PRINCE EDWARD ISLAND

ATLANTIC SALMON SPAWNING SURVEY 2017

Oak Meadows Inc.

March 2018

Prince Edward Island
Atlantic Salmon Spawning Survey 2017

Introduction

Prince Edward Island once had runs of Atlantic salmon in approximately seventy rivers. Today, that number is reduced to about two dozen rivers. Habitat degradation, including sedimentation related to land use issues and blockages to upstream passage are the primary causes of the decline. Watershed and angling organizations have been working to reverse the trend. Along with habitat restoration efforts, many of these groups are involved in assessment of salmon populations. The use of counting fences as an assessment tool, as seen in our neighbouring provinces, is impractical, especially without greater involvement from the Department of Fisheries and Oceans. Thus spawning surveys, combined with juvenile assessments and angler log book information, have become the standard techniques to assess the strength of salmon runs in rivers in PEI.

In 2008, extensive field work was conducted during the development of "A Conservation Strategy for Atlantic Salmon in Prince Edward Island". There is interest in updating this strategy to reflect current conditions and to guide restoration efforts in the coming years. With that in mind, a project was undertaken to complete an Atlantic salmon redd survey in autumn 2017. It is anticipated that additional field work, including juvenile population and riparian zone assessments, will begin in spring 2018.

Methodology

An Atlantic salmon redd survey was conducted from mid-November until mid-December by experienced field personnel representing: Oak Meadows Inc., Central Queens Wildlife Federation, Souris & Area Branch of the PEI Wildlife Federation, Abegweit First Nation and the PEI Forests, Fish and Wildlife Division. On November 14, 2017, many of the survey participants walked a section of the West River to set parameters used for counting and documenting salmon redds. The protocol for doing redd surveys was established in the early 1990s and the counts have been shown to be a good index of salmon populations. Souris & Area Branch of the PEI Wildlife Federation has many years of experience conducting spawning surveys and although they did not attend the November 14 session, we are confident that their surveys are completed in a standard and consistent manner.

Figure 1. Some participants in the 2017 redd survey review the protocol of identifying salmon spawning sites. [Photo: R. MacFarlane]

Surveyors walked upstream counting all salmon redds until an impassible blockage is encountered or until redds were no longer observed. Some of the larger rivers were surveyed by canoe. A GPS location was taken of salmon redd locations and notes were recorded. Salmon redds are generally larger than trout redds and have a more defined depression and rock pile. Salmon redds can be found under cover of alders or other vegetation, however they are most often dug in the open at the head and tail of pools or upper end of riffles. Salmon do not always complete a redd and their test redds or scrapes are smaller, shallow, and lack a pronounced depression at the upstream end. Redds dug in areas with a thin layer of gravel over bedrock can also be shallow. Scrapes are not counted, but when surveyors are unsure, these "half" redds are counted and added to the total. Timing of the survey can be difficult as well. The salmon need adequate time to complete spawning, however delaying the survey can reduce accuracy due to higher water levels and/or reduced visibility. Salmon in some regions, for example north eastern PEI, tend to arrive later in the fall. Low water levels or blockages can also delay migration. During the 2017 survey, portions of a few rivers were walked a second time to ensure that the survey was as complete as possible.

Figure 2. Salmon redd on West River. [Photo: R. MacFarlane]

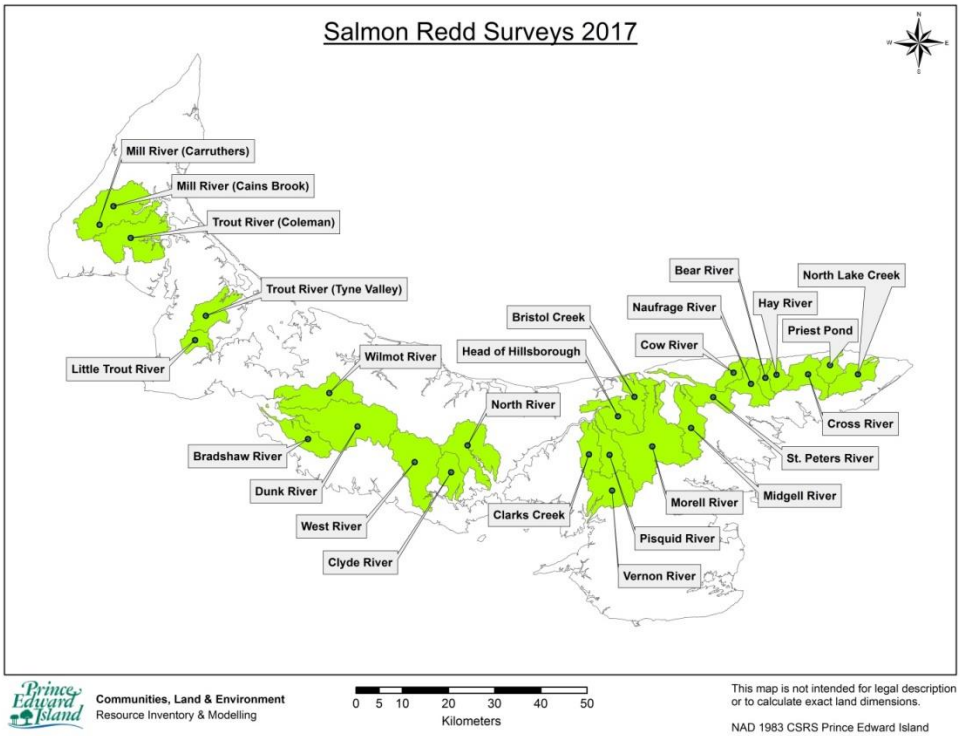

Figure 3. Map of rivers surveyed for Atlantic salmon redds, 2017.

Results

Redd surveys were completed on 26 rivers (Figure 3) during November and December, 2017. Redd counts for each of the rivers were added to a table maintained by Dr. David Cairns at the Department of Fisheries and Oceans (Table 1). Rivers were organized into groups or "clusters" based on geography and proximity and the numbers of redds recorded since 2008 are displayed in Table 1. Maps identifying spawning locations on each river were prepared by the GIS section of the PEI Forests, Fish and Wildlife Division. A Digital Elevation Model (DEM) map is also provided of a section of each river where spawning was observed. Some information was also collected on trout spawning locations, land use issues or blockages encountered. A list of the individuals and organizations involved in carrying out the survey is included in Appendix I and an estimate of labour and travel-related costs are provided in Appendix II.

Table 1. Counts of salmon redds in twenty-six rivers in Prince Edward Island from 2008-2017.

River	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cains Brook	(58)			56	41	38		(38)	44	75
Carruthers Brook	(152)			294	131	(98)		(103)	94	119
Trout River, Coleman	(2)					59	38	38	44	41
Trout River Tyne Valley	14					0	0			(4)
Little Trout River	11	19	(9)	28		0	0	2		20
Dunk River	(17)				(12)					78
Wilmot River	0									6
Bradshaw River										0
North River	18			11		21				8
Clyde River				0						0
West River	141	76	88	87	89	168	113	113	146	149
Vernon River	0				7	11	(8)	0		17
Bristol (Berrigans) Creek	7		23		6	10	0	(1)		8
Morell River	328			450	(243)	(326)	388	(143)	204	191
Midgell River	69	116		110	81	(36)	76	140		104
St. Peters River	53			53	70	44	43	67	(20)	19
Clarks Creek	0				0	3		(0)		4
Pisquid River	38		(37)	68	35	39	(15)	47	29	28
Head of Hillsborough R.	0			0	0	2		0		0
Cross Creek	120	70	100	190	83	268	193	238	170	192
Priest Pond Creek	(11)	8	13	20	21	151	129	138	70	150
North Lake Creek	200	213	205	355	106	333	183	262	251	213
Cow River				4	1	50	12	67	56	38
Naufrage River	100	32	33	429	43	453	217	154	108	89
Bear River				0	0	16	3	13	35	7
Hay River				1	3	43	15	36	41	15

(Brackets indicate incomplete counts)

Cluster 1:

Both Carruthers Brook (Mill River) and Trout River (Coleman) are maintaining a consistent number of Atlantic salmon redds (Figure 4) despite having multiple pesticide-related fishkills between 2011 and 2013. Cains Brook is a smaller tributary of Mill River and most of the salmon redds were found in the lower 1-2 km (Figure 5) although good spawning and rearing habitat is present upstream.

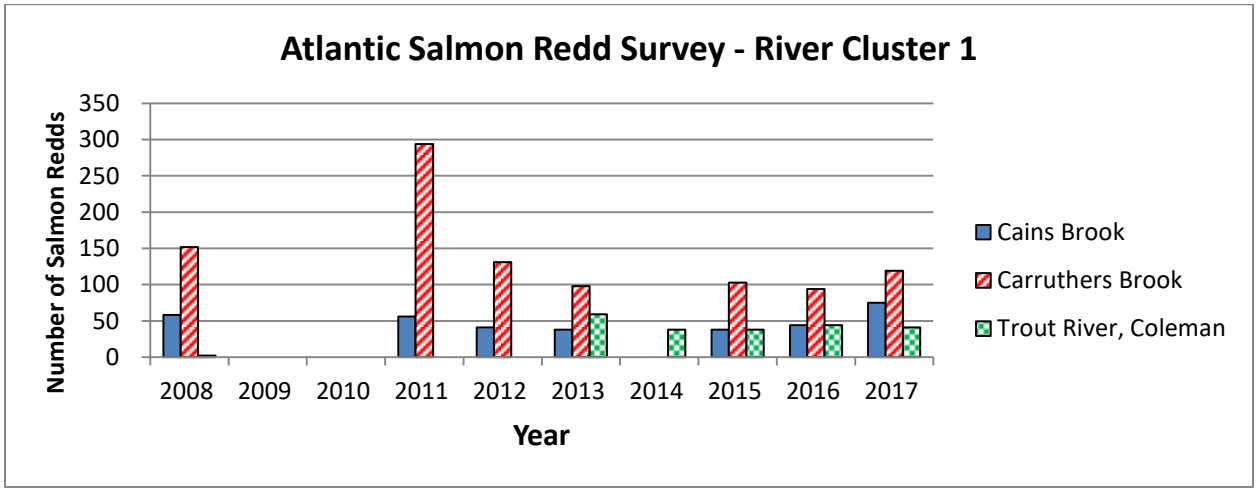

Figure 4. Number of salmon redds in Cluster 1 rivers from 2008 to 2017

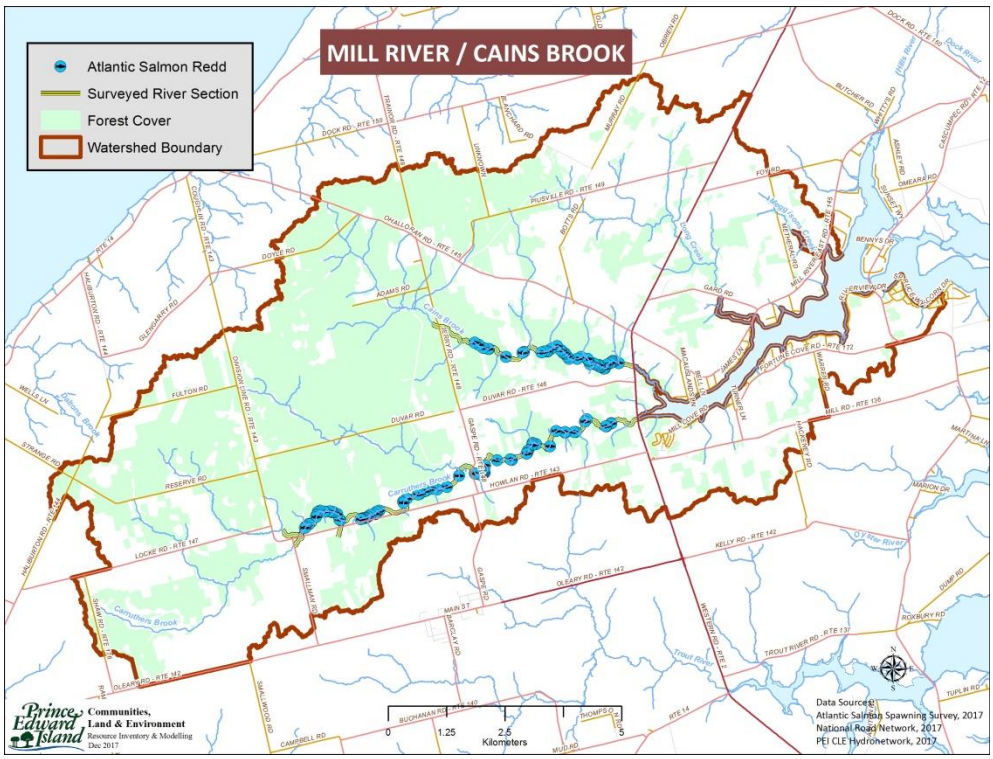

Figure 5. Location of salmon redds in Mill River (Carruthers Brook and Cains Brook) 2017

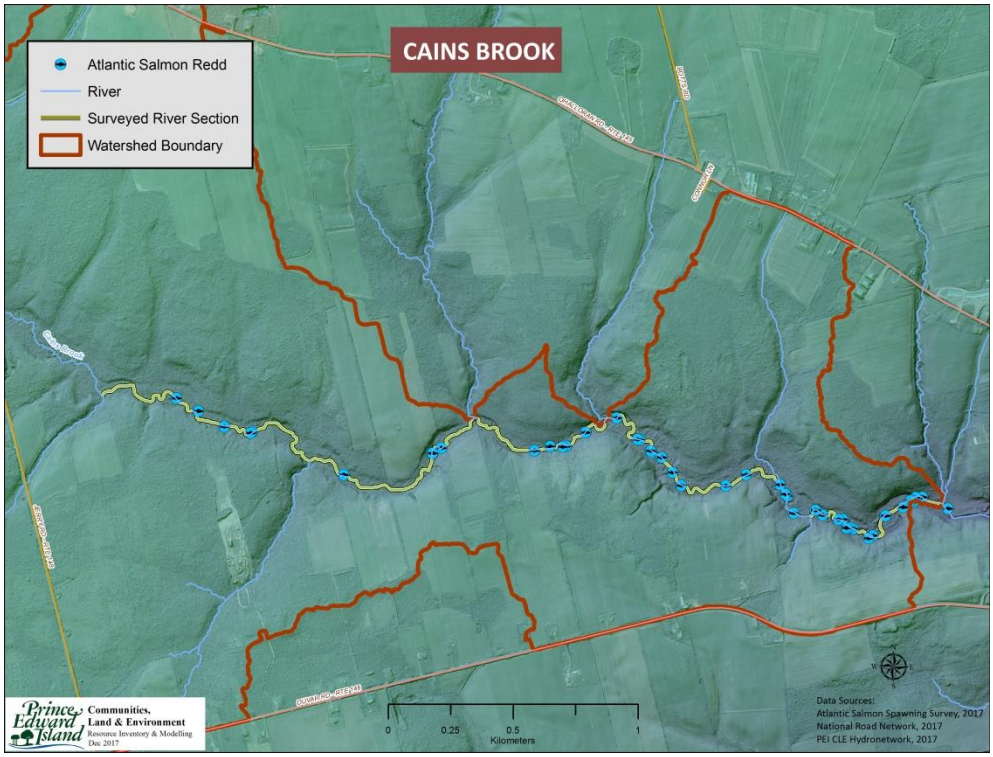

Figure 6. Digital Elevation Model (DEM) map of a section of Cains Brook, Mill River.

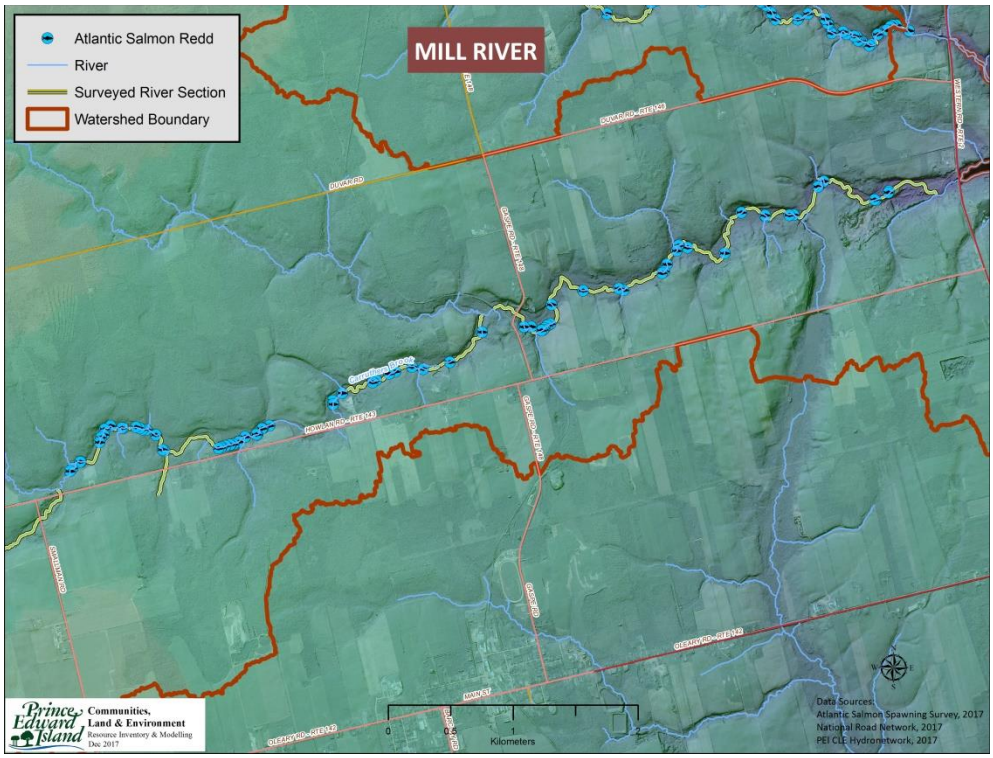

Figure 7. Digital Elevation Model (DEM) map of a section of Carruthers Brook, Mill River.

Figure 8. Carruthers Brook, March 2016. [Photo: R. MacFarlane]

Figure 9. A tributary carrying runoff into Cains Brook, February 2018. [Photo: J. MacEachern]

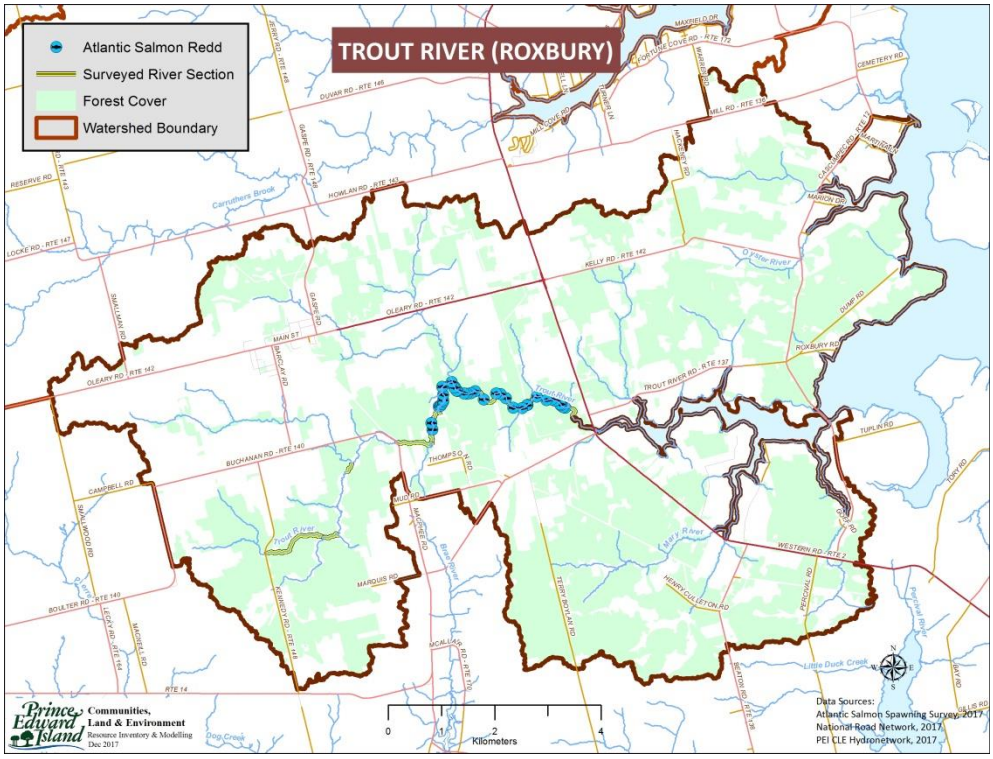

Figure 10. Location of salmon redds on Trout River (Coleman) in 2017.

