



December 20, 2017

TBTE Reference Number: 17-319

Dante Di Gregorio, H.B.A., J.D.
Lempiala Sand and Gravel Limited
dante@brunoscontracting.com

RE: Trout Lake Pit - Groundwater Summary Statement

1 INTRODUCTION

TBT Engineering Limited (TBTE) was retained by Lempiala Sand and Gravel Limited to complete a Groundwater Summary Statement (GWSS) for their Trout Lake Pit.

While the water table is partially controlled by topography, other factors also influence its elevation. Rock can have low porosity and low permeability, impeding the movement of water. Water movement through rock mainly occurs along fractures or faults, which are not necessarily interconnected or consistent.

Porosity and permeability are dictated by rock or soil type and geologic history. Complicated structures such as perched water tables may be present on specific sites, making the actual groundwater table difficult to assess. A perched water table is not typically considered for the purpose of establishing the on-site water table.

This summary relies upon hydrogeological interpretations based on a desktop review of available mapping, well records, and shallow test pit investigations (<6 m). This summary was reviewed by a qualified person (in accordance with the Professional Geoscientist Act, 2000). The development and preparation of this GWSS was carried out with guidance and reference to the Ministry of Natural Resources and Forestry Policy No. A.R.4.01.04 memorandum.

2 SCOPE

The intent of this GWSS is to mitigate the impacts of pit development on groundwater and surface water resources at the site by identifying extraction limitations and offsets in accordance with the Aggregate Resource Act (ARA) Policies.

This GWSS constitutes TBTE's professional opinion of the groundwater and site conditions determined through on-site field investigations and available mapping (geological and topographical).

3 SITE LOCATION

The Trout Lake Pit site is located approximately 20 km northwest of Thunder Bay at UTM Zone 16U Northing 5387483, Easting 324529. Access to the site is by road off of Highway 591. Figure 1 shows the location of the site.

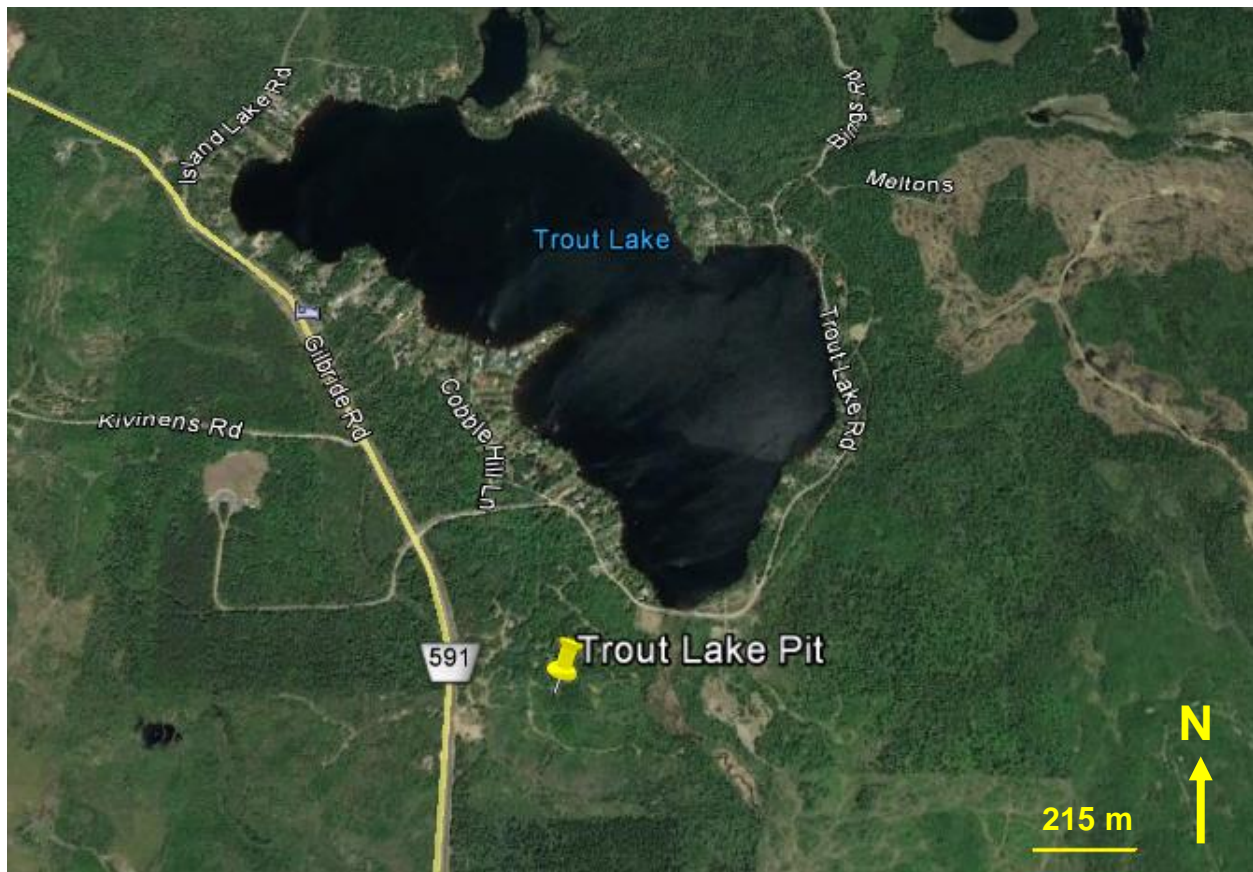


Figure 1: Trout Lake Pit Site Location

Figure 2 shows the approximate permit boundary on site. Bracketed numbers correspond with the surface water features listed in Table 1.

