Horn Lake

Replacement Highland Road Culvert

High Water Level Since Installation

Data Summary and Conclusions

June 2021

Survey Comparison by Township Contractors

Sarafinchin (Old) – November 2012

- Water level elevation 329.0 m or 1,079.40 ft.
- Old culvert was 1650 mm.
- Old culvert west invert elevation of 328.8 m or 1,078.74ft. and 2.2 m or 7.22 ft. below the centreline of the road.
- West culvert invert submerged under water at 0.20 m or 7.87 in's
- Centreline elevation of 331.03 m or 1,086.06 ft. as used Aecom site plan.

Aecom (Old) – October 2012

- Water level elevation 329.0 m or 1,079.40 ft.
- Old culvert was 1650 mm.
- Old culvert west invert elevation 328.51m or 1,077.79 ft. at 2.52 m or 8.27 ft below the centreline of the road.
- West culvert invert submerged under water at 0.49 m or 19.29in's.
- Centreline elevation of 331.03 m or 1,086.06 ft.

Greer Galloway (New) – Fall 2021

- Water level elevation at 329.03 m or 1,079.49 ft in fall 2020.
- Per their report, old culvert was 1600mm. Difference of 50mm.
- New culvert west invert elevation 328.896m or 1,079.06 ft at 2.574 m or 8.44 ft below the centreline of the road.
- West culvert invert submerged under water at 0.134 mor 5.28 in's
- Centreline elevation of 331.47 m or 1,087.50 ft.

Site Plan Elevations Inconsistencies

Centreline of Highland Road

Elevation	Metres	Inches
Greer Galloway	331.47	
Sarafinchin & Aecom (Old)	331.03	
Difference	.44	17.32

West Invert Of Culvert (Bottom)

Elevation	Metres	Inches
Sarafinchin (Old)	328.80	
Aecom (Old)	328.51	
Difference	.29	11.42

- **How was this discrepancy not identified prior to installation**

Elevation	Metres	Inches
Greer Galloway	328.896	
Aecom (Old)	328.51	
Difference	.386	15.20

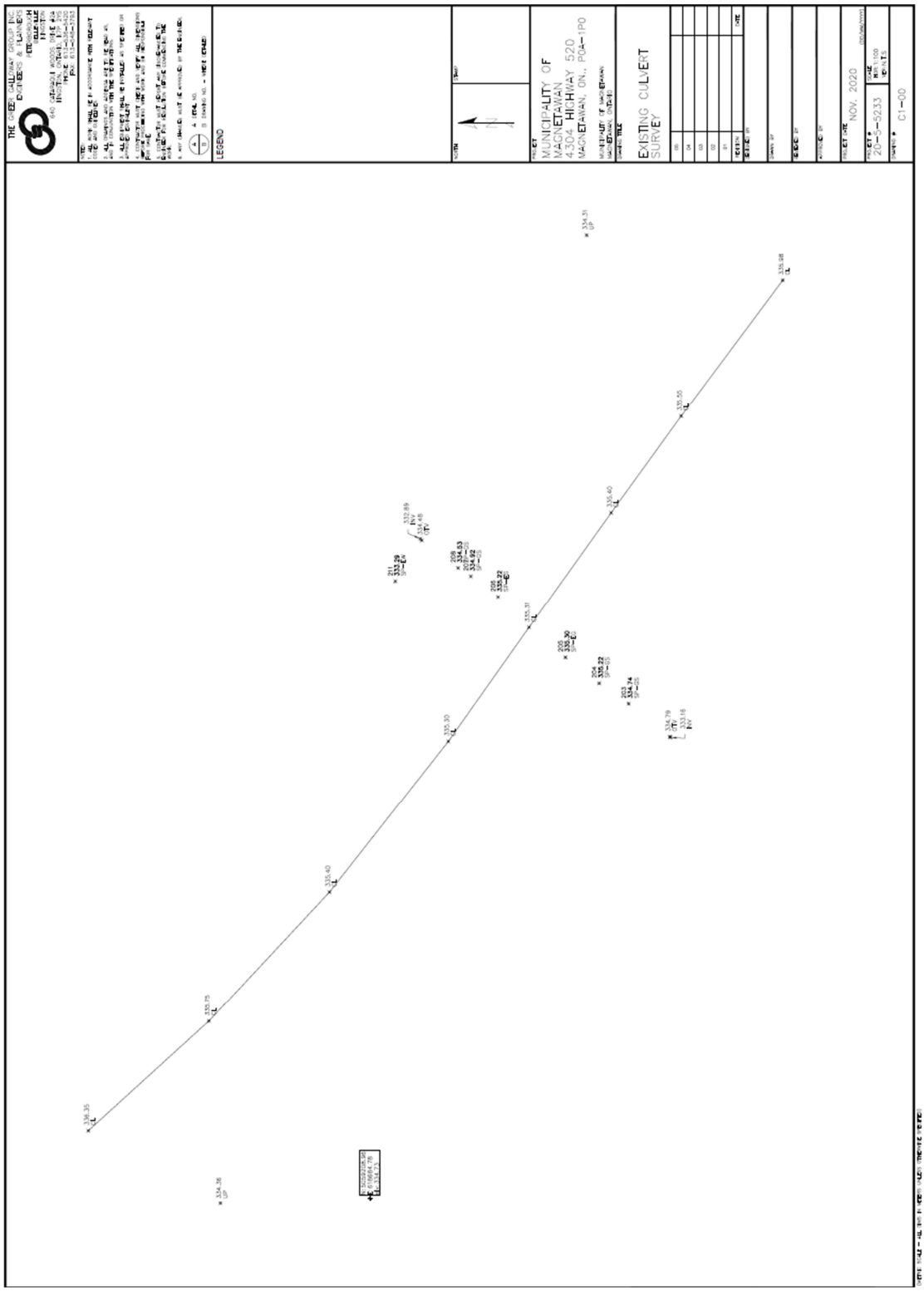
Elevation	Metres	Inches
Greer Galloway	328.896	
Sarafinchin (Old)	328.80	
Difference	.096	3.78