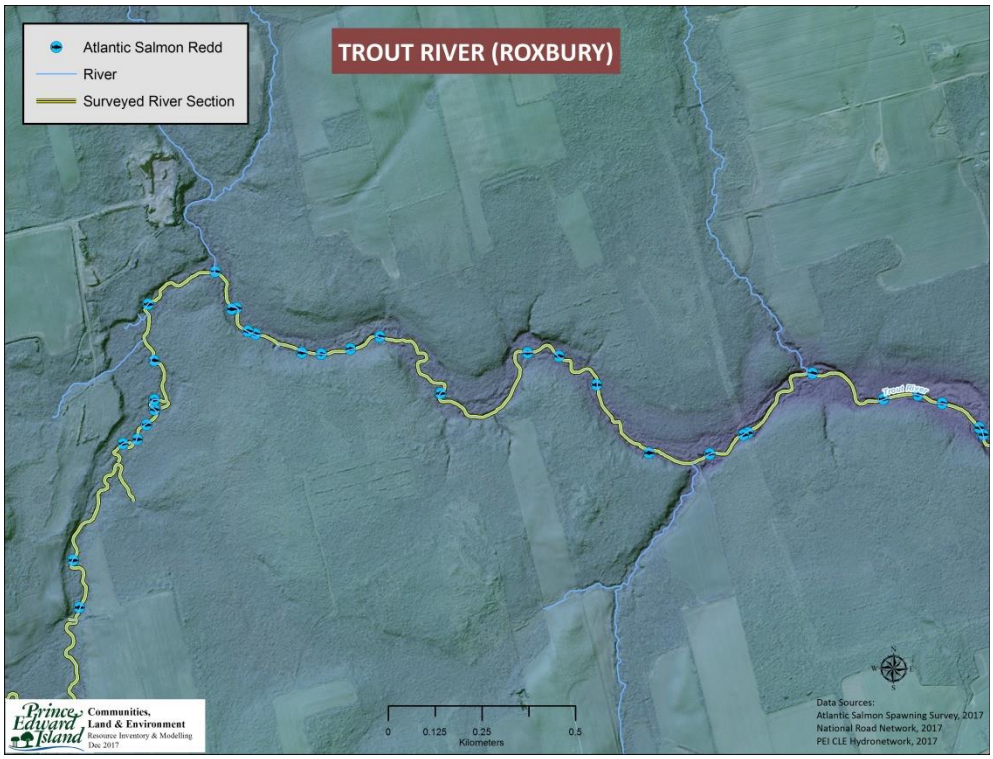

Figure 11. Digital Elevation Model (DEM) map of a section of Trout River (Coleman).

Cluster 2:

Little Trout River often has low water levels in the fall and as a result, salmon are quite late initiating spawning. Recent habitat restoration work in the lower reaches should benefit future runs. The number of salmon redds in this small stream (Figure 12) shows the fluctuation expected in a river with sporadic salmon runs. Flood conditions in Trout River (Tyne Valley) prevented surveyors from doing a complete assessment but four redds were observed along a 1 km section which does not include the best potential salmon spawning habitat (Figure 16).

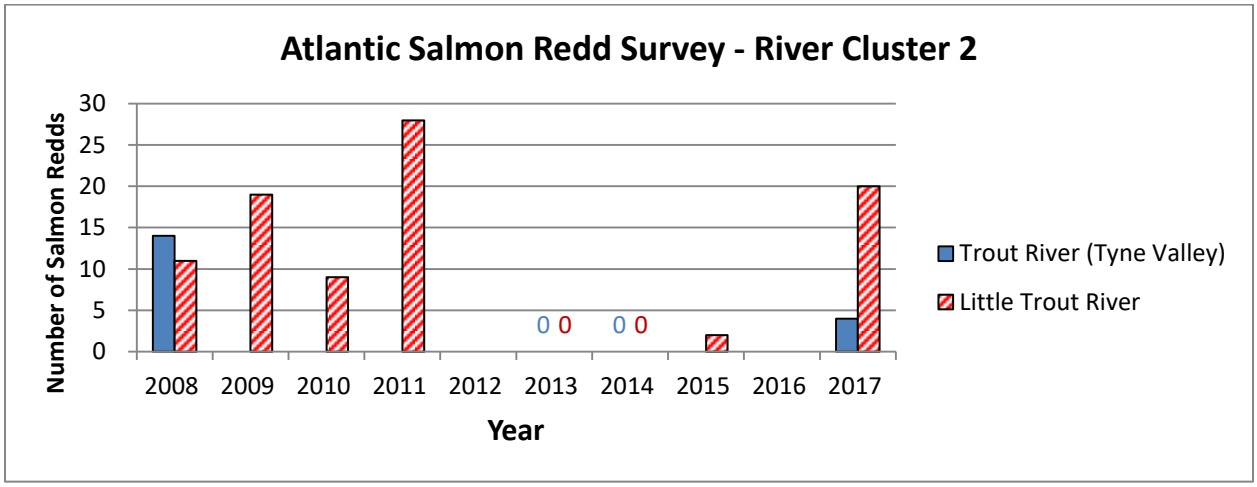

Figure 12. Number of salmon redds in Cluster 2 rivers from 2008 to 2017. Note: A '0' indicates that a survey was undertaken but no redds were recorded.

Figure 13. Trout River (Tyne Valley), November 2017. [Photo: C. Gallant]

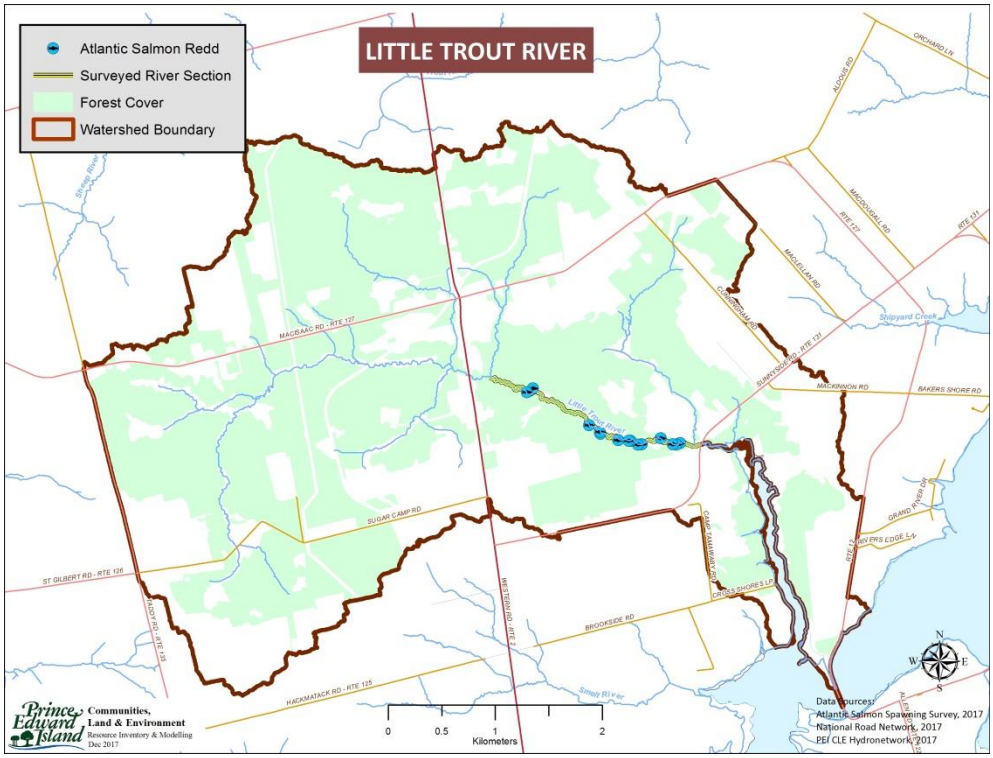

Figure 14. Location of salmon redds on Little Trout River 2017.

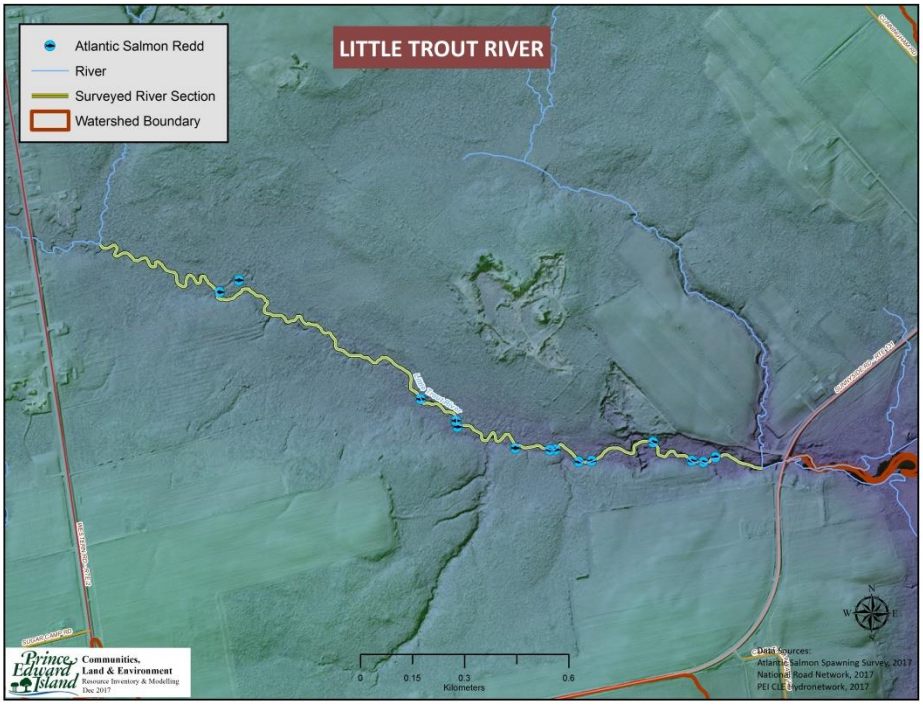

Figure 15. Digital Elevation Model (DEM) map of a section of Little Trout River.

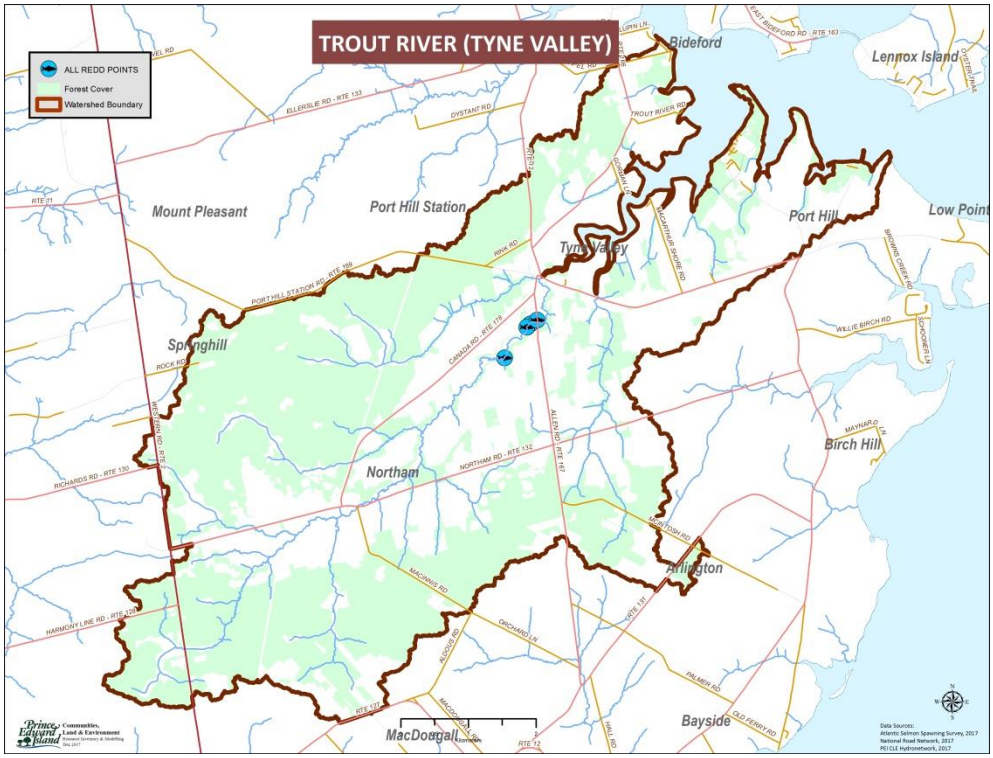

Figure 16. Location of salmon redds in Trout River (Tyne Valley) in 2017.

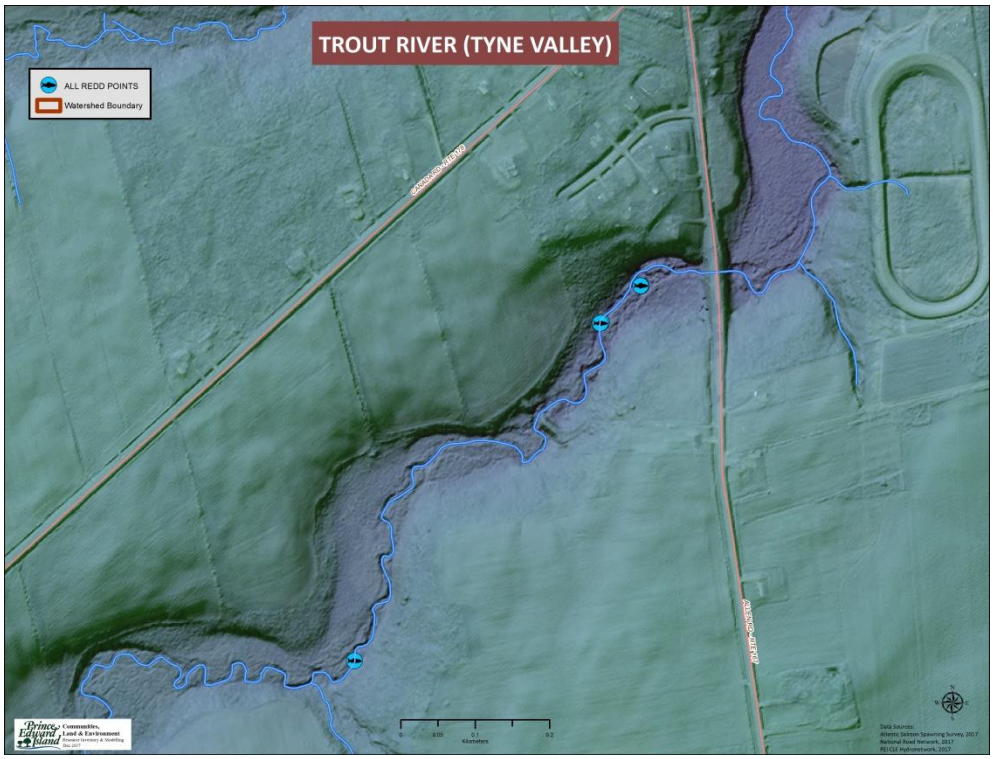

Figure 17. Digital Elevation Model (DEM) map of a section of Trout River (Tyne Valley).

Cluster 3:

Habitat conditions in the Dunk, Wilmot and Bradshaw reflect the intensive agricultural activity in this area. The Dunk River used to have excellent runs of salmon but only a small section of the main river currently has salmon redds. The Bradshaw and Wilmot rivers have numerous springs and high nitrate nitrogen levels and may be better suited to brook trout production. All three systems have strong populations of rainbow trout.

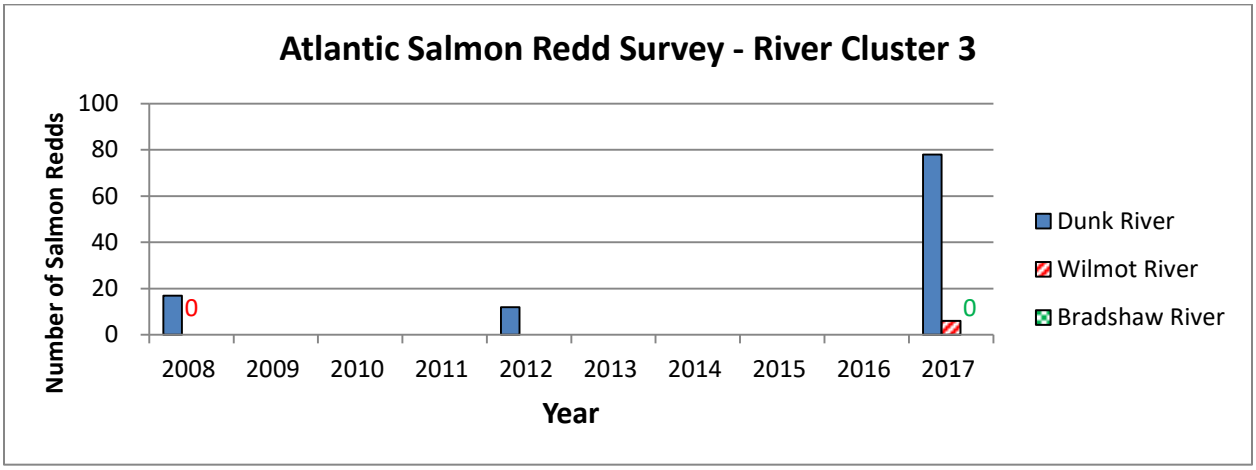

Figure 18. Number of salmon redds in Cluster 3 rivers from 2008 to 2017. Note: A '0' indicates that a survey was undertaken but no redds were recorded.

