

**North River LaHave**

**Sub-watershed**

**Fish Habitat**

**Restoration Plan**

**2019**

**Prepared by**  
LaHave River Watershed Project  
Coastal Action



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## 1. Restoration Plan Objectives

The LaHave River Watershed Project began in 2007 with the goals of developing a long-term record of the river's health through water quality monitoring and the creation of a watershed management plan. The LaHave River Watershed is a large (1700 km<sup>2</sup>), highly branched system, therefore, development of a watershed management plan is being done on a more feasible sub-watershed scale. Sub-watershed Fish Habitat Restoration Plans have been developed for several sub-watersheds in the LaHave and these documents are often adapted and updated as new information is collected.

The objective of this restoration plan is to develop a sound understanding of the environmental conditions within the North River Sub-watershed, which will contribute to the overall goal of a LaHave River Watershed Management Plan. By assessing factors such as land-use practices, aquatic connectivity, fish habitat conditions, riparian health, and water quality, we will be able to identify harmful environmental impacts and carry out restoration activities to address issues.

<b>Objectives</b>	<ul style="list-style-type: none"><li>● Investigate land-use practices within the sub-watershed and identify the potential environmental impacts stemming from these practices.</li><li>● Assess aquatic connectivity within the sub-watershed by identifying culverts and debris blockages which are impeding fish passage.</li><li>● Assess the riparian and in-stream fish habitat conditions of the watercourses within the sub-watershed.</li><li>● Identify and prioritize areas within the sub-watershed which need restoration activities (i.e., digger logs, bank stabilization, riparian planting, debris removal, livestock fencing).</li></ul>
<b>Specific Goals</b>	<ul style="list-style-type: none"><li>● GIS analysis of the sub-watershed to identify land-use types, stream crossing locations, and high priority areas in need of assessment.</li><li>● Complete habitat assessments in watercourses within the sub-watershed (fish habitat, riparian health, water quality).</li><li>● Complete an assessment of aquatic connectivity within the sub-watershed by conducting culvert assessments and identifying and prioritizing barriers to fish passage for remediation.</li><li>● Complete various restoration projects within the sub-watershed to enhance fish habitat and improve the health of the LaHave River Watershed.</li><li>● Complete various public education and outreach initiatives to engage the public in local environmental issues, provide volunteer opportunities, and foster a sense of watershed stewardship within the local communities.</li></ul>

## 2. Introductory Information – North River Sub-watershed

1	Location in province (town[s], county, and region)	<p><b>Watershed:</b> LaHave River Watershed</p> <p><b>Location:</b> Lunenburg County; Nova Scotia Southern Upland Region</p> <p><b>Nearest Communities:</b>  Stanburne  East Dalhousie  New Germany  Crossburn  Cherryfield</p>
2	Watershed area (square km)	364 km <sup>2</sup>
3	Watershed drains into (include coordinates of confluence)	E:0359406 N:4940230
4	Distance of watercourse mouth from ocean (km)	44.99 km
5	Distance of watercourse mouth from head of tide (km)	2.87 km
6	Natural watercourse width at mouth (m)	10 m
7	Length of watercourse (km)	26 km
8	Elevation at headwaters (m)	95 m
9	Elevation at mouth (m)	66 m
10	Lake(s) within watershed (provide name[s], approx. size [square km] and known or suspected impacts)	<p>There are 21 lakes within the sub-watershed:</p> <p>Lake Torment 2.79 km<sup>2</sup>  Black Duck Lake 0.63 km<sup>2</sup>  Owen Lake 0.08 km<sup>2</sup>  Saturday Lake 0.66 km<sup>2</sup>  Spectacle Lake 0.34 km<sup>2</sup>  Mack Lake 0.37 km<sup>2</sup>  Tomahawk Lake 0.18 km<sup>2</sup>  Midconner Lake 0.03 km<sup>2</sup>  South Twin Lake 0.21 km<sup>2</sup>  Oak Lake 0.27 km<sup>2</sup></p>

		<p>Mud Lake 0.03 km<sup>2</sup>  North Twin Lake 0.17 km<sup>2</sup>  Palmer Lake km<sup>2</sup>  Third Pond 0.02 km<sup>2</sup>  First Pond 0.01 km<sup>2</sup>  Rocky Pond 0.01 km<sup>2</sup>  Armstrong Lake 0.89 km<sup>2</sup>  Chain Lakes 0.76 km<sup>2</sup>  South Twin Lake 0.21 km<sup>2</sup></p>
11	<p>Significant tributaries within watershed (name[s] and length[s])</p>	<p>Tributaries of the North River Sub-watershed:</p> <p>North River 24.34 km  Johnson Brook 4.18 km  Robar Brook 9.96 km  Saturday Lake Brook 2.98 km  Bob and Joan Brook 5.85 km  Black Duck Lake Brook 2 km  Camp Four Lake Brook 3.14 km  Ozzie Meadow Brook 3.18 km  Nimchin Brook 3.7 km  Wentzell Brook 6.29 km  Tomahawk Stream 17.11 km  Hamilton Brook 7.73 km</p>
12	<p>Most common substrate type and size</p>	<p>The substrate varies throughout the watershed: on average there is 30% fines, 25% gravel, 30% cobble, and 15% boulders. There is bedrock throughout the entire LaHave Watershed including the North River Sub-watershed.</p>
13	<p>Soil type(s) and geological characteristics</p>	<p><b>Soils:</b>  The North River sub-watershed spans three different Counties; Lunenburg, Annapolis, and Kings. It falls mainly within Kings County which is comprised of many different soil types. The two main soil types found in the North River are Gibraltar and Bridgetown.</p> <p>Gibraltar soil is grayish-brown to coarse sandy loam over yellowish-brown sandy loam. Its parent materials are light yellowish-brown stony sandy loam till derived from granite.</p> <p>Bridgetown soil is dark brown friable sandy loam over yellowish-red to reddish-brown sandy loam. Contains some mottling. Its parent material is reddish-brown sandy loam till composed of a mixture of reddish till and granitic material.</p> <p>Other soils found in moderate quantities in the North River are Wolfville Stony Loam and Halifax Sandy Loam.</p>

		<p>Wolfville Stony Loam is dark brown stony loam over reddish-brown stony loam. Its parent material is dark reddish-brown sandy clay loam till. Good drainage.</p> <p>Halifax Sandy Loam is light brown sandy loam over yellowish-brown sandy loam. Its parent material is olive grey coarse sandy loam till; stony and firm. Also has good drainage.</p> <p>Pockets of Rocky Land are found throughout the North River sub-watershed as well. Rocky Land is soil areas with 50% or more of rock outcrop or boulders. Its parent material is chiefly granite or quartzite bedrock.</p> <p><b>Bedrock:</b></p> <p>The two main types of bedrock in the North River sub-watershed are M€Ggp and Dseflm.</p> <p>M€Ggp, also known as Government Point Formation, is part of the Goldenville group. It is grey with thin- to thick-bedded metasandstone with minor-c-silicate nodules and rare manganese nodules; laminated, green to greyish-green to purple metasiltstone and rare black slate; trace fossils common.</p> <p>Dseflm, known as East Dalhousie Leucomonzogranite, is buff, orange, pink, red, white; fire-grained, equigranular, or slightly megacrystic.</p> <p>Sources:</p> <ul style="list-style-type: none"> <li>• Cann, D.B., and J.D. Hilchey. Soil Survey of Lunenburg County Nova Scotia</li> <li>• <a href="https://novascotia.ca/natr/meb/geoscience-online/interactive-bedrock-geo-map.asp">https://novascotia.ca/natr/meb/geoscience-online/interactive-bedrock-geo-map.asp</a></li> </ul>
14	Average water temperature in summer (June-September)	<b>17.68°C</b>
15	Peak water temperature	<b>20.20°C</b>
16	pH range	<p>The average pH in the North River is 5.71, this range is ideal for fish habitat.</p> <p>The pH along many small tributaries within the North River is low, ranging from 4-6. The average pH of the small tributaries that were assessed is 5.03.</p>
17	Native fish species present	<p>Native fish species in the LaHave Watershed are as follows:</p> <p>American eel  Atlantic salmon  Blacknose shiner  Brook trout</p>

		<p>Brown bullhead  Common shiner  Creek chub  Gaspereau  Golden shiner  Lake chub  Lamprey Eel  White perch  White sucker  Yellow perch</p> <p><b>Note:</b> This is not a complete list and is not specific to the North River Sub-watershed.</p>
18	Non-native fish species present	<p>Smallmouth bass have been confirmed throughout a large portion of the North River Sub-watershed. There is currently no record of chain pickerel in the North River Sub-watershed. *See map on page 38 for specific locations.</p>
19	Endangered / threatened / at risk species present (aquatic or non-aquatic)	<p>The following is an incomplete and unconfirmed list of provincial species of fauna considered at risk which may occur within the North River Sub-watershed:</p> <p>Southern Upland Atlantic salmon – Endangered  Monarch butterfly – Endangered  Little Brown Myotis – Endangered  Northern Myotis – Endangered  Tri-colored Bat – Endangered  Barn Swallow – Endangered  Canada Warbler – Endangered  Rusty Blackbird – Endangered  Chimney Swift – Endangered  Eastern Mainland Moose – Endangered  American Marten – Endangered  Canada Lynx – Endangered  American Marten – Endangered  Blanding’s Turtle – Endangered  Harlequin Duck – Endangered  Brook Floater – Threatened  Olive-sided Flycatcher – Threatened  Eastern Whip-poor-will – Threatened  Wood Turtle – Threatened  Common Nighthawk – Threatened  Yellow Lampmussel – Threatened  Eastern Ribbonsnake – Threatened  Evening Grosbeak – Vulnerable  Snapping Turtle – Vulnerable</p>