- **Whether using Aecom or Sarafinchin surveys, the data clearly shows the new culvert was installed 4" to 15" higher than the previous culvert.**
- **Per Greer Galloway report, new culvert is 1600mm. Aecom and Sarafinchin state 1650mm. Township and Greer Galloway state "like for like". Actual size needs to be confirmed by the Township.**

Site Plan Elevations Inconsistencies Cont'd

- Greer Galloway report on March 4, 2021 stated the current culvert was installed 0.024 m or 0.94 in's lower than the old culvert but when you do the simple elevation math, the new culvert would be 0.096 m or 3.78 in's higher than the old culvert when compared to Sarafinchin and 15.20" when compared to Aecom. **Need to confirm how Greer Galloway came to this conclusion.**

Greer Galloway - Current West Invert Elevation	328.896	Metres
Sarafinchin - West Old West Culvert Invert Elevation	328.800	Metres
Difference	0.096	Metres
	3.780	Inches
Aecom - West Old West Culvert Invert Elevation	328.510	Metres
Difference	.386	Metres
	15.20	Inches



Source: Greer Galloway Site Plan Culvert Survey, Drawing # C1-00 – Centre Line 335.31 – West Invert 333.16. Note the centreline and west invert readings on this Greer Galloway document do not agree to the readings used on their final report (CL – 331.47 and Invert 328.896. See page 12).

4.0 HIGHLAND DRIVE CULVERT SITE

4.1 Site Conditions

The existing Highland Drive culvert is a 1650 mm diameter CSP culvert, approximately 18 m in length. The invert of the culvert is at approximate Elev. 328.8 m or about 2.2 m +/- below the centerline of the unpaved gravel road (reported Elev. 331.03 as per AECOM site plan) and grading slightly from east to west. The water levels were at approximate Elev. 328.83 m and 329.0 m on the east and west sides of the roadway.

4.2 Subsurface Conditions

Borehole 2, encountered approximately 150 mm of sandy gravel (road base) underlain by approximately 1.9 m of compact sand fill characterized by SPT values of N = 15 to 22 blows/300 mm. Below the granular embankment fill, the borehole encountered about 3.5 m of loose to compact sand. The SPT values through the sand were in the range of N = 9 to 16 blows/300mm.

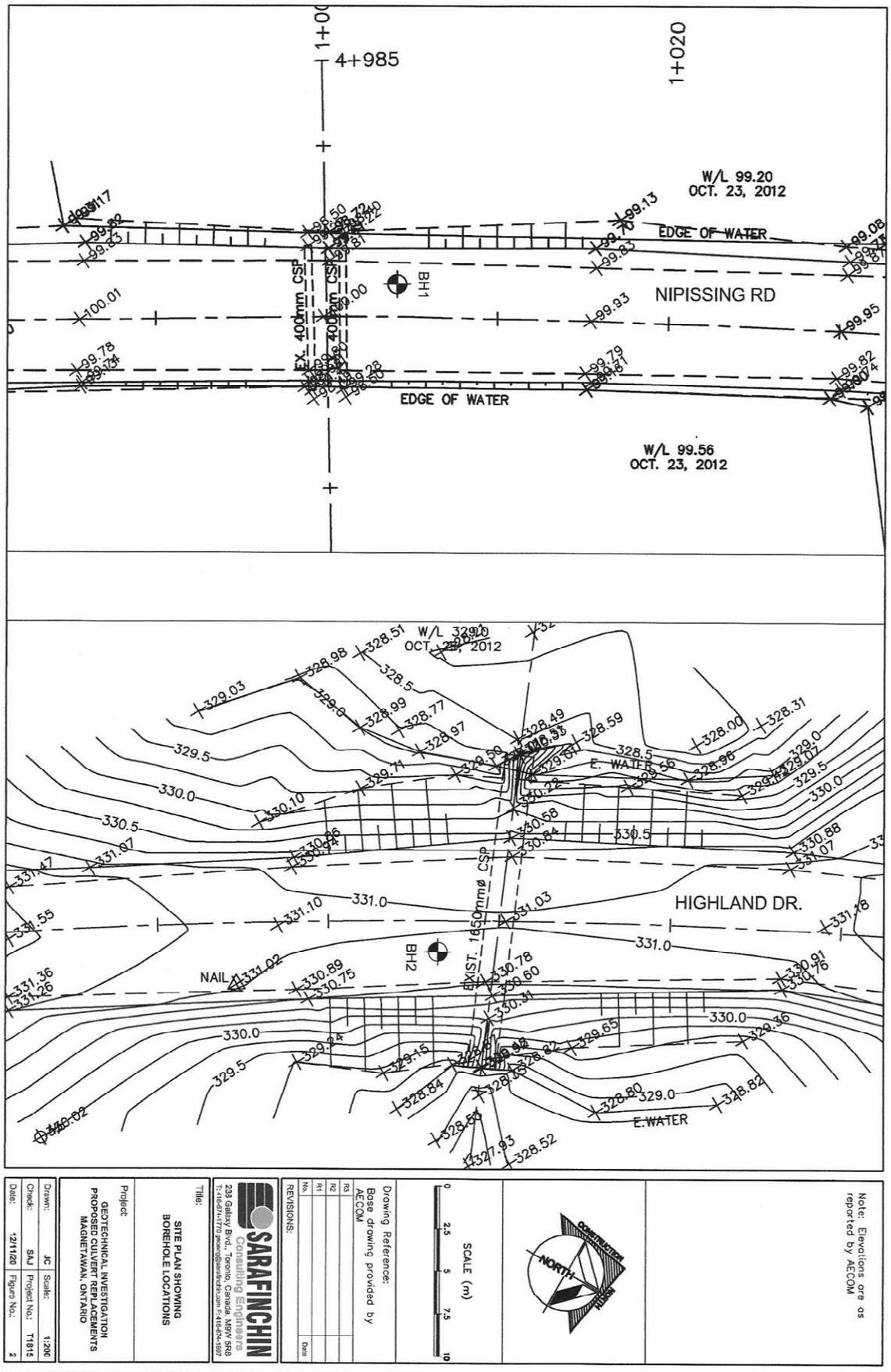
Below the sand, the borehole encountered about 2.3 m of firm to stiff silty clay with SPT values of N = 6 blows/300 mm and an estimated undrained shear strength of 50 kPa. The borehole was terminated in compact sand at 8.1 m depth.

