SALMONID HABITAT RESTORATION

INVERNESS SOUTH ANGLERS ASSOCIATION

Winter Damage Assessment

Submitted by: Kailey Mortensen, Cody Langille

Submitted to: Dave Cameron, Geoff Nishi

Date: 2019

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PROJECT BREIF

Table 1. Project Brief

Group:	Inverness South Angler Association (ISAA)
Contact:	Dave Cameron, *Chair*
Mailing Address:	P.O. Box 255, Mabou N.S. B0E 1X0
Telephone	(902)-258-5998
Email:	dcameroncb@gmail.com

The completed maintenance on the Broad Cove Watershed; Mabou Harbour Watershed; and Graham's River Watershed, was done by the Inverness South Anglers Association. All crew members that were involved in this project activity can be seen below in table 2.

Table 2. Inverness South Anglers Association Crew, 2019.

INVERNESS SOUTH ANGLERS ASSOCIATION CREW
Kailey Mortensen *Field Technician*
Cody Langille *Student Intern Field Technician/Crew Member*
Nathan MacLean *Crew Member*
Alex Mackinnon *Crew Member*
Micheal Campbell *Crew Member*
Sandy Rankin *Crew Member*

PROJECT DESCRIPTION

Over a six-week period, the Inverness South Anglers Association (ISSA) had fully assessed the winter damage and maintained the majority of structures previously installed in the watercourse's listed below in Table 3. The maintained structures include several digger logs, deflectors, diggerlog and deflectors, bank stabilization, channel blockers, rock sills, armour stone rock, and a fish ladder. Most of the maintenance consisted of adding hand-rock and other materials to all structures and the removal of debris jams. Few structures could not be maintained and will require a full structural replacement.

The maintenance completed within each watercourse will continue to expand and enhance water quality, fish spawning habitat and migratory access to all aquatic species. The work done by ISAA will also continue to positively impact the economy and recreational anglers within the area.

Table 3. Watersheds and Watercourses maintained by ISSA.

Watershed	Watercourse(s)
Broad Cove River Watershed	Moor Brook, Broad Cover River, Fraser's Brook
Mabou Harbour Watershed	Glendyre River, Big Shea Brook, Little Shea Brook, Miramichi River, Rosedale, Jeff Lee's
Graham's River Watershed	Graham's River

The maintenance completed on all structures found in the Broad Cove, Mabou Harbour and Graham's River Watershed covered a total area of 63388.9 m^2 and a total length of 11172.64 meters. See table 4 for a further breakdown of the restored area and length for each watershed in meters squared and kilometers squared.

Table 4. Showing the total area and total length restored for the Broad Cove, Mabou Harbour, and Graham's River Watershed, 2019.

Watershed	Total Area Restored		Total Length Restored	
	m^2	km^2	m	km
Broad Cove Watershed	9951.9	0.0099519	1832.94	1.83294
Mabou Harbour Watershed	23497	0.023497	4349.7	4.3497
Graham's River Watershed	29940	0.02994	4990	4.99
TOTAL	**63388.9**	**0.0633**	**11172.64**	**11.17**

The Inverness South Anglers Association had fully completed maintenance on almost all the structures installed in the Broad Cove, Mabou Harbor and Grahams River Watersheds. Out of all the structures installed in the watershed, 52% of them are diggerlogs, 25% are deflectors, 10% are bank rock, 5% are armour stone rock, 5% are diggerlog and deflectors, 2% are channel blockers, 2% rock sills, and the remaining 1% is a fish ladder, see figure 1.

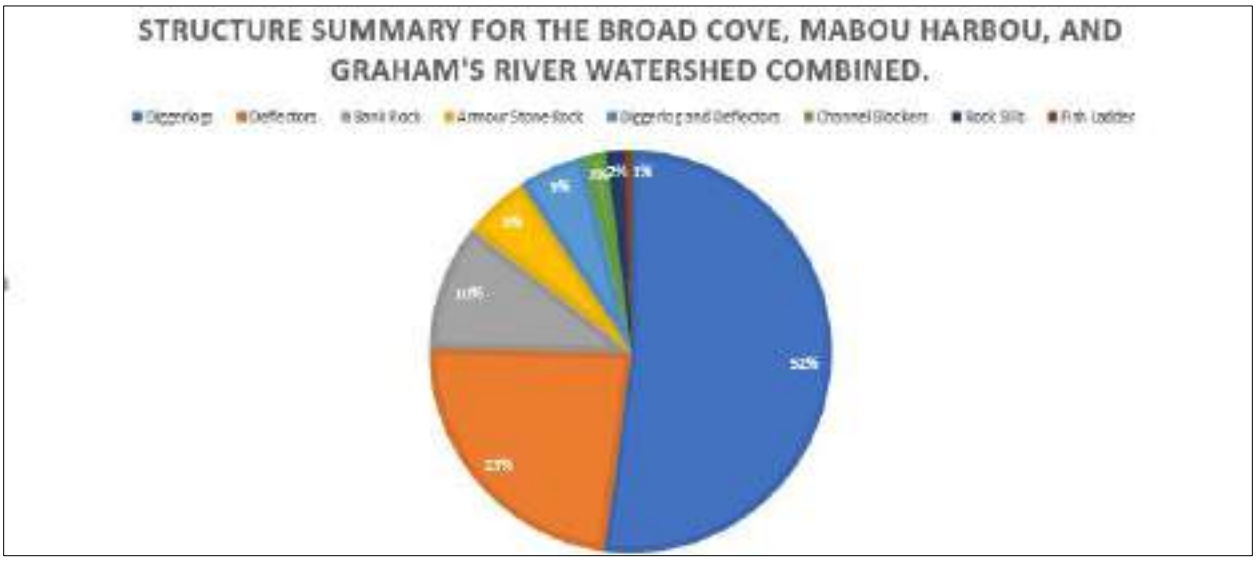

Figure 1. Showing the percentage of each structure installed and maintained in the Broad Cove, Mabou Harbor, and Graham's River Watersheds combined, 2019.

For a further breakdown of each structure type installed and maintained in each watershed, see table 5.

Table 5. Showing a further breakdown of each structure type installed and maintained in each watershed, 2019.

Watershed	Diggerlogs	Deflectors	Bank Rock	Armour Stone Rock	Diggerlog and Deflectors	Channel Blockers	Rock Sills	Fish Ladder
Broad Cove Watershed	31	6	4	0	8	0	0	1
Mabou Harbour Watershed	77	16	1	0	1	0	0	0
Graham's River Watershed		26	16	11	2	4	3	0
TOTAL	**108**	**48**	**21**	**11**	**11**	**4**	**3**	**1**

BROAD COVE WATERSHED

The Inverness South Anglers Association had fully completed the maintenance on all the structures installed in the watercourses in the Broad Cove Watershed. Out of all the structures installed in the watershed, 62% of them are diggerlogs, 16% are diggerlog and deflectors, 12% are deflectors, 8% are bank stabilization, and the remaining 2% is a fish ladder, see figure 3.

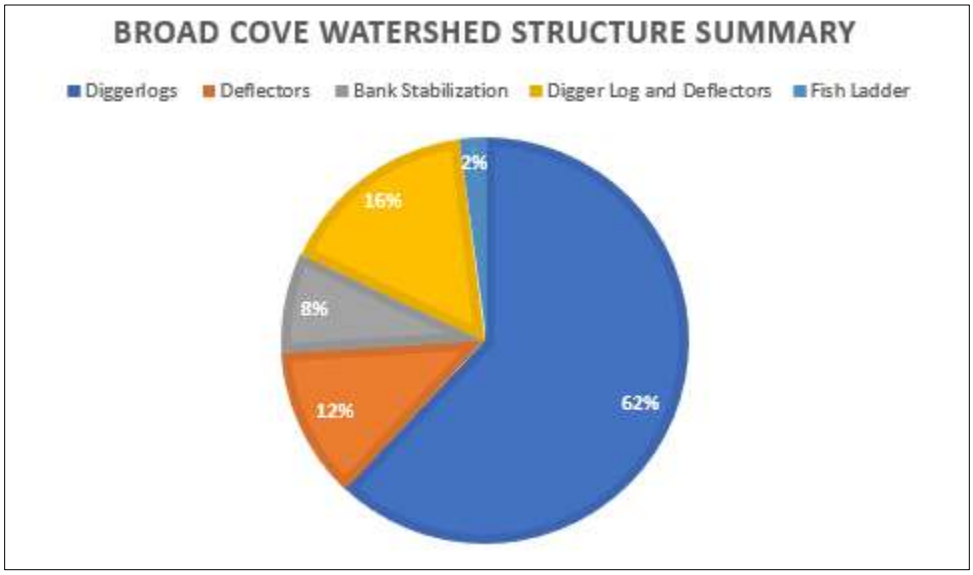

Figure 2. Showing the percentages for each structure type installed and maintained in the Broad Cove Watershed, 2019.

For a further breakdown of each structure type installed and maintained in each watercourse, see table 6.

Table 6. Showing the total of each structure type installed and maintained in the watercourses located in the Broad Cove Watershed, 2019.

Watercourse	Diggerlogs	Deflectors	Bank Stabilization	Digger Log and Deflectors	Fish Ladder
More Brook	10	0	4	0	1
Broad Cove River	10	4	0	5	0
Fraser's Brook	11	2	0	3	0
TOTAL	**31**	**6**	**4**	**8**	**1**

The maintenance completed on all structures found in the Broad Cove Watershed covered a total area of 9951.9 m^2 and a total length of 1832.94 meters. For a further breakdown of the total area and length restored on each structure, see figures 4 and 5.

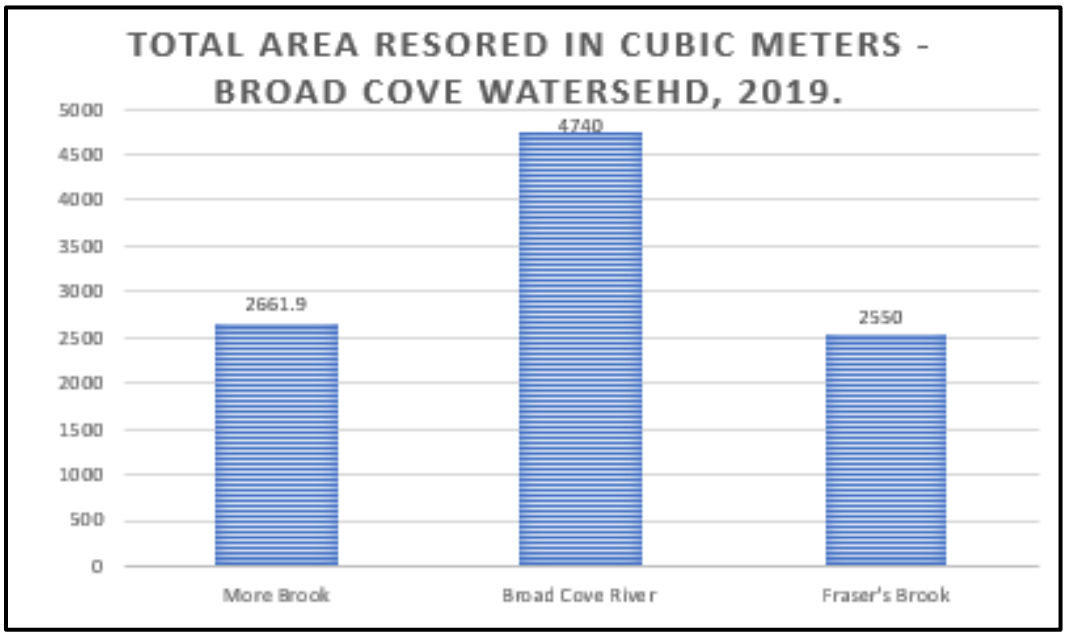

Figure 3. Showing the total area restored in cubic meters for each watercourse in the Broad Cove Watershed, 2019.