Figure 19. Large beaver dam on the Wilmot River, November 2017. [Photo: D. Guignion]

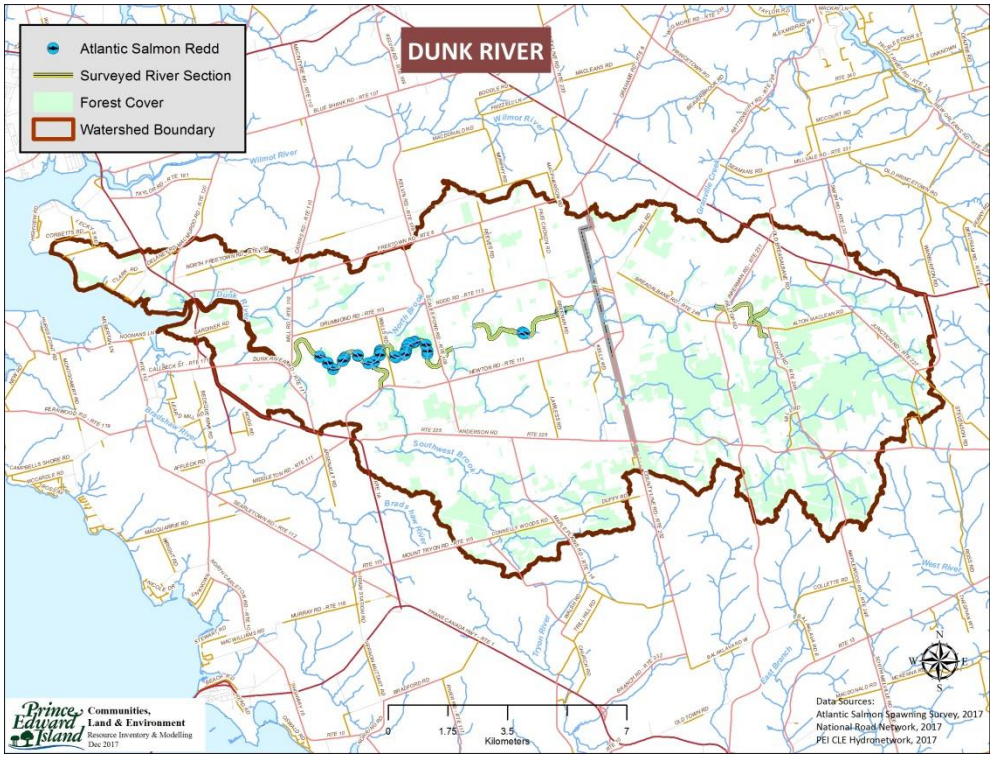

Figure 20. Location of salmon redds in Dunk River, 2017.

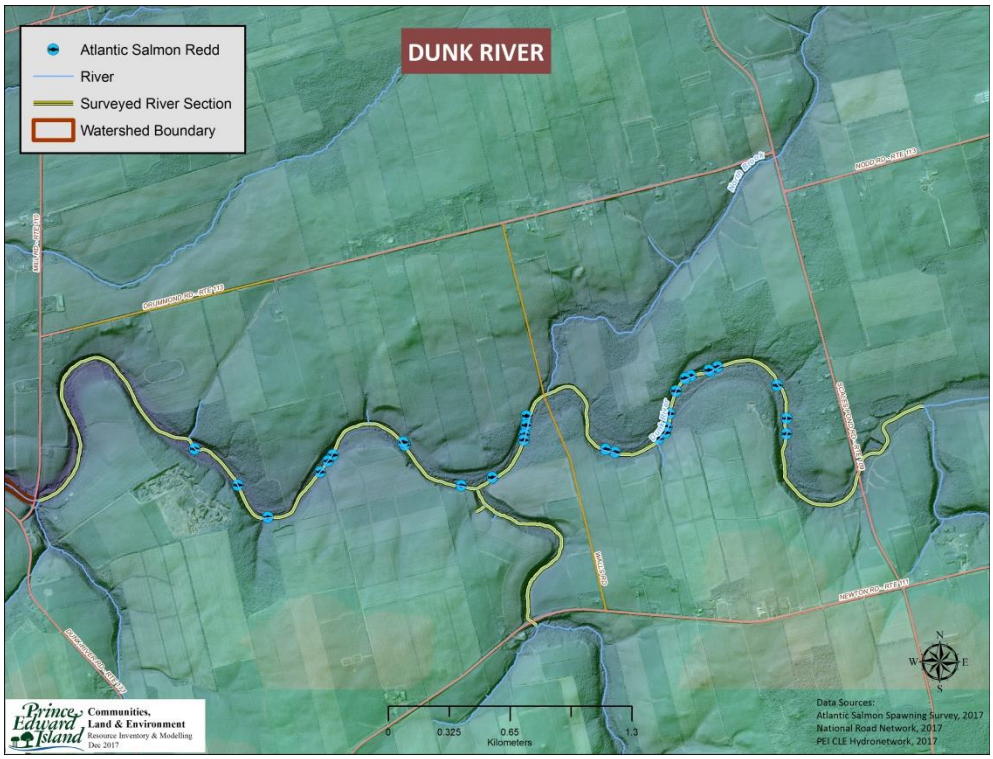

Figure 21. Digital Elevation Model (DEM) map of a section of Dunk River.

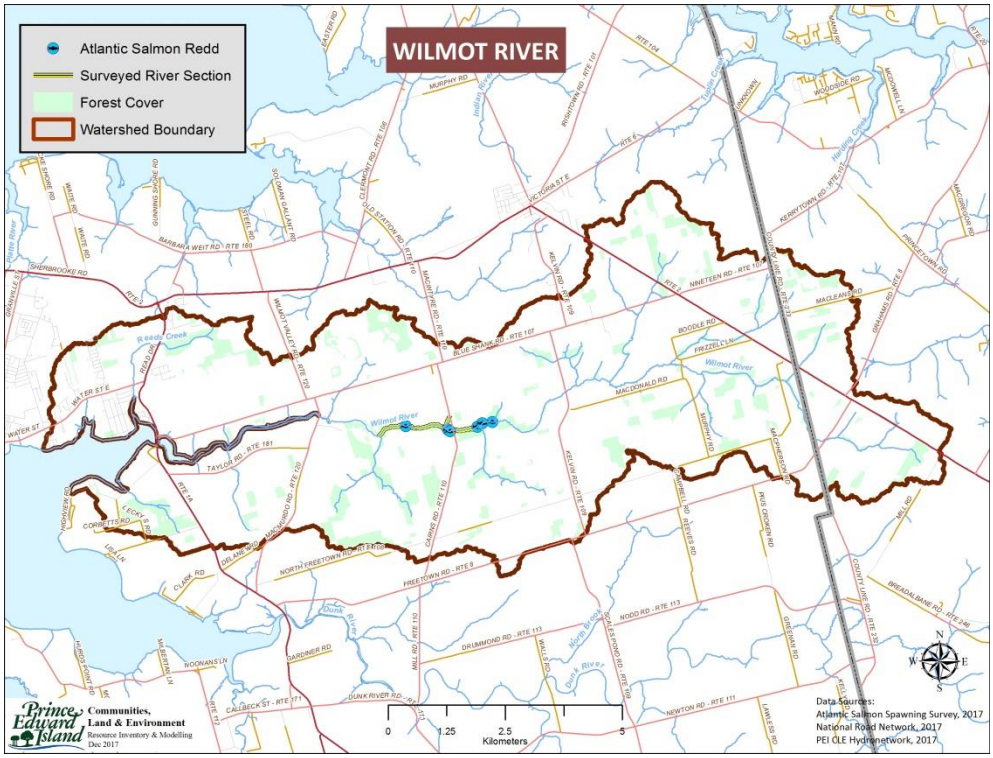

Figure 22. Location of salmon redds in Wilmot River, 2017.

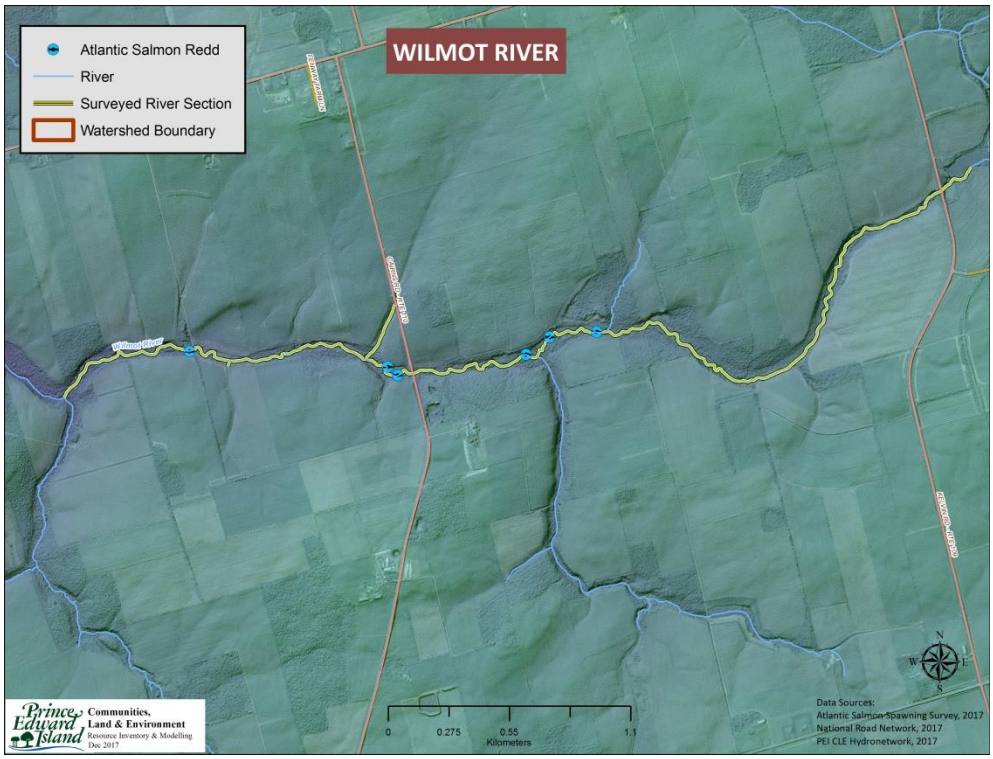

Figure 23. Digital Elevation Model (DEM) map of a section of Wilmot River.

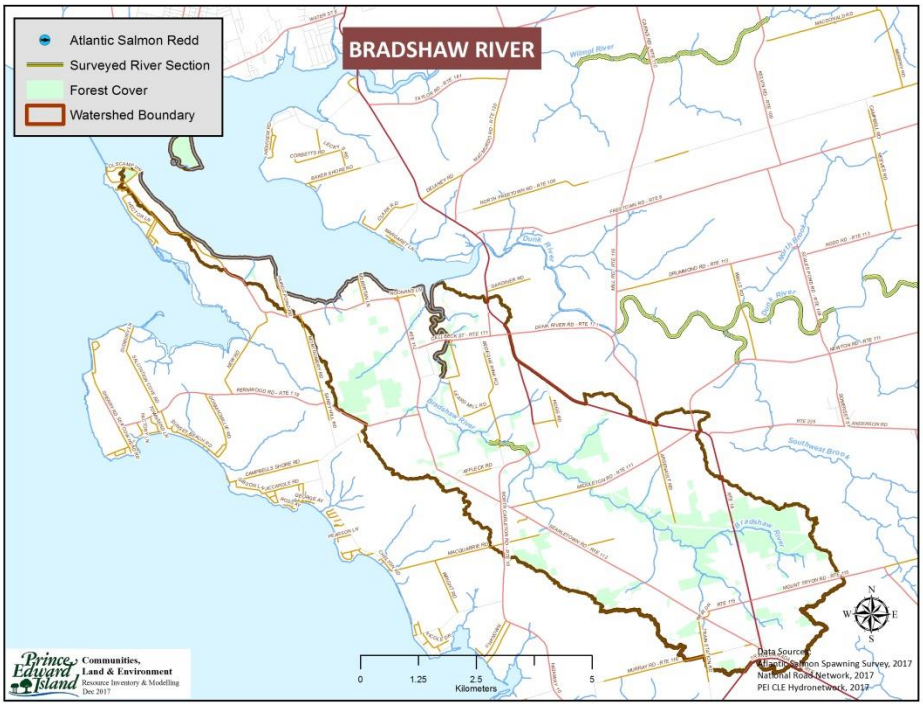

Figure 24. Location of salmon redds in the Bradshaw River, 2017

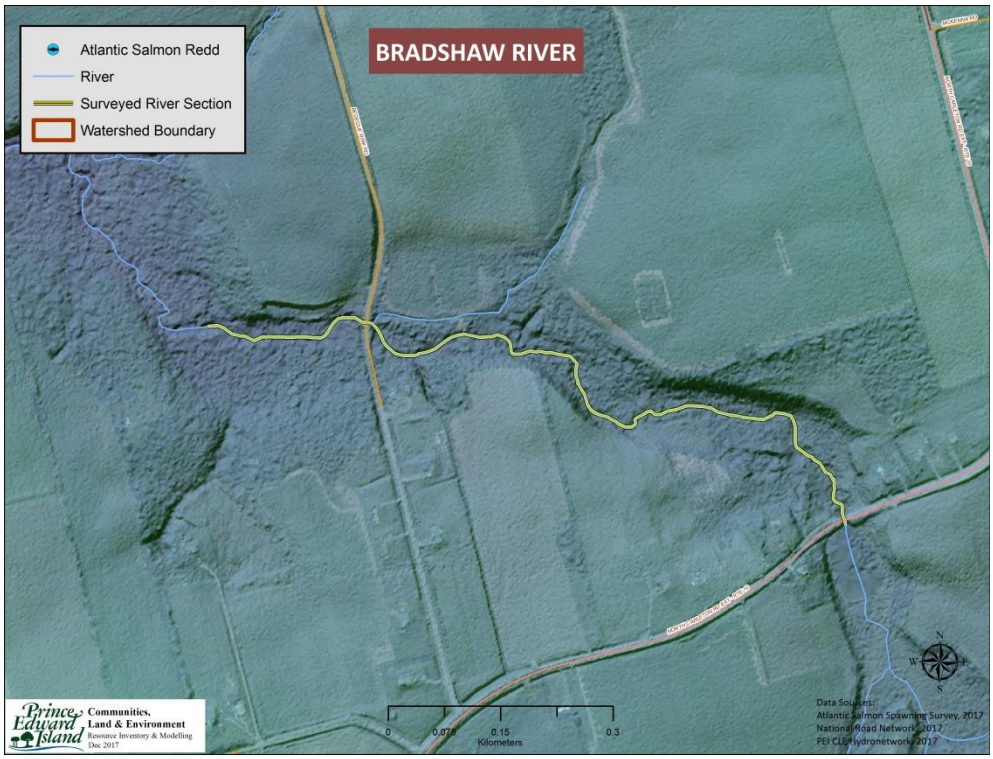

Figure 25. Digital Elevation Model (DEM) map of a section of Bradshaw River.

Cluster 4:

The West, Clyde and North Rivers all had historical runs of Atlantic salmon but currently, only the West maintains a consistent population. Salmon redd counts in the West River have been steadily increasing since habitat restoration work was resumed in 2010. It is anticipated that the 2018 run of salmon will be strong as the first salmon fry stocked from the Abegweit Biodiversity Enhancement Hatchery return to the river. Clyde River once had salmon in both branches, however in recent years it has experienced massive sediment run-off from exposed agricultural land. Redd numbers in North River were disappointingly low in 2017.

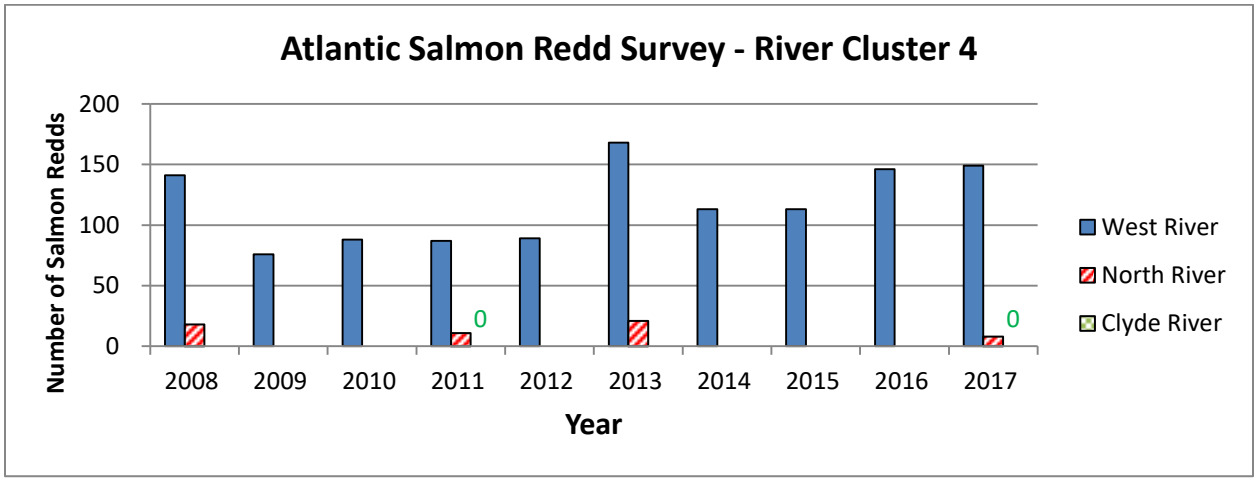

Figure 26. Number of salmon redds in Cluster 4 rivers from 2008 to 2017. Note: A '0' indicates that a survey was undertaken but no redds were recorded.

Figure 27. Massive runoff of sediment from a potato field alongside the Clyde River, April 2017. [Photo: D. Guignion]

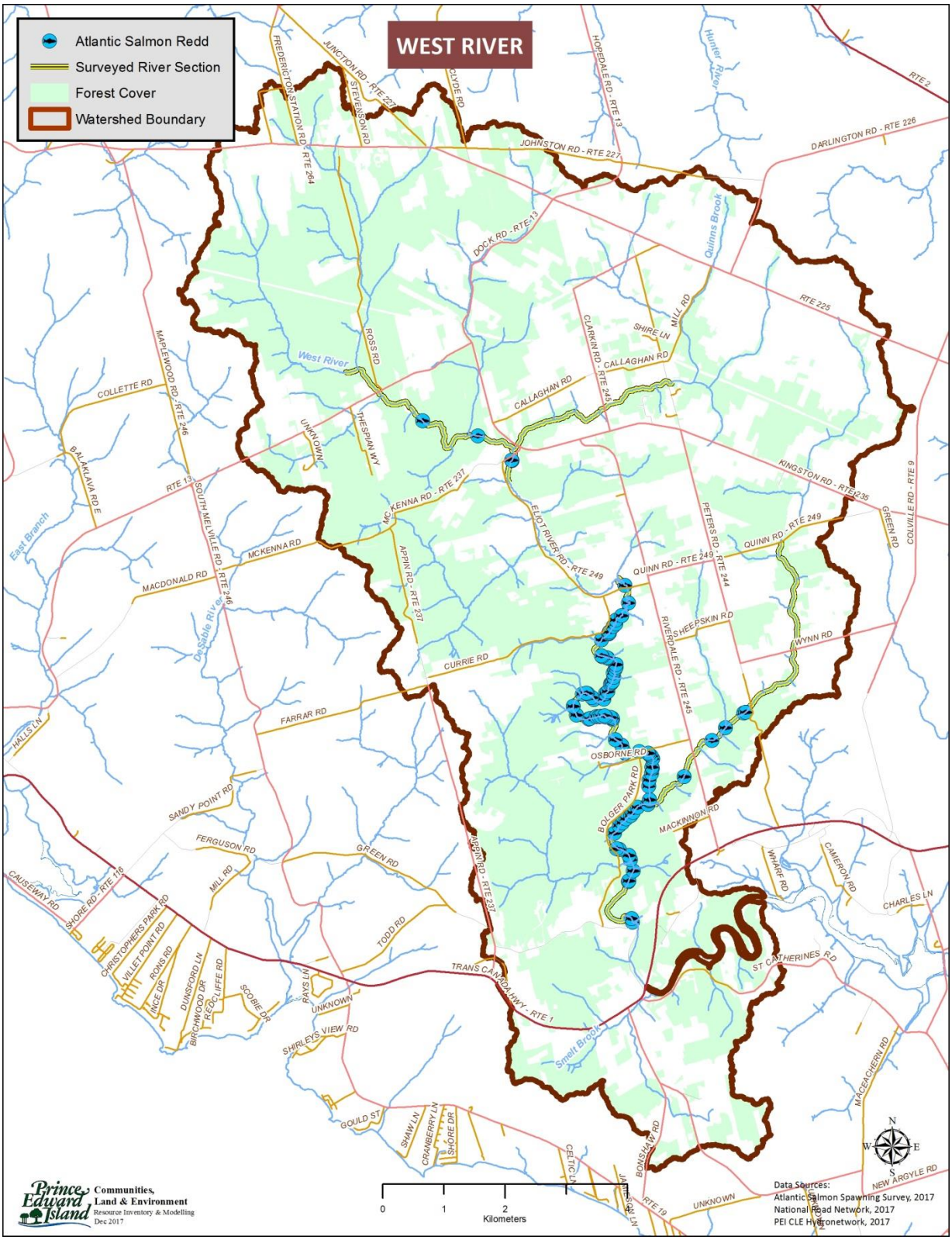

Figure 28. Location of salmon redds on West River 2017.