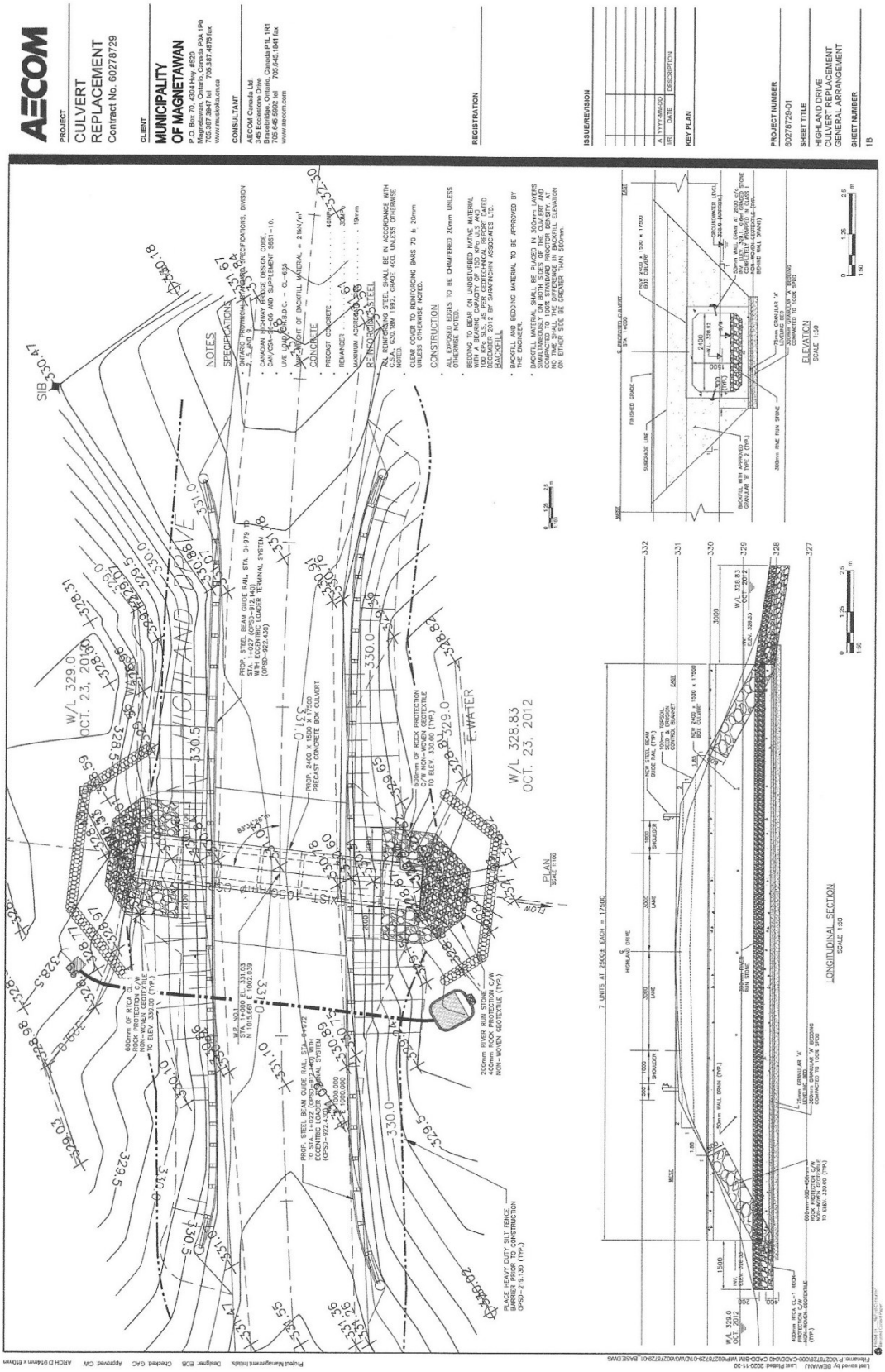
The open borehole groundwater level was at 2.0 m depth upon completion of the borehole.