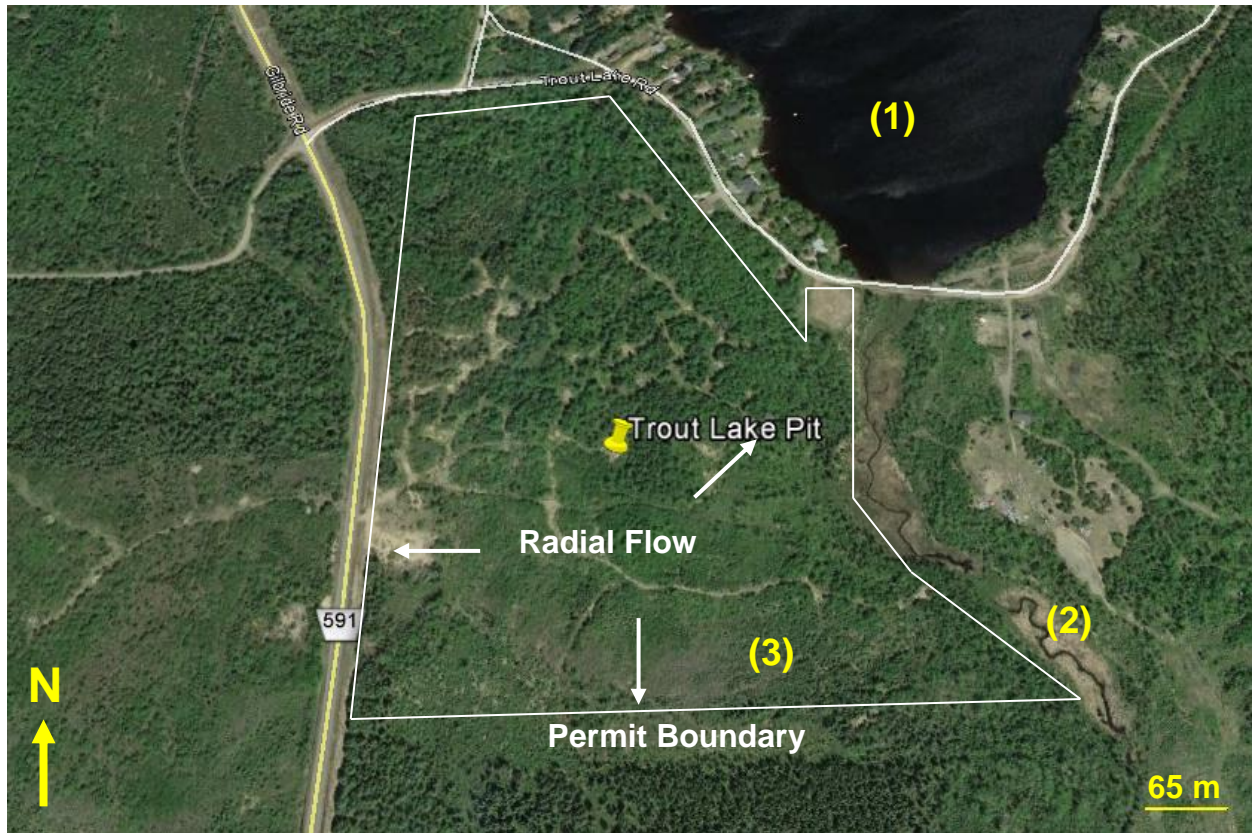


Figure 2: Trout Lake Pit Approximate Permit Boundary

4 PHYSICAL GEOGRAPHY

The site is located in the boreal forest. According to the Northern Ontario Engineering Geology Terrain Study (NOEGTS), the proposed pit is located on an outwash plain bordering bedrock knobs. The site is heavily forested and hosts a network of trails. There are oversized boulders present at surface throughout the site.

5 EXISTING WELL DATA

There are several MOECC wells near to the site. Wells 6107269 and 6102040 were considered most relevant for analysis given their depths and geographic locations north and south of the site. Well 6107269 is located in UTM Zone 16 around Northing 5387671 and Easting 324680, around the northeast boundary the site. Water was identified at 431 mASL. Well 6102040 is located in UTM Zone 16 around Northing 5386602 and Easting 324370.3 approximately 660 m

south of the site. Water was identified at 446.5 mASL. The bedrock within these wells was identified as granite. Well records are included at the rear of this letter.

6 SURFACE WATERS

In general, the site slopes toward the southeast. As shown in Figure 2, surface waters flow radially from the topographic high near the centre of the site. According to Land Information Ontario's Metadata Management Tool, the site is located in the Dog Lake Watershed. Flows from the site eventually drain to Lake Superior.

Surface water features in the area surrounding the site are summarized in Table 1.

Table 1: Surface Water Feature Characteristics

Feature	Distance from Site	UTM Zone 16U		Approximated Elevation (mASL)
		Easting	Northing	
Trout Lake (1)	88 m NE	324783.54	5387799.54	451
River (2)	45 m E	324915.68	5387291.23	450
Floodplain (3)	S side	5387288.18	5387288.18	450

7 FIELD INVESTIGATION

The site was inspected on August 3, 2017. Five (5) test holes were excavated on site to determine the composition of the subsurface. Figure 3 shows the locations of the test holes. Test hole logs are included at the rear of this memo. The subsurface primarily consists of sand with varying fractions of gravel and silt.

Figure 4 shows a photo depicting the foliage and on site.



Figure 3: Test Hole Locations



Figure 4: Site Photo

8 GROUNDWATER TABLE

Water elevations used for the estimation of the groundwater table were obtained from the field investigations and Google Earth imagery. Surface water features are assumed to be hydraulically connected to the groundwater system. Water elevations are assumed to grade uniformly between surface features. Water elevations on site were estimated by extrapolating on this data. The more conservative (higher) value was used in analysis.