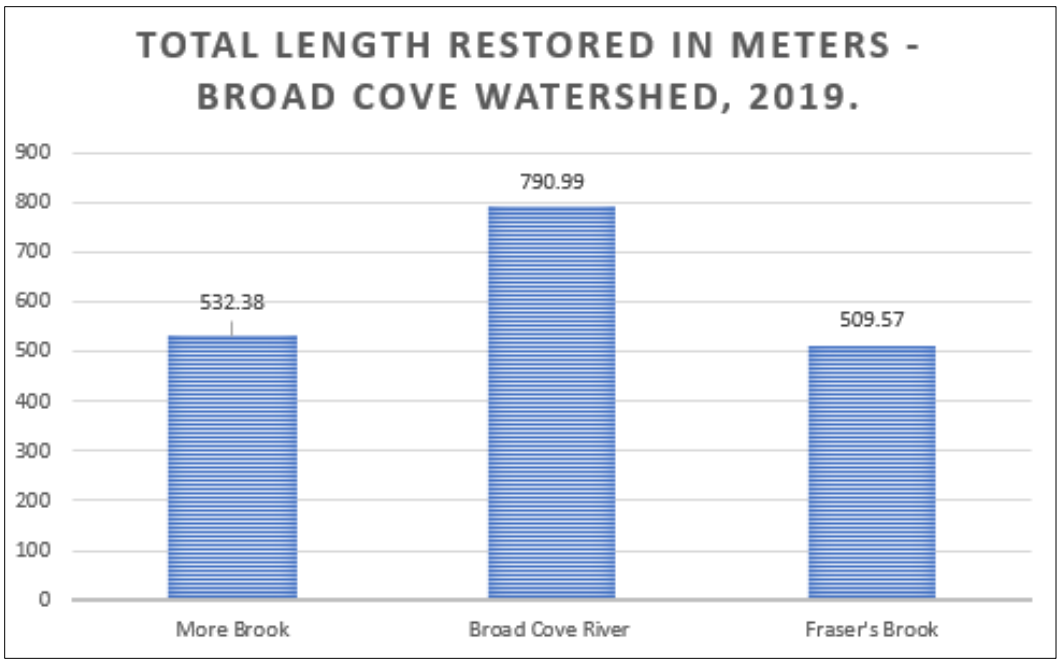

Figure 4. Showing the total length restored in meters for each watercourse in the Broad Cove Watershed, 2019.

Watershed Maps

The maps seen below display both a secondary and tertiary watershed boundaries for the Broad Cove Watershed along with all the water crossing locations.

Figure 5. Showing the secondary watershed boundaries for the Broad Cove Watershed.

Figure 6. Showing the tertiary watershed boundaries for the Broad Cove Watershed.

Figure 7. Showing the locations of all watercourse crossings within the Broad Cove Watershed.

More Brook

Location Information

Watercourse	More River
Watershed	Broad Cove Watershed
Location	Deepdale Road
Nearest Community	Inverness
Road Crossing (Access Point)	Deepdale Road
Map # (NS Topo Series 1:50,000)	Lake Ainslie 11K/3
Coordinates: UTM 20T	
Downstream Project Limit: Easting	0633073
Downstream Project Limit: Northing	5120491
Upstream Project Limit: Easting	0632625
Upstream Project Limit: Northing	5120519

Project Results

Instream Habitat Structures	Diggerlogs, Deflectors, Bank Stabilization (hand-rock), Fish Ladder.
Design Width	5 meters
Number and type of structures	Diggerlogs: 10 Fish Ladder: 1 Bank Stabilization (hand rock): 4
Total length of stream restored	532.38 meters
Area (m^2)	2661.9 m^2
Other Instream Habitat Measures Taken	Debris jam removal with the use of a chainsaw.

The map seen in figure 9 displays the structures installed in the More Brook. Each color-coded flag represents a different structure. The red flag represents a digger log, the green flag represents bank stabilization (hand rock) and the blue triangle represents the fibre glass fish ladder installed next to the boxed culver near the roadside.

Figure 8. Showing a map with the colour coded coordinates of the structures built in the More Brook.

The photos seen below show the structures installed in the More River before and after maintenance was completed. The photos taken start from the upstream side of the road, and then from the downstream side of the road.

Figure 9. Showing the first digger log structure upstream from the road. Before and after picture of performed maintenance.

Figure 10. Showing a before and after picture of the maintenance preformed on the second diggerlog upstream from the road.

Figure 11. Before and after picture of digger log #3 upstream from the road.

Figure 12. Showing before and after pictures of digger log #4 upstream from the road.

Figure 13. Showing before and after pictures of digger log #5 upstream from the road.

Figure 14. Showing before and after photos of digger log #6 upstream from the road. This structure is buried into the substrate and need removal and replacement.

After structure 6 there was a location that was flagged of for a diggerlog installation from the Adopt a stream training in 2017. The cut log was found nearby – uninstalled.

Figure 15. Showing the location of an uninstalled digger log from the 2017 adopt a stream training.

Figure 16. Showing the before and after photos of the fish ladder downstream from the road. The structure was fully blocked up with rock and other woody debris. The fish ladder is now flowing water and is providing upstream access to migrating fish species.

Figure 17. Showing the baffles in the boxed culvert. Rock was added on the left-hand side to avoid any further bank erosion from occurring.

Figure 18. Showing the before and after photos of a digger log - structure #8 downstream from the road.

Figure 19. Bank stabilization - structure #9 downstream from the road.

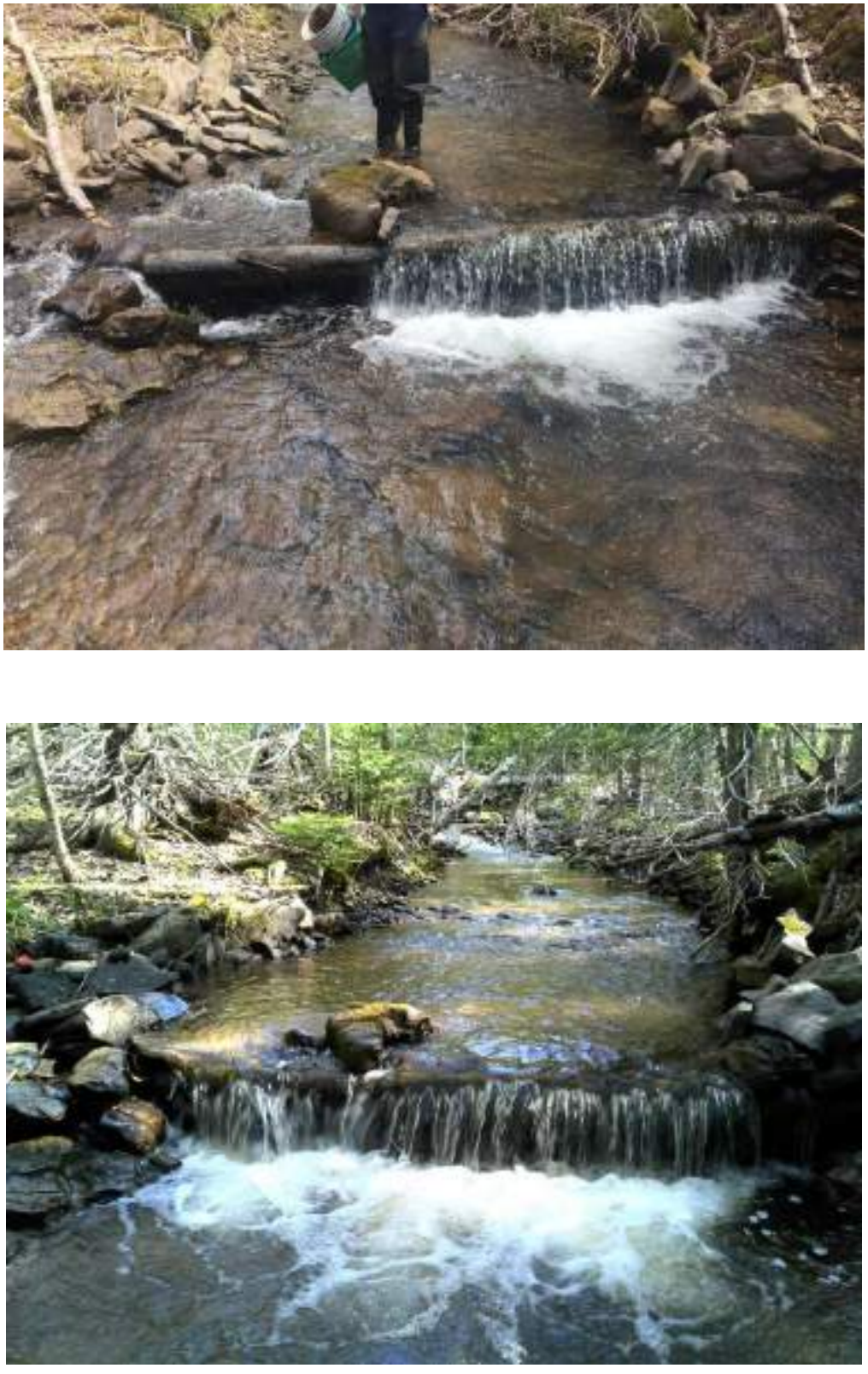

Figure 20. Showing the before and after photos of a diggerlog - structure #10 downstream from the road.

Figure 21. Showing the before and after photos of a digger log - structure #11 downstream from the road.

Figure 22. Showing the before and after pictures of a bank stabilization structure #12 - downstream from the road.

Figure 23. Showing a bank stabilization structure - #13 downstream from the road

Figure 24. Showing a bank stabilization structure #14 - downstream from the road.

Figure 25. Showing the before and after photos of a digger log structure - #15 downstream from the road.

Figure 26. This photo shows a buried digger log - structure #16 on the downstream side of the road. This structure could not be maintained and needs a replacement

Other Photos:

The photos seen below display the multiple debris jams located on the More Brook along with an old braid channel in the river.

Debris Jams:

Braid in river:

Found after structure #13 Downstream from the road.

Broad Cove River

Location Information

Watercourse	Broad Cove
Watershed	Broad Cove Watershed
Location	Glenora Distillery
Nearest Community	Inverness
Road Crossing (Access Point)	Route 19 Highway
Map # (NS Topo Series 1:50,000)	Lake Ainslie 11K/3
Coordinates: UTM 20T	
Downstream Project Limit: Easting	0628754
Downstream Project Limit: Northing	5112210
Upstream Project Limit: Easting	0629450
Upstream Project Limit: Northing	5112442

Project Results

Instream Habitat Structures	Diggerlogs, Deflectors, Bank Stabilization (hand-rock)
Design Width	6 meters
Number and type of structures	Diggerlogs: 10 Diggerlog & Deflectors: 5 Deflectors: 4
Total length of stream restored	790.99 meters
Area (m^2)	4740 m^2
Other Instream Habitat Measures Taken	N/A

The map seen in figure 28 displays the structures installed in the Broad Cove River. Each color-coded flag represents a different structure. The red flag represents a digger log, the blue flag represents a deflector and the red triangles represent both a diggerlog and deflector combined into one structure.