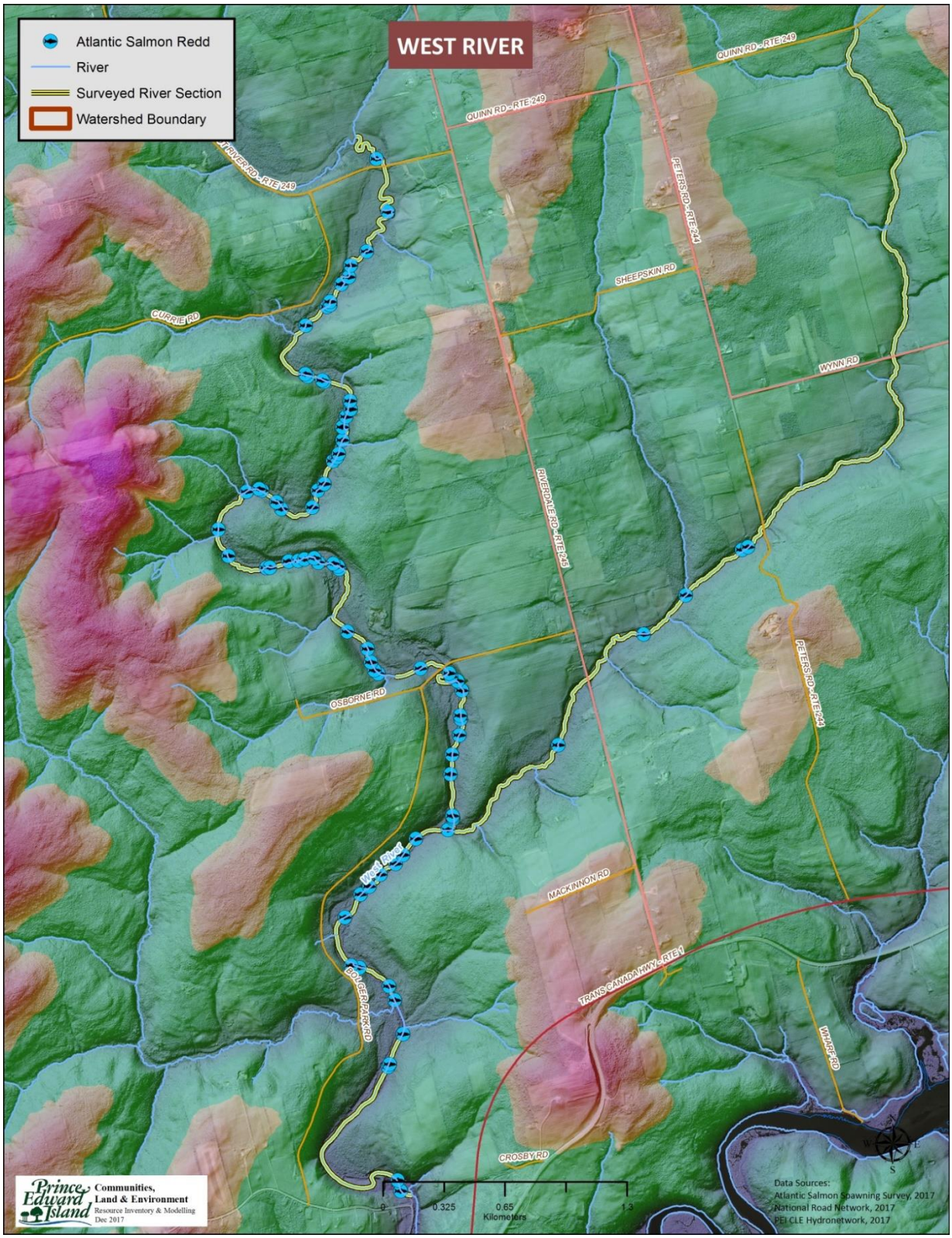

Figure 29. Digital Elevation Model (DEM) map of a section of river.

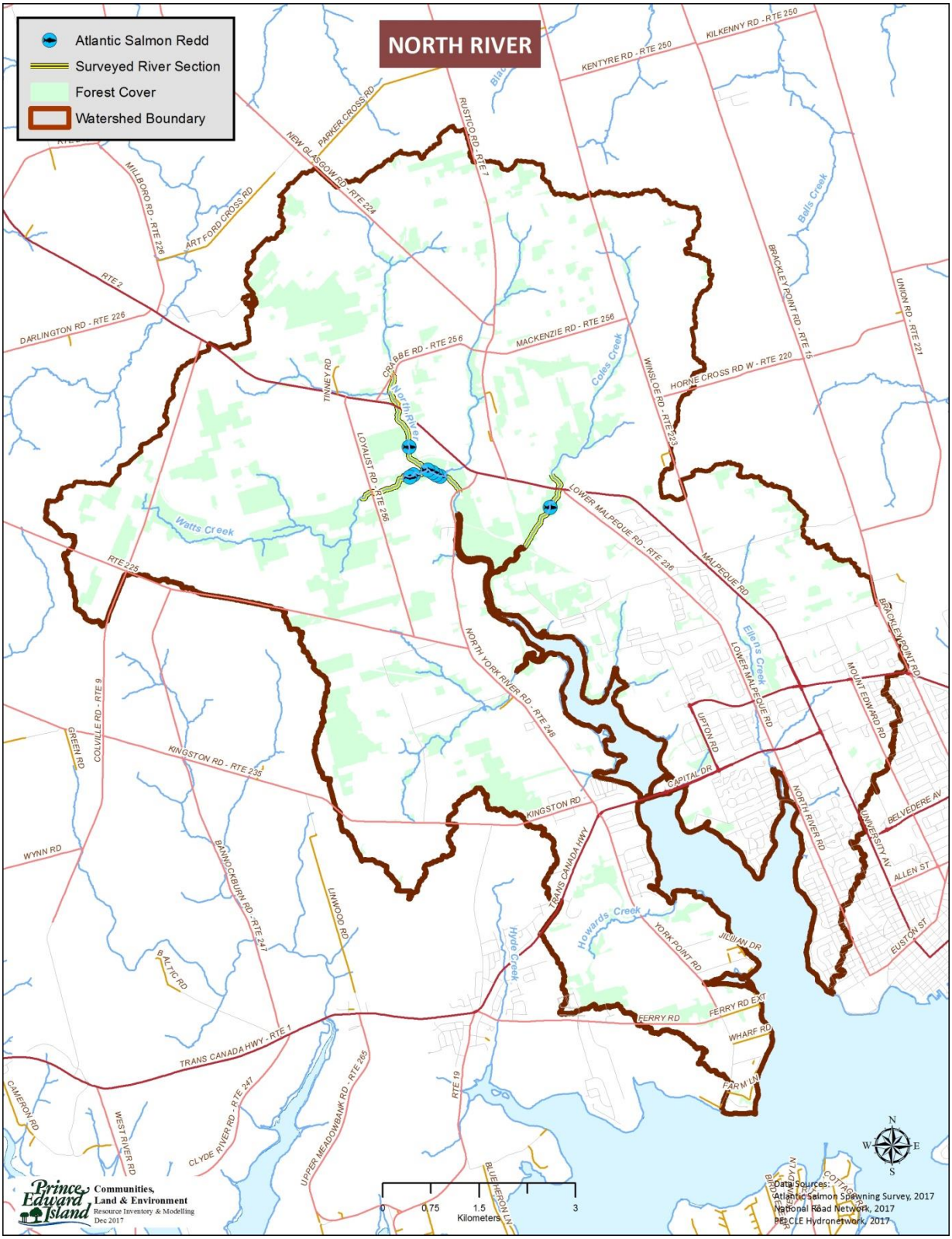

Figure 30. Location of salmon redds on North River, 2017.

Figure 31. Digital Elevation Model (DEM) map of a section of North River.

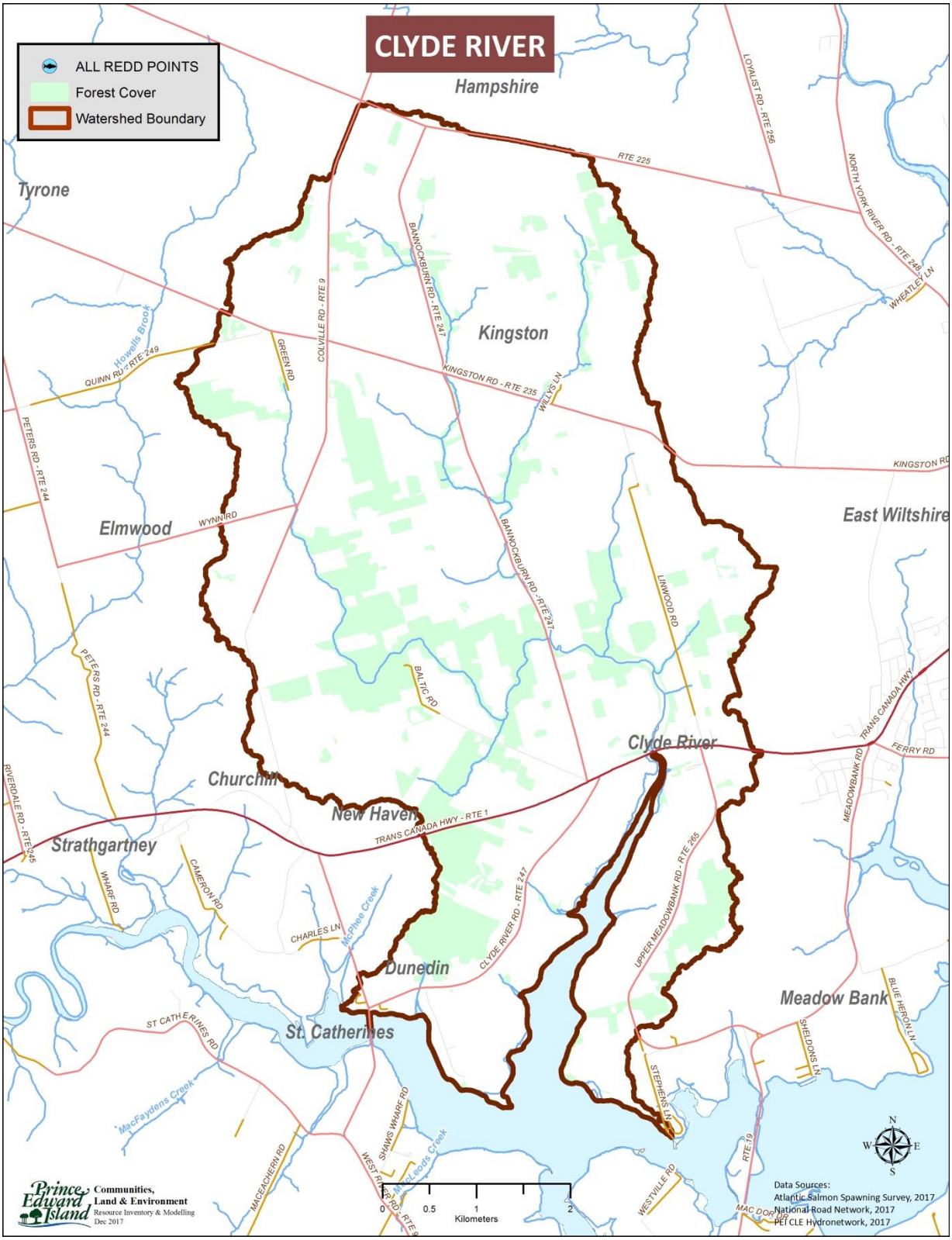

Figure 32. Location of salmon redds on Clyde River, 2017.

Figure 33. Digital Elevation Model (DEM) map of a section of Clyde River.

Cluster 5:

The salmon redd count in Vernon River is low but there is potential for additional habitat restoration within the system. Vernon River is relatively isolated from other salmon rivers and because of this, it would be beneficial to open up and improve fish habitat on nearby Seal River. The watershed group counted 18 redds in Seal River in 2015 but there has been no juvenile salmon assessment completed.

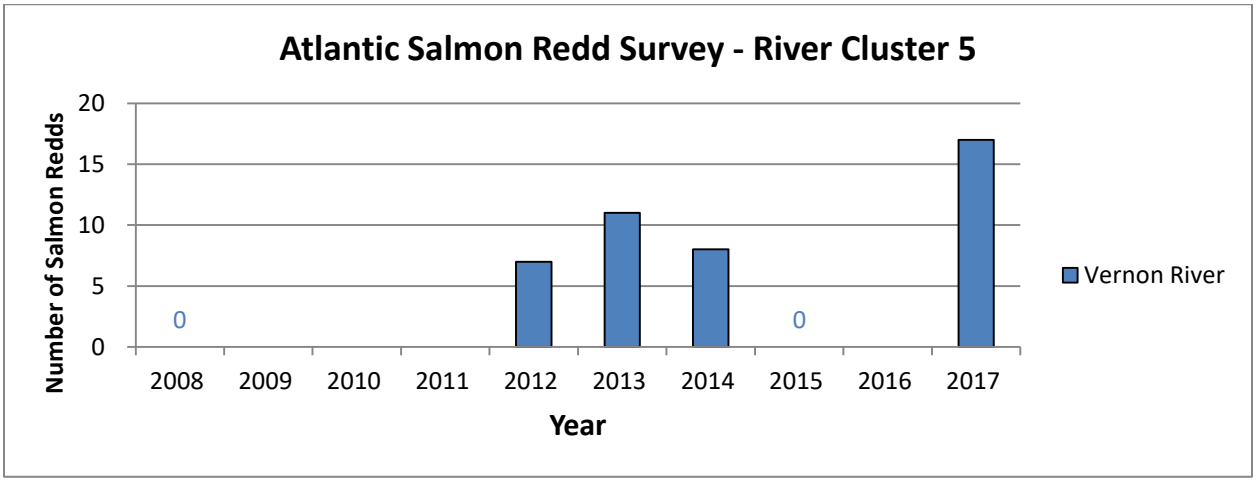

Figure 34. Number of salmon redds in Cluster 5 rivers from 2008 to 2017. Note: A '0' indicates that a survey was undertaken but no redds were recorded.

Figure 35. A salmon redd on Vernon River, November 2017. [Photo: C. MacLean]

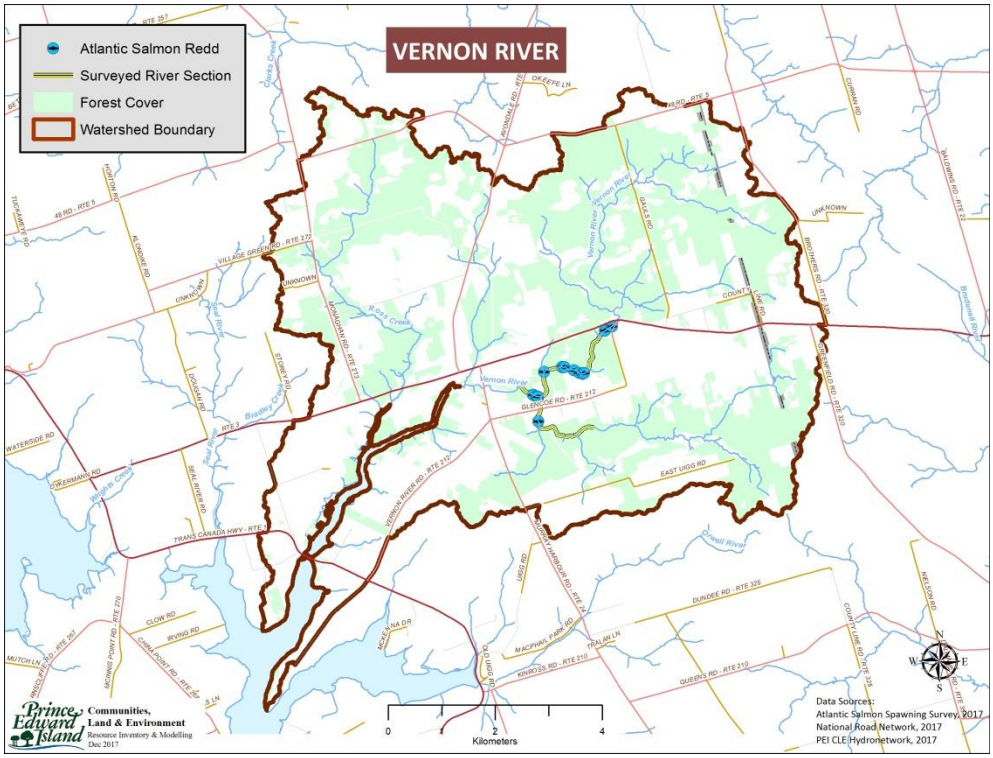

Figure 36. Location of salmon redds in Vernon River, 2017.

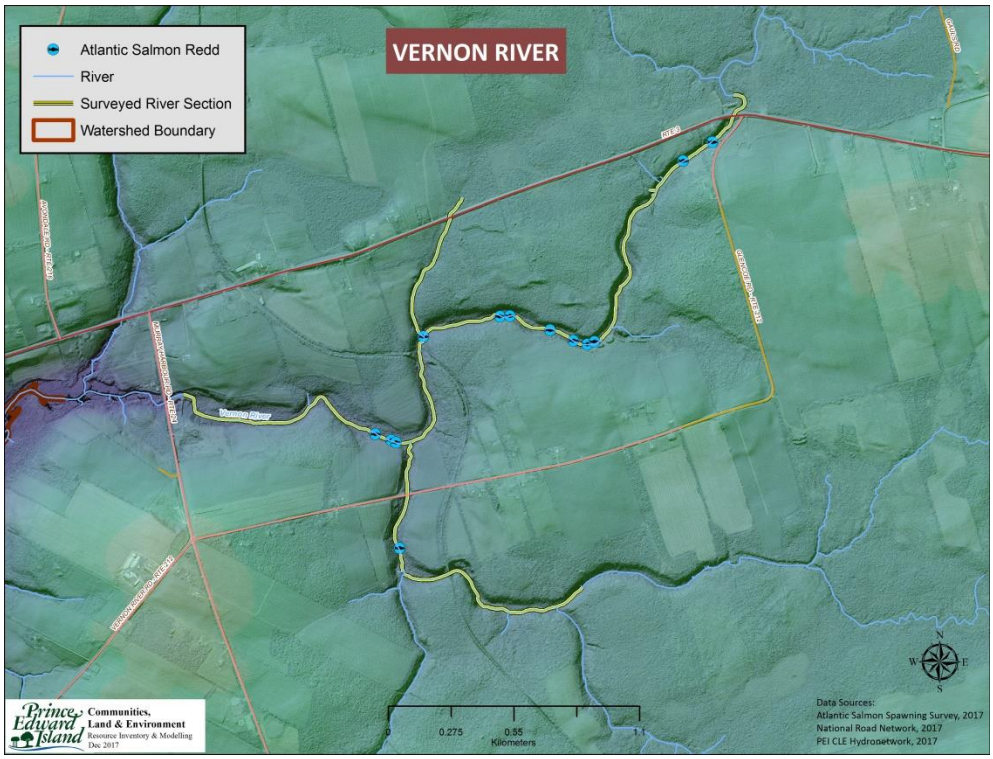

Figure 37. Digital Elevation Model (DEM) map of a section of Vernon River.