Groundwater was encountered in TH3 at 5.0 m below grade, having an estimated elevation of 455 masl based on available topographic details.

The attached water well records were obtained from the existing wells in 1978 and 2004. The wells are located further from the site than the surface water features; thus their water levels are considered irrelevant for this study. However, the wells do provide an indication of subsurface composition.

Figure 5 shows an estimated groundwater level contour plan. The cyan numbers represent known groundwater elevations. It should be noted that this plan is an estimate as the actual location of the groundwater contours are dependent on factors such as subsurface layer permeability.

Based on the surface water features, the groundwater table is anticipated to grade from 455 to 452 masl along the western boundary with groundwater mounding to 460 masl near the centre of the site, and grading from 455 masl at the northeast corner sloping to 450 masl at the southeast corner, illustrated in Figure 5. In general, the gradient of the groundwater flows outward (to the west and east) from the centre of the site and is anticipated to mimic the shape of ground surface.

9 EXTRACTION LIMITS

For a pit above water, the final depth of extraction must be at least 1.5 m above the established groundwater table. Based on the estimated groundwater levels, the extraction limit to maintain a 1.5 m vertical buffer between the pit extraction limit and the estimated groundwater table ranges from 456.5 masl to 453.5 masl in the west, grading upward to 461.5 masl within the centre of the site, and 456.5 to 451.5 masl along the eastern boundary.

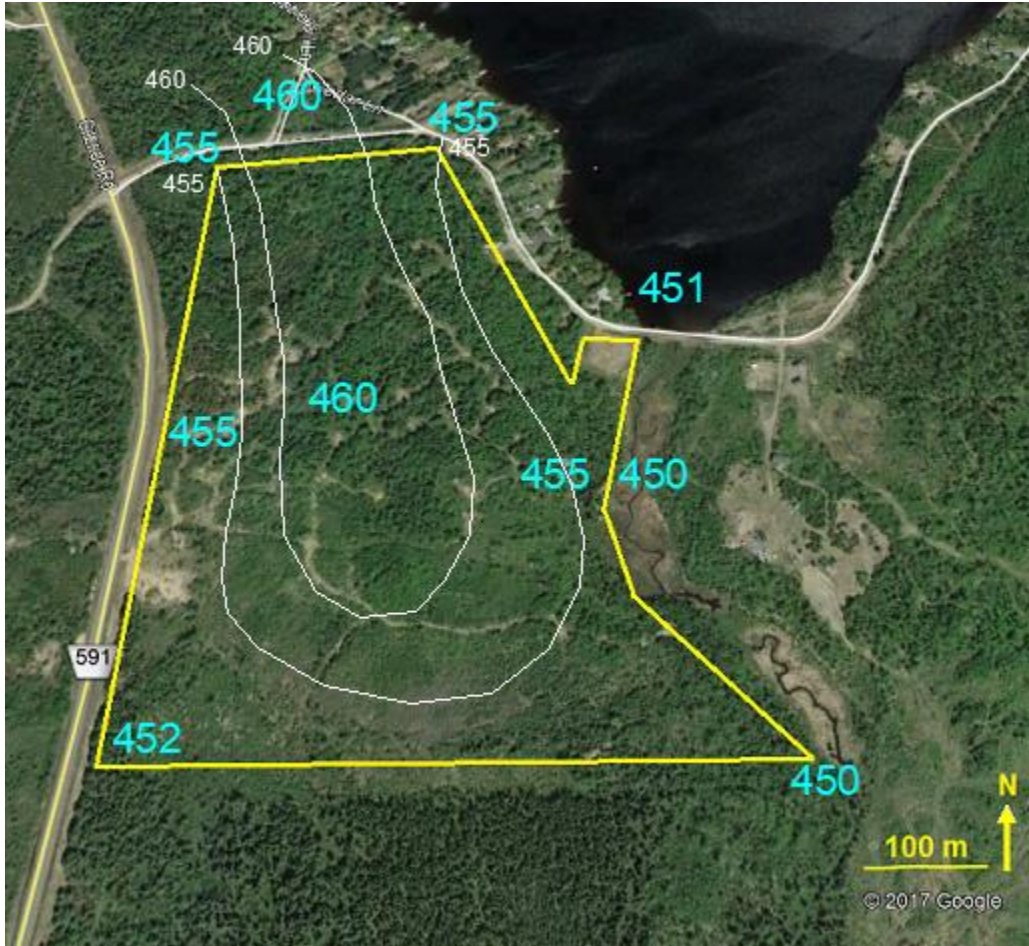


Figure 5: Groundwater Contour Estimate

10 SUMMARY

The groundwater table is anticipated to grade from 455 to 452 masl along the western boundary with groundwater mounding to 460 masl near the centre of the site, mimicking topographical conditions, and grading from 455 masl at the northeast corner sloping to 450 masl at the southeast corner. The extraction limit to maintain a 1.5 m vertical buffer between the pit extraction limit and the estimated groundwater table ranges from 456.5 masl to 453.5 masl in the west, grading upward to 461.5 masl within the centre of the site, and 456.5 to 451.5 masl along the eastern boundary.

11 CLOSURE

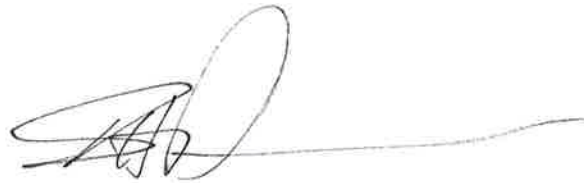
Conclusions and recommendations presented in this Groundwater Summary Statement are based on the best available information at the time of preparation, TBTE's field investigations, and published mapping. This report constitutes the professional opinion of TBTE.