4.3 Existing Culvert and Roadway Embankment

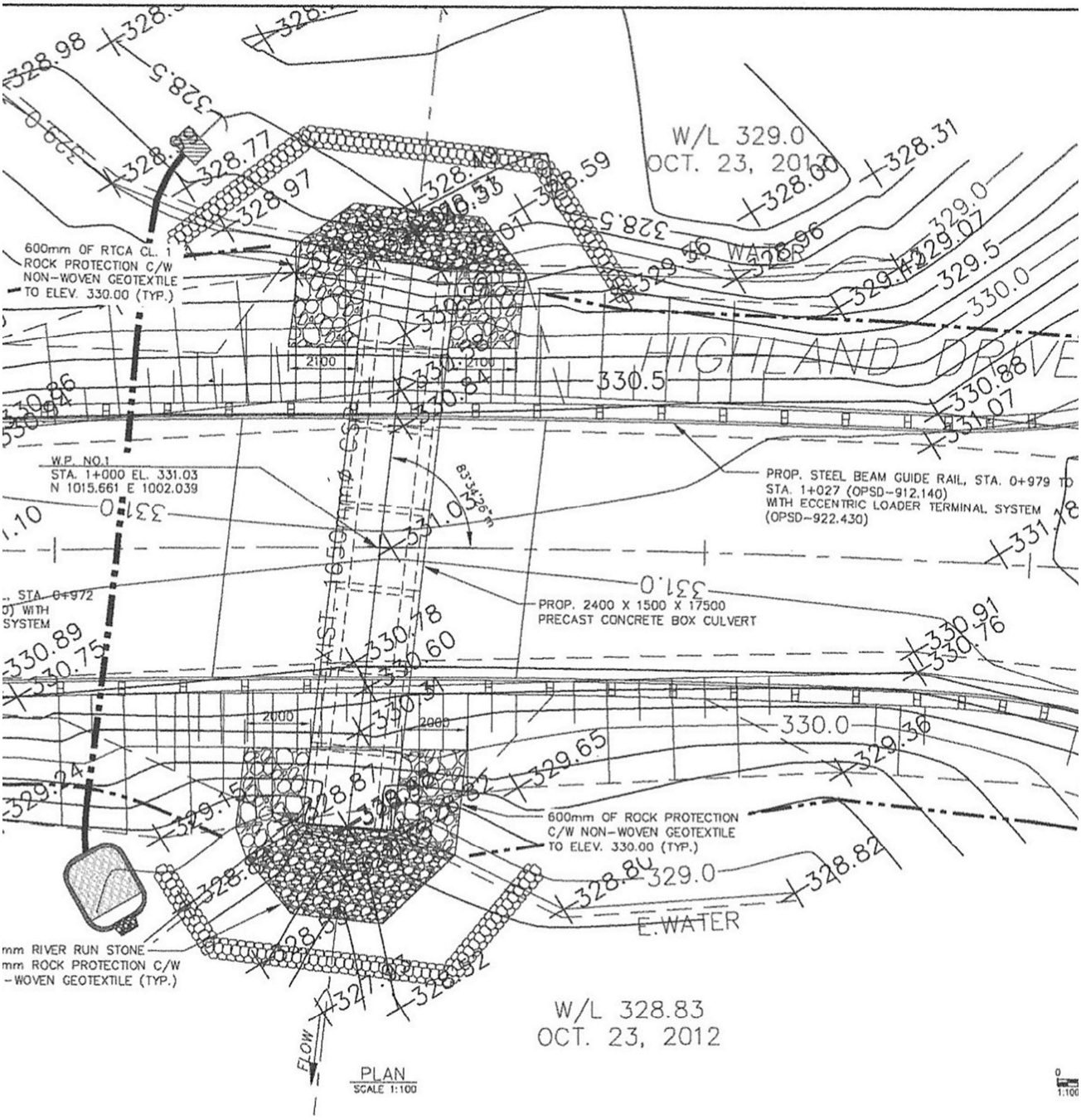
Based on the subsurface conditions encountered at Borehole 2, it appears that Highland Road embankment is approximately 2.1 m thick and is constructed over loose to compact native sand. The existing 1.65 m diameter culvert is embedded within the embankment fill. The invert of the existing culvert is at or close to the bottom of the embankment fill.

Source: Sarafinchin Geotechnical Investigation, Page 7 – Centre Line 331.03 - Invert 328.80. See survey next page.