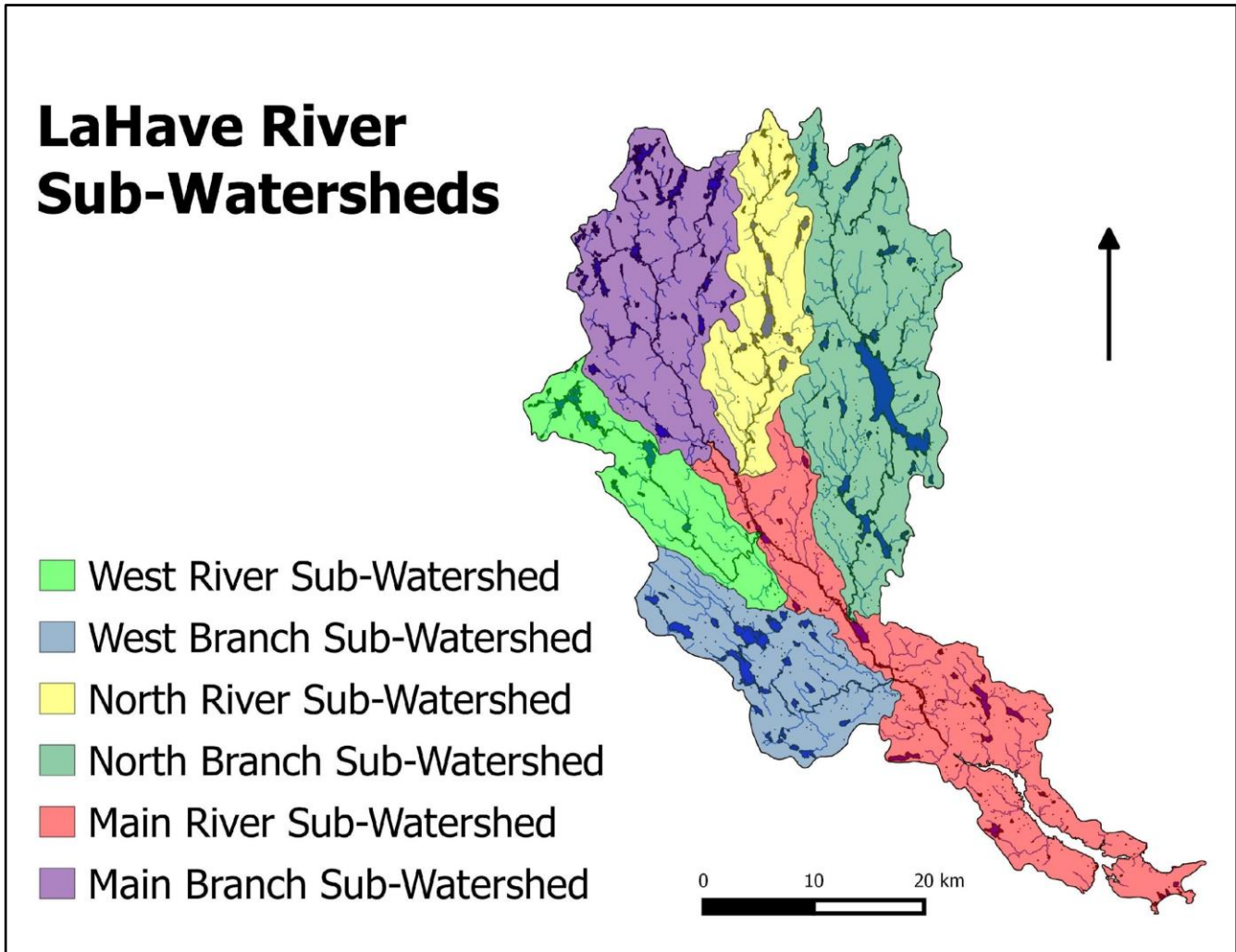


		<p>Eastern Wood Peewee – Vulnerable  Bobolink – Vulnerable  Peregrine Falcon – Vulnerable</p> <p>Sources:  COSEWIC. 2012. Atlantic Salmon – Nova Scotia Southern Upland Population.  Nova Scotia Species at Risk Guide 2<sup>nd</sup> edition.  Nova Scotia Department of Natural Resources. Nova Scotia’s Species at Risk.</p>
20	Angling	<p><b>Speckled trout:</b>  April 1 to September 30  Bag limit: 5 fish per day  September 1 to September 30 no speckled trout may be retained, and natural bait is prohibited in all waters for all trout species, including Special Trout Management Areas, except for waters with extended seasons for trout.</p> <p><b>White Perch, Yellow Perch, Brown Bullhead, and White Sucker:</b>  April 1 to October 30  Bag limit: 25 fish</p> <p><b>Chain Pickerel:</b>  Open season coincides with an open season for sportfish April 1 to October 31  Bag limit: 100 fish</p> <p><b>Smallmouth (black) bass:</b>  April 1 to October 31  Bag limit: 5 fish</p> <p><b>Lake Whitefish:</b>  April 1 to October 31  Bag limit: 8 fish</p> <p><b>Gaspereau:</b>  April 1 to October 31  Bag limit (Netting and angling): 20 fish</p> <p><b>Shad:</b>  April 1 to October 31  Bag limit: 5 fish</p> <p><b>Eel:</b>  April 1 to October 31  Minimum size limit is no less than 35 cm</p>

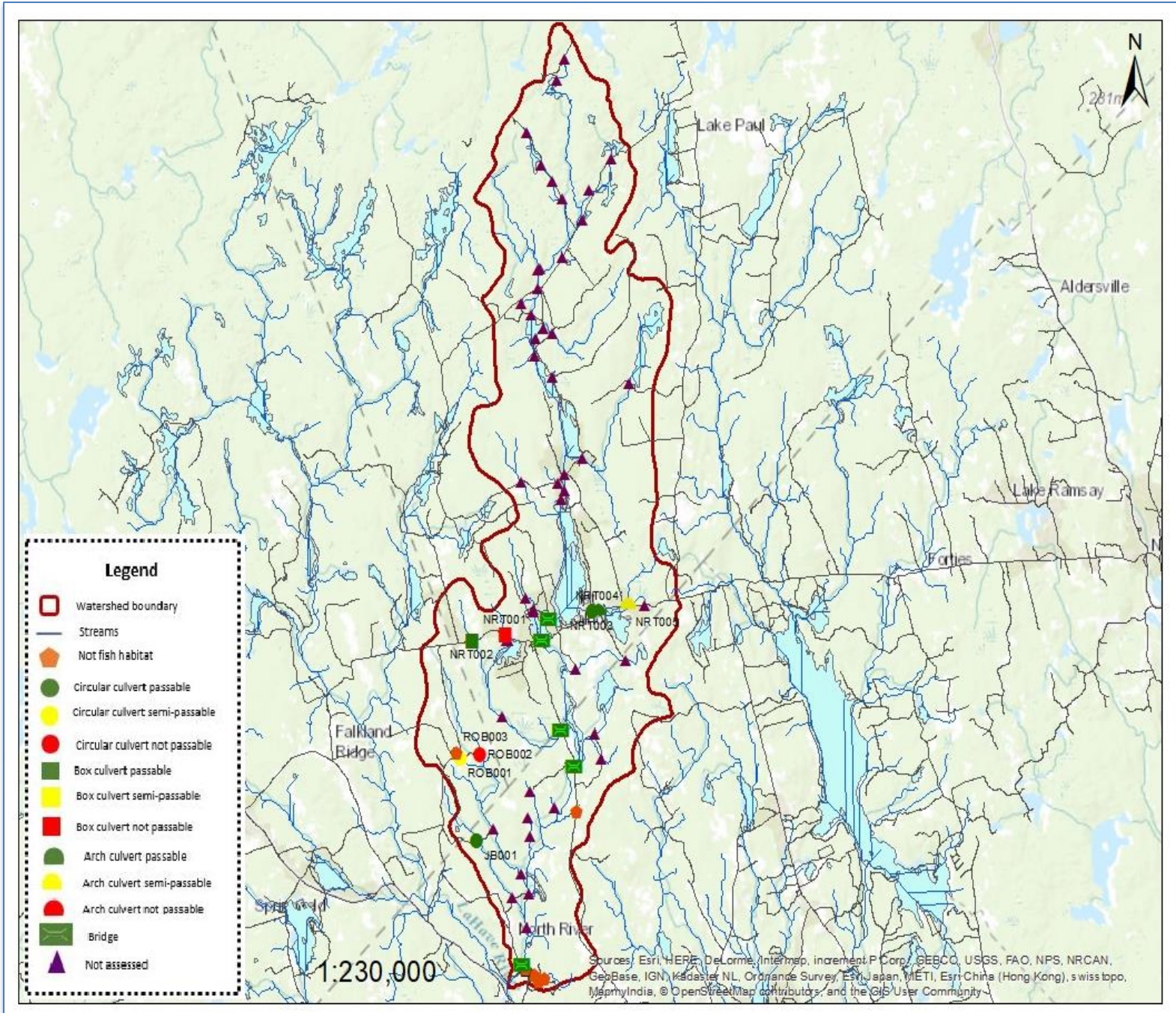
		<p>Bag limit: 10 fish</p> <p><b>Atlantic Salmon:</b> Closed all season</p>
22	Forestry activities and impacts (explain)	<p>Throughout the watershed, there are areas where forestry clear-cutting (more than a 50% cut) has occurred, as well as Christmas Tree farming. Where ideally a minimum riparian zone of 30 – 40 m would be kept along the perimeter of the watercourse, there are some sections of private woodlots where the owner has cut to the bank. Under the N.S. Wildlife Habitat and Watercourses Protection Regulations, forest harvesters are required to maintain a 20 m riparian buffer along all watercourses. Clearing of riparian area often results in increased water temperatures due to reduced cover from shade. Species such as Atlantic salmon require cold, highly oxygenated water to survive throughout their various life stages. Degradation of riparian areas can also result in increased levels of suspended solids which negatively impact the ability for fish to breathe and migrate.</p> <p>Unfortunately, the Department of Natural Resources no longer tracks compliance of this regulation annually and has never seen more than a 30% compliance rate. As well, there are several instances where logging roads or old trails pass through the watercourse. These practices have a major impact on the water quality and wildlife habitat in the area. With a lack of healthy riparian area, fish habitat may be destroyed due to a rise in water temperature from lack of shade. As well, an increase in runoff and infiltration may occur due to the decrease in riparian vegetation. This increase in runoff and infiltration may increase the fines found in the watercourse, filling in substrate and creating inadequate spawning ground. The lack of riparian vegetation may lead to a decrease in the food supply available for aquatic species.</p> <p>Sources: Nova Scotia Environment. 2013. Wildlife Habitat and Watercourses Protection Regulations. Rankin, J. &amp; Miller, M. 2014. 'Province Failing on Water Governance'.</p>
23	Urban/residential development impacts (explain)	<p>There are many areas along the North River, its lakes and tributaries, where cabins, cottages, campers, and homes have been built; in some cases, landowners have cleared all forest</p>

		and vegetation up to the water's edge. Certain lakeshores within the Sub-watershed such as Lake Torment, Black Duck Lake, and Mack Lake have been developed for a mixture of cottages and homes. The high level of human activity on these lakes may be impacting water quality and potentially aquatic habitat.
24	Agricultural impacts (explain)	Agricultural impacts within the North River are very low. Agriculture in this sub-watershed consists of a few hobby farms and some Christmas tree plantations.
25	Other industry impacts (explain if applicable)	<p>Acid rain has a major impact on water quality, wildlife, and wildlife habitat within the watershed. If soils are unable to buffer or neutralize the effects of the acid rain, then a decrease in pH of water and soils will occur. This decrease in pH can cause the destruction of certain species of wildlife and vegetation who cannot thrive at a low pH. Many rivers in Southwestern NS have been significantly impacted by acid precipitation due to the poor buffering capacity of soils in this region. Acidification impacts have been more severe in the western half of the LaHave River Watershed, due to the high acid rock drainage potential of that area.</p> <p>As well, a low pH can cause metals to precipitate out of soil and water, where it may then accumulate in salmonids. This accumulation causes physical stress on the fish and may result in poor reproductive capability. Destruction of emerging fry or successfully laid eggs may occur due to low water pH.</p> <p>Sources: Trudell, L. L. and White, C. E. 2013. Overview map showing locations of bedrock acid rock drainage potential maps for the southwestern area of Nova Scotia.</p>
26	Historical conditions, impacts and considerations	There is evidence of old pastures and ATV trails in some of the riparian areas of the North River sub-watershed. The increase of human activity around some of the lakes situated in the mid-point of the watershed has likely altered water quality over time.
27	Other information	