Cluster 6:

Populations of salmon in the East (Hillsborough) River are quite low. The salmon run in the Head of Hillsborough appears to be gone and few redds were recorded in Clarks Creek. Both of these systems are heavily impacted by beaver impoundments and large amounts of instream sediment. Salmon continue to spawn in the east branch of the Pisquid River, but low water levels and a scarcity of pools on the west branch may be discouraging salmon from ascending and using the area.

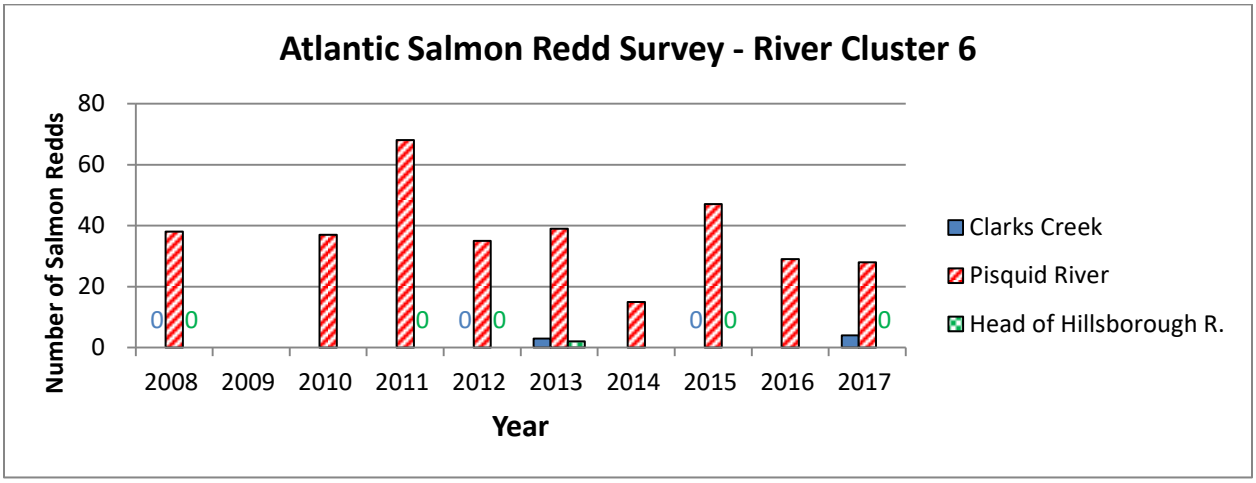

Figure 38. Number of salmon redds in Cluster 6 rivers from 2008 to 2017. Note: A '0' indicates that a survey was undertaken but no redds were recorded.

Figure 39. A section of Clarks Creek, November 2017. [Photo: C. MacLean]

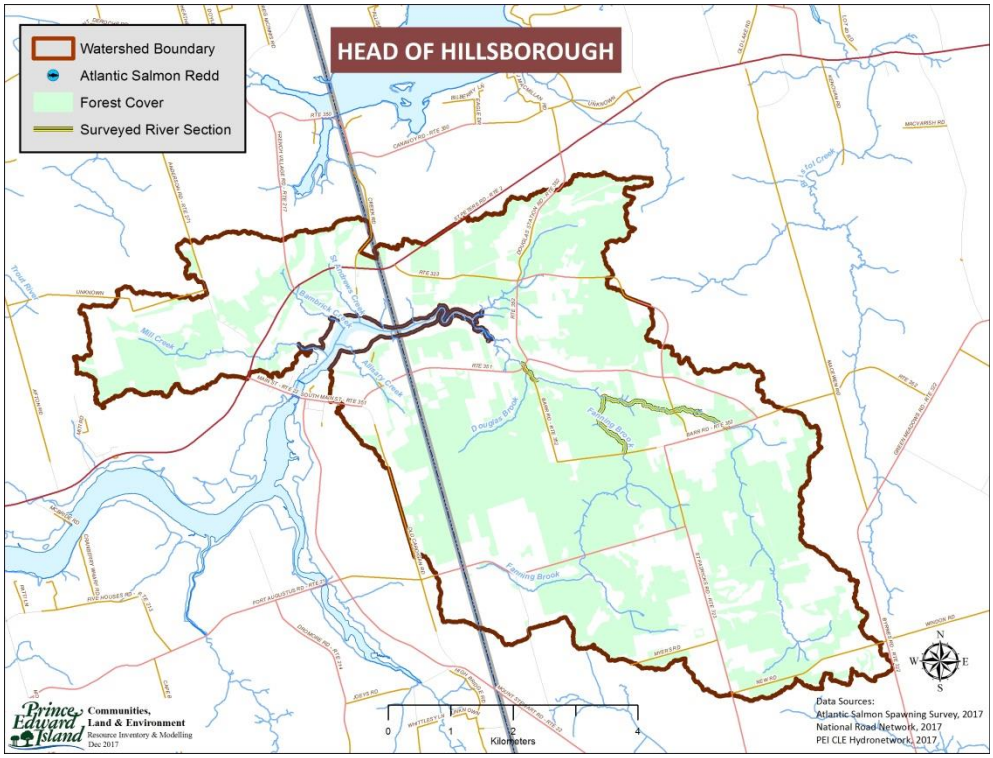

Figure 40. Location of salmon redds in Head of Hillsborough River, 2017.

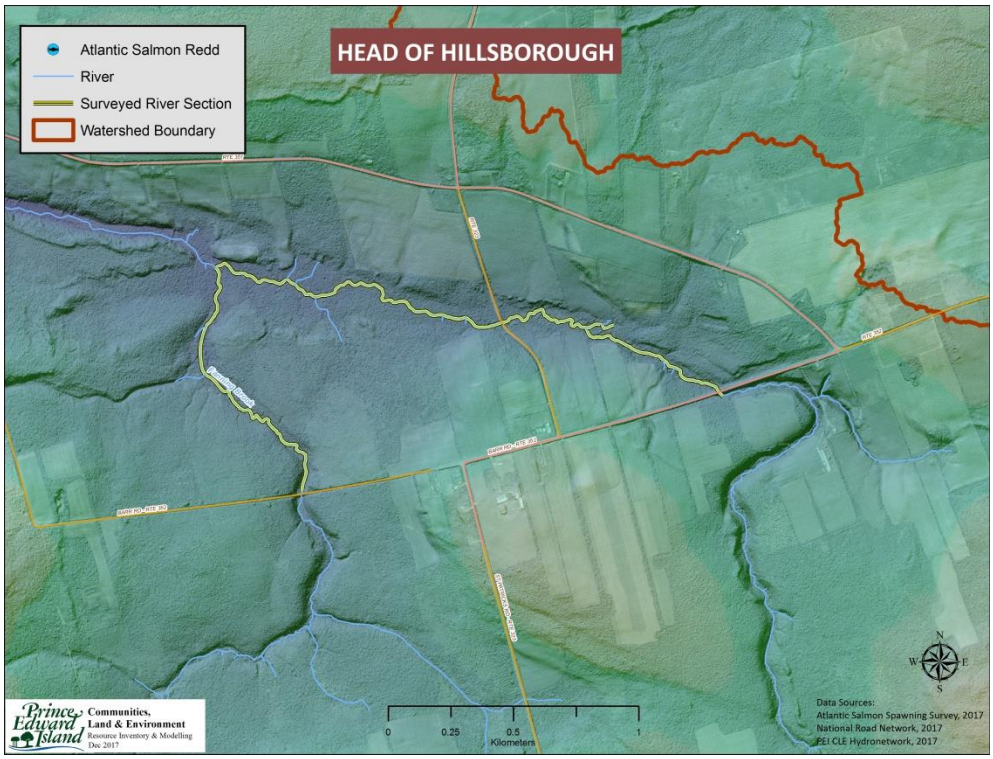

Figure 41. Digital Elevation Model (DEM) map of a section of Head of Hillsborough River.

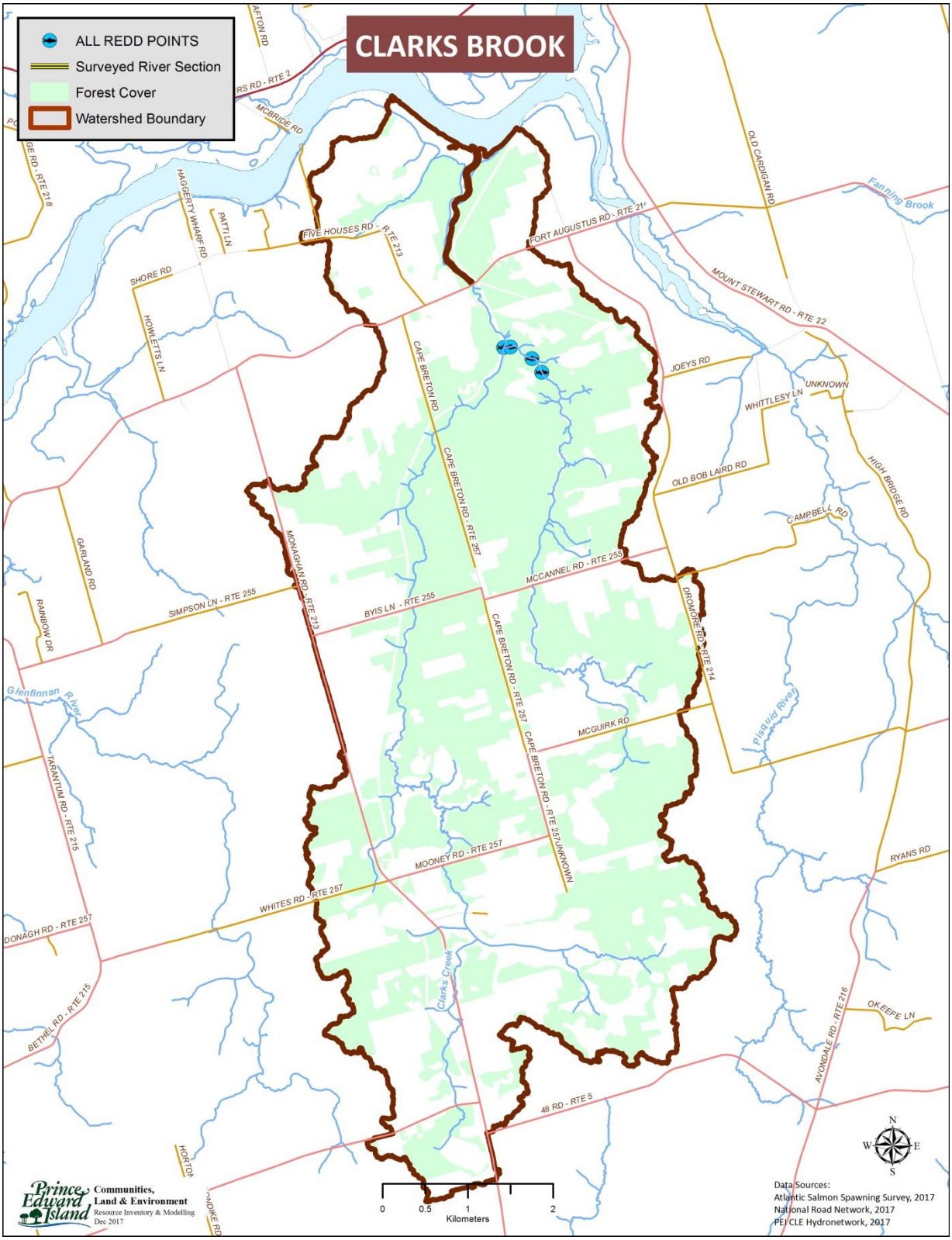

Figure 42. Location of salmon redds in Clarks Creek, 2017.

Figure 43. Digital Elevation Model (DEM) map of a section of Clarks Creek.

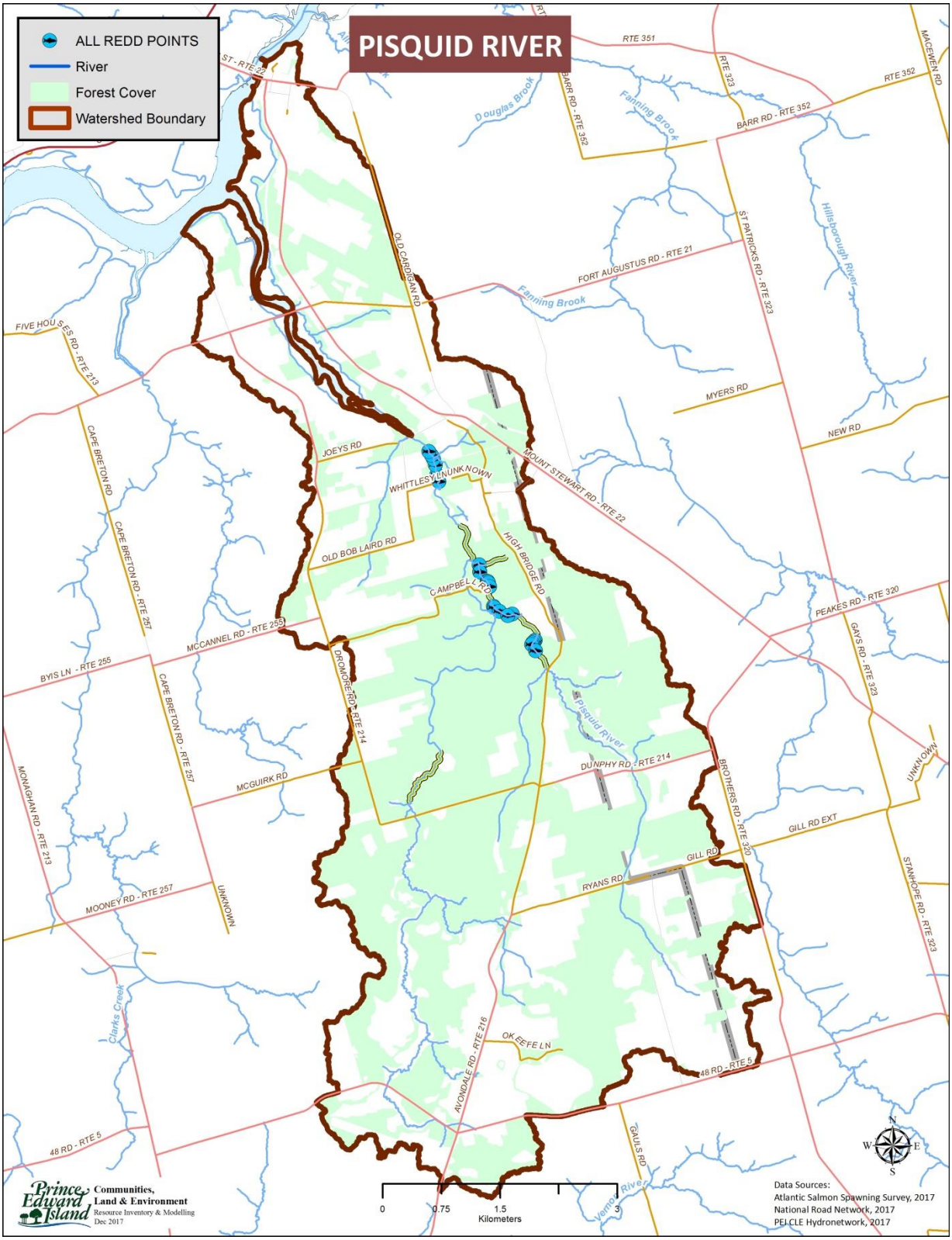

Figure 44. Location of salmon redds on Pisquid River, 2017.

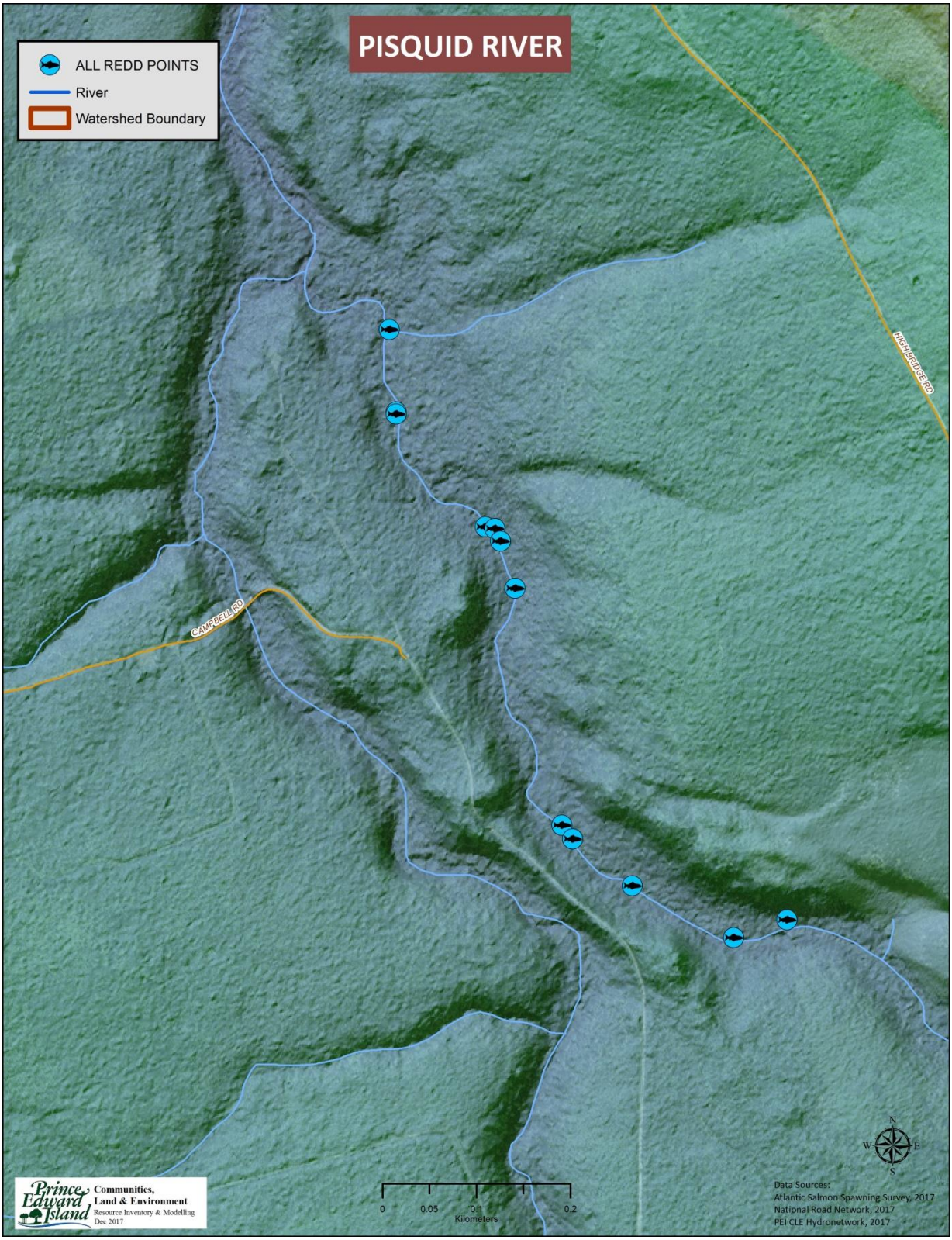

Figure 45. Digital Elevation Model (DEM) map of a section of Pisquid River.