Conditions may become apparent during extraction that were not detected and could not be anticipated at the time of the site investigation. It is recommended that TBTE be contacted to review the significance of the new information, and its potential impact on the recommendations provided in this report.

TBTE accepts no responsibility for damages suffered by any third party as a result of decisions made based on this report. Should there be any changes to project details, or should you have any questions, please contact the undersigned.

Prepared by:

Reviewed by:



Leah Cosby, P.Eng
TBT Engineering Limited

Scott Peterson, P. Geo
TBT Engineering Limited

LOG OF TEST HOLE TH-01

PROJECT: **NEL 1 & GWSSs**
 LOCATION: **Trout Lake Pit**
Gorham, Ontario
 CLIENT: **Lampiala Sand and Gravel Limited**
 SURFACE ELEV.: **469.0 metres**

EQUIPMENT: **Excavator**
 DIAMETER: **N/A**
 COORDINATES: **16U N 5387580 E 324372**
 VV EQUIPMENT:
 DATE: **3 August 2017**
 TBT Ref. No. **17-319**

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH SCALE	VOLATILE VAPOURS				PLASTIC NATURAL LIQUID			REMARKS		
DEPTH	ELEV.	DESCRIPTION	STRAT PLOT	% RECOVERY	TYPE			"N" VALUES	PPM	40	80	120	160	200		W _p	W
																	GR SA SI CL
1	468	SILT															
2	467	GRAVEL - Sandy															
3	466	SAND - Gravelly															
4	465																
5	464	End of Test Hole @ 5.0 m.															
6	463																
7	462																

02A-1 GEO WITH MW 17-319 TROUT LAKE.GPJ TBT.GDT 19/12/17



TBT Engineering Limited
 1918 Young Street
 Thunder Bay, Ontario P7E 6T9
 PH: 807-624-5160
 FX: 807-624-5161
 Email: tbte@tbte.ca
 Web: www.tbte.ca

SAMPLE TYPE LEGEND

AS	Auger Sample
SS	Split Spoon Sample
TW	70mm Thin Wall Tube
CC	Concrete Core
RC	Rock Core
PS	Ponar Sample
CB	Core Barrel
WS	Wash Sample

NOTES:
 Elevations are based on GPS estimate.

ENCLOSURE 1

LOG OF TEST HOLE TH-02

PROJECT: **NEL 1 & GWSSs**
 LOCATION: **Trout Lake Pit**
Gorham, Ontario
 CLIENT: **Lampiala Sand and Gravel Limited**
 SURFACE ELEV.: **471.0 metres**

EQUIPMENT: **Excavator**
 DIAMETER: **N/A**
 COORDINATES: **16U N 5387720 E 324499**
 VV EQUIPMENT:
 DATE: **3 August 2017**
 TBT Ref. No. **17-319**

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH SCALE	VOLATILE VAPOURS				PLASTIC NATURAL LIQUID LIMIT			REMARKS
DEPTH	ELEV.	DESCRIPTION	STRAT PLOT	% RECOVERY	TYPE			"N" VALUES	PPM	LEL	SPT (N)	W _p	W	W _L	
							40 80 120 160 200	×	▪	◆	●	▲	GR SA SI CL		
1	470	SAND & SILT													
2	469														
3	468	SAND - with silt													
4	467	SAND - Gravelly													
5	466	End of Test Hole @ 5.0 m.													
6	465														
7	464														

02A-1 GEO WITH MW 17-319 TROUT LAKE.GPJ TBT.GDT 19/12/17



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 Web: www.tbte.ca

SAMPLE TYPE LEGEND

AS	Auger Sample
SS	Split Spoon Sample
TW	70mm Thin Wall Tube
CC	Concrete Core
RC	Rock Core
PS	Ponar Sample
CB	Core Barrel
WS	Wash Sample

NOTES:
 Elevations are based on GPS estimate.

ENCLOSURE 2

LOG OF TEST HOLE TH-03

PROJECT: **NEL 1 & GWSSs**
 LOCATION: **Trout Lake Pit**
Gorham, Ontario
 CLIENT: **Lampiala Sand and Gravel Limited**
 SURFACE ELEV.: **460.0 metres**

EQUIPMENT: **Excavator**
 DIAMETER: **N/A**
 COORDINATES: **16U N 5387483 E 324701**
 VV EQUIPMENT:
 DATE: **3 August 2017**
 TBT Ref. No. **17-319**

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH SCALE	VOLATILE VAPOURS				PLASTIC NATURAL LIQUID LIMIT			REMARKS		
DEPTH	ELEV.	DESCRIPTION	STRAT PLOT	% RECOVERY	TYPE			"N" VALUES	PPM	40	80	120	160	200		W _p	W
																	GR SA SI CL
1	459	SAND															
2	458																
3	457	SAND - Silty															
4	456																
5	455	End of Test Hole @ 5.0 m.															Water table @ 5.0 m depth.
6	454																
7	453																

02A-1 GEO WITH MW 17-319 TROUT LAKE.GPJ TBT.GDT 19/12/17



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 Web: www.tbte.ca

SAMPLE TYPE LEGEND

AS	Auger Sample
SS	Split Spoon Sample
TW	70mm Thin Wall Tube
CC	Concrete Core
RC	Rock Core
PS	Ponar Sample
CB	Core Barrel
WS	Wash Sample

NOTES:
 Elevations are based on GPS estimate.