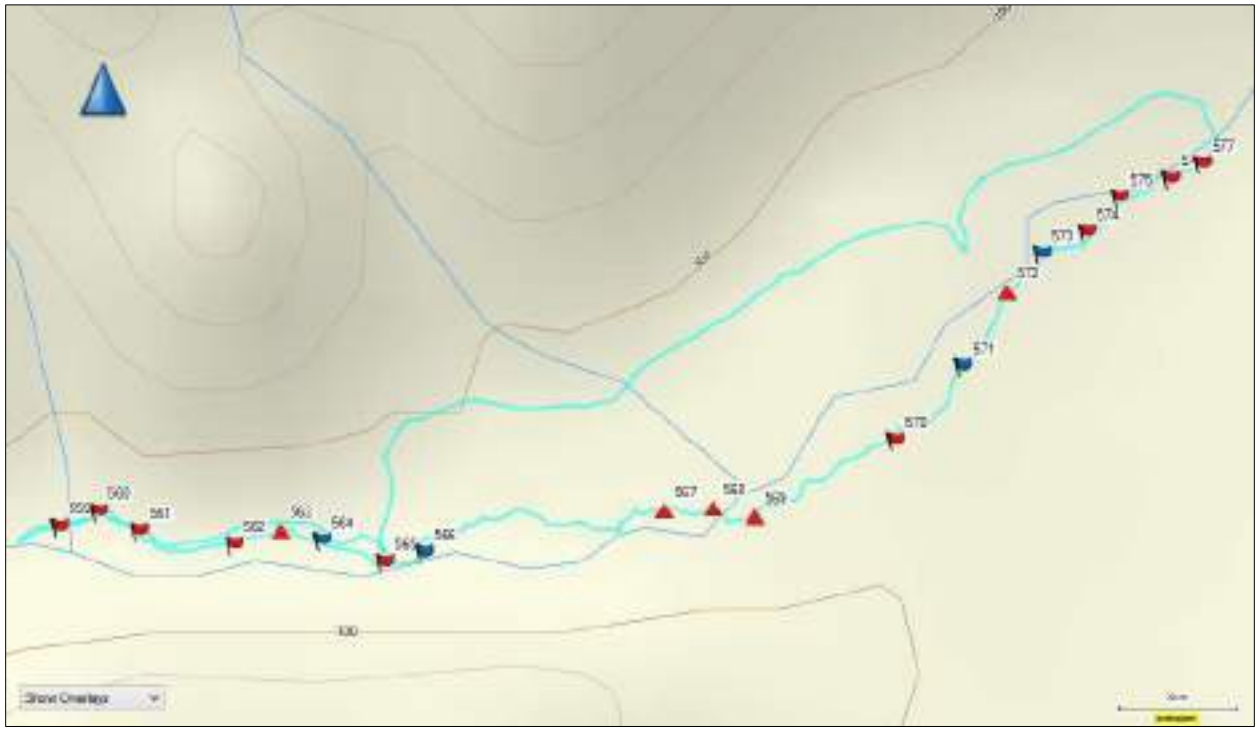

Figure 27. Showing a map with the colour coded coordinates of the structures built in the Broad Cove River.

The photos seen below show the structures installed in the Broad Cove River, starting from the furthest structure downstream moving upstream.

Figure 28. Diggerlog #1 - before and after pictures of maintenance. This is the furthest structure downstream.

Figure 29. Diggerlog #2 - before and after pictures of maintenance.

Figure 30. Diggerlog #3 - before and after pictures of attempted maintenance.

Figure 31. Diggerlog #4 - before and after pictures of maintenance.

Figure 32. Diggerlog #5 - before and after pictures of maintenance.

Figure 33. Deflector #6 - before and after picture of maintenance performed.

Figure 34 - Diggerlog #7 - before and after pictures of maintenance performed.

Figure 35. Deflector #8 - before and after pictures of maintenance.

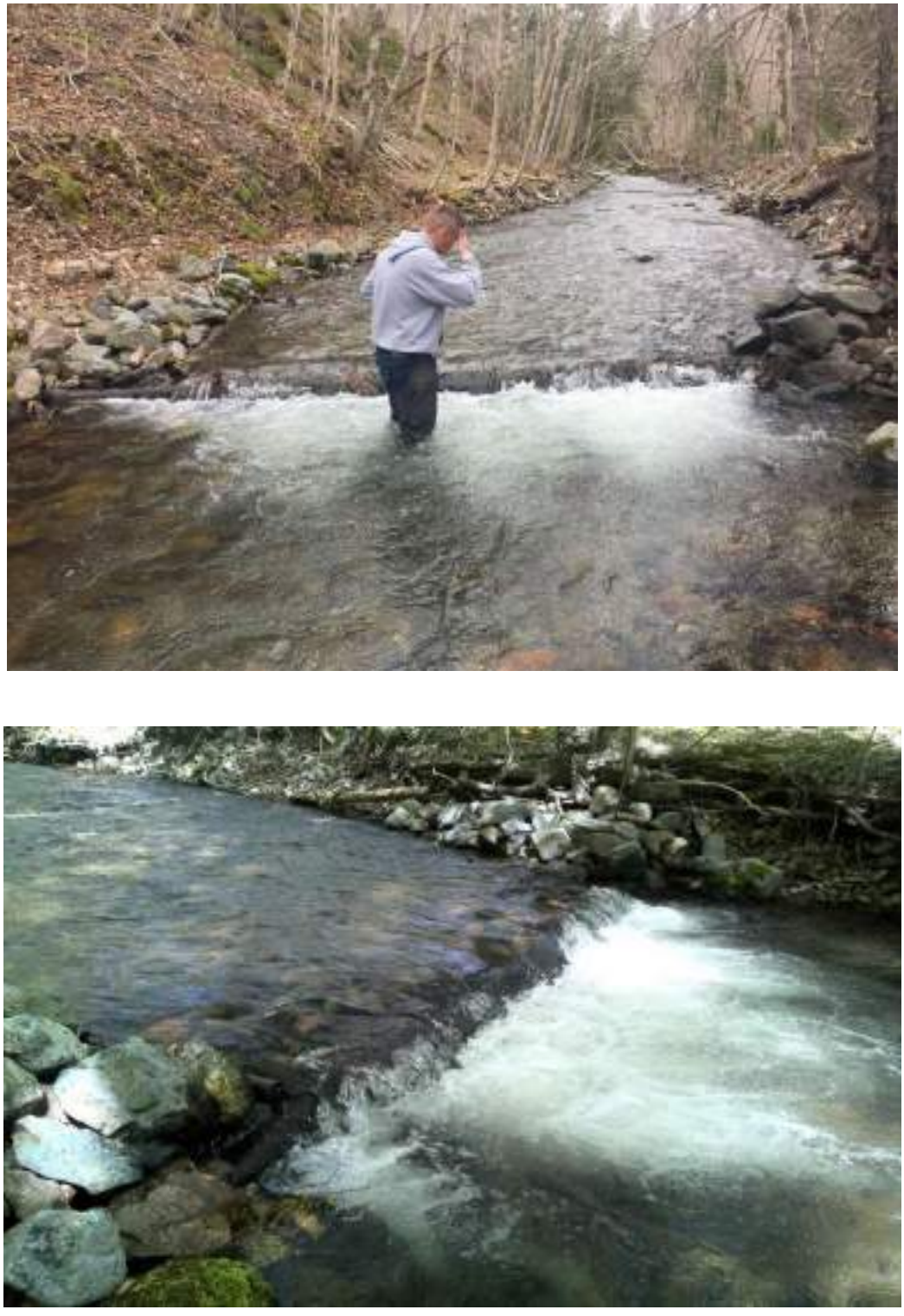

Figure 36. Diggerlog #9 - before and after pictures of maintenance.

Figure 37. Diggerlog #10 - before and after pictures of maintenance.

Figure 38. Diggerlog #11 - before and after pictures of maintenance.

Figure 39. Diggerlog #12 - before picture of maintenance. No after photo taken.

Figure 40. Deflector #13 - structure is no longer in-stream.

Figure 41. Diggerlog #14 - before and after pictures of maintenance.

Figure 42. Deflector #15 - before and after pictures of maintenance.

Figure 43. Diggerlog #16 - buried diggerlog. Before and after pictures show attempted maintenance on the structure.

Figure 44. Diggerlog #17 - before and after pictures of maintenance.

Figure 45. Diggerlog and deflector #18 - before and after pictures of maintenance.

Figure 46. Diggerlog #19 - before and after pictures of maintenance.

Figure 47. Diggerlog #20 - before and after pictures of maintenance.

Other Photos:
Photos taken of debris jams, a tributary and a natural digger log.

Debris Jams:

Natural Digger Log:

Tributary:

Fraser's River

Location Information

Watercourse	Frasers Brook
Watershed	Broad Cove Watershed
Location	Foot Cape Road
Nearest Community	Inverness
Road Crossing (Access Point)	Foot Cape Road
Map # (NS Topo Series 1:50,000)	Lake Ainslie 11K/3
Coordinates: UTM 20T	
Downstream Project Limit: Easting	0630946
Downstream Project Limit: Northing	5116652
Upstream Project Limit: Easting	0630582
Upstream Project Limit: Northing	5116973

Project Results

Instream Habitat Structures	Diggerlogs, Deflectors, Diggerlog and Deflectors
Design Width	5 meters
Number and type of structures	Diggerlogs: 11 Diggerlog & Deflectors: 3 Deflectors: 2
Total length of stream restored	509.57 meters
Area (m^2)	2550 m^2
Other Instream Habitat Measures Taken	N/A

The map seen in figure 49 displays the structures installed in Frasers Brook. Each color-coded flag represents a different structure. The red flag represents a digger log, the blue flag represents a deflector and the red triangles represent both a diggerlog and deflector combined into one structure.

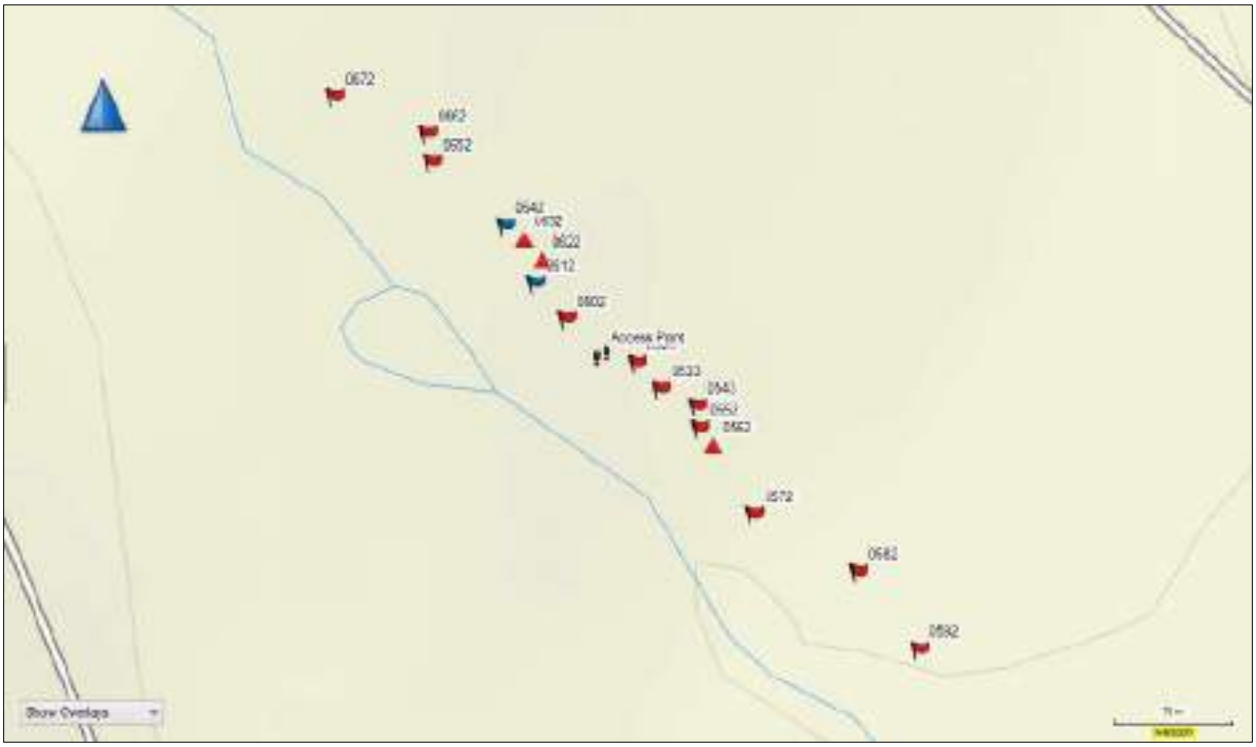

Figure 48. Showing a map with the colour coded coordinates of the structures built in Fraser's Brook.

The photos seen below show the structures installed in Fraser’s River, starting from the furthest structure upstream, moving downstream.

Figure 49. Digger log #1 - furthest structure upstream. Before and after pictures of the completed maintenance.

Figure 50. Structure #2 - Deflector that needs replacement. No maintenance completed.

Figure 51. Structure #3 - Diggerlog. Before and after pictures of attempted maintenance. This structure needs an extension on the upstream side of the log.

Figure 52. Structure #4 - Before and after picture of the maintenance completed on a digger log.

Figure 53. Structure #5 - after picture of the maintenance completed on a deflector.

Figure 54. Structure #6 - before and after picture of the maintenance completed on a deflector.

Figure 55. Structure #7 - Before and after picture of the maintenance completed on a digger log and deflector structure.

Figure 56. Structure #8 - before and after picture of the maintenance completed on a digger log and deflector structure.

Figure 57. Structure #9 - Before and after picture of the maintenance completed on a deflector.