Cluster 7:

The five rivers in the St. Peters Bay region – St. Peters, Marie, Midgell, Morell and Bristol – have had historical runs of Atlantic salmon. Each of these rivers experience elevated water temperatures resulting from an abundance of impoundments flooding low relief land. Currently, there is no evidence of salmon remaining in the Marie River, a river which has been heavily impounded. The St. Peters River is maintaining a run of salmon but they are currently restricted to the lower section of the main river. Intensive habitat restoration and removal of blockages would be needed to open up additional stream for use by salmon. The Morell and Midgell rivers are also maintaining runs of Atlantic salmon but numbers of redds are lower than historical levels and less than one would expect from large systems. For salmon populations to improve, additional upstream habitat would need to be made accessible and restored.

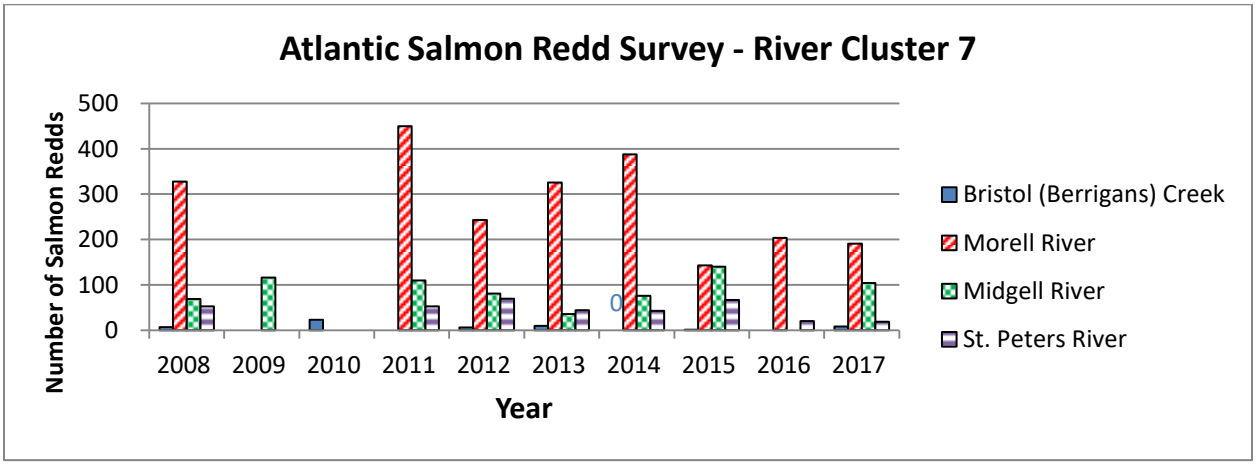

Figure 46. Number of salmon redds in Cluster 7 rivers from 2008 to 2017. Note: A '0' indicates that a survey was undertaken but no redds were recorded.

Figure 47. A large redd at the top end of a riffle on Morell River, November 2017. [Photo: R. MacFarlane]

Figure 48. Location of salmon redds in Bristol Creek, 2017.

Figure 49. Digital Elevation Model (DEM) map of a section of Bristol Creek.

Figure 50. Location of salmon redds in the Morell River, 2017.

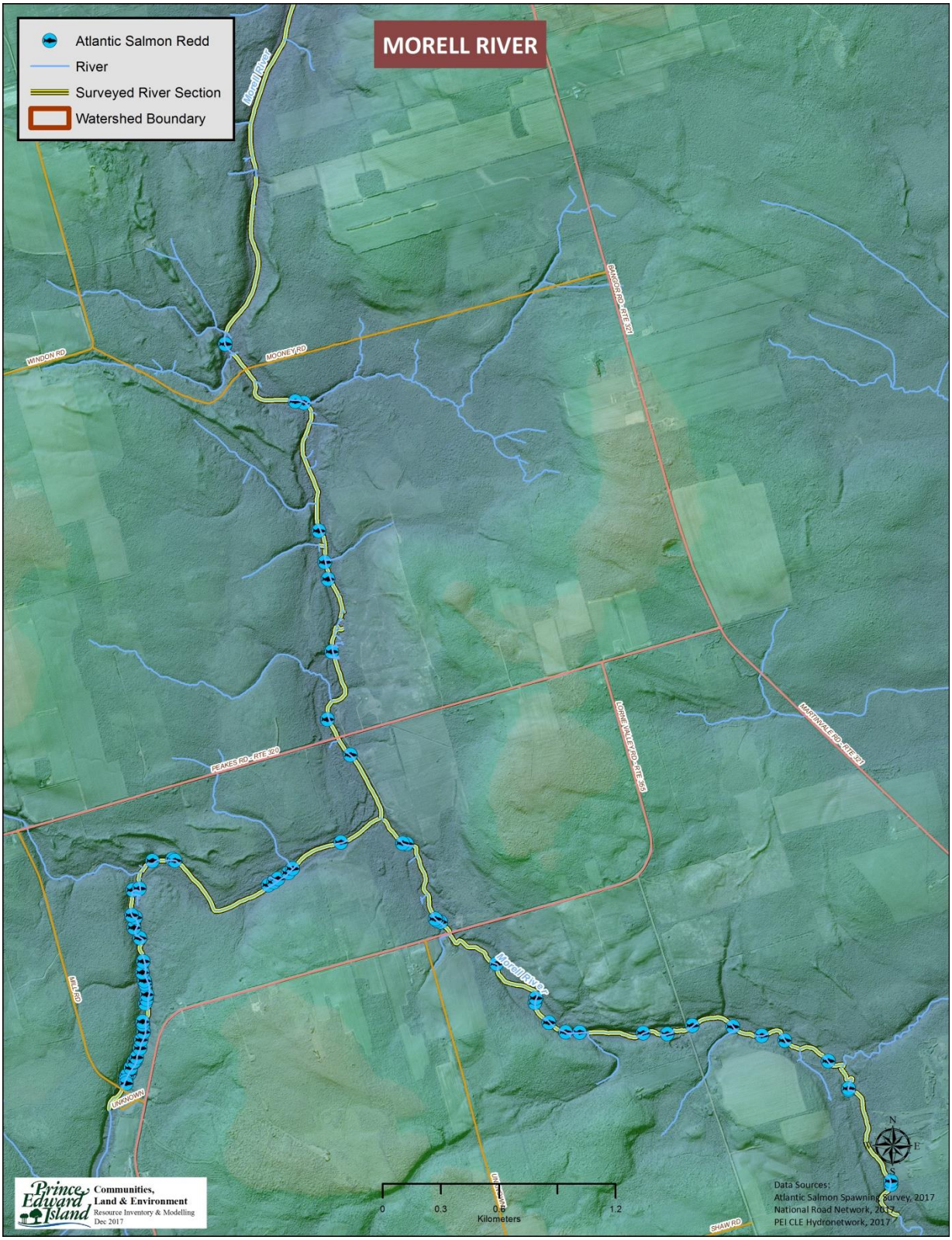

Figure 51. Digital Elevation Model (DEM) map of a section of Morell River.

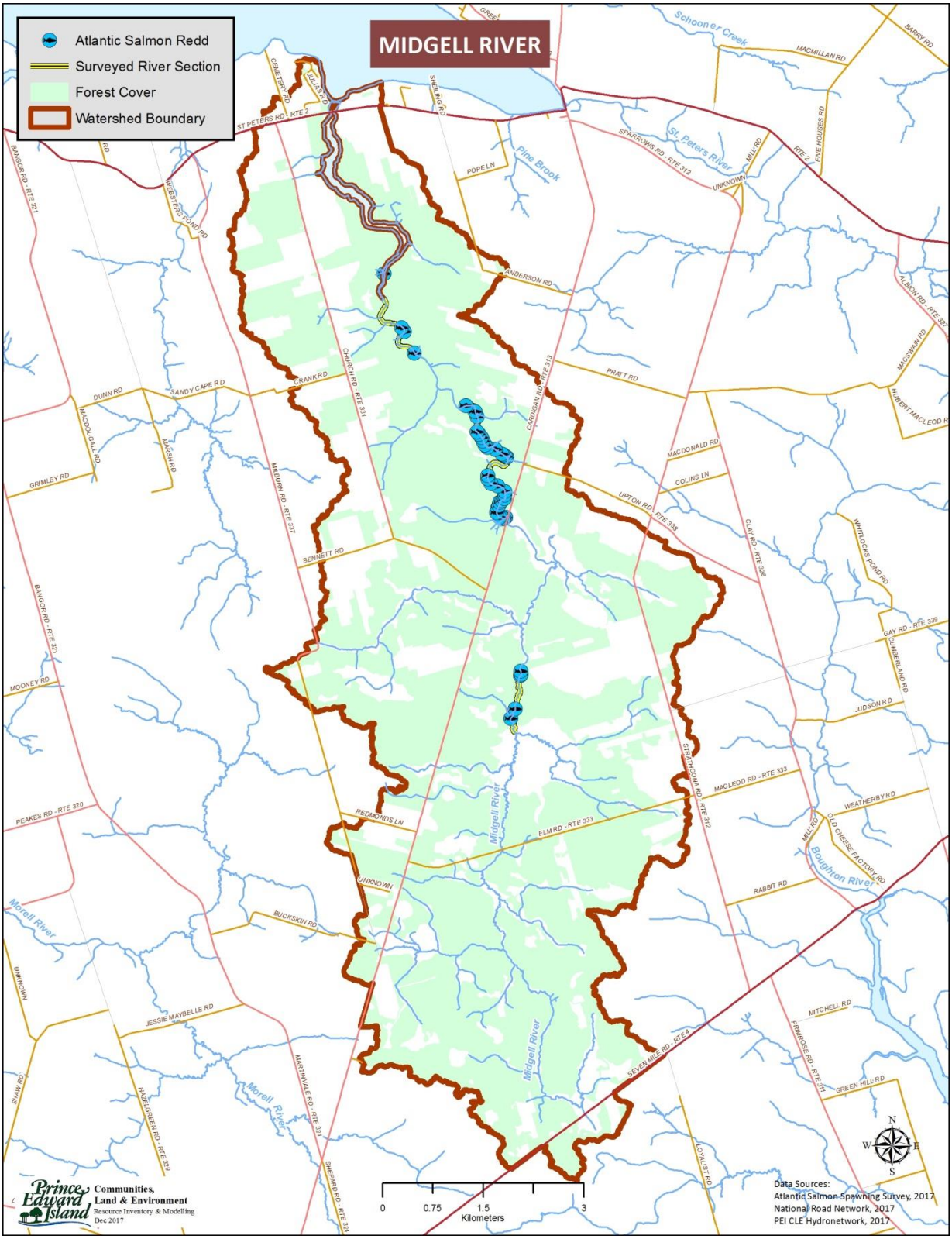

Figure 52. Location of salmon redds in Midgell River, 2017.

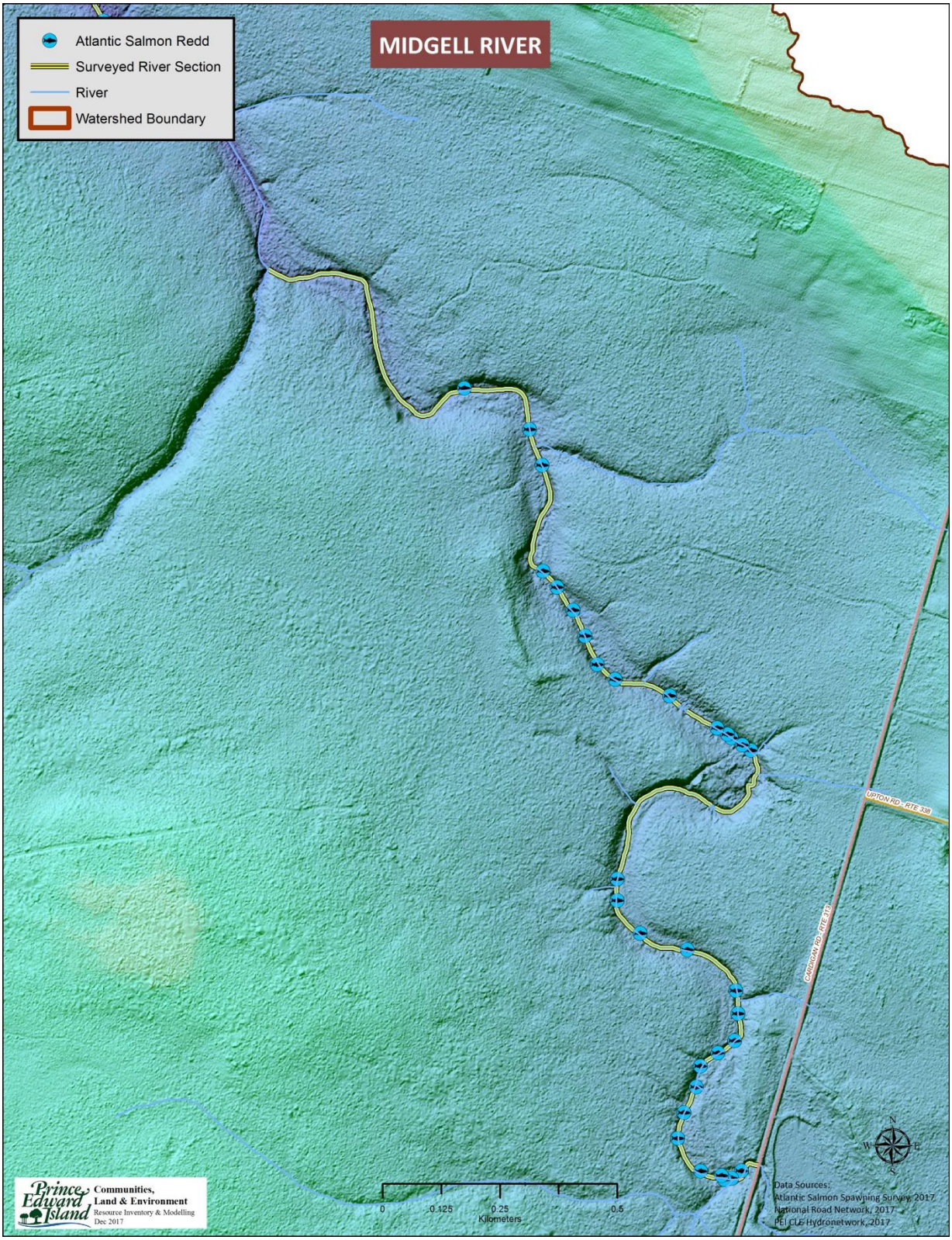

Figure 53. Digital Elevation Model (DEM) map of a section of Midgell River.

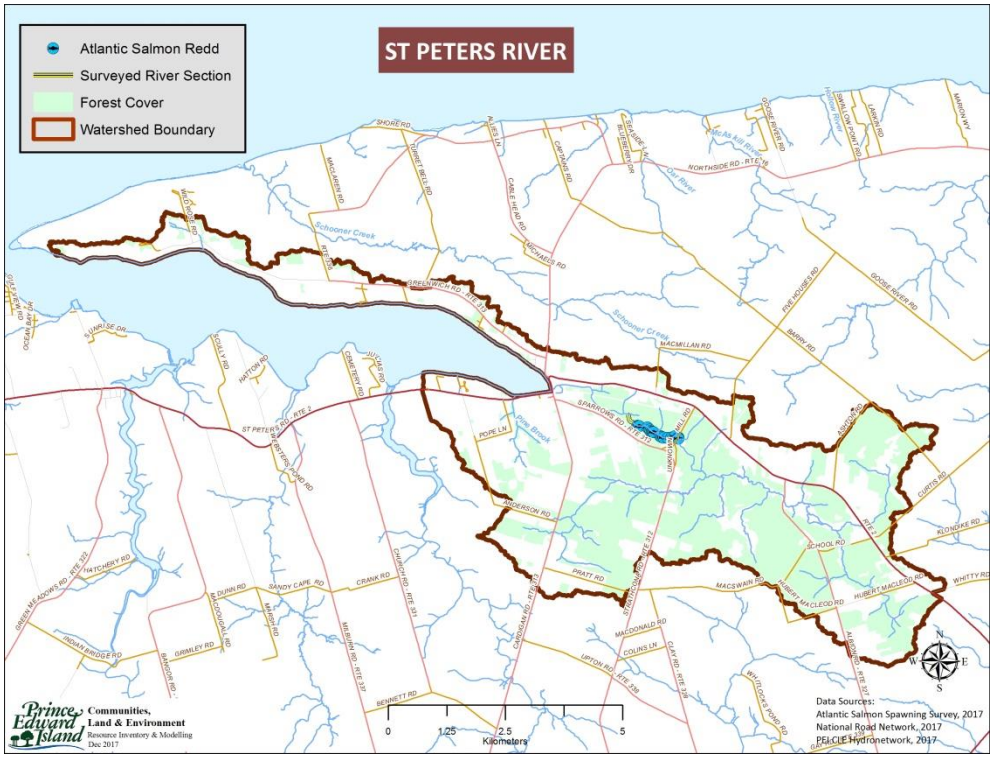

Figure 54. Location of salmon redds in St. Peters River, 2017.

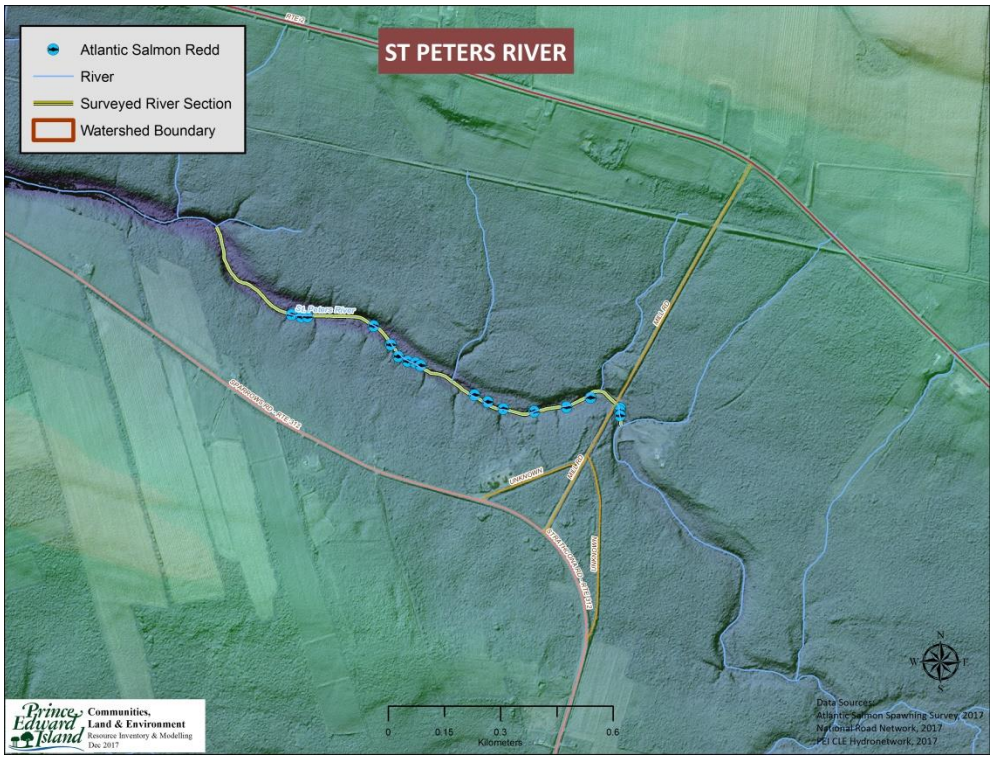

Figure 55. Digital Elevation Model (DEM) map of a section of St. Peter's River.