ENCLOSURE 3

LOG OF TEST HOLE TH-04

PROJECT: **NEL 1 & GWSSs**
 LOCATION: **Trout Lake Pit**
Gorham, Ontario
 CLIENT: **Lampiala Sand and Gravel Limited**
 SURFACE ELEV.: **462.0 metres**

EQUIPMENT: **Excavator**
 DIAMETER: **N/A**
 COORDINATES: **16U N 5387320 E 324564**
 VV EQUIPMENT:
 DATE: **3 August 2017**
 TBT Ref. No. **17-319**

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH SCALE	VOLATILE VAPOURS				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	REMARKS
DEPTH	ELEV.	DESCRIPTION	STRAT PLOT	% RECOVERY	TYPE			"N" VALUES	40	80	120				
															GR SA SI CL
1	461	SAND - Silty													
2	460	SAND - with gravel													
3	459														
4	458														
5	457														
6	456	End of Test Hole @ 6.0 m.													
7	455														

02A-1 GEO WITH MW 17-319 TROUT LAKE.GPJ TBT.GDT 19/12/17



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 Web: www.tbte.ca

SAMPLE TYPE LEGEND

AS	Auger Sample
SS	Split Spoon Sample
TW	70mm Thin Wall Tube
CC	Concrete Core
RC	Rock Core
PS	Ponar Sample
CB	Core Barrel
WS	Wash Sample

NOTES:
 Elevations are based on GPS estimate.

ENCLOSURE 1

LOG OF TEST HOLE TH-05

PROJECT: **NEL 1 & GWSSs**
 LOCATION: **Trout Lake Pit**
Gorham, Ontario
 CLIENT: **Lampiala Sand and Gravel Limited**
 SURFACE ELEV.: **469.0 metres**

EQUIPMENT: **Excavator**
 DIAMETER: **N/A**
 COORDINATES: **16U N 5387518 E 324474**
 VV EQUIPMENT:
 DATE: **3 August 2017**
 TBT Ref. No. **17-319**

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH SCALE	VOLATILE VAPOURS				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			REMARKS	
DEPTH	ELEV.	DESCRIPTION	STRAT PLOT	% RECOVERY	TYPE			'N' VALUES	40	80	120	160	200	W _p		W
1	468	SAND - trace gravel, trace silt														
2	467															
3	466															
4	465	GRAVEL														
		GRAVEL - Sandy, trace silt														
5	464	End of Test Hole @ 5.0 m.														
6	463															
7	462															

02A-1 GEO WITH MW 17-319 TROUT LAKE.GPJ TBT.GDT 19/12/17



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SAMPLE TYPE LEGEND

- AS Auger Sample
- SS Split Spoon Sample
- TW 70mm Thin Wall Tube
- CC Concrete Core
- RC Rock Core
- PS Ponar Sample
- CB Core Barrel
- WS Wash Sample

NOTES:
 Elevations are based on GPS estimate.

ENCLOSURE 5



WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK CORRECT BOX WHERE APPLICABLE

11

6102040

MUNICIPALITY 61068

CON. CON

07

COUNTY OR DISTRICT
THUNDER BAY

TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE
GORHAM TOWNSHIP

CON., BLOCK, TRACT, SURVEY, ETC.
N $\frac{1}{2}$ of N.W. $\frac{1}{4}$ CONC #7

LOT 25-27
018

14 THUNDER BAY "P" ONT.

DATE COMPLETED
DAY 10 MO. 03 YR. 78

86375

5

ELEVATION 1550

6

21

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)					
GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
Brown	Sand	Clay	Beach Sand	0	20
Grey	Granite		Hard	20	37
Red	Granite		Med. Hard	37	48
Grey	Granite		Med. Hard	48	94
Red	Granite		Hard	94	108
Grey	Granite		Hard	108	225

31 002062805 0037221173 0048721173 0094221173 0108721173 0225221173

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER			
10-13	1 <input checked="" type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR		
	2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
15-18	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR		
	2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
20-23	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR		
	2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
25-28	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR		
	2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
30-33	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR		
	2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET	
			FROM	TO
10-11	1 <input checked="" type="checkbox"/> STEEL		0	0023
	2 <input type="checkbox"/> GALVANIZED	.188		
	3 <input type="checkbox"/> CONCRETE			
	4 <input type="checkbox"/> OPEN HOLE			
17-18	1 <input type="checkbox"/> STEEL		23	0225
	2 <input type="checkbox"/> GALVANIZED			
	3 <input type="checkbox"/> CONCRETE			
	4 <input checked="" type="checkbox"/> OPEN HOLE			
24-25	1 <input type="checkbox"/> STEEL			
	2 <input type="checkbox"/> GALVANIZED			
	3 <input type="checkbox"/> CONCRETE			
	4 <input type="checkbox"/> OPEN HOLE			