Figure 58. Structure #10 - Before and after picture of the maintenance completed on a diggerlog.

Figure 59. Structure #11 - Before and after picture of the maintenance completed on a digger log.

Figure 60. Structure #12 - After picture of the maintenance completed on a two-tier bank stabilization structure.

Figure 61. Structure #13 - Before and after picture of the maintenance completed on a digger log.

Figure 62. Structure #14 - Before and after picture of the maintenance completed on a diggerlog.

Figure 63. Structure #15 - Before and after picture of the maintenance completed on a digger log.

Figure 64. Structure #16 - Before and after picture of the maintenance completed on a digger log and deflector structure.

Figure 65. Structure #17 - Before and after picture of the maintenance completed on a diggerlog.

Figure 66. Structure #18 - Before picture of a deflector structure. No after picture of maintenance

.

Figure 67. Structure #19 - Before and after picture of the maintenance attempted on a digger log.

Figure 68. Structure #20 - Before and after picture of the maintenance completed on a diggerlog.

Other Photos:
The photos seen below show the multiple debris jams located on Frasers Brook.

Debris Jams:

MABOU HARBOUR WATERSHED

The Inverness South Anglers Association had fully completed the maintenance on all the structures installed in the watercourses in the Mabou Harbour Watershed. Out of all the structures installed in the watershed, 81% of them are diggerlogs, 17% are deflectors, 1% are bank stabilization, and the remaining 1% are diggerlog and deflectors, see figure 70.

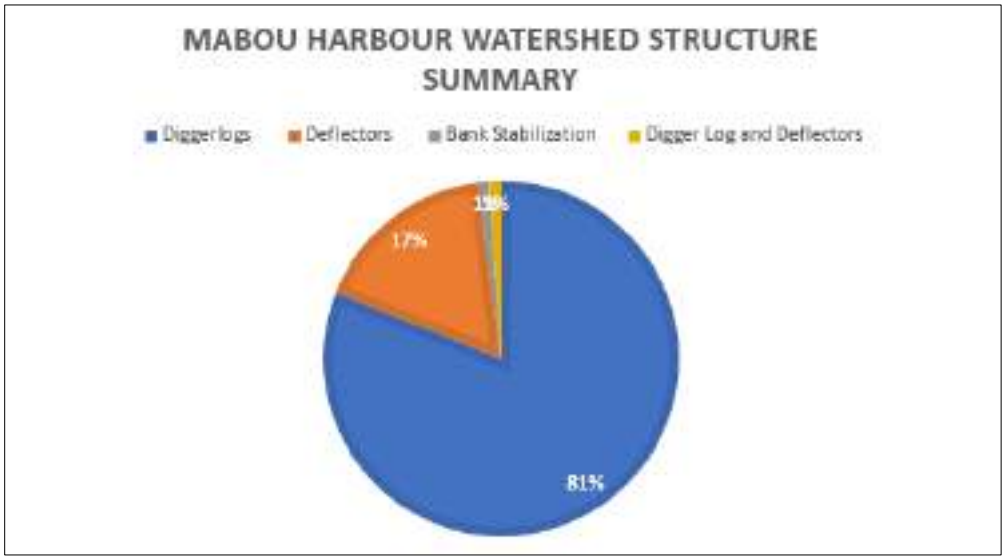

Figure 69. Showing the percentages of each structure type installed and maintained in the Mabou Harbour Watershed, 2019.

For a further breakdown of each structure type installed and maintained in each watercourse, see table 7.

Table 7. Showing the total of each structure type installed and maintained in the watercourses located in the Mabou Harbour Watershed, 2019.

Watercourse	Diggerlogs	Deflectors	Bank Stabilization	Digger Log and Deflectors
Glendyre Brook	15	2	0	0
Little Shea Brook	40	1	0	1
Big Shea Brook	2	8	0	0
Miramichi River	6	4	1	0
Rosedale Brook	7	1	0	0
MacQuarrie's Brook	7	0	0	0
TOTAL	**77**	**16**	**1**	**1**

The maintenance completed on all structures located in the Mabou Harbour Watershed covered a total area of 23497m^2 and a total length of 4349.7meters. For a further breakdown of the total area and length restored on each structure, see figures 71 and 72.

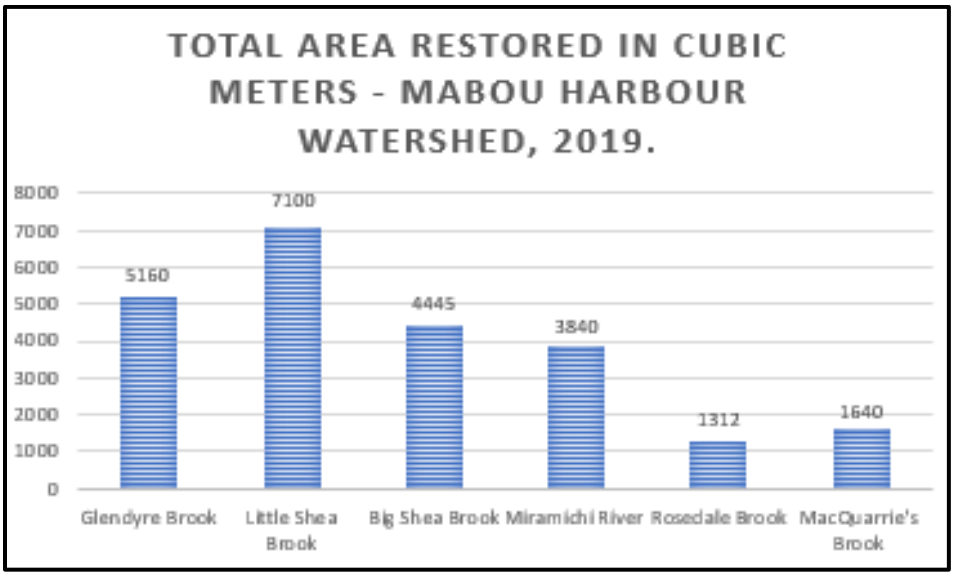

Figure 70. Showing the total area restored in cubic meters for each watercourse in the Mabou Harbour Watershed, 2019.

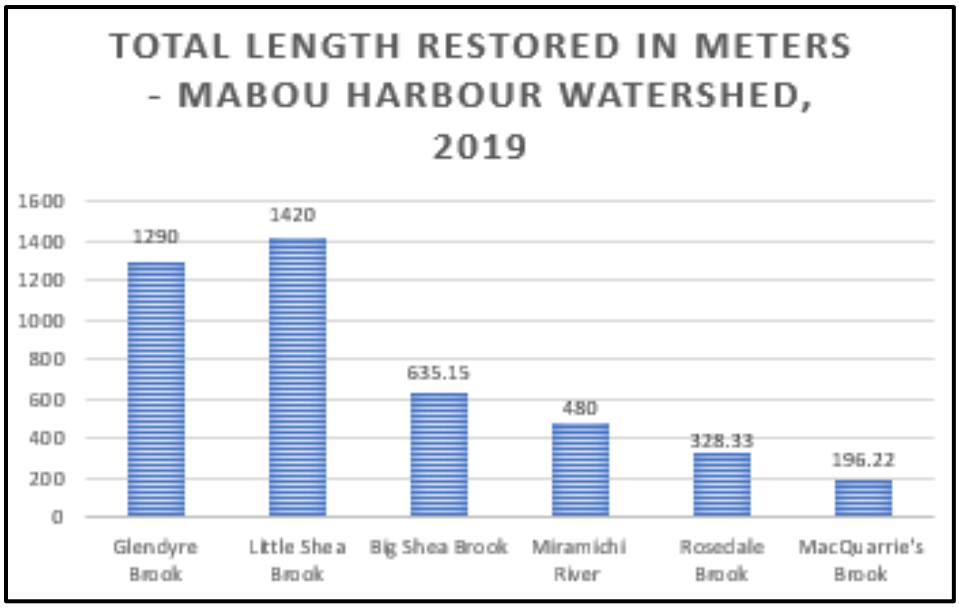

Figure 71. Showing the total length restored in meters for each watercourse in the Mabou Harbour Watershed, 2019.

Watershed Maps

The maps seen below display both a secondary and tertiary watershed boundaries for the Mabou Harbour Watershed along with all the water crossing locations.

Figure 72. Showing the secondary watershed boundaries for the Mabou Harbour Watershed.

Figure 73. Showing the tertiary boundaries for the Mabou Harbour Watershed.

Figure 74. Showing all water crossing locations on the Mabou Harbour Watershed.

Glendyre Brook

Location Information

Watercourse	Glendyre Brook
Watershed	Mabou Harbour Watershed
Location	Smithville
Nearest Community	Inverness
Road Crossing (Access Point)	Smithville Road
Map # (NS Topo Series 1:50,000)	Lake Ainslie 11K/3
Coordinates: UTM 20T	
Downstream Project Limit: Easting	0629225
Downstream Project Limit: Northing	5108561
Upstream Project Limit: Easting	0630349
Upstream Project Limit: Northing	5109521

Project Results

Instream Habitat Structures	Diggerlogs, Deflectors
Design Width	4 meters
Number and type of structures	Diggerlogs: 15 Deflectors: 2
Total length of stream restored	1.29 kilometers
Area (m^2)	5160 m^2
Other Instream Habitat Measures Taken	Debris jams were cleared with the use of a chainsaw.

The map seen in figure 76 displays each structure that was installed in the Glendyre Brook. Each colour coded flag represents a different structure. The red flags represent a diggerlog and the blue flags represent a deflector. The first seven structures are located near the Trans Canada Trail where the remaining structures are placed upstream and downstream from Smithville Road.

Figure 75. Showing a map with the colour coded coordinates of the structures built in the Glendyre Brook.

The photos seen below show the structures installed in the Glendyre river. The pictures start from the furthest structure downstream starting from the Trans Canada Trail – moving to the furthest structure upstream from Smithville Road.

Figure 76. First diggerlog structure upstream from Trans Canada Trail

Figure 77. Digger log structure #2 upstream from the Trans Canada Trail.

Figure 78. Diggerlog structure #3 upstream from the Trans Canada Trail.

Figure 79. Deflector structure #4 upstream from the Trans Canada Trail..

Figure 80. Diggerlog structure #5 upstream from the Trans Canada Trail.

Figure 81. Diggerlog structure #6 upstream from the Trans Canada Trail.

Figure 82. Structure #7 - buried diggerlog that needs a replacement.

Figure 83. Structure #8 - diggerlog that needs a replacement. This is the last structure on the downstream side of Smithville Road.

Figure 84. Diggerlog structure #9 - downstream side of Smithville Road.

Figure 85. Diggerlog structure #10 - downstream side of Smithville Road.

Figure 86. Diggerlog structure #11 - downstream side of Smithville Road.

Figure 87. Diggerlog #12 - first structure on the upstream side of Smithville Road.

Figure 88. Diggerlog #13 - buried and needs replacement.

Figure 89. Diggerlog #14 - upstream from Smithville Road.