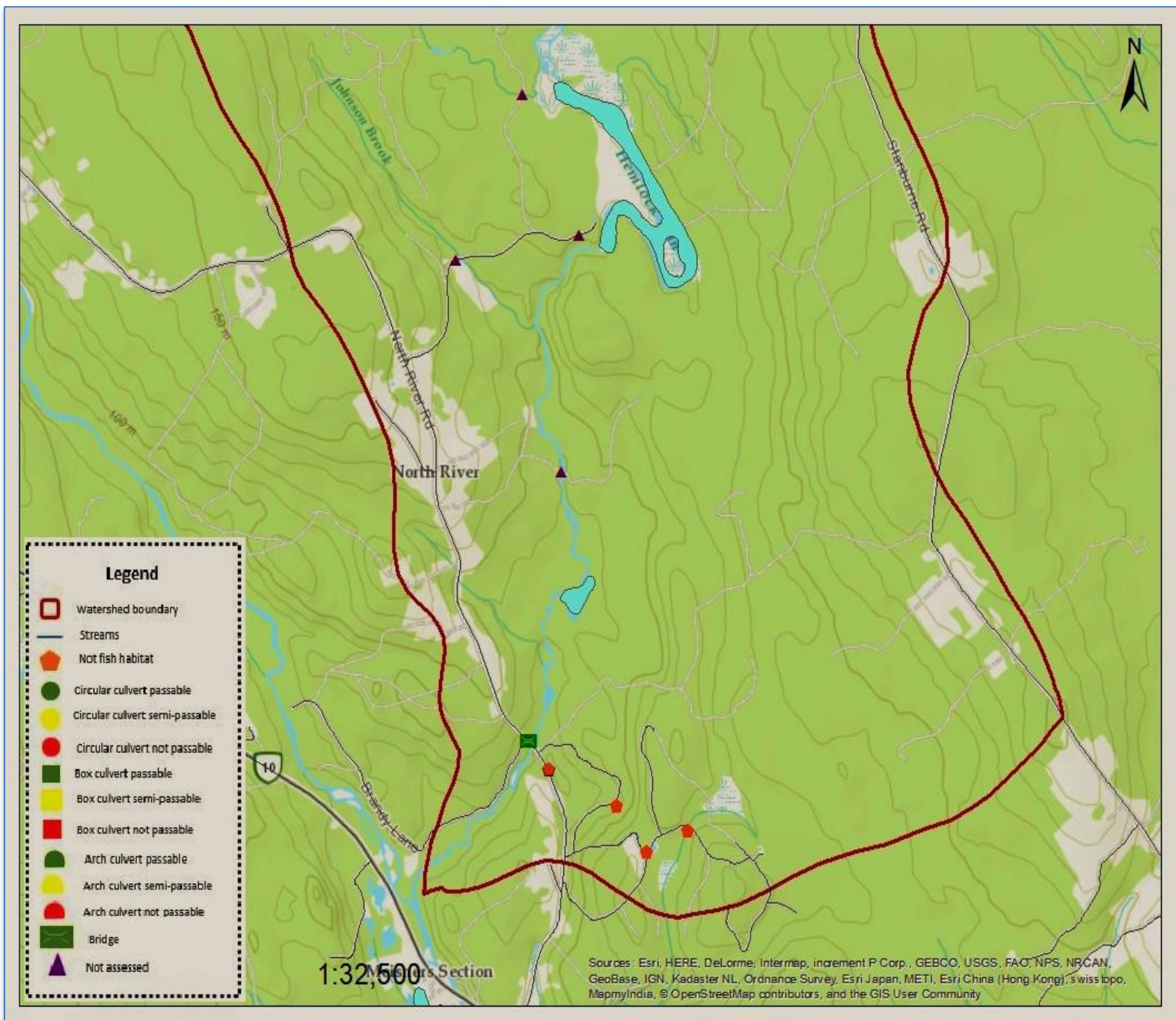
### 3. North River Sub-watershed stream crossing maps and culvert assessment data



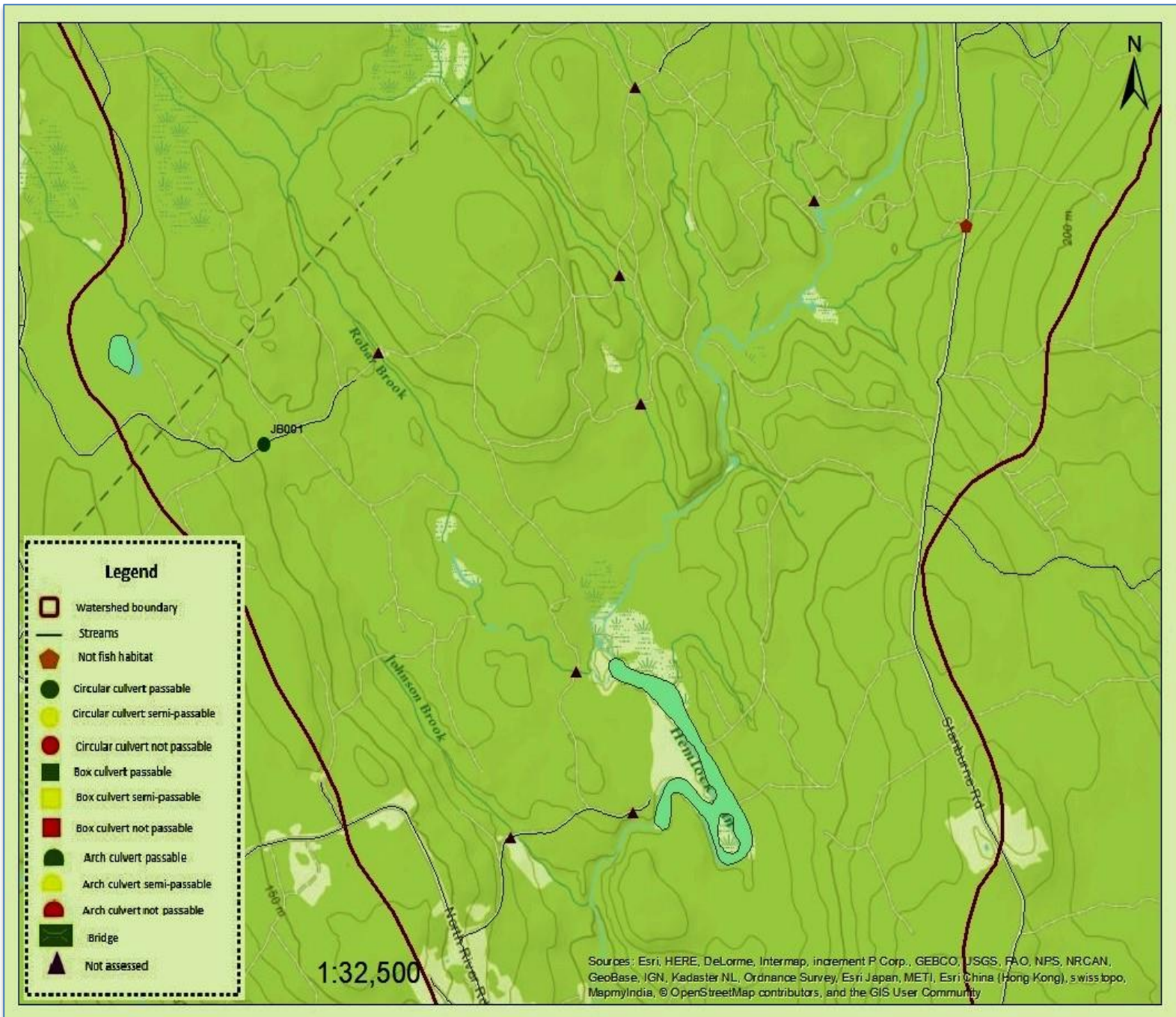
# North River Stream Crossing Assessment Maps



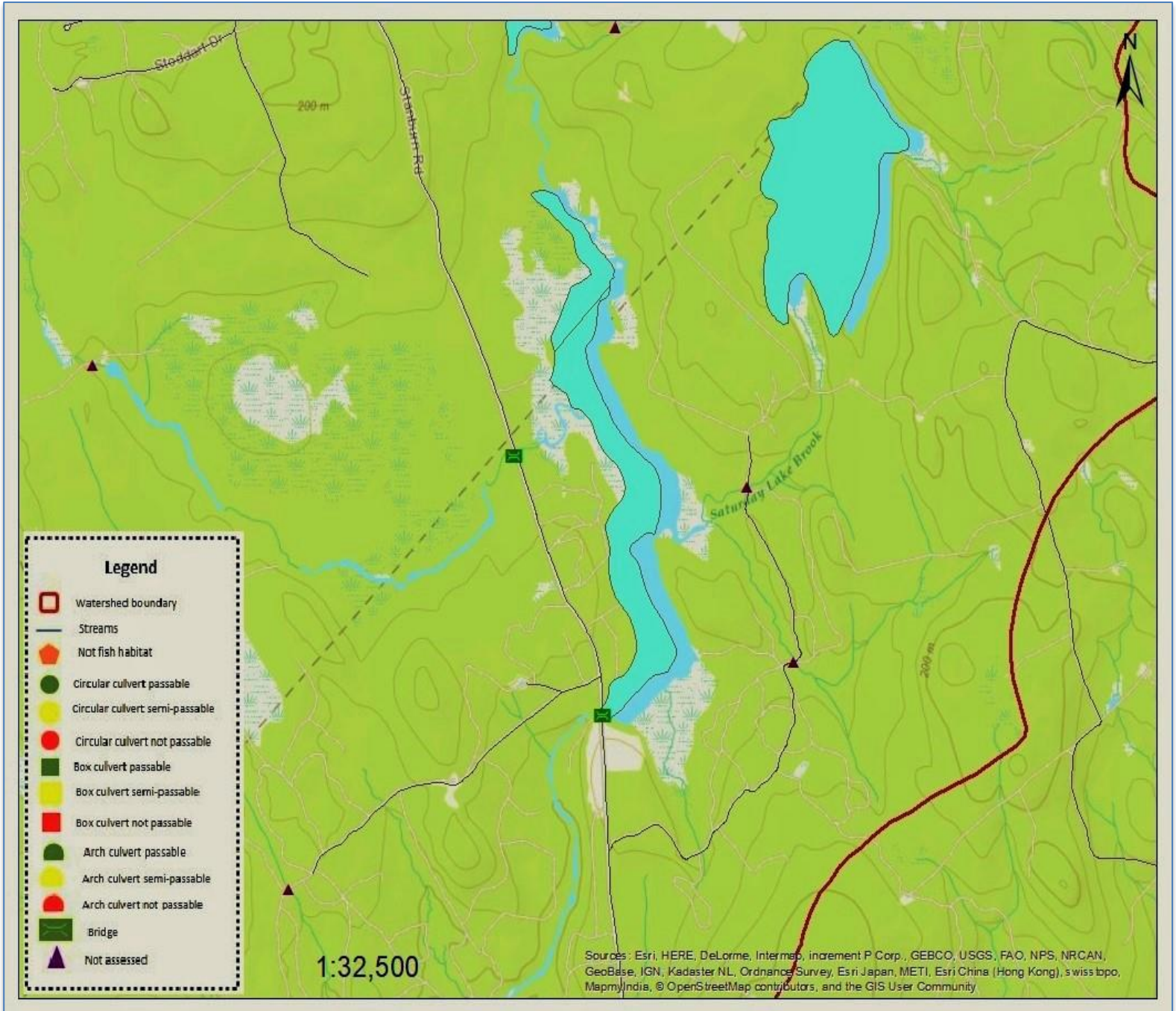
Map showing all crossings in the North River Sub-watershed and the current status regarding fish passage.