SCREEN

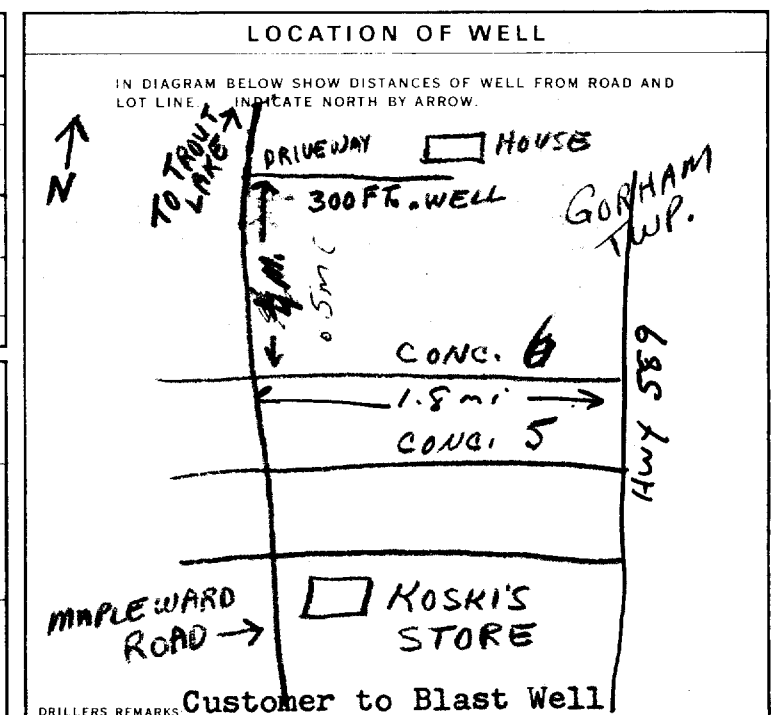
SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
20-23	Casing set in rock
18-21	Socket with Drive
26-29	Shoe

71 PUMPING TEST METHOD

PUMPING TEST	PUMPING RATE		DURATION OF PUMPING	
	1 <input type="checkbox"/> PUMP	2 <input checked="" type="checkbox"/> BAILER	1-14 178000 GPM	15-16 01 HOURS
19-21	22-24	15 MINUTES	30 MINUTES	45 MINUTES
019 FEET	225 FEET	222 FEET	222 FEET	219 FEET
IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST		
	225 GPM	1 <input type="checkbox"/> CLEAR 2 <input type="checkbox"/> CLOUDY		
RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	43-45	RECOMMENDED PUMPING RATE	46-49
<input type="checkbox"/> SHALLOW <input type="checkbox"/> DEEP				



FINAL STATUS OF WELL 5

1 <input type="checkbox"/> WATER SUPPLY	5 <input checked="" type="checkbox"/> ABANDONED, INSUFFICIENT SUPPLY
2 <input type="checkbox"/> OBSERVATION WELL	6 <input type="checkbox"/> ABANDONED POOR QUALITY
3 <input type="checkbox"/> TEST HOLE	7 <input type="checkbox"/> UNFINISHED
4 <input type="checkbox"/> RECHARGE WELL	

WATER USE

1 <input checked="" type="checkbox"/> DOMESTIC	5 <input type="checkbox"/> COMMERCIAL
2 <input type="checkbox"/> STOCK	6 <input type="checkbox"/> MUNICIPAL
3 <input type="checkbox"/> IRRIGATION	7 <input type="checkbox"/> PUBLIC SUPPLY
4 <input type="checkbox"/> INDUSTRIAL	8 <input type="checkbox"/> COOLING OR AIR CONDITIONING
<input type="checkbox"/> OTHER	9 <input type="checkbox"/> NOT USED

METHOD OF DRILLING 4

1 <input type="checkbox"/> CABLE TOOL	6 <input type="checkbox"/> BORING
2 <input type="checkbox"/> ROTARY (CONVENTIONAL)	7 <input type="checkbox"/> DIAMOND
3 <input type="checkbox"/> ROTARY (REVERSE)	8 <input type="checkbox"/> JETTING
4 <input checked="" type="checkbox"/> ROTARY (AIR)	9 <input type="checkbox"/> DRIVING
5 <input type="checkbox"/> AIR PERCUSSION	

CONTRACTOR

NAME OF WELL CONTRACTOR HARDY ENTERPRISES	LICENCE NUMBER 2568
ADDRESS P.O. BOX 146 THUNDER BAY "F" ONT.	
NAME OF DRILLER OR BORER CHRISTINE HARDY	LICENCE NUMBER 2567
SIGNATURE OF CONTRACTOR <i>Chris Hardy</i>	SUBMISSION DATE DAY 24 MO. 03 YR. 78

OFFICE USE ONLY

DATA SOURCE 1	CONTRACTOR 2568	DATE RECEIVED 040478
DATE OF INSPECTION Sept 17 78	INSPECTOR BB	
REMARKS		

Instructions for Completing Form

- For use in the Province of Ontario only. This document is a permanent legal document. Please retain for future reference.
All Sections must be completed in full to avoid delays in processing.
Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
All metre measurements shall be reported to 1/10th of a metre.
Please print clearly in blue or black ink only.

Well Owner's Information and Location of Well Information

Ministry Use Only
MUN 6107268 CON (CON) 07 LOT 16

42 TROUT LAKE ROAD GOCHAM 16 M-118
RR#/Street Number/Name City/Town/Village Site/Compartment/Block/Tract etc.
GPS Reading NAD Zone Easting Northing Unit Make/Model Mode of Operation: Undifferentiated Averaged Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

Table with columns: General Colour, Most common material, Other Materials, General Description, Depth From, Metres To. Includes handwritten entries like 'Brown Gravel', 'pink Gravel Quarts', 'stone's + Boulders', 'packed Medium - hard'.

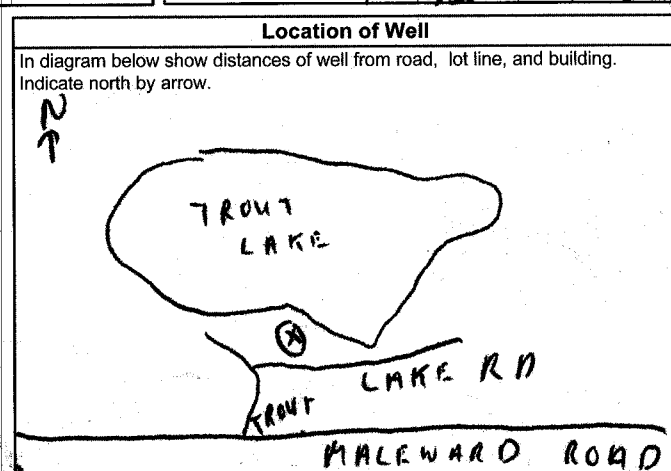
Hole Diameter table with columns: Depth From, Metres To, Diameter Centimetres. Includes handwritten values: 0-22m (25cm), 22-73m (15cm).