4+985
1+020
W/L 99.20
OCT. 23, 2012
EDGE OF WATER
NIPISSING RD
BH1
EX. 400mm CSP
EDGE OF WATER
W/L 99.56
OCT. 23, 2012
W/L 329.0
OCT. 23, 2012
E. WATER
HIGHLAND DR.
BH2
NAIL
EXIST. 1650mmø CSP
E.WATER
Note: Elevations are as reported by AECOM
NORTH
SCALE (m)
0 2.5 5 7.5 10
Drawing Reference:
Base drawing provided by AECOM
REVISIONS:
SARAFINCHIN
Consulting Engineers
238 Galaxy Blvd., Toronto, Canada M9W 5R8
Title:
SITE PLAN SHOWING BOREHOLE LOCATIONS
Project:
GEOTECHNICAL INVESTIGATION
PROPOSED CULVERT REPLACEMENTS
MAGNETAWAN, ONTARIO
Drawn: JC
Scale: 1:200
Check: SAJ
Project No.: T1815
Date: 12/11/20
Figure No.: 2



Source: Aecom via Township – Centre Line 331.03 - Invert 328.31. See exploded view next page.


W/L 329.0
OCT. 23, 2012
600mm OF RTCA CL. 1
ROCK PROTECTION C/W
NON-WOVEN GEOTEXTILE
TO ELEV. 330.00 (TYP.)
HIGHLAND DRIVE
W.P. NO.1
STA. 1+000 EL. 331.03
N 1015.661 E 1002.039
PROP. STEEL BEAM GUIDE RAIL, STA. 0+979 TO
STA. 1+027 (OPSD-912.140)
WITH ECCENTRIC LOADER TERMINAL SYSTEM
(OPSD-922.430)
PROP. 2400 X 1500 X 17500
PRECAST CONCRETE BOX CULVERT
600mm OF ROCK PROTECTION
C/W NON-WOVEN GEOTEXTILE
TO ELEV. 330.00 (TYP.)
E.WATER
W/L 328.83
OCT. 23, 2012
FLOW
PLAN
SCALE 1:100

Survey Difference CGG to HLPOA

Greer Galloway Group (CGG) Survey 2020

Elevation	Metres	Feet
Centreline	331.470	1,087.50
West Invert	328.896	1,079.05
Difference	2.574	8.45

Horn Lake Property Owner's Association (HLPOA) Survey 2021

Elevation	Metres	Feet
West Invert	3.102	10.17
Centreline (Top of Road)	0.938	3.07
Difference	2.164	7.10

Survey Difference Greer Galloway to HLPOA

Elevation	Metres	Feet
Greer Galloway	2.574	8.45
HLPOA	2.164	7.10
Difference	0.410	1.35

Conclusions

- The new culvert at Highland Rd. appears to be .41metres, 1.35ft higher in elevation than stated by Greer Galloway in their report.
- Lake invert at 1.35ft higher plus water elev. of 1.35ft or 16.2in. on May 2 2021 makes the water elev. 2.7ft or 32.4in. higher than the old culvert invert prior to 2017.

GREER
GALLOWAY
CONSULTING
ENGINEERS

640 Cataraqui Woods Drive
Unit 2A
Kingston, Ontario
K7P 2Y5

Telephone
(613) 536-5420

Facsimile
(613) 548-3793

March 4, 2021

Municipality of Magnetawan
P.O. Box 70, 4304 Hwy 520
Magnetawan, ON
P0A 1P0

Attention: Mr Scott Edwards, Public Works Superintendent

Re: Sollman Creek Culvert at Highland Road

As requested by the Township of Magnetawan the Greer Galloway Group has completed an onsite survey of the existing 1600mm CSP culvert located on Sollman Creek Culvert at Highland Road & compared the culvert elevations to the historical culvert elevation.

Sollman Creek acts as an outlet for Horn lake and has a drainage area of 19.5km^2, as per the Ontario Flow Assessment Tool (MNR). The water shed contains over 5.5km^2 of lakes/ wetlands.

TIMELINE OF THE SOLLMAN CREEK CULVERT

Prior to 2012: An existing 1600mm CSP culvert was installed. Date of installation is not known.

2012: AECOM submitted Final design drawings and final hydrologic/ hydraulic report to Municipality of Magnetawan. The design drawings replaced the existing 1,600mm diameter x 20m length CSP culvert with a 2,400mm x 1500mm x 17500mm precast concrete box culvert.

June 21, 2017: Municipality of Magnetawan issued a Request for Tender for a *like-for-like* replacement of the 1,600mm existing CSP culvert.

September 2017: Contractor completed project.

SURVEY DATA

Existing AECOM Survey 2012

Elevation		Slope
Centerline	331.2 m	
West Invert	328.51 m	Slope= -2%
East Invert	328.92 m	
Water Elevation	329 m	

Consulting Engineers of Ontario
Professional Engineers Ontario

Notes:

- The slope of the culvert was angled west to east; the culvert was angled towards the lake.

Greer Galloway Group Survey 2020

	Elevation	Slope
Centerline	331.47 m	
West Invert	328.896 m	Slope= 1.35%
East Invert	328.626 m	
Water Elevation	329.03 m	

Notes:

- The replaced culvert is angled east to west; the culvert is angled away from the lake.