Map 1.

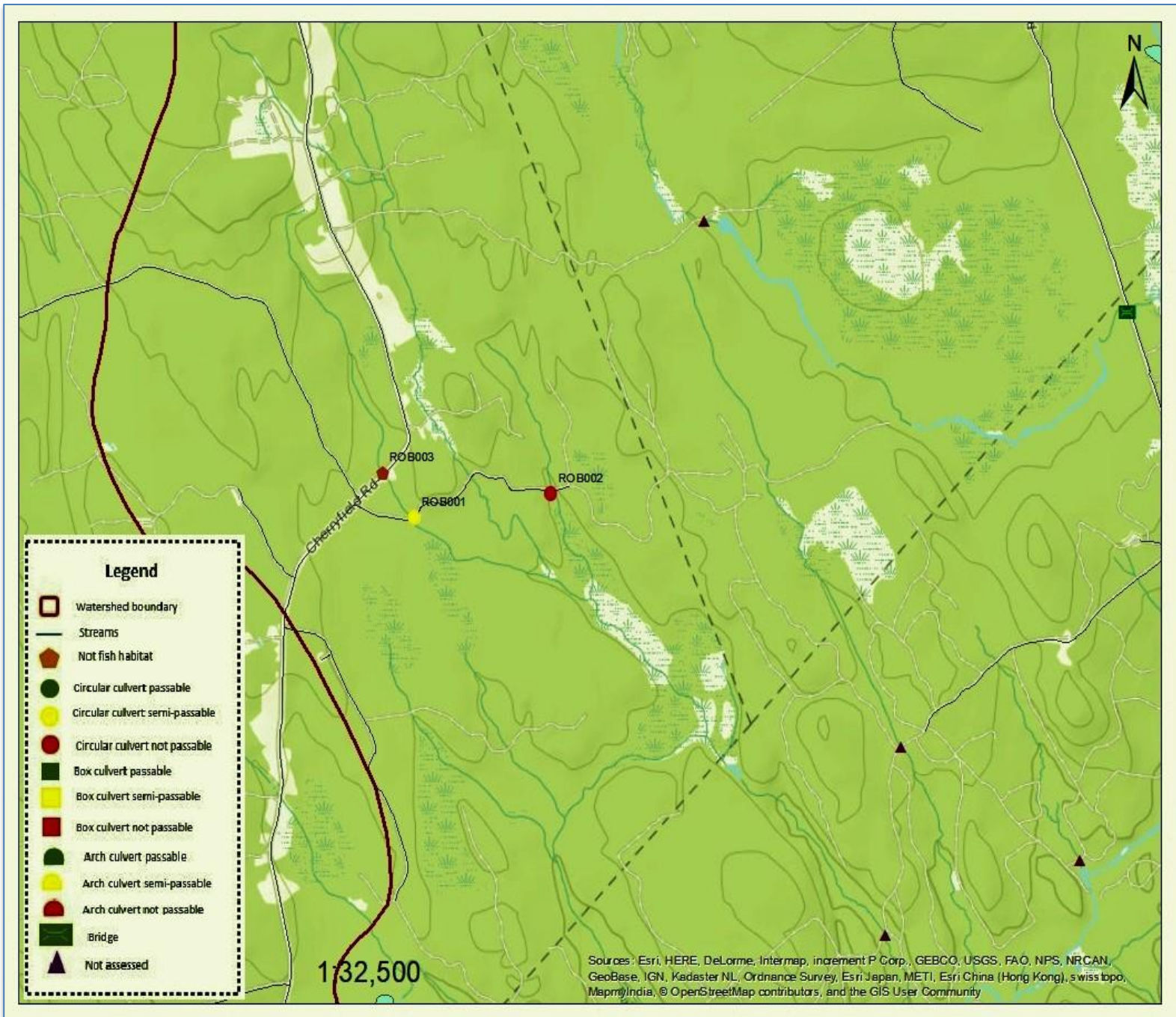


Map 2.

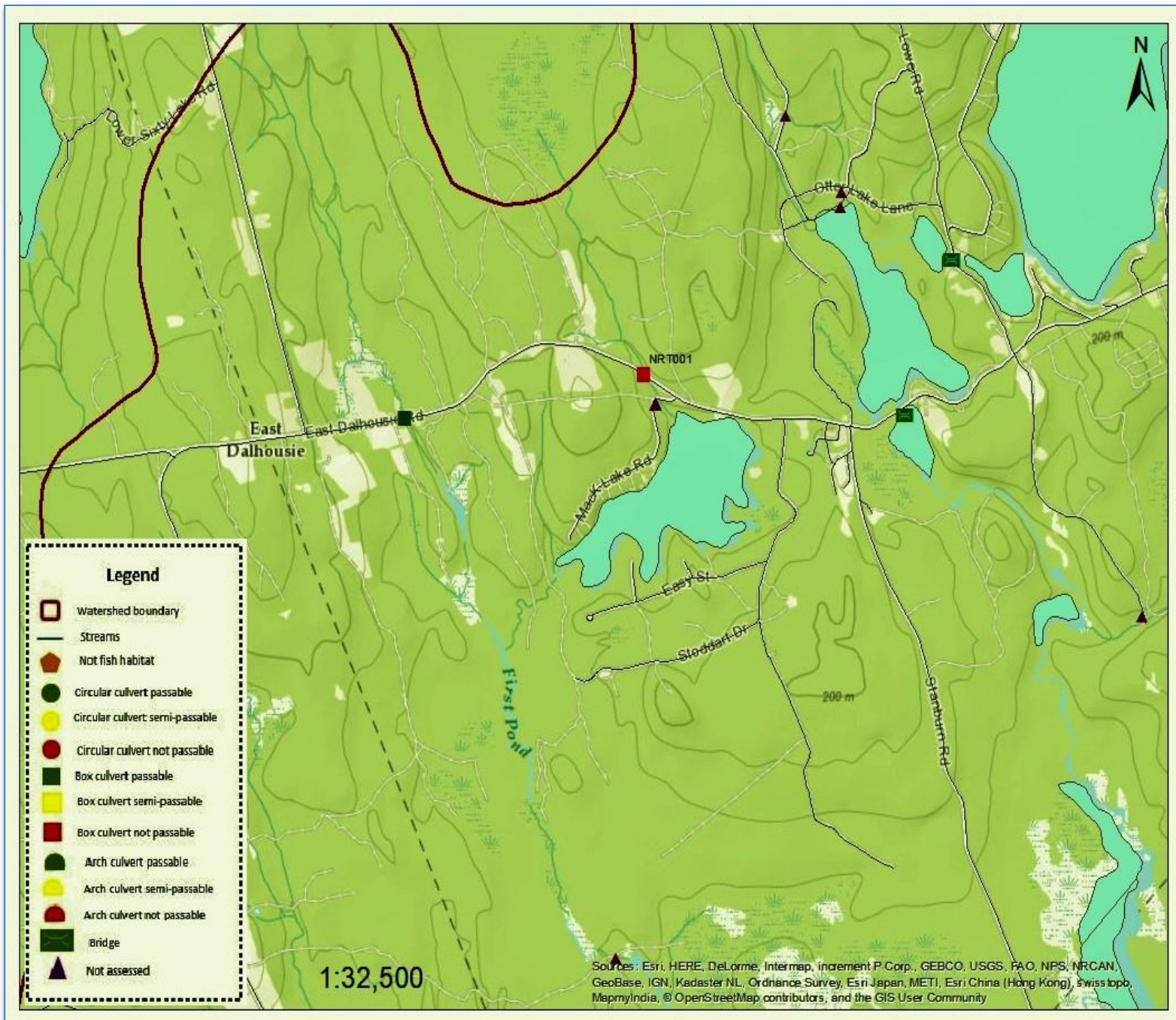


Map 3.