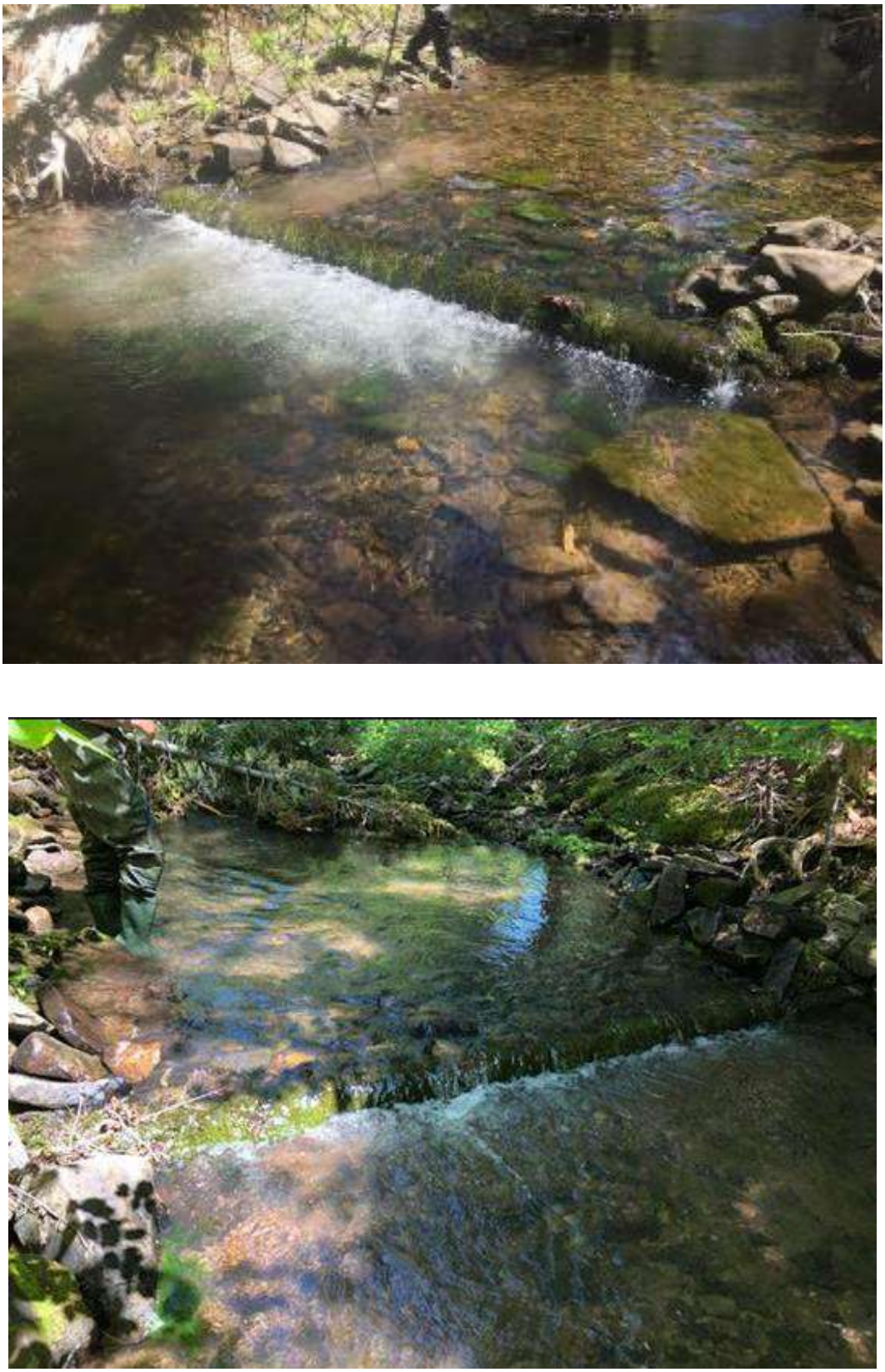

Figure 90. Diggerlog #15 - upstream from Smithville Road.

Figure 91. Diggerlog #16 - upstream from Smithville Road.

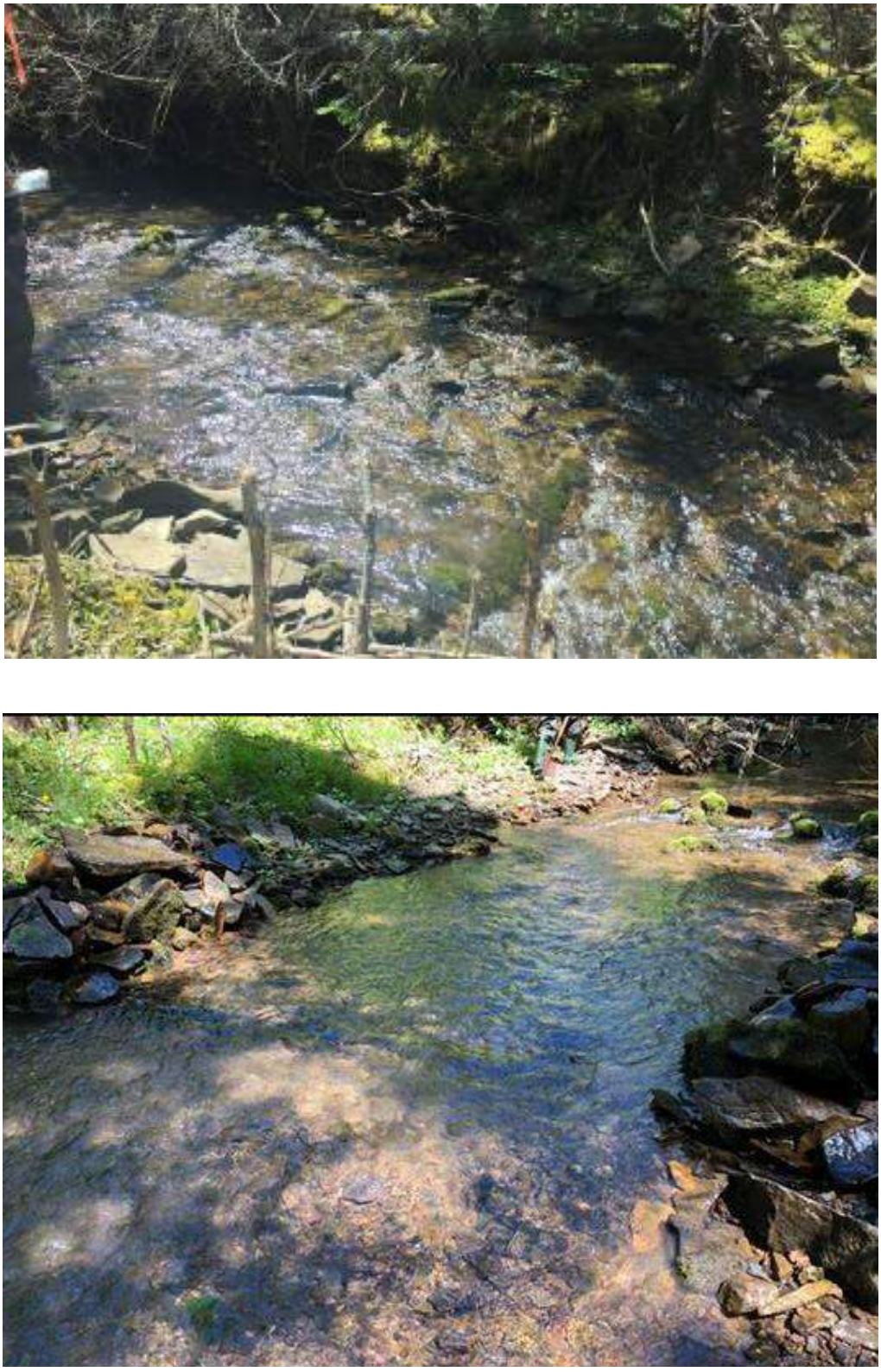

Figure 92. Diggerlog #17 - upstream from Smithville Road.

Figure 93. Deflector structure #18 - last structure upstream from Smithville Road.

Little Shea River

Location Information

Watercourse	Little Shea
Watershed	Mabou Harbour Watershed
Location	Old Mull River Road
Nearest Community	Inverness
Road Crossing (Access Point)	Old Mull River Road
Map # (NS Topo Series 1:50,000)	Lake Ainslie 11K/3
Coordinates: UTM 20T	
Downstream Project Limit: Easting	0630356
Downstream Project Limit: Northing	5099988
Upstream Project Limit: Easting	0631418
Upstream Project Limit: Northing	5099269

Project Results

Instream Habitat Structures	Diggerlogs, Deflectors, Diggerlog and Deflectors
Design Width	4-5 meters
Number and type of structures	Diggerlogs: 40 Diggerlog & Deflectors: 1 Deflectors: 1
Total length of stream restored	1.42 kilometers
Area (m^2)	7100 m^2
Other Instream Habitat Measures Taken	Debris jams were cleared with the use of a chainsaw.

The map seen in figure 95 displays each structure that was installed in the Little Shea Brook. Each colour coded flag represents a different structure type. The red flags represent a diggerlog, the blue flags represent a deflector and the red triangle represents a diggerlog with a deflector.

Figure 94. Showing a map with the colour coded coordinates of the structures built in the Little Shea Brook.

The photos seen below show the structures installed in the Little Shea Brook. The pictures start from the furthest structure upstream from the Old Mull River Road and move towards the last structure on the downstream side of the road. The pictures show the maintenance performed on each structure. During the winter damage assessment on this river we had experienced technical difficulties therefore there are no before pictures taken for these structures. The assessment was completed, and field notes were taken.

Figure 95. Diggerlog structure #1 furthest upstream - after photo of maintenance.

Figure 96. Diggerlog #2 - after photo of maintenance.

Figure 97. Diggerlog #3 - this picture is taken after maintenance, showing the extension added on the downstream side to restrict water flow to log.

Figure 98. Diggerlog #4 - after picture of maintenance performed.

Figure 99. Diggerlog #5 - maintenance was attempted but not successful. This structure may need replacement.

Figure 100. Diggerlog #6 - after picture of maintenance performed.

Figure 101. Diggerlog #7 - after picture of maintenance performed.

Figure 102. Diggerlog #8 - after picture of maintenance performed.

Figure 103. Diggerlog #9 - after picture of maintenance performed.

Figure 104. Diggerlog #10 - after picture of maintenance performed.

Figure 105. Diggerlog #11 - after picture of maintenance performed.

Figure 106. Diggerlog #12 - after picture of maintenance performed.

Figure 107. Diggerlog #13 - picture of the maintenance attempted on this structure.

Figure 108. Diggerlog #14 - after picture of maintenance performed.

Figure 109. Diggerlog #15 - after picture of maintenance performed.

Figure 110. Diggerlog #16 - no maintenance performed. Structure needs to be removed and replaced.

Figure 111. Diggerlog #17 - after picture of maintenance performed.

Figure 112. Diggerlog #18 - after picture of maintenance performed.

Figure 113. Diggerlog #19 - after picture of maintenance performed.

Figure 114. Diggerlog #20 - after picture of maintenance performed.

Figure 115. Diggerlog #21 - after picture of maintenance performed.

Figure 116. Deflector structure #22 - after picture of maintenance performed.

Figure 117. Diggerlog #23 - structure is washed out underneath. No maintenance performed - recommended removal.

Figure 118. Diggerlog #24 - after picture of maintenance performed.

Figure 119. Diggerlog and deflector structure #25 - after picture of maintenance performed.

Figure 120. Diggerlog #26 - after picture of maintenance performed.

Figure 121. Diggerlog #27 - after picture of maintenance performed.

Figure 122. Diggerlog #28 - after picture of maintenance performed.

Figure 123. Diggerlog #29 - after picture of maintenance performed.

Figure 124. Diggerlog #30 - after picture of maintenance performed.

Figure 125. Diggerlog #31 - after picture of maintenance performed.

Figure 126. Diggerlog #32 - after picture of maintenance performed.

Figure 127. Diggerlog #33 - after picture of maintenance performed.

Figure 128. Diggerlog #34 - after picture of maintenance performed.

Figure 129. Diggerlog #35 - after picture of maintenance performed.

Figure 130. Diggerlog #36 - after picture of maintenance performed.

Figure 131. Diggerlog #37 - after picture of maintenance performed.

Figure 132. Diggerlog #38 - after picture of maintenance performed.

Figure 133. Diggerlog #39 - after picture of maintenance performed.

Figure 134. Before and after picture of the maintenance performed on diggerlog #40

Figure 135. Before and after picture of the maintenance performed on digger log #41.

Figure 136. Diggerlog #42 - after picture of maintenance performed.

Other Photos:

The photos seen below display the few debris jams located on the Little Shea Brook.

Big Shea River

Location Information

Watercourse	Big Shea River
Watershed	Mabou Harbour Watershed
Location	Old Mull River Road
Nearest Community	Mabou
Road Crossing (Access Point)	Old Mull River Road – first bridge
Map # (NS Topo Series 1:50,000)	Lake Ainslie 11K/3
Coordinates: UTM 20T	
Downstream Project Limit: Easting	0630404
Downstream Project Limit: Northing	5100058
Upstream Project Limit: Easting	0630795
Upstream Project Limit: Northing	5100424

Project Results

Instream Habitat Structures	Diggerlogs, Deflectors
Design Width	6-7 meters
Number and type of structures	Diggerlogs: 2 Deflectors: 8
Total length of stream restored	635.15 meters
Area (m^2)	4445 m^2
Other Instream Habitat Measures Taken	Debris jams were cleared with the use of a chainsaw.