Construction Record table with columns: Inside diam, Material, Wall thickness, Depth, Metres. Includes handwritten entries for casing (15cm diam, steel, 1.48cm thick, 0-22m depth) and screen (22-73m depth).

Test of Well Yield table with columns: Pumping test method, Draw Down, Recovery. Includes handwritten data for 2.2 LPM pumping rate and various draw down/recovery measurements.

Water Record section with fields for Water found at, Kind of Water (Fresh, Sulphur, Gas, Salty, Minerals), Chlorinated status.

Plugging and Sealing Record table with columns: Depth set at, Material and type, Volume Placed. Includes handwritten entry: 0-22m Bentonite Grout, 5cm.



Method of Construction and Water Use sections. Includes checkboxes for Cable Tool, Rotary (air/percussion), Boring, Domestic, Industrial, etc.

Audit No. Z 02395, Date Well Completed 2004 09 29, Date Delivered 2004 10 19.

Final Status of Well and Well Contractor/Technician Information. Includes Name of Well Contractor (John Donkacz Water Well LTD), Business Address (P.O. Box 20091 Thunder Bay ON), Name of Well Technician (Shabat Darryl), Signature of Technician/Contractor (Daniel Ch...).

Ministry Use Only section with fields for Date Source, Contractor (1751), Date Received (NOV 02 2004), Date of Inspection, Remarks, Well Record Number (6107269).



Scott Peterson, P.Geo.

Vice President – Professional Services

Summary of Qualifications

16 years' experience providing geotechnical, geological, and environmental services for a variety of clients:

Work Scope Includes:

- Environmental & hydrogeological investigations and assessments, geotechnical pavement engineering & geological investigations and design studies, pavement structure evaluation and rehabilitation investigations and design reports, aggregate and quarry source studies, and land development projects

Degrees/Certificates/Courses

- Practicing Member of the Association of Professional Geoscientists of Ontario (P.Geo.)
- Bachelor of Science Degree – Geology Major – Lakehead University, Thunder Bay, Ontario
- Civil Engineering Technology Diploma – Lakehead University, Thunder Bay, Ontario
- Nielsen Environmental Field School, Inc – 2006 Environmental Field Conference
- Evaluation and Rehabilitation of Pavements – Educational Program Innovations Center
- American Concrete Institute Field Testing Certification – Thunder Bay Testing & Engineering Limited
- Health & Safety Training Program – Thunder Bay Testing & Engineering Limited
- WHMIS Training – Thunder Bay Testing & Engineering Limited

Relevant Experience

Vice President, Professional Services, Divisional Manager (2013 – Present)

Manager, Geological Services & Pavement Engineering (2006 – 2012)

Assistant Manager, Geotechnical Services (2004 – 2006)

TBT Engineering Limited, Thunder Bay, ON

- Responsible for project management, technical services, and design report preparation for TBTE's geological, hydrogeological, and pavement engineering divisions.
- Geological, geotechnical, and geoenvironmental analysis and design for industrial, commercial, and government sectors
- Project management and coordination of field supervisors for site characterization program
- Inspections for specialty geosciences projects, earthworks and foundation works

TBT Engineering Limited

I consent to the disclosure of the personal information provided herein

A handwritten signature in black ink, appearing to be "SP", is written over a horizontal line.

Geologist / Engineering Technologist

(2003 – 2004)

TBT Engineering Limited, Thunder Bay, ON

- Responsible for coordinating and conducting field investigations as well as the preparation and issuing of detailed reports for the geotechnical, environmental, and civil engineering fields
- Geotechnical and geoenvironmental analysis and design for industrial, commercial and residential buildings, roadways & highways, slopes, pavements and landfills, soil and rock characteristics with field and laboratory tests
- Field supervision and project management of site characterization programs.

Geologist / Engineering Technologist

(1996 – 2003)

DST, Thunder Bay, ON

- Responsible for working in the areas of Geotechnical and civil engineering, construction projects, environmental sciences, office administration and project management

Relevant Experience

MTO, Aggregate Source Investigations – Northwestern Region 2005 – 2017

As the overall project manager for the MTO's ASI's for the past decade, Scott is responsible for the arrangement and execution of the annual field program which typically included 15 – 20 sites across northwestern Ontario and management of a technical team comprised of Biologists, Archaeologists, Geoscientists, Engineers, and Technicians. Exploratory testing required at each includes a mixture of test pit excavations and diamond drill holes for quarry sources. Technical reports included Natural Science, Cultural Heritage, and Ground Water Summary Statements. Scott has authored and co-authored over 100 ground water reports for aggregate development purposes.

Rosslyn Brickyard Subdivision – Industrial Site Reclamation for 52 Lot Residential Subdivision Development

As the overall project manager and technical reviewer for the Brickyard subdivision project, Scott is responsible for the arrangement and execution of the environmental site assessments, archaeological studies, hydrogeological studies, field investigation and sampling programs, consultation and public meetings with the planning authorities and Municipality and management of a technical team comprised of Biologists, Archaeologists, Geoscientists, Engineers, and Technicians.