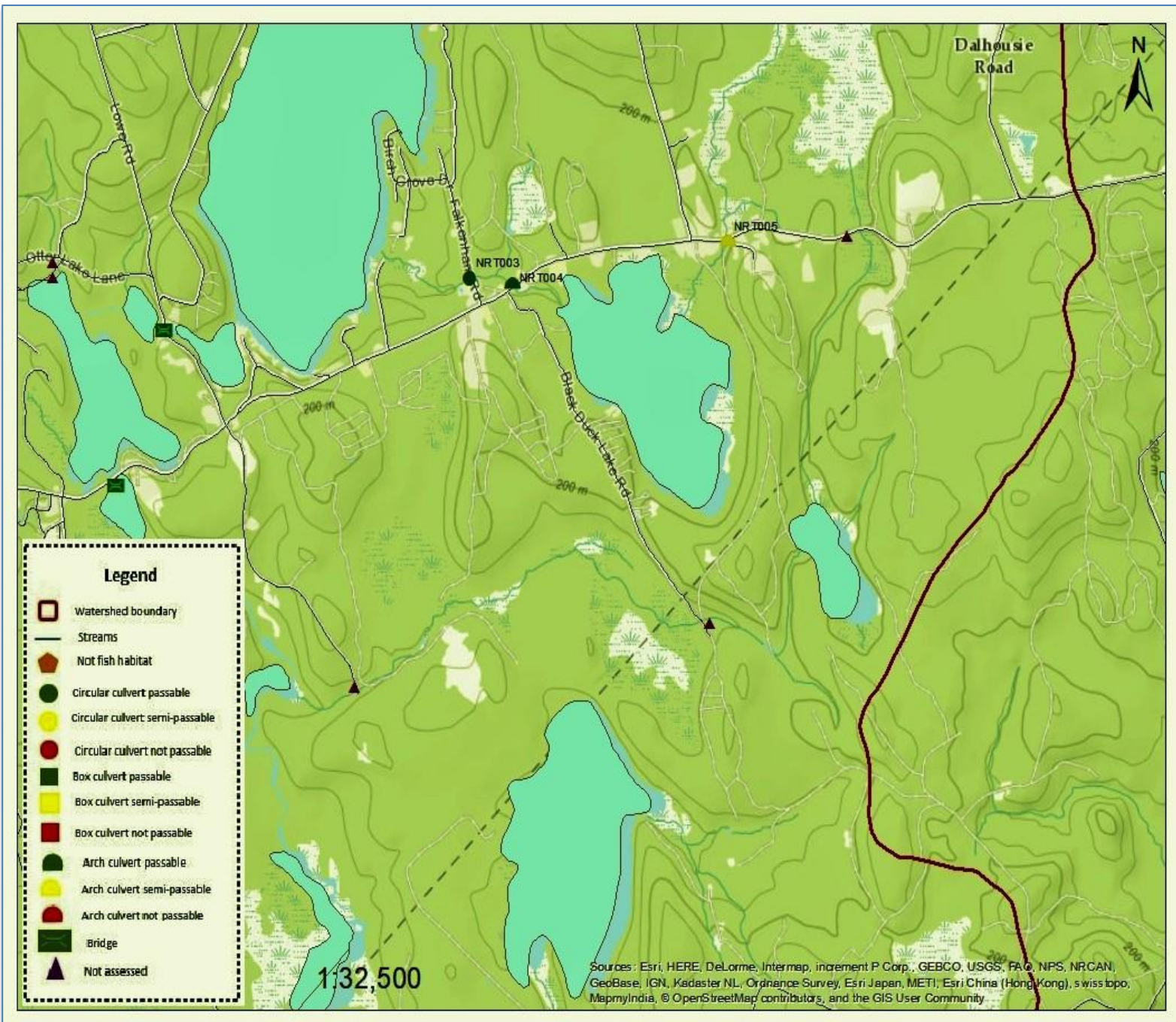




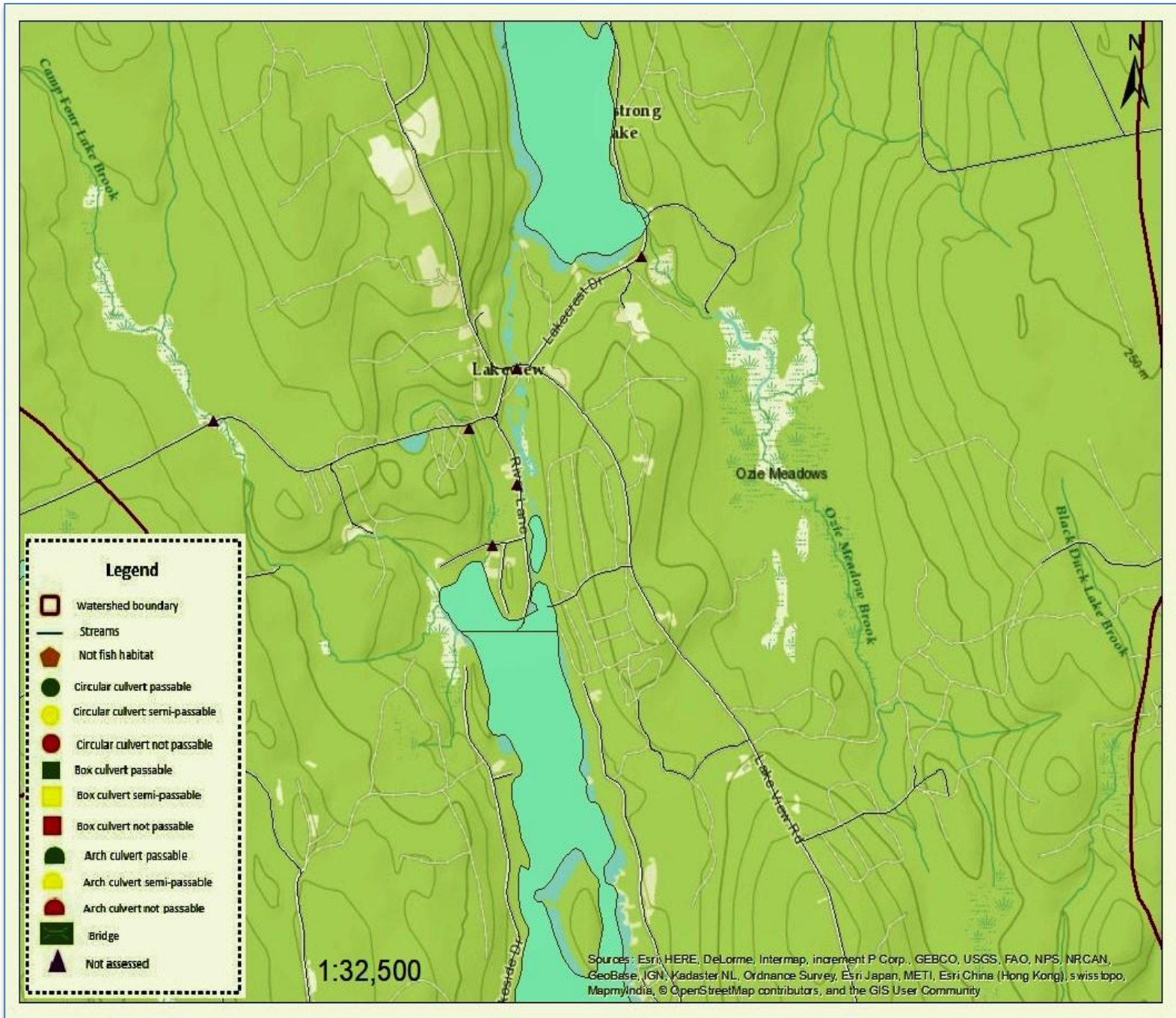
Map 4.



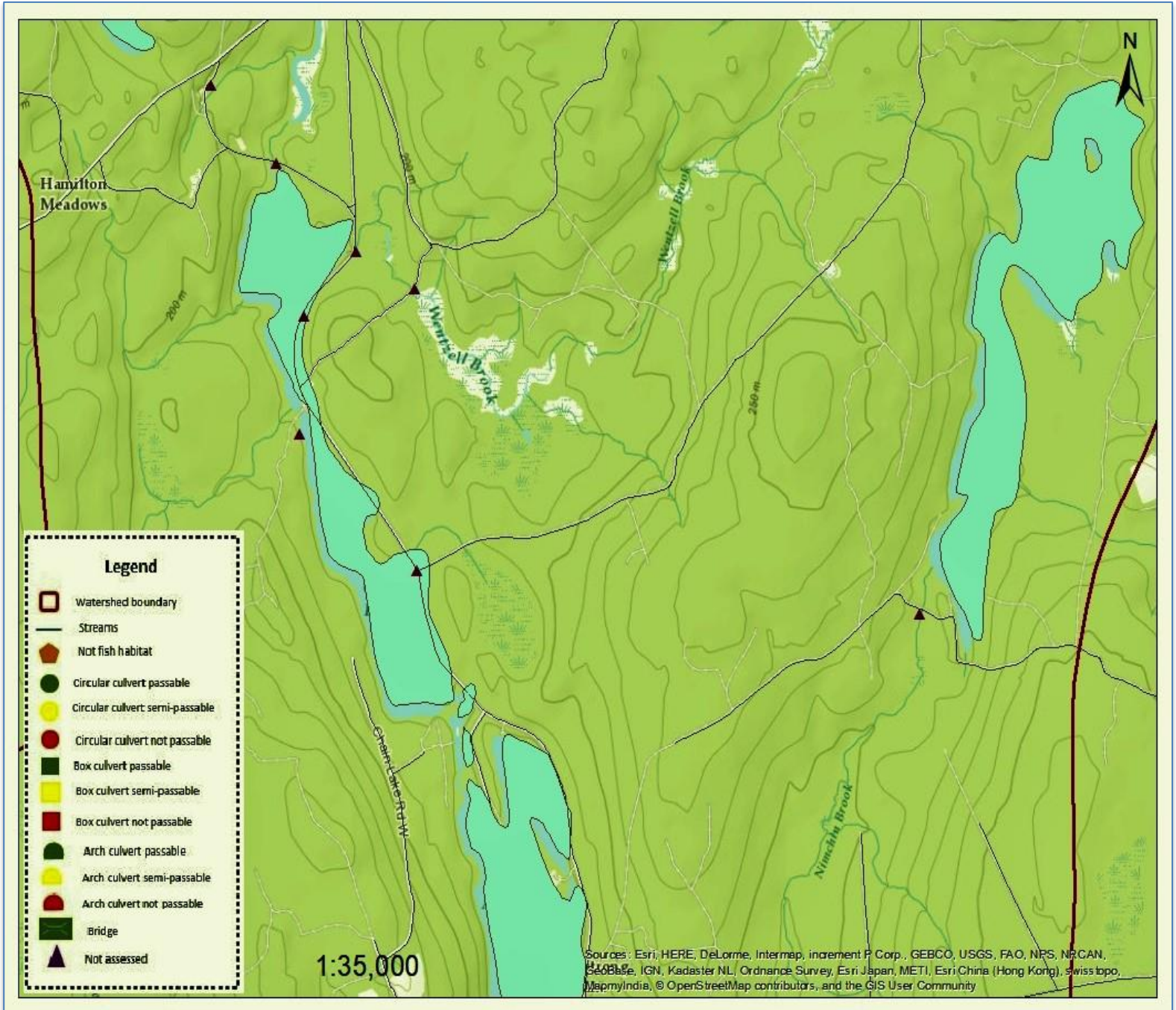
Map 5.



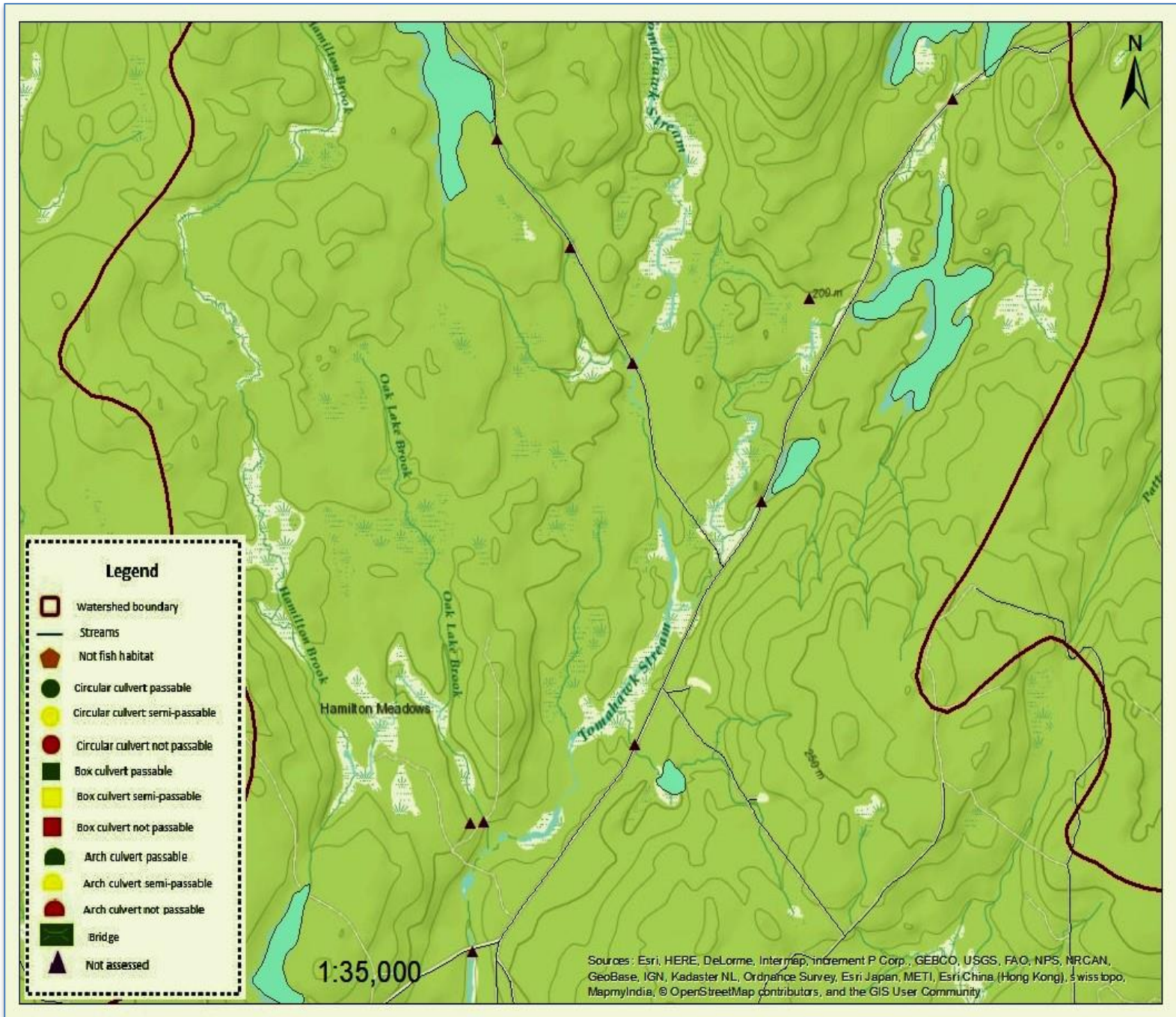
Map 6.



