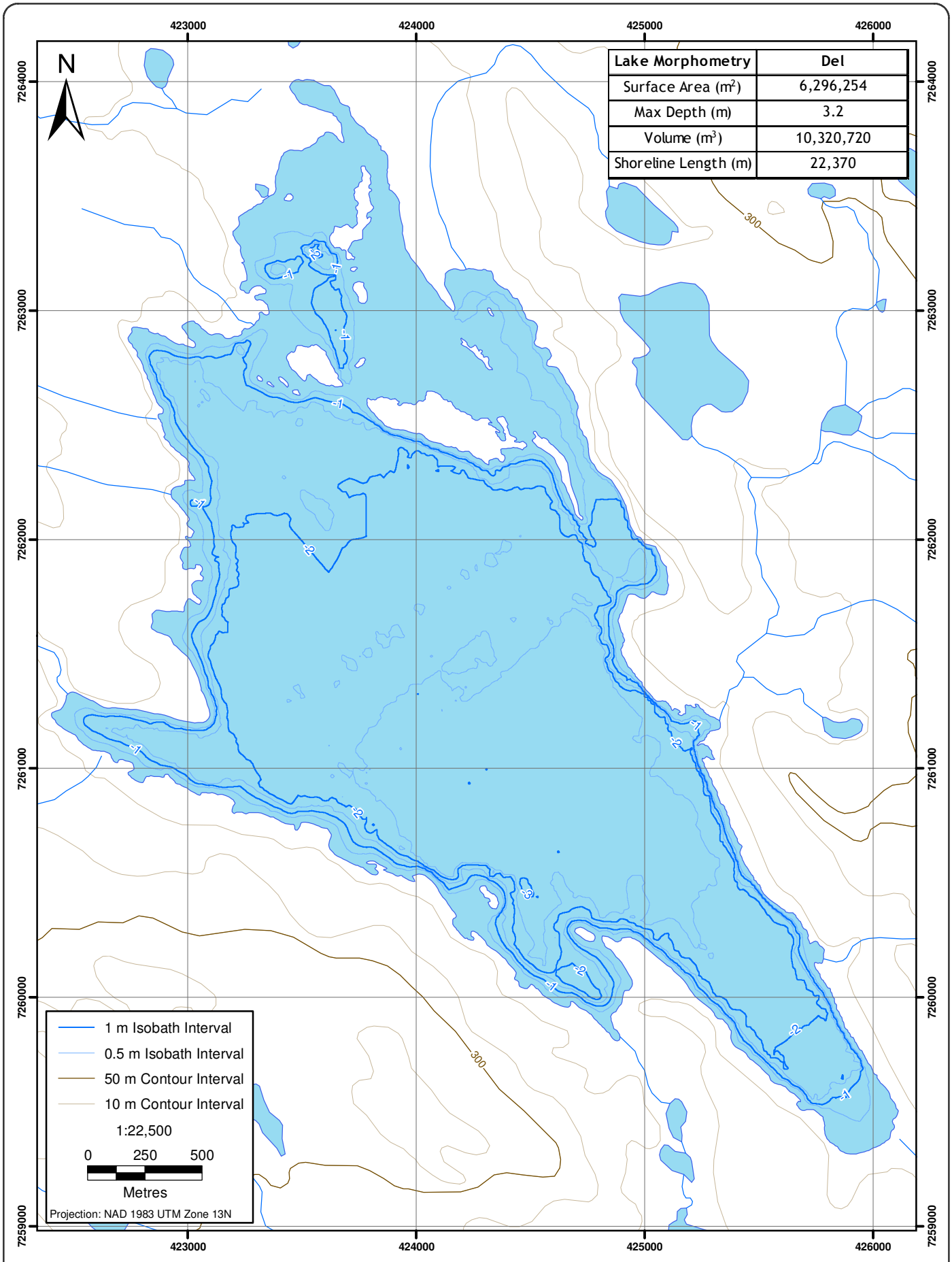

Figure V6-3D-14

Bathymetry of Del Lake, Back River Project, 2012

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