Cluster 8:

The salmon redd numbers in rivers comprising Cluster 8 are considerably lower than the three rivers discussed above. The Naufrage River is affected by beaver impoundments in its headwaters, as well as Larkins Pond. Warm water temperature and fish passage obstructions are negatively impacting the potential of the river as salmon habitat. Although a few salmon redds have been observed in Bear River, there have been no confirmed juvenile salmon in that system for many years. Hay River and Cow River continue to respond to the habitat restoration and beaver management work that has taken place. In some years, access from the Gulf may be restricted by storms creating blockages.

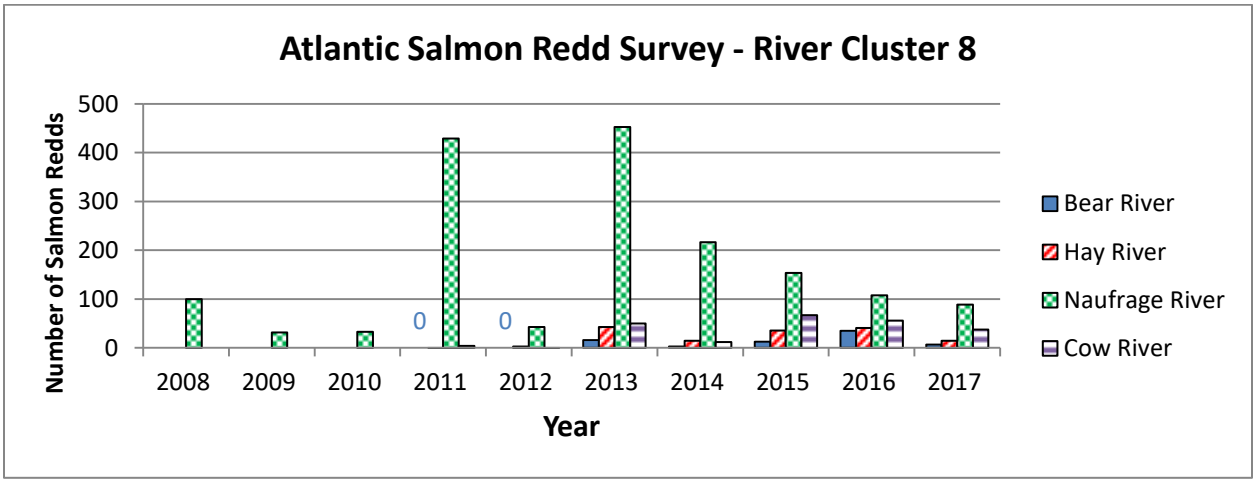

Figure 56. Number of salmon redds in Cluster 8 rivers from 2008 to 2017. Note: A '0' indicates that a survey was undertaken but no redds were recorded.

Figure 57. Bear River. [Photo: R. Flynn]

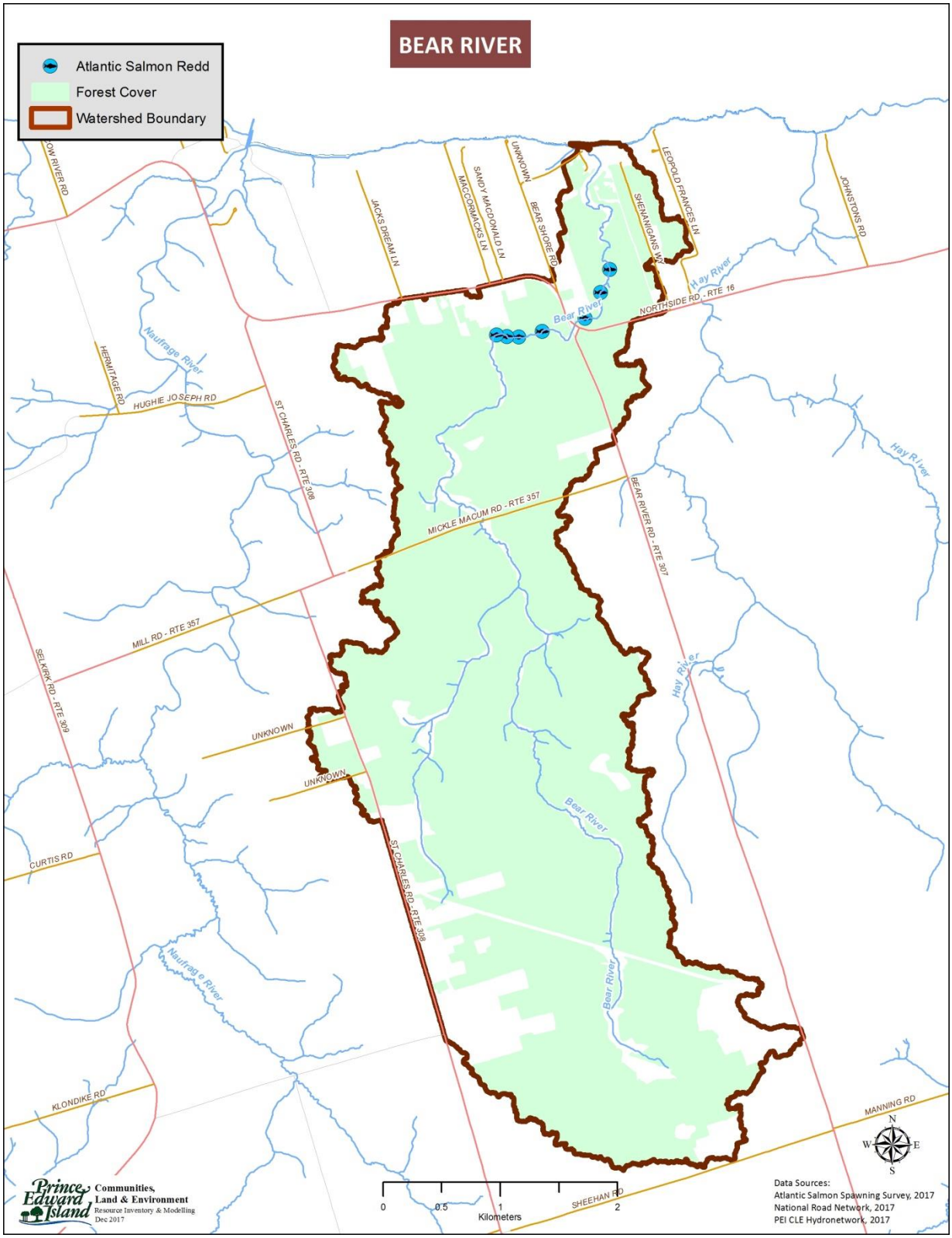

Figure 58. Location of salmon redds in Bear River, 2017.

Figure 59. Digital Elevation Model (DEM) map of a section of Bear River.

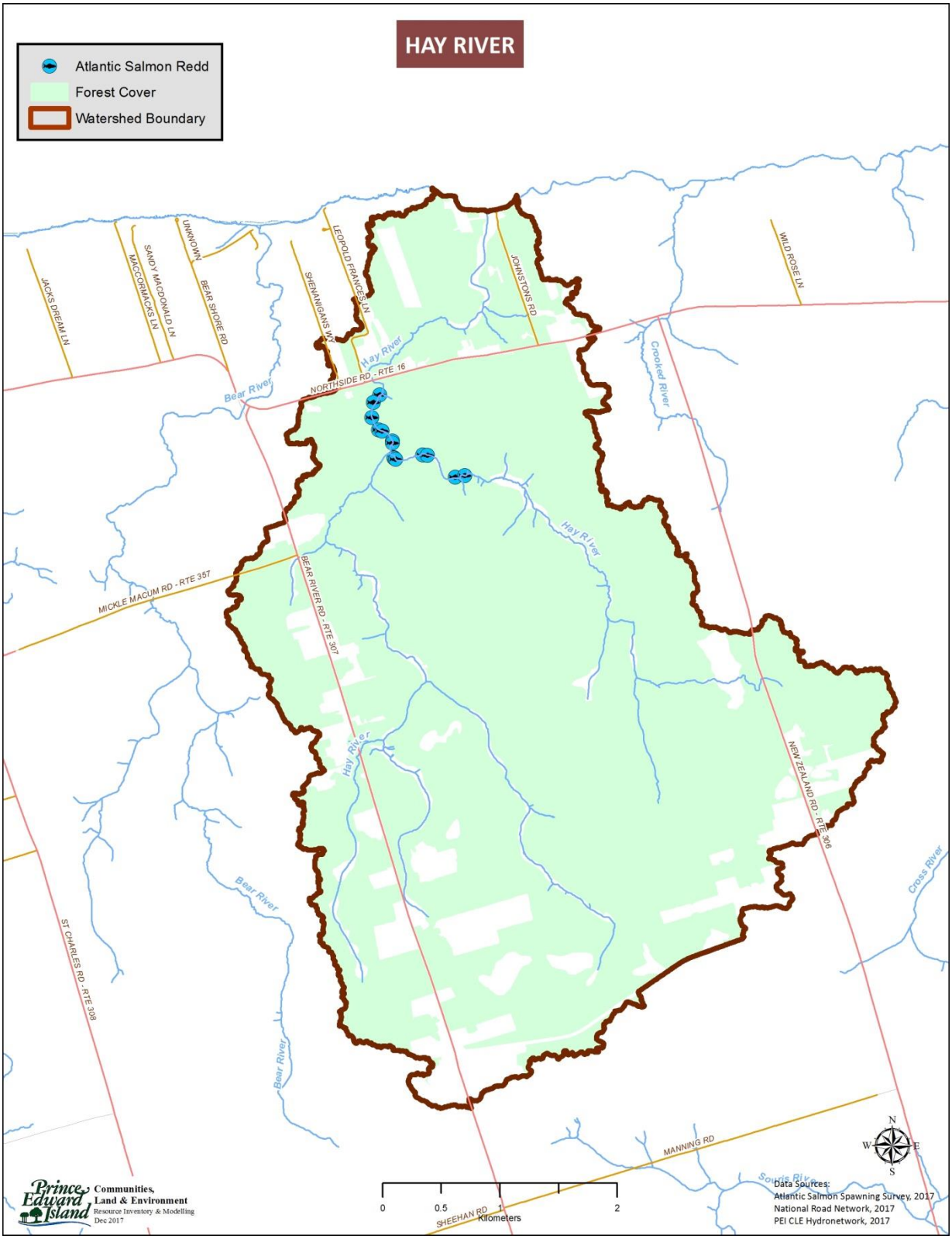

Figure 60. Location of salmon redds in Hay River, 2017.

Figure 61. Digital Elevation Model (DEM) map of a section of Hay River.

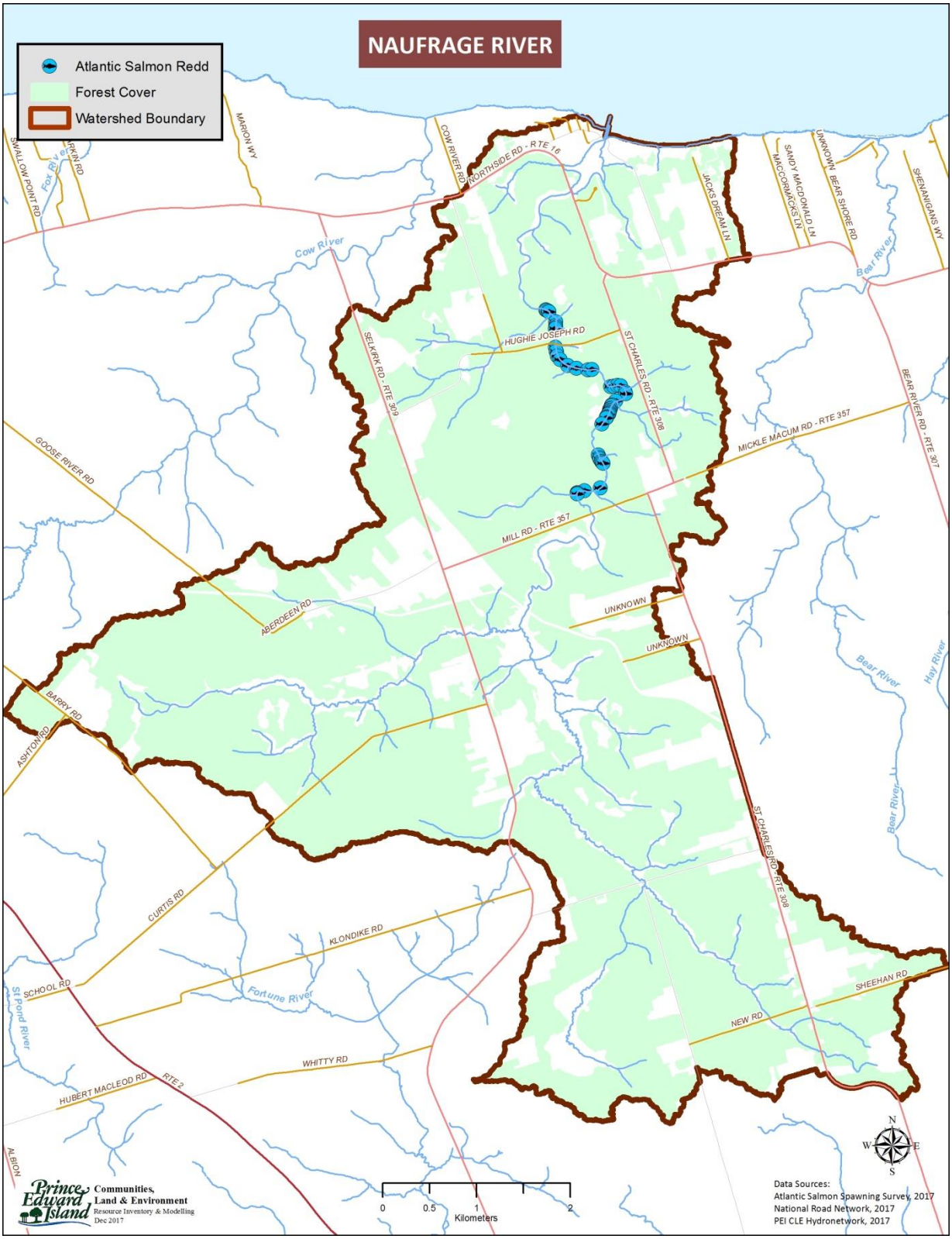

Figure 62. Location of salmon redds in Naufrage River, 2017.

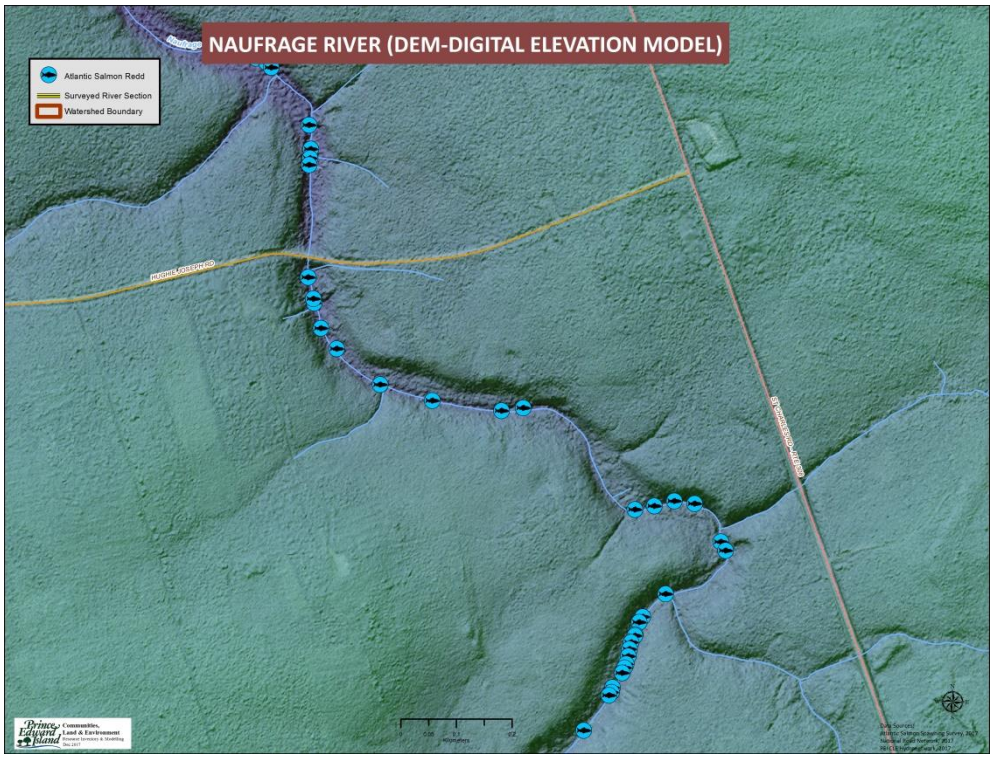

Figure 63. Digital Elevation Model (DEM) map of a section of Naufrage River.

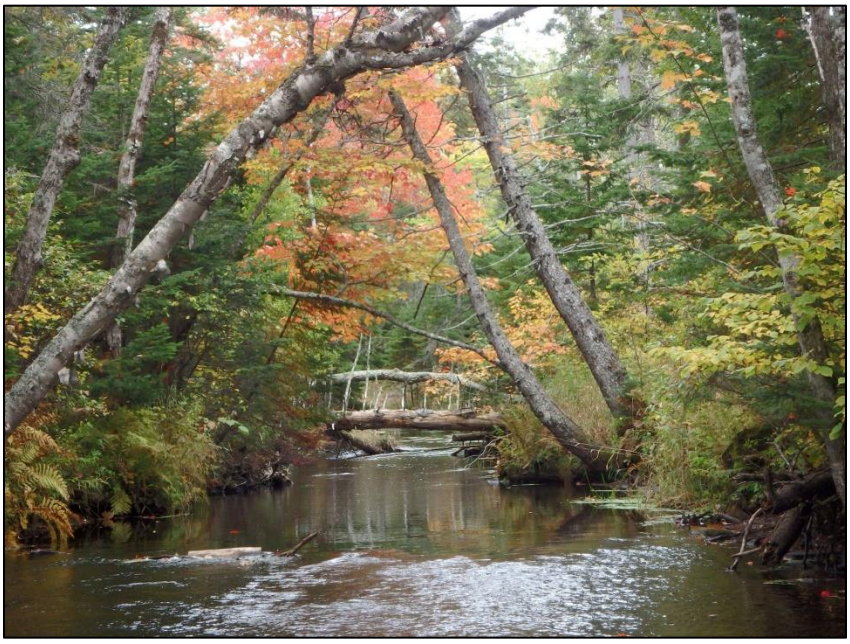

Figure 64. Naufrage River, November 2017. [Photo: S. Meade]

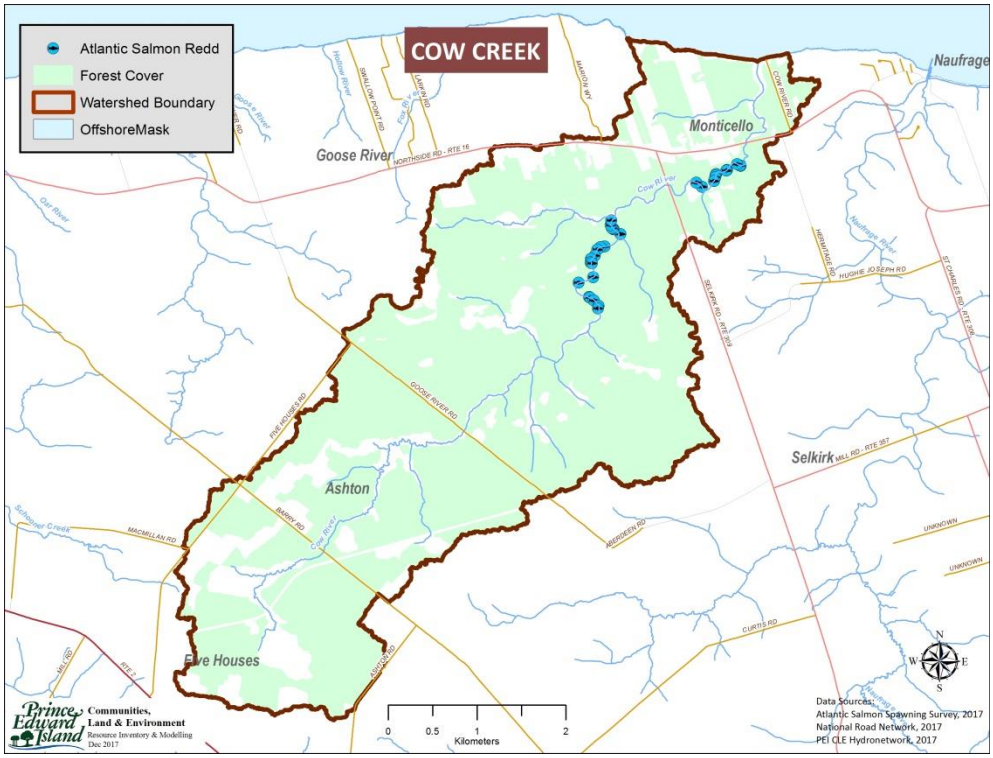

Figure 65. Location of salmon redds on Cow Creek, 2017.