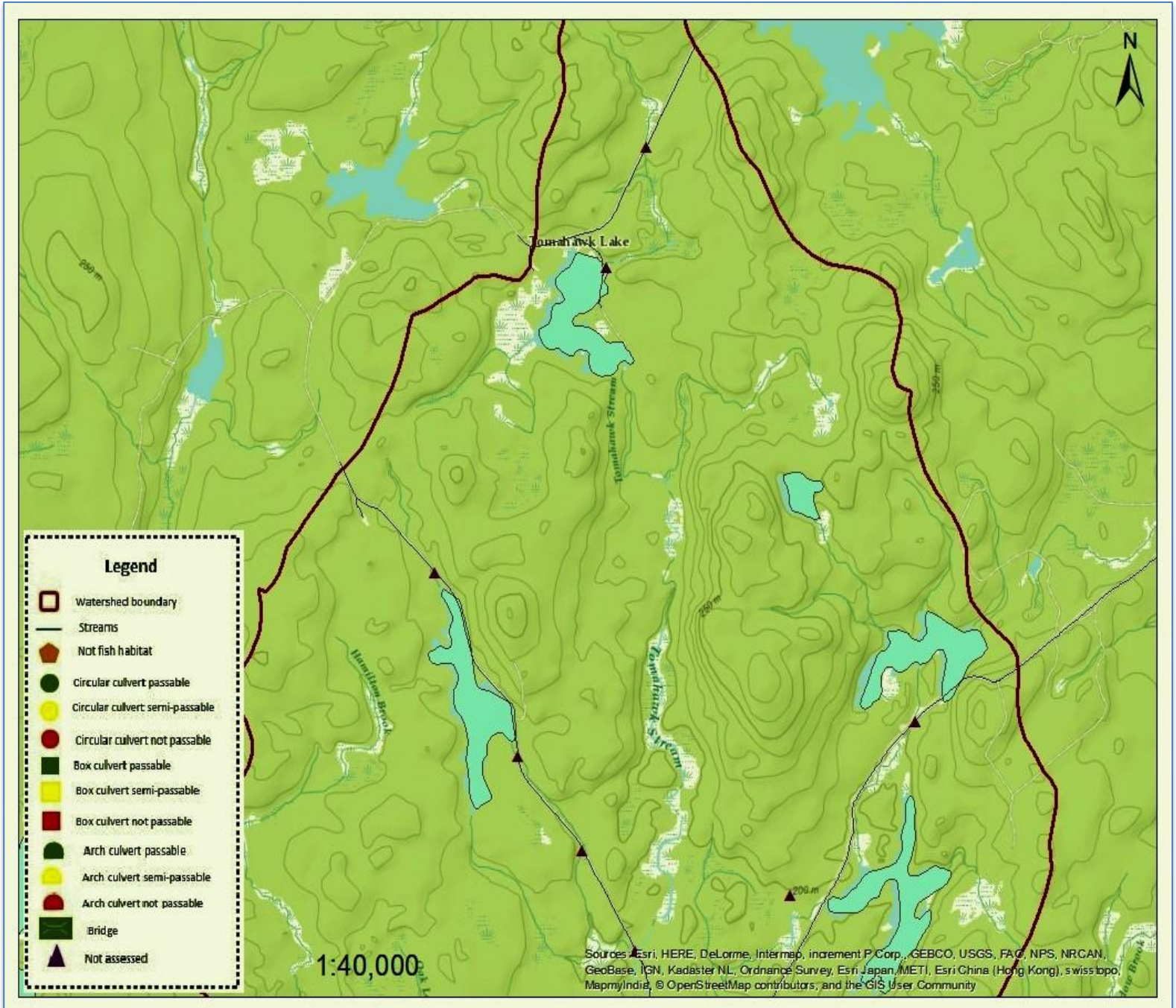
Map 7.





Map 8.





Map 9.




Map 10.



Culvert ID	Photo	Stream Name/ Road Name	Coordinates	Culvert Information	Site Details	Barrier Status	Prescription for Restoration	Project Priority Ranking	Project Status
NRT001		Un-named stream  East Dalhousie Road	E 0359663 N 4952439	<b>Material:</b> Wood <b>Shape:</b> Box <b>Entrance:</b> Mitered <b>Baffles:</b> Absent <b>Deformed:</b> No <b>Culvert Bottom:</b> Unnatural	<b>Date:</b> May 8, 2019 <b>Crew:</b> Simon I, Spencer C <b>Culvert Slope (%):</b> <b>Outflow Drop (cm):</b>  Notes: Partial assessment done  <u><b>YSI</b></u> <b>Temperature:</b> 8.2 <b>DO mg/L:</b> 11.44 <b>SPC:</b> 0.038 <b>TDS:</b> 25 <b>pH:</b> 5.12	No Barrier	N/A	N/A	N/A
NRT002		Un-named stream  East Dalhousie Road	E 0358328 N 4952263	<b>Material:</b> Wood <b>Shape:</b> Box <b>Entrance:</b> Mitered <b>Baffles:</b> Absent <b>Deformed:</b> No <b>Culvert</b>	<b>Date:</b> May 9, 2019 <b>Crew:</b> Simon I, Spencer C <b>Culvert Slope (%):</b> 0.4 <b>Outflow Drop:</b> 0.06  Notes:	Partial Barrier	Installation of baffles/chute	Medium	Incomplete



				<b>Bottom:</b> Natural	Beaver Dam Present  <u>YSI</u> <b>Temperature:</b> 8 <b>DO mg/L:</b> 7.59 <b>SPC:</b> 0.037 <b>TDS:</b> 24 <b>pH:</b> 5.5				
NRT004		Un-named stream  East Dalhousie Road	E 0363280 N 4953140	<b>Material:</b> Corrugated Metal Pipe <b>Shape:</b> Open arch <b>Entrance:</b> Projecting <b>Baffles:</b> Absent <b>Deformed:</b> No <b>Culvert Bottom:</b> Natural	<b>Date:</b> May 9, 2019 <b>Crew:</b> Simon I, Spencer C <b>Culvert Slope (%):</b> N/A <b>Outflow Drop:</b> N/A  Notes: Partial assessment  <u>YSI</u> <b>Temperature:</b> 14.4 <b>DO mg/L:</b> 9.91 <b>SPC:</b> 0.028 <b>TDS:</b> 27 <b>pH:</b> 5.4	No barrier	N/A	N/A	N/A
NRT005		Un-named Stream  East Dalhousie Road	E 0364448 N 4953322	<b>Material:</b> Corrugated metal (Annular) <b>Shape:</b> Open arch <b>Entrance:</b>	<b>Date:</b> May 9, 2019 <b>Crew:</b> Simon I, Spencer C <b>Culvert Slope (%):</b> N/A	Partial barrier	Removal of Beaver dam		

				<p>Projecting  <b>Baffles:</b>  Absent  <b>Deformed:</b>  No  <b>Culvert Bottom:</b>  Natural</p>	<p><b>Outflow Drop:</b>  N/A</p> <p>Notes: Partial assessment due to large beaver dam in culvert</p> <p><b>YSI Temperature:</b>  8.3  <b>DO mg/L:</b>  7.05  <b>SPC:</b> 0.026  <b>TDS:</b> 17  <b>pH:</b> 5.14</p>			Medium	Incomplete
KR001		<p>Un-named Stream  Knox Road</p>	<p>E 0362213  N 4916031</p>	<p><b>Material:</b>  Corrugated Metal (Annular)  <b>Shape:</b>  Circular  <b>Entrance:</b>  Headwall  <b>Baffles:</b>  Absent  <b>Deformed:</b>  No  <b>Culvert bottom:</b>  Unnatural</p>	<p><b>Date:</b> May 21, 2019  <b>Crew:</b> Sam R, Simon I, Spencer C  <b>Culvert Slope (%):</b> N/A  <b>Outflow Drop:</b>  N/A</p> <p>Notes: Partial Assessment</p>	No Barrier	N/A	N/A	N/A

JB001		<p>Johnson Brook</p> <p>Un-named Road off Cherryfield</p>		<p><b>Material:</b> Corrugated Metal Pipe (Spiral)</p> <p><b>Shape:</b> Circular</p> <p><b>Entrance:</b> Projecting</p> <p><b>Baffles:</b> Absent</p> <p><b>Deformed:</b> Yes</p> <p><b>Culvert Bottom:</b> Unnatural</p>	<p><b>Date:</b> May 24, 2019</p> <p><b>Crew:</b> Sam R, Simon I, Spencer C</p> <p><b>Culvert Slope (%):</b> 0.59</p> <p><b>Outflow Drop:</b> 0.04</p>	<p>Partial Barrier</p>	<p>Culvert needs replacement</p>	<p>Medium</p>	<p>Incomplete</p>
BTJ001		<p>Un-named stream</p> <p>Bob and Joan Lane</p>		<p><b>Material:</b> Corrugated Metal (Spiral)</p> <p><b>Shape:</b> Circular</p> <p><b>Entrance:</b> Projecting</p> <p><b>Baffles:</b> Absent</p> <p><b>Deformed:</b> Yes</p> <p><b>Culvert Bottom:</b> Unnatural</p>	<p><b>Date:</b> May 24, 2019</p> <p><b>Crew:</b> Sam R, Simon I, Spencer C</p> <p><b>Culvert Slope (%):</b> 1.8</p> <p><b>Outflow Drop:</b> 0.05</p> <p><b>Notes:</b> Bottom has rotted out</p>	<p>No Barrier</p>	<p>N/A</p>	<p>N/A</p>	<p>N/A</p>
BJ002		<p>Robar Brook</p> <p>Bob and Joan Lane</p>		<p><b>Material:</b> Corrugated Metal Pipe (Spiral)</p> <p><b>Shape:</b> Circular</p> <p><b>Entrance:</b> Projecting</p> <p><b>Baffles:</b></p>	<p><b>Date:</b> June 4, 2019</p> <p><b>Crew:</b> Sam R, Simon I, Spencer C</p> <p><b>Culvert Slope (%):</b> N/A</p> <p><b>Outflow Drop:</b> N/A</p>	<p>Full barrier</p>	<p>Culvert requires replacement</p>	<p>Medium</p>	<p>Incomplete</p>