CONCLUSIONS

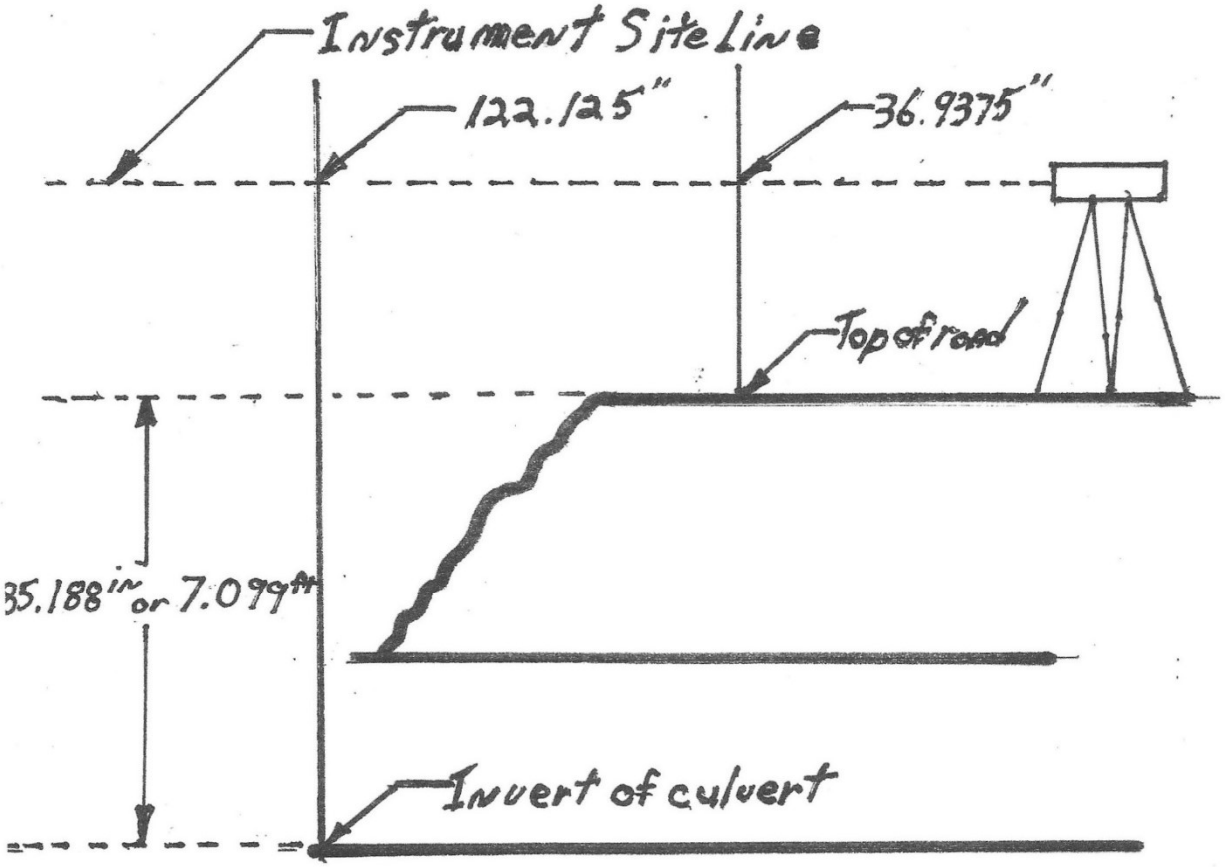
- The current CSP culvert (after 2017) was installed 0.024m (approximately 1'') lower than the previous culvert (before 2017).
- Minimal changes in water elevation where observed between the 2012 survey (329.000m) and 2020 survey (329.030m). Water elevation was 30mm (approximately 1, 1/8'') higher in 2020.
- The current culvert (after 2017) has been installed as per Ontario Standards.
- Both the previous culvert and the current culvert are the same size and same material.
- The Hydraulic performance of both culverts is similar, and the installation was "like for like". The replacement of this culvert would have had negligible impacts to lake levels of Horn Lake based on the comparison of the pre- and post-2017 survey data.

Best regards,

GREER GALLOWAY
CONSULTING ENGINEERS

Kevin Hawley, P.Eng.
Project Manager

Highland Road Culvert
Elevation Schematic
May - 02 - 2021



Horn Lake Highland Rd. Culvert Installation Scenarios

As you can clearly see from the picture below, we could not verify the elevations from the Bench Mark at the solid iron bar (SIB) as it not set in solid ground and therefore unreliable. We can only go by the centreline or top of the road as the starting point for the elevations.

Scenario #1

The contractor raised the centreline of the road to 331.47 (CGG report from 331.03 (Aecom report) a difference of 0.44m or 1.44ft higher and installed the culvert just above the existing waterline in the fall of 2017.

Horn Lake Highland Rd. Culvert Installation Scenarios Cont'd

Scenario #2

The contractor raised the centreline of the road to 333.47m from 331.03m (Aecom) a difference of 0.44m or 1.44ft higher and were required to install the invert of the culvert at 2.574m or 8.44ft (Aecom) below the centreline of the road. Instead, they installed the invert of the new culvert at Sarafinchin reported culvert elev. of 2.2m or 7.22ft below the centreline of the road. If so, the result is a difference of 0.374m or 1.227ft higher than height the new culvert should have been placed.