The map seen in figure 138 displays each structure that was installed in the Big Shea Brook. Each colour coded flag represents a different structure type. The red flags represent a diggerlog, and the blue flags represent a deflector.

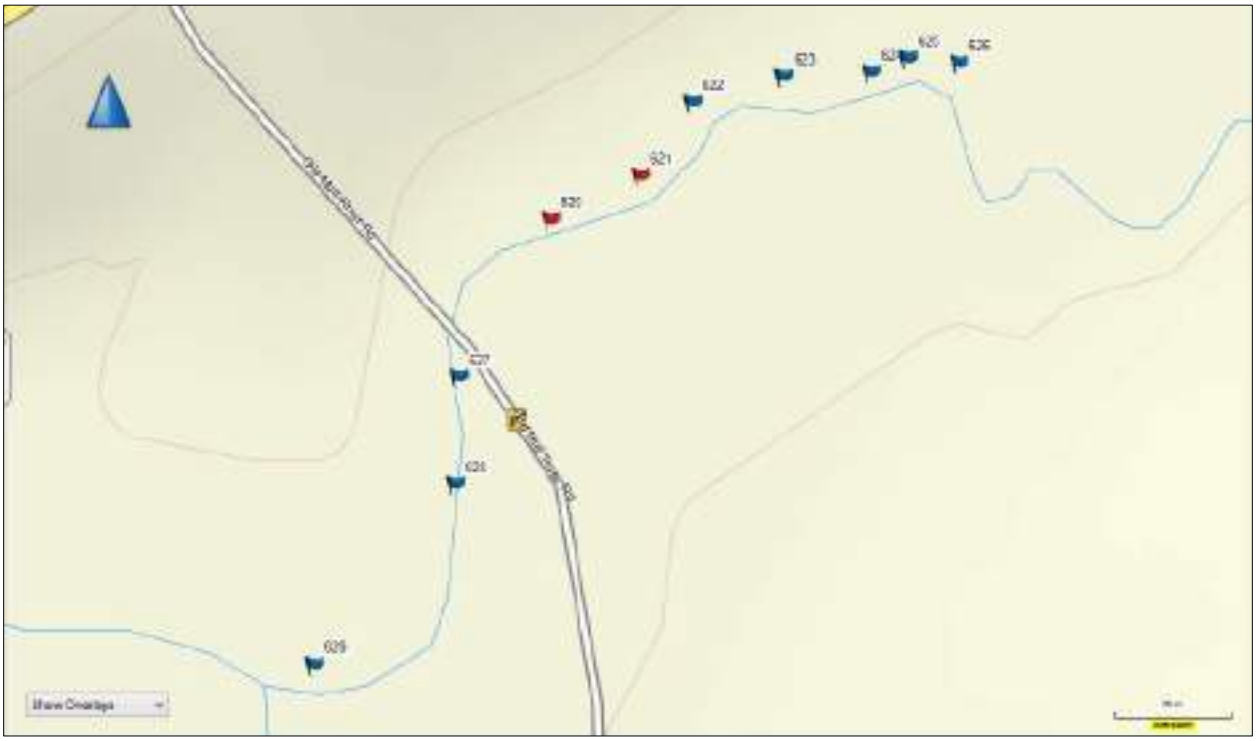

Figure 137. Showing a map with the colour coded coordinates of the structures built in the Big Shea Brook.

The photos seen below show the structures installed in the Big Shea Brook. The pictures start from the furthest structure upstream from the Old Mull River Road and move towards the last structure on the downstream side of the road. The pictures show the before and after of the maintenance performed on each structure.

Figure 138. Before and after pictures of the maintenance performed on the furthest upstream structure - Deflector #1.

Figure 139. Before and after pictures of maintenance performed on deflector #2.

Figure 140. Before and after picture of the maintenance performed on deflector #3.

Figure 141. Before and after picture of the maintenance performed on deflector #4.

Figure 142. Deflector #5 - this deflector is in very good condition and is now becoming part of the bank side and has lots of vegetation growth.

Figure 143. Diggerlog #6 - after picture of maintenance performed. This structure was in very good condition.

Figure 144. Diggerlog #7 - before and after picture of maintenance performed. This structure is too short and may require a full replacement or permanent extension. Debris materials were added to direct waterflow over the log.

Figure 145. Deflector #8 - before and after picture of maintenance performed.

Figure 146. Deflector #9 - after picture of maintenance performed.

Figure 147. Deflector #10 - before and after pictures of maintenance performed.

Miramichi River

Location Information

Watercourse	Miramichi Brook
Watershed	Mabou Harbour Watershed
Location	Rosedale
Nearest Community	Mabou
Road Crossing (Access Point)	Rosedale Road
Map # (NS Topo Series 1:50,000)	Lake Ainslie 11K/3
Coordinates: UTM 20T	
Downstream Project Limit: Easting	0631811
Downstream Project Limit: Northing	5095725
Upstream Project Limit: Easting	0631817
Upstream Project Limit: Northing	5095476

Project Results

Instream Habitat Structures	Diggerlogs, Deflectors, Bank Stabilization (hand-rock)
Design Width	8 meters
Number and type of structures	Diggerlogs: 6 Deflectors: 4 Bank Stabilization: 1
Total length of stream restored	480 meters
Area (m^2)	4616.07 m^2
Other Instream Habitat Measures Taken	N/A

The map seen in figure 149 displays each structure that was installed in the Miramichi River. Each colour coded flag represents a different structure type. The red flags represent a diggerlog, the blue flags represent a deflector, and the green flag represents bank stabilization (hand-rock).

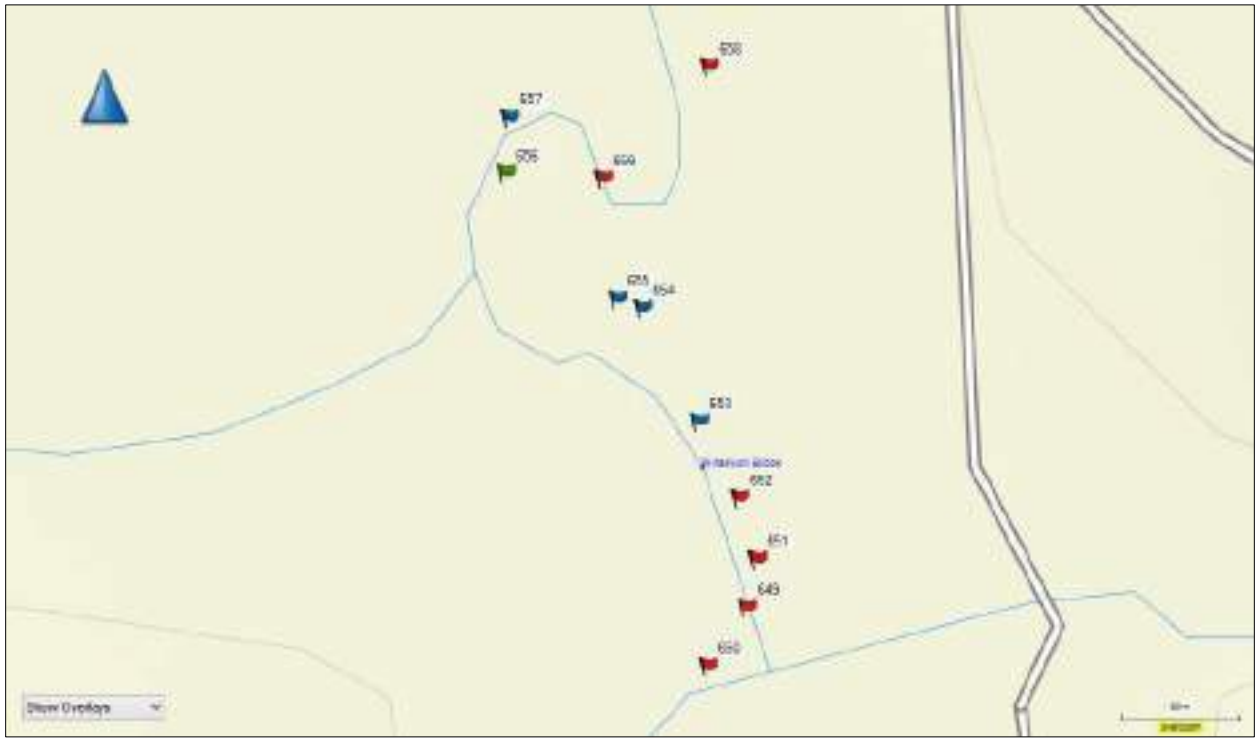

Figure 148. Showing a map with the colour coded coordinates of the structures built in the Miramichi River.

The photos seen below show the structures installed in the Miramichi River. The pictures start from the furthest structure upstream and move towards the last structure downstream. The pictures show the after pictures of the maintenance performed on each structure.

Figure 149. Diggerlog #1 - before and after picture of maintenance performed.

Figure 150. Diggerlog #2 – before and after picture of maintenance performed.

Figure 151. Diggerlog #4 - after picture of maintenance performed.

Figure 152. Diggerlog #5 - after picture of maintenance performed.

Figure 153. Deflector #6 - this deflector is now growing vegetation on it and is slowly becoming part of the bankside.

Figure 154. Deflector #7 - no maintenance performed. The channel started flowing around the structure, flooding it with water.

Figure 155. Deflector #8 - after picture of maintenance. The front of the structure is missing and needs to be fixed. Rock was added to help deflect the waterflow from the bank.

Figure 156. Bank rock/stabilization #9 - after picture of maintenance performed. There is also an old diggerlog log here that is buried into the substrate.

Figure 157. Deflector #10 - after picture of maintenance.

Figure 158. Diggerlog #11 - after picture of the maintenance performed.

Figure 159. Diggerlog #12 - after picture of maintenance performed.

Other Photos:

The photo below shows the tributary running into the Miramichi river.

Figure 160. Tributary running into the Miramichi River.

Rosedale Brook

Location Information

Watercourse	Rosedale Brook
Watershed	Mabou Harbour Watershed
Location	Rosedale
Nearest Community	Mabou
Road Crossing (Access Point)	Rosedale Road
Map # (NS Topo Series 1:50,000)	Lake Ainslie 11K/3
Coordinates: UTM 20T	
Downstream Project Limit: Easting	0631356
Downstream Project Limit: Northing	5095577
Upstream Project Limit: Easting	0632628
Upstream Project Limit: Northing	5095668

Project Results

Instream Habitat Structures	Diggerlogs, Deflectors, Diggerlog and Deflectors
Design Width	5 meters
Number and type of structures	Diggerlogs: 7 Diggerlog & Deflectors: 1 Deflectors: 1
Total length of stream restored	328.33 meters
Area (m^2)	1312 m^2
Other Instream Habitat Measures Taken	N/A

The map seen in figure 162 displays each structure that was installed in the Rosedale Brook. Each colour coded flag represents a different structure type. The red flags represent a diggerlog, the blue flags represent a deflector and the red triangle represents a diggerlog with a deflector.