				<p>Absent  <b>Deformed:</b>  Yes  <b>Culvert Bottom:</b>  Unnatural</p>	<p><b>YSI Temperature:</b>  8.3  <b>DO mg/L:</b>  10.69  <b>SPC:</b> 0.41  <b>TDS:</b> 27  <b>pH:</b> 5.18</p>				
RTB001		<p>Unknown Stream  Falkenham Road</p>	<p>E 0362589  N 4955819</p>	<p><b>Material:</b> Flat smooth metal  <b>Shape:</b> Circular  <b>Entrance:</b> Headwall  <b>Baffles:</b> Absent  <b>Deformed:</b> No  <b>Culvert Bottom:</b> Unnatural</p>	<p><b>Date:</b> June 4, 2019  <b>Crew:</b> Sam R, Simon I, Spencer C  <b>Culvert Slope (%):</b> 0  <b>Outflow Drop:</b> 0</p>	<p>Partial Barrier</p>	<p>Needs chute installed.</p>	<p>Low</p>	<p>Incomplete</p>
NRT003		<p>Unknown Stream  Falkenham Road</p>	<p>E 0394923  N 4914413</p>	<p><b>Material:</b> Corrugated Metal Pipe  <b>Shape:</b> Circular  <b>Entrance:</b> Projecting  <b>Baffles:</b> Absent  <b>Deformed:</b> Yes  <b>Culvert Bottom:</b> Unnatural</p>	<p><b>Date:</b> June 12, 2019  <b>Crew:</b> Sam R, Simon I, Spencer C  <b>Culvert Slope (%):</b> 2.17  <b>Outflow Drop:</b> - 0.16    <b>YSI Temperature:</b>  19.9  <b>DO mg/L:</b> 9.1  <b>SPC:</b> 0.027  <b>TDS:</b> 17.55</p>	<p>Fully backwatered even during low flow making culvert fully passable.</p>		<p>N/A</p>	<p>N/A</p>

					pH: 5.21				

#### 4. Stream assessments and Restoration Opportunities – North River Sub-watershed

Section Number and Site	Stream Feature	Lower Limit (coordinates and landmarks)	Upper Limit (coordinates and landmarks)	Site Details	Adjacent Land Use Considerations	Prescription for Restoration	Project Priority Ranking	Project Status
NR001	Open pool, dark water, riffle/rapids at outflow run at inflow, not much cover, large boulders	4941434, 0360175		<b>Left Bank:</b> Mostly softwood dominant <b>Right Bank:</b> Mixed wood forest, spruce, pine, red maple, fairly steep banks, large exposed boulders, footprint <b>Wetted Width:</b> 65m <b>Bankfull Width:</b> 70m <b>Left Floodplain:</b> 5m <b>Right Floodplain:</b> 15m <b>Average Depth:</b> N/A <b>Thalweg:</b> N/A <b>Shade (%):</b> 30 <b>Embeddedness (%):</b> N/A <b>Inverts Present:</b> N/A <b>Substrate (% Coverage and Type):</b> N/A  <b>Riparian Health</b>	N/A			

				<b>Assessment Score: 54</b>  <b>YSI</b> <b>Temperature: 12.5</b> <b>Pressure: 757.4</b> <b>DO %: 100</b> <b>DO mg/L: 10.67</b> <b>SPC: 0.023</b> <b>TDS: 15</b> <b>Salinity: 0.01</b> <b>pH: 5.9</b>				
NR002	Waterfall, pool/run, dark water, large boulders, small grass bar in stream	E 0360175 N 4941434		<b>Left Bank:</b> Mostly softwood standing, alders along the bank, large exposed boulders, fairly steep bank <b>Right Bank:</b> Mixed stand, large exposed boulders <b>Water Description:</b> Fast moving, mildly tannin, foam on top of pools <b>Wetted Width:</b> 40-50m <b>Bankfull:</b> 50-60m <b>Left Floodplain:</b> 5m <b>Right Floodplain:</b> 20+m <b>Average Depth:</b> N/A <b>Thalweg:</b> N/A <b>Shade (%):</b> 35 <b>Embeddedness (%):</b> 25 <b>Inverts Present:</b> Yes; caddisfly, May fly, stone fly <b>Substrate (% Coverage and Type):</b> 30% boulder, 30% cobble,	None			

				<p>10% fines, 30% gravel</p> <p><b>Riparian Health Assessment Score: 55</b></p> <p><b>YSI</b>  <b>Temperature:</b> 13.9  <b>Pressure:</b> 756.5  <b>DO %:</b> 100  <b>DO mg/L:</b> 10.42  <b>SPC:</b> 0.022  <b>TDS:</b> 15  <b>Salinity:</b> 0.01  <b>pH:</b> 5.72</p>			
NR003	Bedrock, tanin water, lots of boulders	E 0360248 N 4941709		<p><b>Left Bank:</b> Large boulders, mostly hardwoods, large floodplain, hemlock present</p> <p><b>Right Bank:</b> Large boulders/bedrock, mostly softwood, large flood plain</p> <p><b>Water Description:</b> Tanin, quick moving, slightly foamy, large boulders present</p> <p><b>Wetted Width:</b> 16m  <b>Bankfull:</b> 16m  <b>Left Floodplain:</b> 5m  <b>Right Floodplain:</b> 20+m  <b>Average Depth:</b> 100cm  <b>Thalweg:</b> N/A  <b>Shade (%):</b> 75  <b>Embeddedness (%):</b> 45  <b>Inverts Present:</b> Yes – dobson fly, caddisfly</p>	None		

				<p><b>Substrate (% Coverage and Type):</b> 40% Boulder, 30% Cobble, 30% Gravel, 10% Fines</p> <p><b>Riparian Health Assessment Score: 55</b></p> <p><b>YSI</b> <b>Temperature:</b> 11 <b>Pressure:</b> 756.5 <b>DO %:</b> 100 <b>DO mg/L:</b> 11.09 <b>SPC:</b> 0.023 <b>TDS:</b> 15 <b>Salinity:</b> 0.01 <b>pH:</b> 5.46</p>			
NR004	Lots of boulders, tanin water, mostly cobble, riffle where measurements were taken	E 0360266 N 4942150		<p><b>Left Bank:</b> Hardwood/ softwood mix, lots of ferns/ grasses, gradual sloping bank. <b>Right Bank:</b> Hardwood / softwood mix, steeper sloping bank. Lots of ferns/ grasses <b>Water Description:</b> Dark tannin, riffle – pool - riffle <b>Wetted Width:</b> 30m <b>Bankfull:</b> 31m <b>Left Floodplain:</b> 4m <b>Right Floodplain:</b> 4m <b>Average Depth:</b> 50cm <b>Thalweg:</b> 65cm <b>Shade (%):</b> 15 <b>Embeddedness (%):</b> 10 <b>Inverts Present:</b></p>	Some forestry activity approx. 40m back on left bank.		



				<p>Mollusk, stonefly, caddisfly</p> <p><b>Substrate (% Coverage and Type):</b> 60% bedrock, 20% boulder, 20% cobble</p> <p><b>Riparian Health Assessment Score:</b> 54</p> <p><b>YSI</b>  <b>Temperature:</b> 10.9  <b>Pressure:</b> 755.9  <b>DO %:</b> 100  <b>DO mg/L:</b> 11.14  <b>SPC:</b> 0.023  <b>TDS:</b> 15  <b>Salinity:</b> 0.01  <b>pH:</b> 5.84</p> <p>Notes:</p>			
NR005	Riffles, quick, shallow water, ATV track through stream, boulders out of water	4942363, 0360244		<p><b>Left Bank:</b> Clear cut, ATV track, about 25% cover (mostly pines and hemlocks, some hardwood) 10% boulder.</p> <p><b>Right Bank:</b> No cut on right bank, small furs and medium hardwoods, lots of grass and fiddle heads fewer boulder than left bank.</p> <p><b>Water Description:</b> Medium-slow riffle, dark</p> <p><b>Wetted Width:</b> 15  <b>Bankfull:</b> 15.5  <b>Left Floodplain:</b> 5  <b>Right Floodplain:</b> 20+</p>	Some clearcutting		

				<p><b>Average Depth:</b> 30cm  <b>Thalweg:</b> 65cm  <b>Shade (%):</b> 15  <b>Embeddedness (%):</b>  30-40  <b>Inverts Present:</b>  Mayfly, Caddisfly  <b>Substrate (% Coverage and Type):</b>  15% boulder, 50% cobble, 10% fines, 25% gravel</p> <p><b>Riparian Health Assessment Score:</b>  39</p> <p><u><b>YSI</b></u>  <b>Temperature:</b> 10.9  <b>Pressure:</b> 755.7  <b>DO %:</b> 100  <b>DO mg/L:</b> 11.14  <b>SPC:</b> 0.023  <b>TDS:</b> 15  <b>Salinity:</b> 0.01  <b>pH:</b> 5.73</p> <p>Notes:</p>			
SW001	Stream has narrowed some, lots of exposed bedrock and boulders	E 0356229 N 4944376		<p><b>Left Bank:</b> Hardwood dominant, lots of red maple. Many ferns and grasses along bank, land is level.  <b>Right Bank:</b> Hardwood/ softwood mix, grasses, ferns and mosses on bank, steep slope  <b>Water Description:</b> Dark, slow moving, small foam patches on</p>			

				<p>top.  <b>Wetted Width:</b> 20m  <b>Bankfull:</b> 25m  <b>Left Floodplain:</b> 10m  <b>Right Floodplain:</b> 1m  <b>Average Depth:</b> 70cm  <b>Thalweg:</b> 80cm  <b>Shade (%):</b> 25  <b>Embeddedness (%):</b>  20  <b>Inverts Present:</b>  Mollusk, dragonfly,  caddisfly  <b>Substrate (%  Coverage and Type):</b>  50% bedrock, 15%  boulder, 20% fines,  15% cobble</p> <p><b>Riparian Health  Assessment Score:</b> 54</p> <p><u><b>YSI</b></u>  <b>Temperature:</b>  <b>Pressure:</b>  <b>DO %:</b>  <b>DO mg/L:</b>  <b>SPC:</b>  <b>TDS</b>  <b>Salinity:</b>  <b>pH:</b></p> <p>Notes: 30min angling  caught 0 fish</p>			
NRD00 1	Riffle/Run - Beaver Dam on left flood plain. 2	4940852, 0359963		<p><b>Left Bank:</b> Beaver  Dam and lodge present.  mixed stand, minor  regen, ferns, mosses,  horsetails, alders and  other shrubs  <b>Right Bank:</b> Steep</p>	Trail and beaver dam, Brandy Lane on other side		

	grass bars creating braiding		bank, mixed stand, ferns, (no mosses) exposed boulders <b>Water Description:</b> Tanin, quick moving, some foam <b>Wetted Width:</b> 15m <b>Bankfull:</b> 15m <b>Left Floodplain:</b> 10m <b>Right Floodplain:</b> 2m <b>Average Depth:</b> 40cm <b>Thalweg:</b> 50cm <b>Shade (%):</b> 40-50 <b>Embeddedness (%):</b> 40 <b>Inverts Present:</b> Caddisfly <b>Substrate (% Coverage and Type):</b> 40% Boulder, 15% Cobble, 30% Gravel, 15% Fines  <b>Riparian Health Assessment Score:</b> 50  <b>YSI</b> <b>Temperature:</b> 12.4 <b>Pressure:</b> 749.3 <b>DO %:</b> 101.1 <b>DO mg/L:</b> 10.1 <b>SPC:</b> .022 <b>TDS:</b> 14 <b>Salinity:</b> 0.01 <b>pH:</b> 6.7  Notes:				
NRD00 2	Run, exposed boulders and	4940351, 0359412	<b>Left Bank:</b> Mixed Stand (mature). Ferns, shrubs, mosses <b>Right Bank:</b> Cabin	Brandy Lane and Cabins			