Conclusions

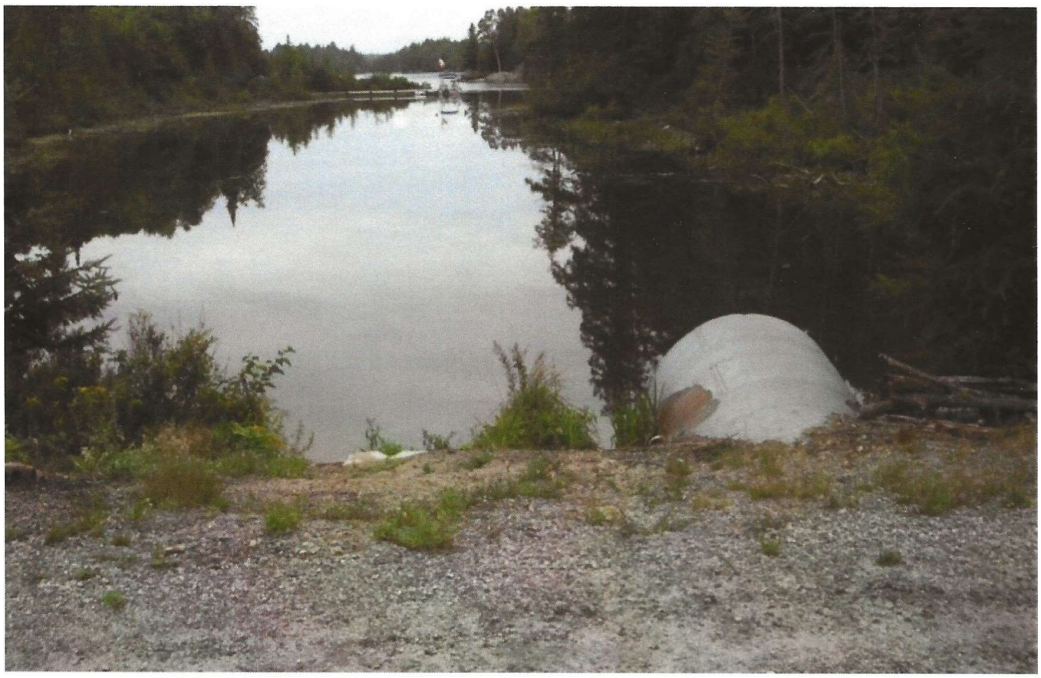
1. HLPOA elevation readings of the culvert being 0.411m or 1.35ft higher to the centreline of road are almost similar to scenario #2 of the culvert being 0.374m or 1.227ft higher.
2. Culverts are not “like for like” as confirmed by the Township and the Greer Galloway report for both size and installation. It appears the culvert is .50mm smaller with the new culvert significantly higher than the prior culvert as confirmed by all 3 sources of comparative data which accounts for the significant damage to the shoreline, trees, buildings and docks.
3. If the Township chooses to dispute the findings of the survey conducted by a Horn Lake resident with a surveying background, the data provided by both Aecom and Sarafinchin clearly support the culvert was installed below the specifications resulting in a permanent rise in the water level of this spring fed lake.
4. Given the specifications required that the outlet being dammed off during the installation, one has to ask did the contractor do this during the late fall installation. The data suggests he did not.
5. Was the installation monitored by the Township during the installation and inspected and verified after that the installation was completed and met the specifications prior to payment.

Pictures Of Horn Lake Properties Before And After The Installation Of The New Culvert On Highland Road

These photos clearly support the environmental damage to by the permanent increased water levels resulting in shoreline erosion, dead trees as well as property damage to owner's properties at the shoreline i.e., docks and buildings which were installed prior to the new culvert.

Horn Lake at Highland Road Culvert (West View)