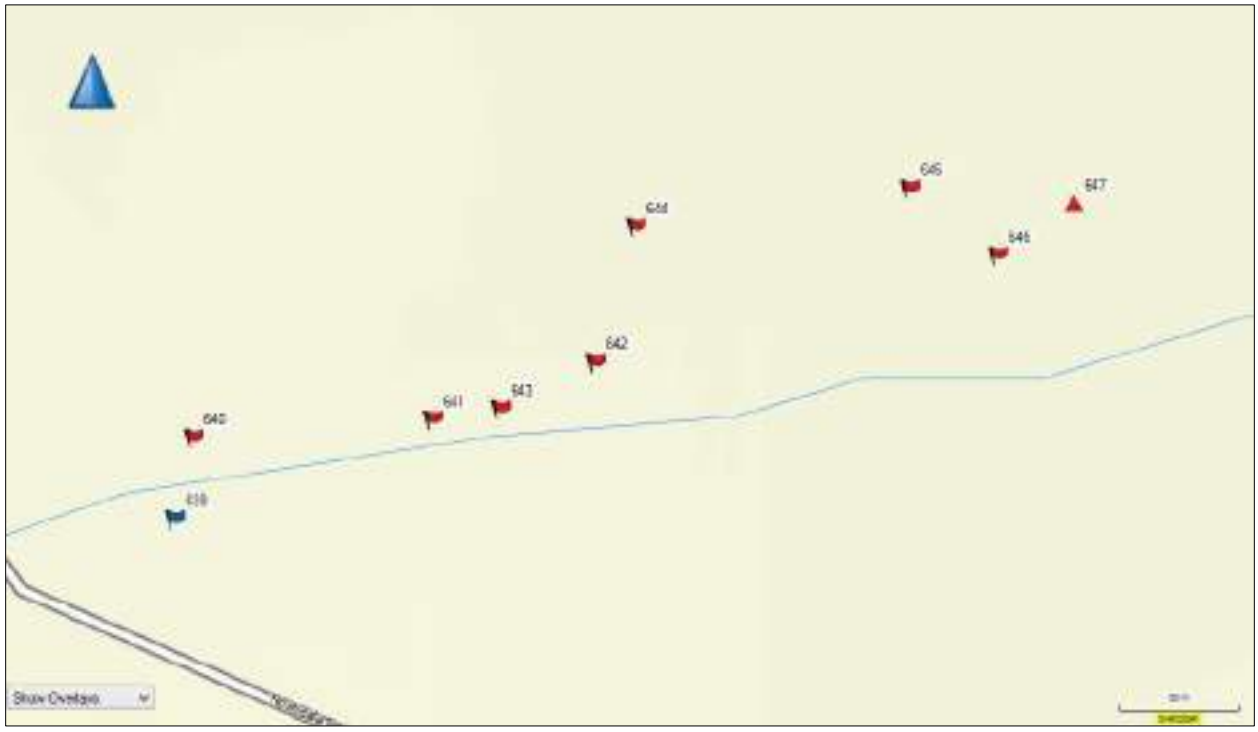

Figure 161.Showing a map with the colour coded coordinates of the structures built in the Rosedale Brook.

The photos seen below show the structures installed in the Rosedale Brook. The pictures start from first structure upstream from Rosedale Road and end at the furthest structure upstream. The pictures show the maintenance performed on each structure.

Figure 162. Deflector #1 - this structure is no longer in the channel and needs to be replaced, and repositioned.

Figure 163. Diggerlog #2 - this structure was undercut in some areas and had a large amount of debris caught on the top of the log. No maintenance was performed.

Figure 164 - Diggerlog #3 - after picture of the maintenance performed.

Figure 165. Diggerlog #4 - after picture of maintenance performed.

Figure 166 - Diggerlog #5 - the channel had changed course and the structure is no longer in the channel. This structure needs to be replaced, and repositioned.

Figure 167. Diggerlog #6 - this structure needs to be replaced.

Figure 168. Diggerlog #7 - after picture of the maintenance performed. Debris materials were added to the upstream side of the log to help direct waterflow.

Figure 169.. Diggerlog #8 - after picture of the maintenance performed.

Figure 170. Diggerlog and deflector #9 - after picture of the maintenance performed.

MacQuarries Brook

Location Information

Watercourse	MacQuarries Brook
Watershed	Mabou Harbour Watershed
Location	MacQuarries Brook – Jeff Lee's
Nearest Community	Brook Village
Road Crossing (Access Point)	Lake Ainslie Chapel Brook Village Rd.
Map # (NS Topo Series 1:50,000)	Lake Ainslie 11K/3
Coordinates: UTM 20T	
Downstream Project Limit: Easting	0634988
Downstream Project Limit: Northing	5103446
Upstream Project Limit: Easting	0635171
Upstream Project Limit: Northing	5103479

Project Results

Instream Habitat Structures	Diggerlogs, Diggerlog and Deflectors
Design Width	3-4 meters
Number and type of structures	Diggerlogs: 7 Diggerlog & Deflectors: 2
Total length of stream restored	196.22 meters
Area (m^2)	803.58 m^2
Other Instream Habitat Measures Taken	N/A

The map seen in figure 172 displays each structure that was installed in MacQuarries Brook. Each colour coded flag represents a different structure type. The red flags represent a diggerlog, the blue flags represent a deflector and the red triangle represents a diggerlog with a deflector.

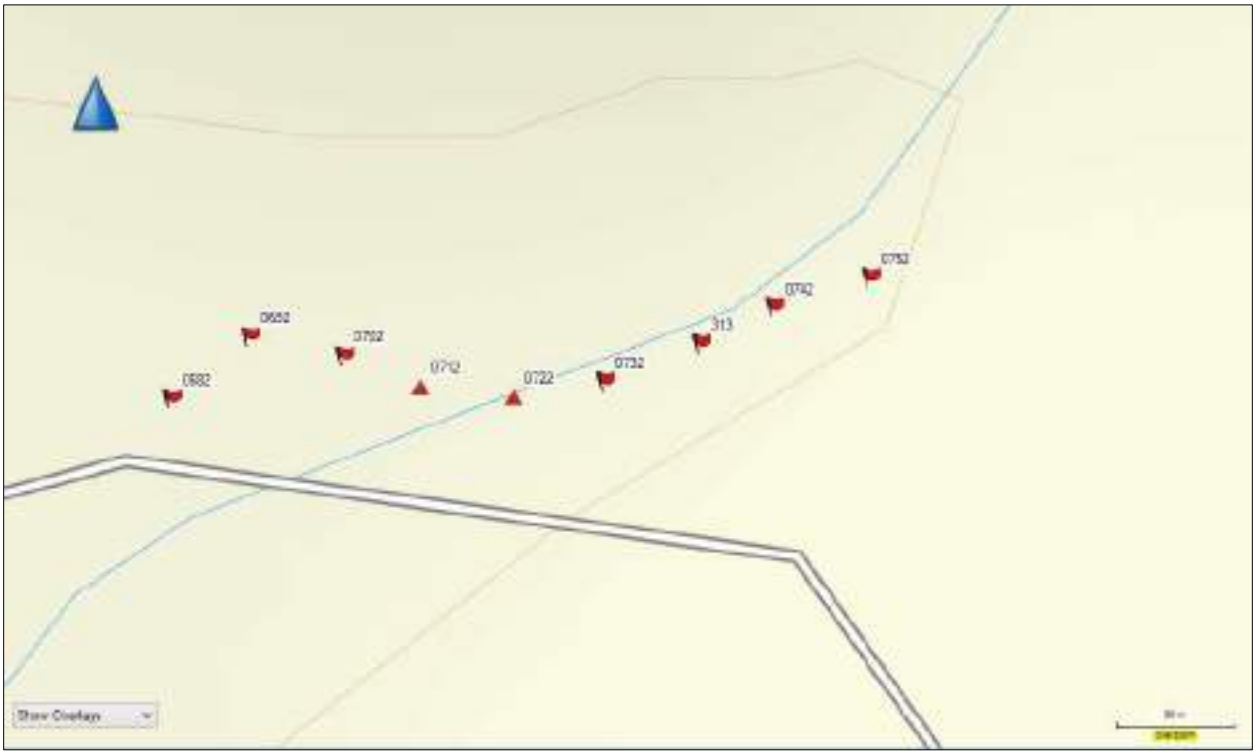

Figure 171. Showing a map with the colour coded coordinates of the structures built in MacQuarries Brook.

The photos seen below show the maintenance completed on the structures installed in McQuarrie's Brook starting from the furthest structure downstream moving upstream. Due to technical difficulties during the winter damage assessment completed on this brook – no before pictures were taken prior to maintenance.

Figure 172. Structure #1 furthest downstream - After picture of the maintenance completed on a digger log.

Figure 173. Structure #2 - After picture of the maintenance completed on a digger log.

Figure 174. Structure #3 - After picture of the maintenance completed on a digger log.

Figure 175. Structure #4 - After picture of the maintenance completed on a digger log and deflector structure.

Figure 176. Structure #5 - After picture of the maintenance completed on a diggerlog and deflector structure.

Figure 177. Structure #6 - After picture of the maintenance completed on a digger log.

Figure 178. Structure #7 - After picture of the maintenance completed on a digger log.

Figure 179. Structure #8 - After picture of the maintenance completed on a digger log.

Figure 180. Structure #9 - After picture of the maintenance completed on a digger log. (This photo is very blurry)

GRAHAM'S RIVER WATERSHED

The Inverness South Anglers Association had fully completed the maintenance on all the structures installed in the watercourses in the Graham's River Watershed. Out of all the structures installed in the watershed, 41% of them are deflectors, 25% are bank rock/stabilization, 18% are armour stone/bank stabilization, 6% are channel blockers, 5% are rock sills, 3% are diggerlog and deflectors and the remaining 2% are diggerlogs, see figure 182.

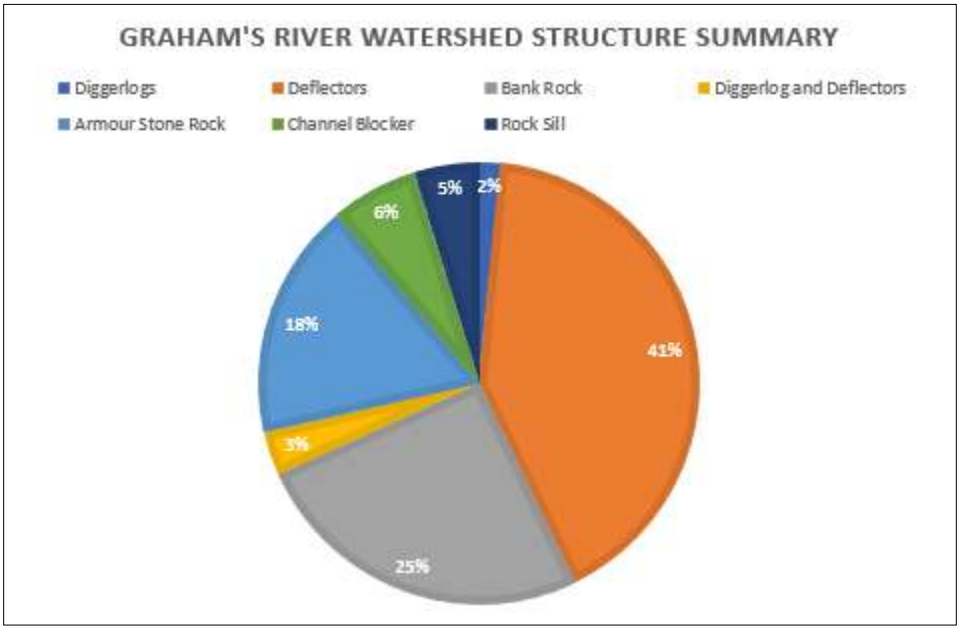

Figure 181. Showing the percentages of each structure type installed and maintained in the Graham's River Watershed, 2019.

For a further breakdown of each structure type installed and maintained in each watercourse, see table 8.

Table 8. Showing the total of each structure type installed and maintained in the watercourses located in the Mabou Harbour Watershed, 2019.

Watercourse	Diggerlogs	Deflectors	Bank Rock	Diggerlog and Deflectors	Armour Stone Rock	Channel Blocker	Rock Sill
Graham's River	1	26	16	2	11	4	3
TOTAL	**1**	**26**	**16**	**2**	**11**	**4**	**3**
	63						

The maintenance completed on all structures located in the Graham's River Watershed covered a total area of 29940 m^2 and a total length of 4990 meters. For a further breakdown of the total area and length restored on each structure, see figure 181.