Animbiigoo Zaagi'igan Anishinaabek First Nation – Hydrogeological Study, Proposed Partridge Lake Community Site

Hydrogeological study for the proposed AZA First Nation Partridge Lake Community Site, investigating groundwater supply for the proposed community needs. The program included the installation of deep production wells for aquifer quality and quantity testing to support hydrogeological analysis evaluating well yield, interference effects, available drawdown, interaction with adjacent surface water features, and water chemistry and potability for communal supply.

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Shenston Landfill – Hydrogeological Investigation, Waste Disposal Site Expansion

Hydrogeological study designed and executed to investigate impairment of the groundwater and surface water at the current landfill site and provide recommendations for future landfill operation and closure, optimal attenuation, monitoring requirements, and attenuation zone determination.

Pearl Harbour Estates – Land Development, Hydrogeological Assessment

Detailed hydrogeological investigation for the proposed Stage 3 land development to include 30 residential year-round lots on the shore of Lake Superior. The study included hydrogeological review and interpretation of the conditions, geotechnical exploratory drilling and construction of deep pumping test wells, evaluation of the geochemical and physical properties of the groundwater unit, detailed pump testing and monitoring, and preparation of a final technical report for submission to the Ministry of the Environment and Climate Change.

Alice Avenue Subdivision – Hydrogeological Assessment, Site Servicing Options Study

Detailed hydrogeological investigation for the proposed development of 14.4 hectares of land to support year-round residential lots. The study included hydrogeological review and interpretation of the conditions, geotechnical exploratory drilling and construction of deep pumping test wells, evaluation of the geochemical and physical properties of the groundwater unit, detailed pump testing and monitoring, and preparation of a final technical report for submission to the Ministry of the Environment and Climate Change and City of Thunder Bay.

MTO GWP 647-89-00, Highway 11/17 Four-Laning, New Construction (Nipigon)

Detailed design pavement engineering services for MTO WP's 124-90-01 & 647-89-01 which included the four-laning of Highway 11/17 from 1.3 km east of Highway 585 extending easterly for 4.4 km, and from 4.8 km west of Highway 628 extending easterly 11.2 km, respectively. WP 647-89-01 has complicated subsurface conditions with deep deposits of soft clay and high relief bedrock terrain. Field investigations included hand auger borings, test pitting, and hydraulic boreholes. Geotechnical Design Reports was provided for each WP.





Leah Cosby

Geological Project Engineer

P.Eng.

Summary of Qualifications

- Rock core logging
- Petrographic analysis
- Groundwater summary statements
- Hydrogeological investigations
- Pit and quarry applications
- Septic system design

Degrees/Certificates/Courses

- Bachelor of Applied Science - Geological Engineering, University of Waterloo, ON (2013)
- Professional Engineer in the province of Ontario (2017)
- CCIL Petrographic Analysis Certification (2018)
- WHMIS Health and Safety Training – TBT Engineering Limited
- First Aid Training

Relevant Experience

Geological Project Engineer

(2016 – Present)

TBT Engineering Limited, Thunder Bay, ON

- Rock core logging
- Petrographic analysis
- WipFrag analysis
- Technical writing regarding surficial (soil) and bedrock geology, groundwater, terrain, mining, pits and quarries, and septic system design
- Lithological cross-section interpretation and geological map development
- Petrographic workshop instruction
- Geological laboratory development
- Liaison with Consultants, Government Agencies, and Contractors

Designer (E.I.T.)

(2013 – 2016)

MMM Group Limited, Mississauga, ON

- Drainage Projects
- Dam Assessments

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A handwritten signature in blue ink that reads "Leah Cosby".

Engineering Project Experience

Rock Identification

Leah performs rock core logging for a variety of projects including foundation design, highway design, and mine development. Leah also provides geological overviews of exposed outcrops including composition and jointing. She calculates core recovery and Rock Quality Density (RQD). She selects samples for diametral, axial, block, and irregular lump testing to determine rock strength.

Petrographics

Leah is a certified petrographic analyst using a low powered magnification microscope to assess the geological composition and quality of aggregate samples. She authored the Petrographic Compendium, detailing the procedure for performing petrographic analysis and identifying the geology listed in LS-609. She also compiled a reference library of rock and gravel samples from throughout Ontario for training others, which she does during an annual petrographics workshop hosted in TBTE's laboratory facility.

Aggregate Applications and Source Investigations

Leah prepares Groundwater Summary Statements for use in aggregate applications. This involves coordination with clients and MNR, site investigations, reviewing hydrogeological maps and data, interpretation of geophysical formations, approximating groundwater levels and extraction depths, and summarizing her findings into technical reports.

Shoreline Regression Analyses

Leah studies historic aerial and stereoscopic photographs to identify changes to shorelines over time. This can be used to determine erosion and deposition rates. She develops technical reports and provides conclusions and recommendations, depending on project requirements. In erosional situations, shoreline protection may be required. Leah has used Wipfrag analysis on boulders for potential shoreline protection to ensure they meet size requirements.

Mine Closure Studies

Leah travels to remote locations to assess existing mine sites and report on her findings. She performs project scheduling and coordination with local staff, subconsultants, and equipment transport. She completed working from heights training to improve safety around open shafts. Her focus in mine closure studies is on the geology of the area and geological Strength Index (GSI).

Hydrogeological Studies & Septic Design

Leah performs site visits and supervised drilling operations to assess the hydrogeological setting of various projects. Understanding the setting relies on well records, surface water receptors, and test hole results. From this, Leah develops and interprets a subsurface lithology cross-section to define the potentiometric surface and groundwater contour map. This map can be used to estimate the direction of flow and environmental impacts of proposed developments.

Septic Design

Leah analyses flow requirements for septic systems based on the Ontario Building Code and develops Water Quality Impact Assessments based on MOECC Procedure D-5-4.

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Leah