Before New Culvert



2021 – Significant Change In Shoreline

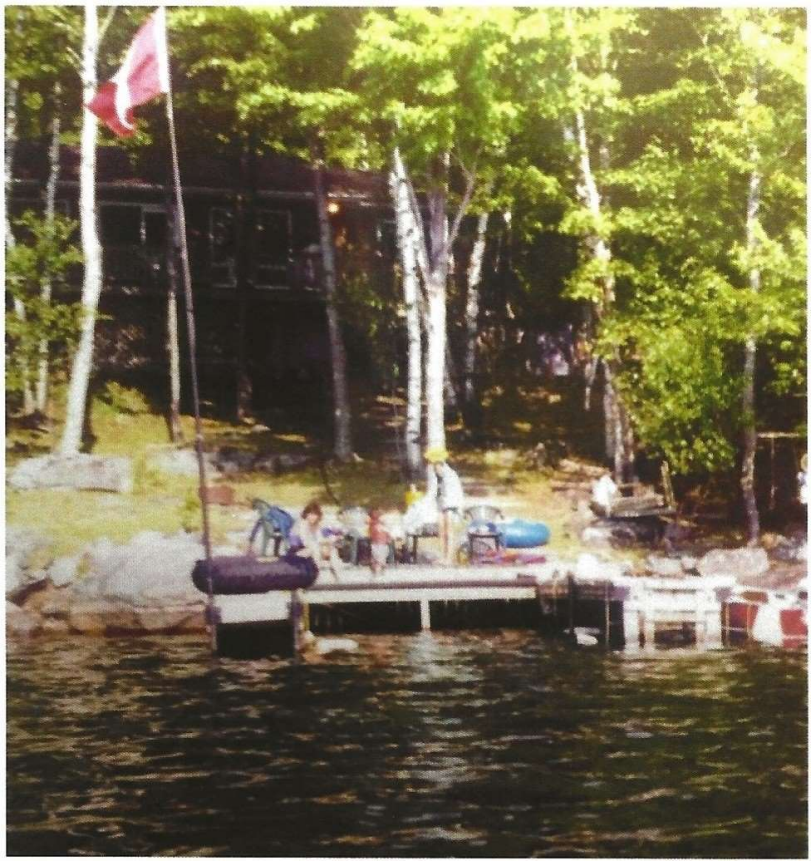
Horn Lake Bidwell Beach

Before New Culvert

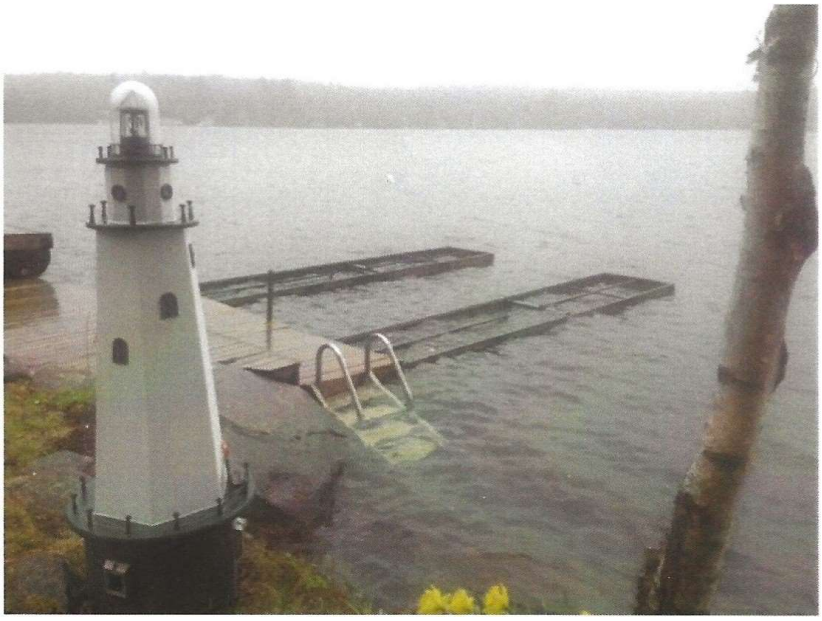
2020 – Beach Permanently Under Water

Permanent Swing Dock – Birch Crest Bay

Installed Prior to New Culvert

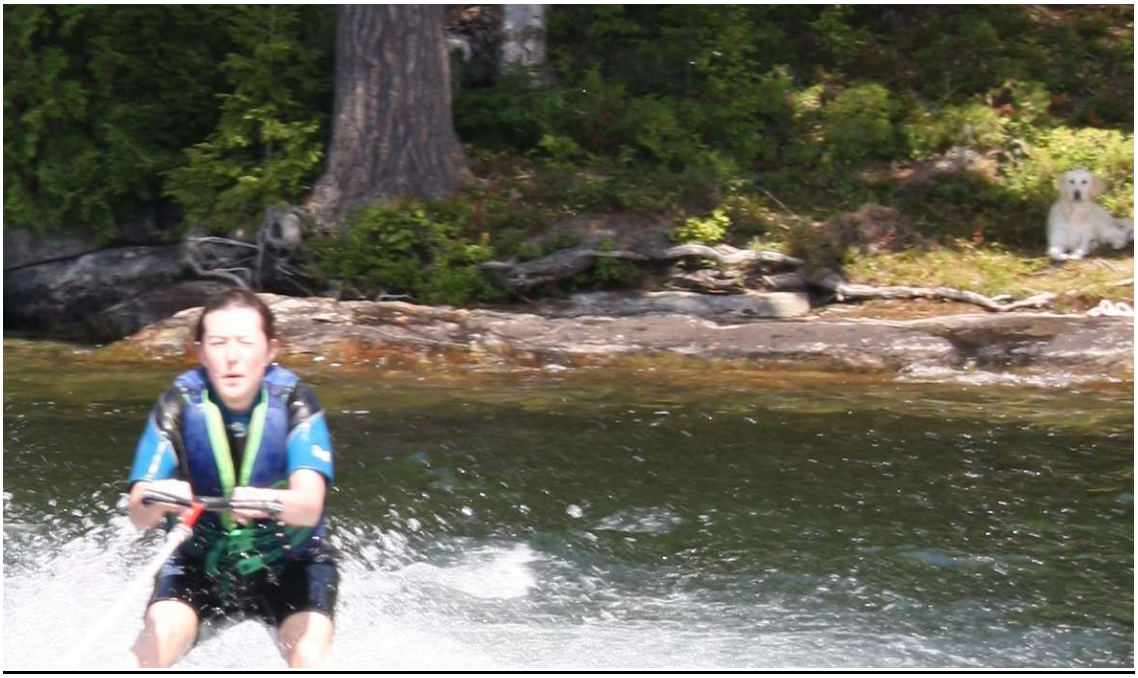


After New Culvert Installed



Wotherspoon Cottage – Slowly Dying Very Old Hemlock

Pre-New Culvert Not Even Close to Water's Edge



After New Culvert Installed – Permanent Exposure to Water Erosion