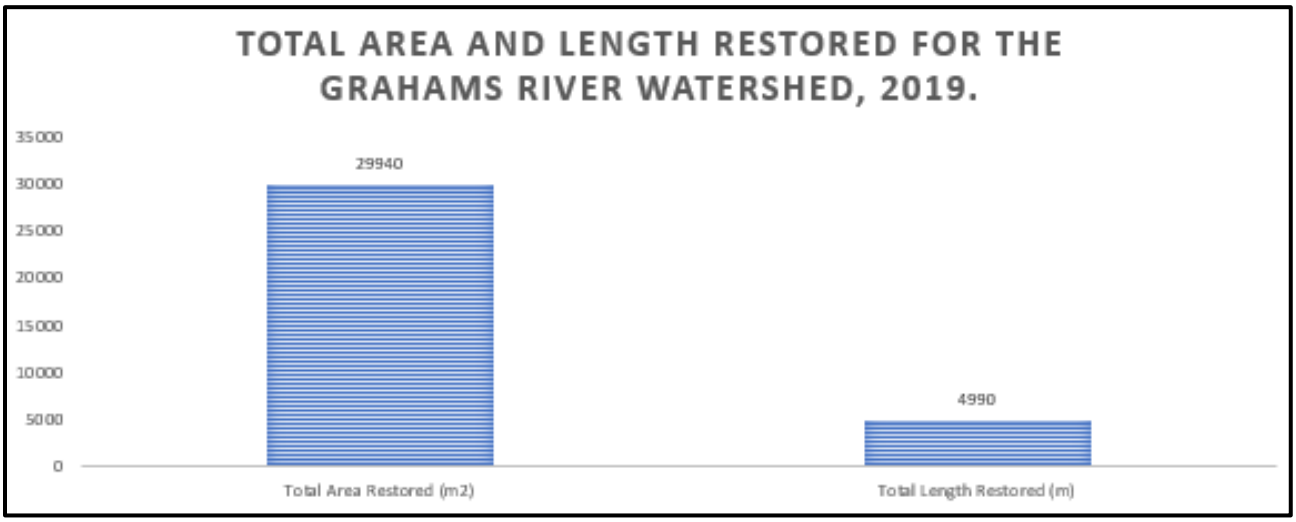

Figure 182. Showing the total area and length restored in the Graham's River Watershed, 2019.

Watershed Maps

The maps seen below display both a secondary and tertiary watershed boundaries for the Mabou Harbour Watershed along with all the water crossing locations.

Figure 183. Showing the secondary boundary lines for the Graham's River Watershed.

Figure 184. Showing the water crossing locations for the Graham's River Watershed.

Graham's River

Location Information

Watercourse	Graham's River
Watershed	Graham's River Watershed
Location	Route 19 Bridge (Graham's Rd.) to MacDonald Bridge (Campbell's Rd)
Nearest Community	Judique
Road Crossing (Access Point)	Graham's Rd. and Campbell's Rd.
Map # (NS Topo Series 1:50,000)	Lake Ainslie 11K/3
Coordinates: UTM 20T	
Downstream Project Limit: Easting	0617223
Downstream Project Limit: Northing	5079594
Upstream Project Limit: Easting	0621688
Upstream Project Limit: Northing	5079184

Project Results

Instream Habitat Structures	Diggerlogs, Deflectors, Diggerlog and Deflector, Bank Stabilization (hand-rock), Channel Blockers, Rock Sills, Armour Stone Rock (machine work).
Design Width	5-7 meters
Number and type of structures (*maintained only*)	Diggerlogs: 1 Deflectors: 26 Bank Stabilization: 16 Channel Blockers: 4 Rock Sills: 3 Armour Stone Rock: 11

	Diggerlog and Deflector: 2 TOTAL: **63**
Total length of stream restored	4.99 kilometres
Area (k^2)	29940 m^2
Other Instream Habitat Measures Taken	Debris jams were cleared with the use of a chainsaw.

The map seen in figure 186 displays the structures placed on Graham's River. Each structure type is represented with a different colour. The blue flag represents a deflector, the green flag represents bank stabilization for both hand rock and machine rock, the red flag represents diggerlogs, the red triangle represents a diggerlog and deflector, and the blue triangle represents a channel blocker. The map below is missing coordinates upstream from the MacDonald Bridge.

The structures upstream from the MacDonald bridge did not receive maintenance due to the damage that occurred over the winter months. None of the structures were braced in with logs, therefore they washed out over time and will require a rebuild.

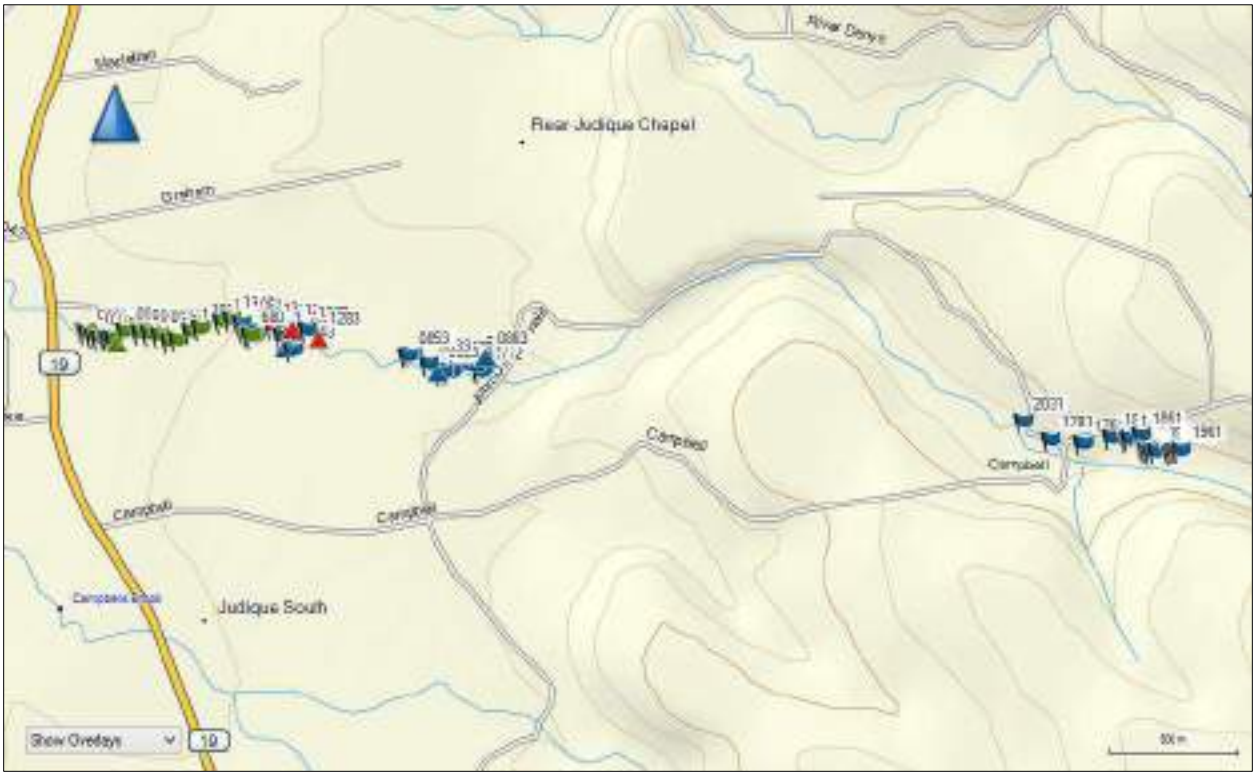

Figure 185. Showing a map with the colour coded coordinates of the structures built in Graham's River.

The photos seen below show the structures installed in Graham's River. The pictures start from the furthest structure downstream (Route 19 Bridge) and move towards the furthest structure upstream. The pictures show the after pictures of the maintenance performed on each structure.

Figure 186. Structure #1 Bank Rock - before picture of maintenance, first structure starting upstream from Route 19 bridge. No after picture taken.

Figure 187. Structure #2 Bank Rock - before and after pictures of the completed maintenance.

Figure 188. Structure #3 Bank Rock - before and after pictures of completed maintenance.

Figure 189. Structure #4 Bank Rock - before and after pictures of completed maintenance.

Figure 190. Structure #5 Deflector - before and after pictures of completed maintenance.

Figure 191. Structure #6 - before and after picture of completed maintenance.

Figure 192. Structure #7 Armour Stone - bank stabilization

Figure 193. Structure #8 Armour Stone Rock Sill

Figure 194. Structure #9 - Armour Stone - bank stabilization

Figure 195. Continuation of structure #9 - Armour stone - bank stabilization.

Figure 196. Structure #10 Armour Stone - bank stabilization.

Figure 197. Structure #11 Armour Stone - bank stabilization.

Figure 198. Structure #12 Armour Stone - bank stabilization.

Figure 199. Structure #13 Armour Stone - bank stabilization.

Figure 200. Structure #14 Armour Stone - bank stabilization.

Figure 201. Structure #15 Bank Rock - before and after pictures of completed maintenance.

Figure 202. Structure #16 Armour Stone - bank stabilization.

Figure 203. Structure #17 Armour Stone - bank stabilization.

Figure 204. Structure #18 Armour Stone - bank stabilization.

Figure 205. Structure #19 Deflector - before and after pictures of completed maintenance.

Figure 206. Structure #20 Armour Stone - bank stabilization, across from structure #19.

Figure 207. Structure #21 Deflector - before and after pictures of completed maintenance.

Figure 208. Structure #22 Bank Rock - before and after picture of completed maintenance.

Figure 209. Structure #23 Bank Rock - before and after picture of completed maintenance.

Figure 210. Structure #24 Diggerlog - before and after picture of completed maintenance. This log was cut in half during installation due to its weight.

Figure 211. Structure #25 Deflector - before and after picture of completed maintenance.

Figure 212. Structure #26 Channel Blocker - no maintenance required.

Figure 213. Structure #27 Deflector - before and after picture of completed maintenance.

Figure 214. Structure #28 Deflector

Figure 215. Structure #29 Diggerlog and Deflector - before and after picture of completed maintenance. (water levels are high in the after photo)

Figure 216. Structure #30 Deflector - before and after picture of completed maintenance.

Figure 217. Structure #31 Diggerlog and Deflector - before and after picture of completed maintenance.

Figure 218. Structure #32 Deflector - before and after picture of completed maintenance.

Figure 219. Structure #33 Deflector - before and after picture of completed maintenance.

Figure 220. Structure #34 Deflector - before and after picture of completed maintenance.

Fish 

Figure 221. Structure #35 Channel Blocker - no maintenance required.

Figure 222. Structure #36 Deflector - didn't require any maintenance.

Deflector, showing photo before maintenance.

Figure 223. Structure #37 Deflector - before and after pictures of completed maintenance.

Figure 224. Structure #38 Deflector - before and after picture of completed maintenance.

Figure 225. Structure #39 Channel Blocker constructed with rocks - before and after pictures of completed maintenance.

Figure 226. Structure #40 Bank Rock - no maintenance required.

Figure 227. Structure #41 Two Tier Channel Blocker - before and after picture of completed maintenance.

The photos below show the upstream structures from MacDonald Bridge on Campbells Road. No maintenance was done due to the poor condition of the structures. Bank rock remained in good condition, but the deflector structures had blown out over the winter months due to them not being braced in by logs and rebar. Each deflector and rock sill will require a full rebuild.

Figure 228. Structure #42 Bank Rock

Figure 229. Structure #43 Bank Rock - no maintenance required.

Figure 230. Structure #44 Bank Rock - no maintenance required.

Figure 231. Structure #45 Deflector - requires full rebuild.

Figure 232. Structure #46 Bank Rock - no maintenance required.

Figure 233. Structure #47 Deflector - requires full rebuild.

Figure 234. Structure #48 Bank Rock - no maintenance required.

Figure 235. Structure #49 Deflector - requires full rebuild.

Figure 236. Structure #50 Bank Rock - no maintenance required.

Figure 237. Structure #51 Bank Rock - no maintenance required.

Figure 238. Structure #52 Bank Rock

Figure 239. Structure #53 Deflector - requires a full rebuild.

Figure 240. Structure #54 Deflector - requires a full rebuild.

Figure 241. Structure #55 Rock Sill

Figure 242. Structure #56 Rock Sill - requires maintenance.

The photos below show the structures upstream from the bridge at the bottom of Campbell's Road. Most of the structures are deflectors and are blown out due to them not being braced in with logs and rebar. Each deflector will require a full rebuild.

Figure 243. Structure #57 Deflector - upstream from the bottom of Campbells road. This structure needs to be rebuilt.

Figure 244. Structure #58 Deflector - requires a rebuild.

Figure 245. Structure #59 Double Deflectors - requires a rebuild.

Figure 246. Structure #60 Double Deflectors - requires a rebuild.

Figure 247. Structure #61 Deflector - missing and requires a rebuild.

Figure 248. Structure #62 Deflector - missing and requires a rebuild.

Figure 249. Structure #63 Deflector - missing and requires a rebuild.

Other Photos:
Photos taken of debris jams, cut trees and remnants of beaver dams, tributaries and braiding.