	<p>bedrock. Grass bar downstre am</p>		<p>right up to the edge of the bank. mixed stand <b>Water Description:</b> Tanin, quick moving, foam forming <b>Wetted Width:</b> 15m <b>Bankfull:</b> 15m <b>Left Floodplain:</b> 5m <b>Right Floodplain:</b> 3m <b>Average Depth:</b> 120cm <b>Thalweg:</b> 77cm <b>Shade (%):</b> 35 <b>Embeddedness (%):</b> 45 <b>Inverts Present:</b> Caddisfly, stonefly <b>Substrate (% Coverage and Type):</b> 40% Boulder, 15% Cobble, 30% Gravel, 15% Fines</p> <p><b>Riparian Health Assessment Score:</b> 37</p> <p><u><b>YSI</b></u> <b>Temperature:</b> 12.5 <b>Pressure:</b> 749.8 <b>DO %:</b> 101.2 <b>DO mg/L:</b> 10.77 <b>SPC:</b> .022 <b>TDS:</b> 14 <b>Salinity:</b> 0.01 <b>pH:</b> 5.27</p> <p>Notes: Cottages all along right bank (may influence water quality)</p>			
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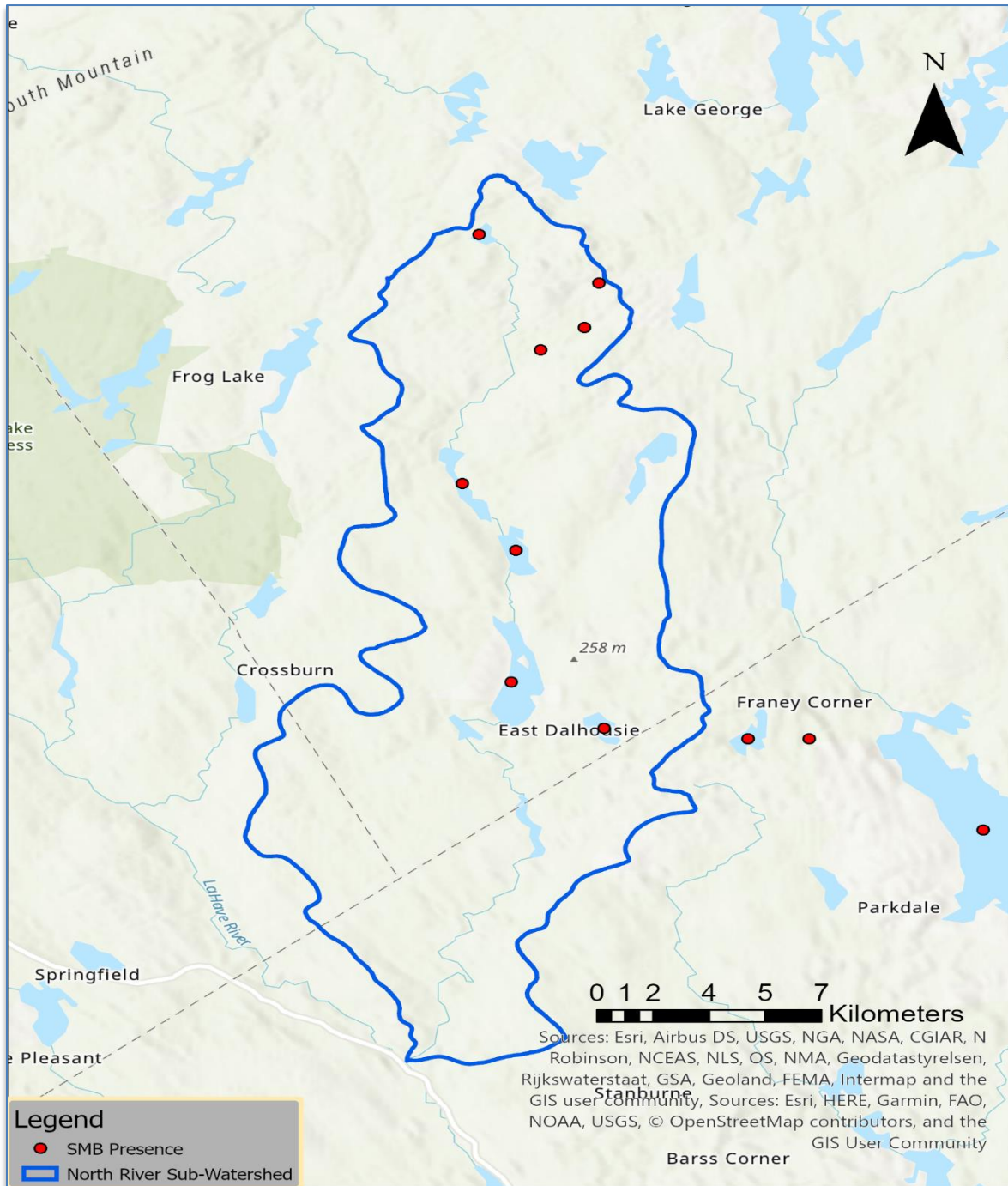
ERD00 1	Dark, Muddy bottom, lots of boulder s		<p><b>Left Bank:</b> Grassy, +10m fkiid okaub, small trees behind (mostly maple) <b>Right Bank:</b> Trees right up to the bank, lots of hardwoods and a small floodplain <b>Water Description:</b> Medium dark lots of insects on top of water <b>Wetted Width:</b> 10m <b>Bankfull:</b> 11m <b>Left Floodplain:</b> 20+ m <b>Right Floodplain:</b> 10+ m <b>Average Depth:</b> 200cm <b>Thalweg:</b> 100cm <b>Shade (%):</b> 10 <b>Embeddedness (%):</b> 55 <b>Inverts Present:</b> Caddisfly, stonefly, mayfly <b>Substrate (% Coverage and Type):</b> 40% Boulders, 60% fines</p> <p><b>Riparian Health Assessment Score:</b></p> <p><u>YSI</u> <b>Temperature:</b> 18.7 <b>Pressure:</b> 746 <b>DO %:</b> 96 <b>DO mg/L:</b> 8.9 <b>SPC:</b> .022 <b>TDS:</b> 14 <b>Salinity:</b> 0.01</p>				
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				pH: 6.21				
EDR00 2	<p>Lots of boulders, about 35% shade cover (Spruce, Hemlock, fur, maple and ash). Lots of foam and riffles, with a little drop upstream</p>			<p><b>Left Bank:</b> Full of boulders, steep bank with hemlock cover  <b>Right Bank:</b> +10m flood plain, small hemlocks, ferns and small boulders line the shore  <b>Water Description:</b> Dark, Tannin, foamy fast-moving riffles  <b>Wetted Width:</b> 10m  <b>Bankfull:</b> 12m  <b>Left Floodplain:</b> 1m  <b>Right Floodplain:</b> 10+m  <b>Average Depth:</b> 200cm  <b>Thalweg:</b> 110cm  <b>Shade (%):</b> 35  <b>Embeddedness (%):</b> 45  <b>Inverts Present:</b> Caddisfly, stonefly, mayfly  <b>Substrate (% Coverage and Type):</b> 50% Boulders, 35% cobble, 25% Fines/gravel</p> <p><b>Riparian Health Assessment Score:</b></p> <p><u>YSI</u>  <b>Temperature:</b> 19.6</p>				

			<b>Pressure:</b> 745 <b>DO %:</b> 99 <b>DO mg/L:</b> 9.1 <b>SPC:</b> .022 <b>TDS:</b> 14 <b>Salinity:</b> 0.01 <b>pH:</b> 6.23				
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## 5. North River Sub-watershed Invasive Fish Species Presence/Absence Maps



Map showing known smallmouth bass presence throughout the North River Sub-watershed.

## 6. Restoration Plan Summary – North River Sub-watershed

<p>Changes in the watershed - current conditions compared to historical conditions. Future changes to the natural environment expected in the watershed</p>	<p>The North River appears to be in healthy condition and aside from some small-scale forestry activity is experiencing low impact from human-related activities. Some areas throughout the sub-watershed such as Black Duck lake, Lake Torment, and Mack lake have been developed over time for residential housing and cottages. This development has likely been affecting water quality through increased runoff, petroleum leaks from boat motors, and changes in hydrogeology due to the installation of wells and septic systems. The level of forestry activity that would have occurred during the 1900s is unknown at this time; however, during recent assessments it was noted that some commercial forestry is taking place along the North River. If commercial forestry activity expands further throughout the watershed it will have a long-lasting negative impact on fish habitat.</p>
<p>Most likely limiting factors regarding aquatic productivity in the watershed</p>	<p>The most likely limiting factors are:</p> <ol style="list-style-type: none"> <li>1. Changes in water quality over time which has resulted in pH levels below the threshold for Atlantic salmon as well increased water temperatures above the upper limit for salmon.</li> <li>2. A large population of invasive smallmouth bass which are likely outcompeting and preying upon native species resulting in a loss of biodiversity.</li> <li>3. Changes to in-stream habitat due to various types of development and human related activities.</li> </ol>
<p>Most important habitat restoration needs in the watershed</p>	<p>The most significant habitat restoration needs in the sub-watershed are as follows:</p> <ol style="list-style-type: none"> <li>1. Improving water quality through liming and restoration of riparian buffers and degraded riparian areas.</li> <li>2. Proper mitigation measures in place during development activities.</li> <li>3. Removal of invasive species (annually).</li> <li>4. Improvement of in-stream physical habitat</li> <li>5. Improving aquatic connectivity throughout the watershed.</li> </ol>
<p>Water quality improvement and/or monitoring projects, in order of importance</p>	<ul style="list-style-type: none"> <li>● Water quality monitoring at sampling sites throughout the North River will continue monthly, any concerning changes in parameters should be investigated to determine a cause.</li> </ul>

	<ul style="list-style-type: none"> <li>● Continue to assess water quality during both stream and culvert assessments to help identify potential salmon habitat.</li> <li>● Install data loggers throughout the North River to monitor water temperature and pH.</li> </ul>
Riparian buffer zone restoration projects, in order of importance	<p>The following riparian buffer zone restoration projects are recommended:</p> <ul style="list-style-type: none"> <li>● Continue to assess waterways throughout the North River Sub-watershed to identify riparian areas in need of restoration.</li> <li>● Monitor areas where forestry activity is taking place.</li> <li>● Plant young trees in areas where cutting has degraded riparian areas.</li> </ul>
Physical habitat restoration and improvement projects, in order of importance	<p>The following physical habitat restoration projects are recommended:</p> <p>Results from 2019 fish habitat assessments on the North River show the in-stream habitat is mainly in a healthy state and providing adequate habitat for Atlantic salmon. There were no sites identified that required restoration such as the installation of digger logs, deflectors, and rock sills, there is however some opportunity for riparian restoration projects which will help ensure that the current habitat quality is maintained.</p>
Needed land use improvement practices, in order of importance	<p>The following land-use improvement practice projects are recommended:</p> <ol style="list-style-type: none"> <li>1. Attempt to ensure any future development is completed in a way that does not cause harm to any fish bearing streams throughout the watershed.</li> <li>2. Identify and prioritize areas in need of restoration due to impacts from forestry, road building, etc.</li> </ol>

## Reference Material

<https://novascotia.ca › fish › documents › Anglers-Handbook-2019>

<http://sis.agr.gc.ca/cansis/publications/surveys/ns/ns7/index.html>

<http://sis.agr.gc.ca/cansis/publications/surveys/ns/ns7/index.html>

[https://novascotia.ca/fish/documents/special-management-areas-reports/2010\\_028\\_e.pdf](https://novascotia.ca/fish/documents/special-management-areas-reports/2010_028_e.pdf)