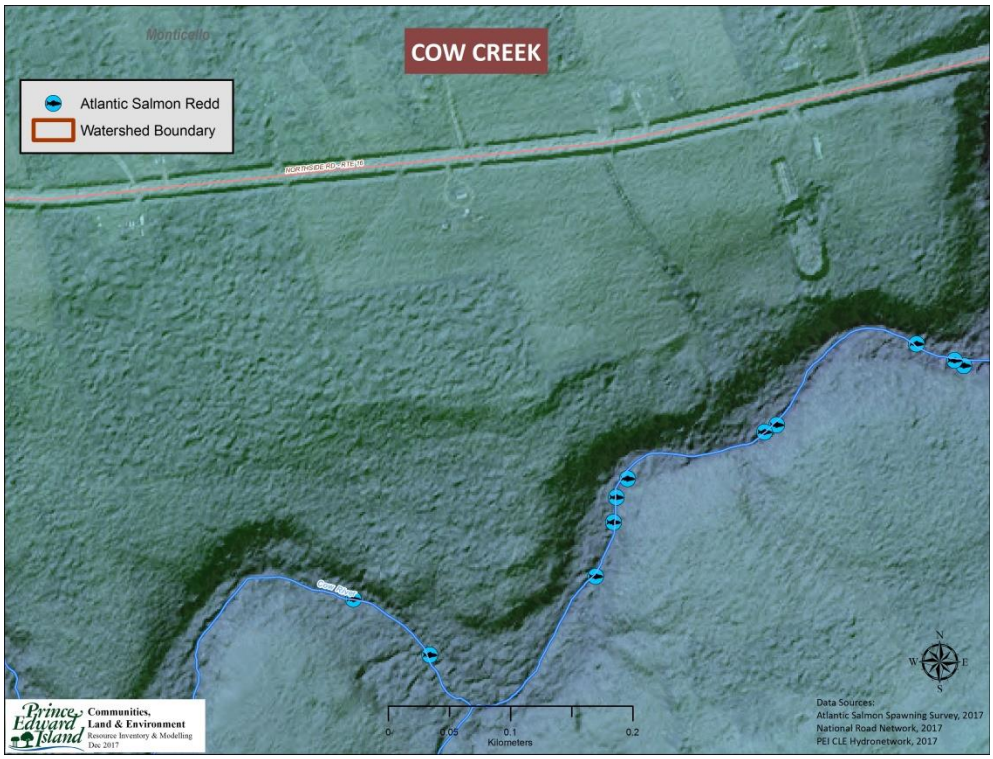

Figure 66. Digital Elevation Model (DEM) map of a section of Cow Creek.

Cluster 9:

North Lake, Cross River and Priest Pond Creek are the gems of north eastern PEI. The number of redds in these systems is reflective of the intensive habitat restoration and beaver management efforts that have taken place over many years. These rivers also have the added benefit of being primarily wooded, and thus they do not suffer the sedimentation or pesticide issues seen in more agricultural regions of the Island.

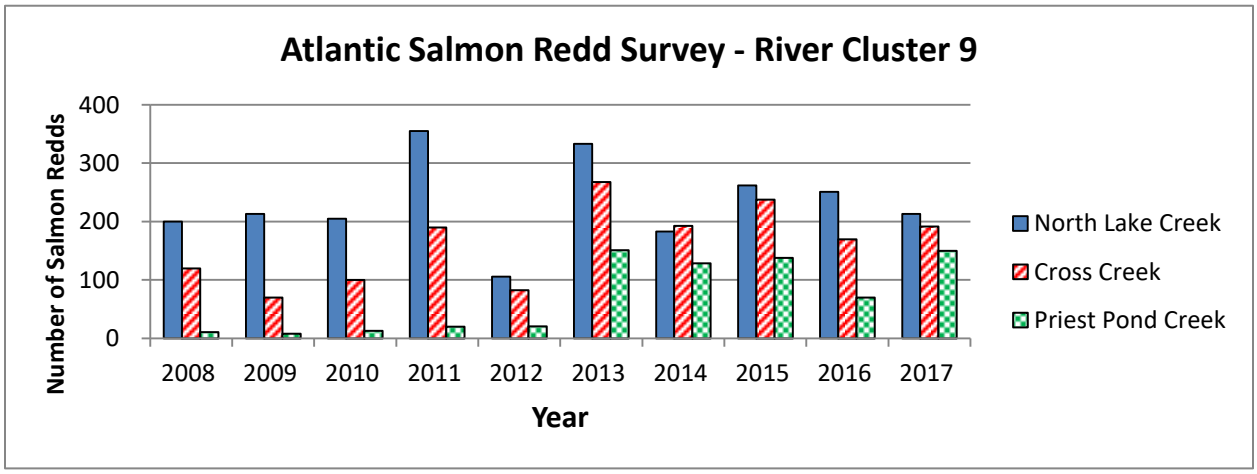

Figure 67. Number of salmon redds in Cluster 9 rivers from 2008 to 2017.

Figure 68. A salmon redd being marked on Cross River, November 2017 [Photo: S. Meade]

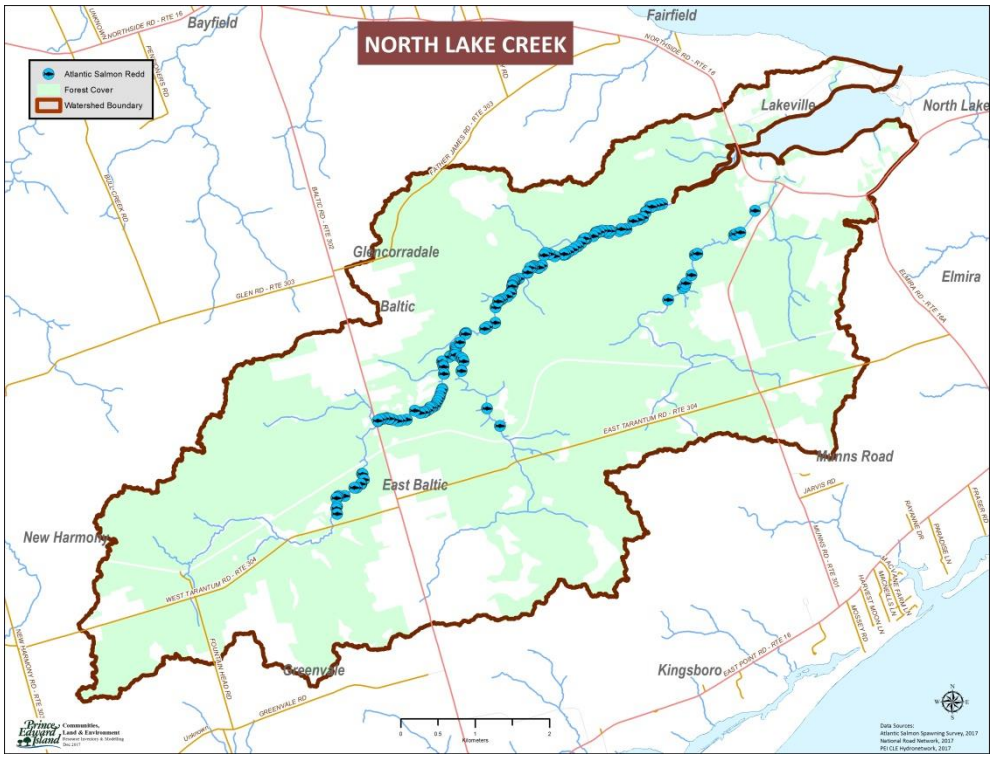

Figure 69. Location of salmon redds in North Lake Creek, 2017.

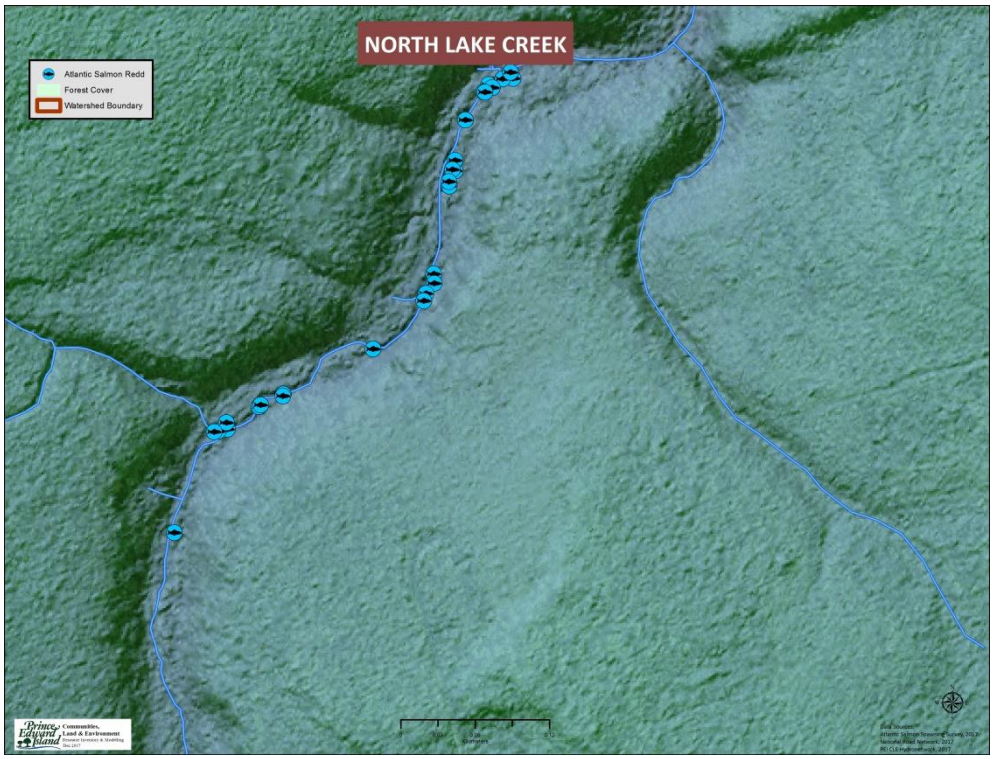

Figure 70. Digital Elevation Model (DEM) map of a section of North Lake Creek.

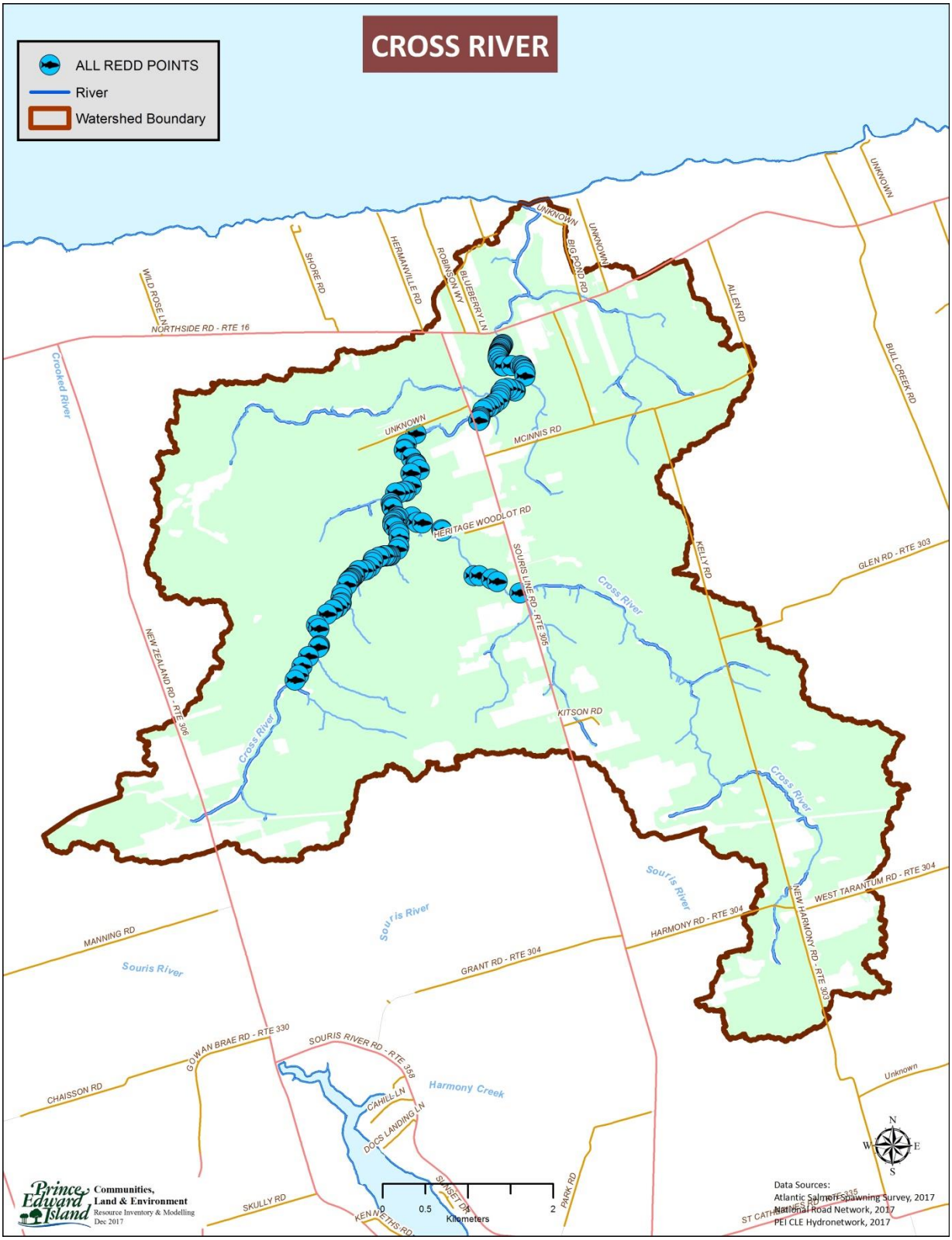

Figure 71. Location of salmon redds on Cross River, 2017.

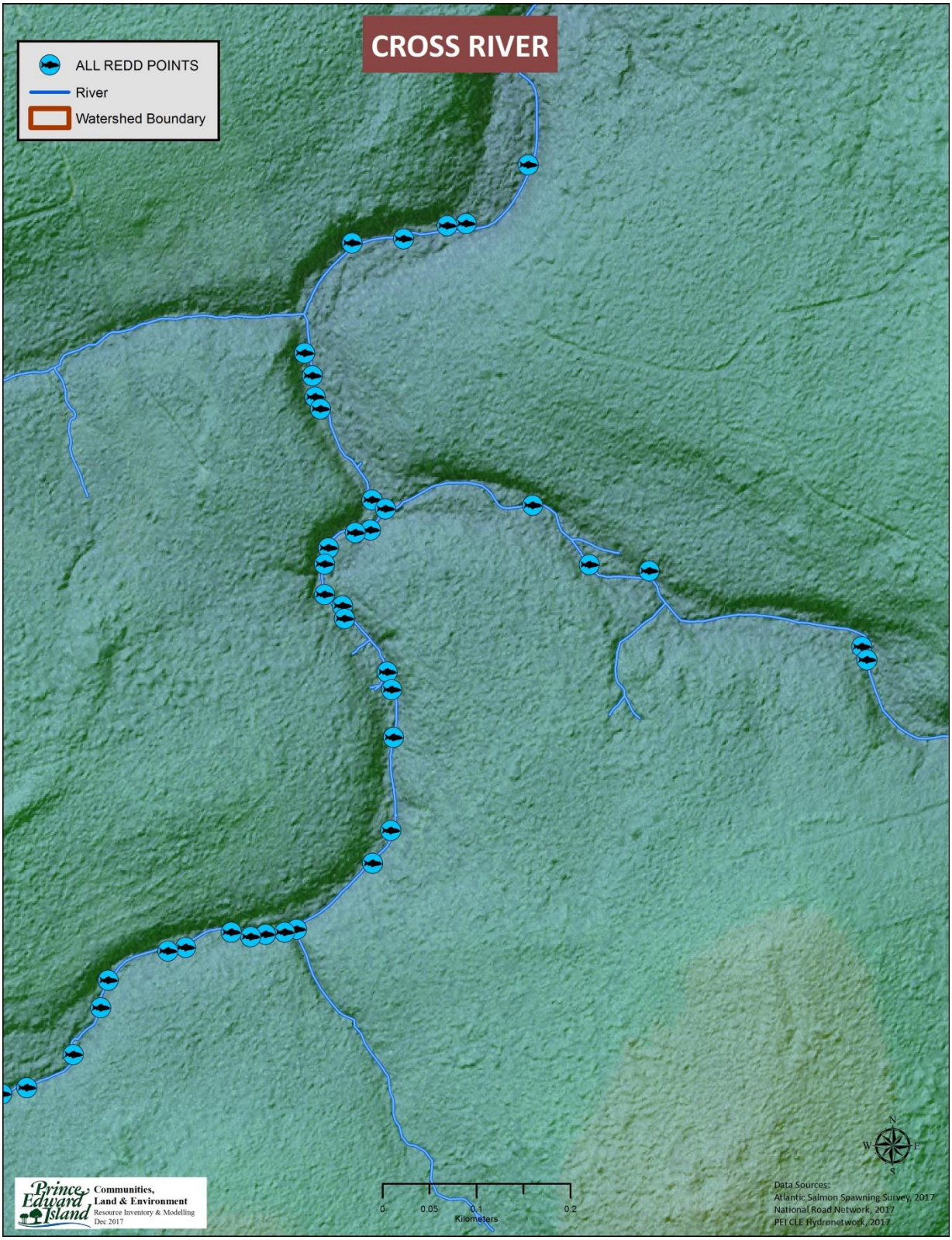

Figure 72. Digital Elevation Model (DEM) map of a section of Cross River.

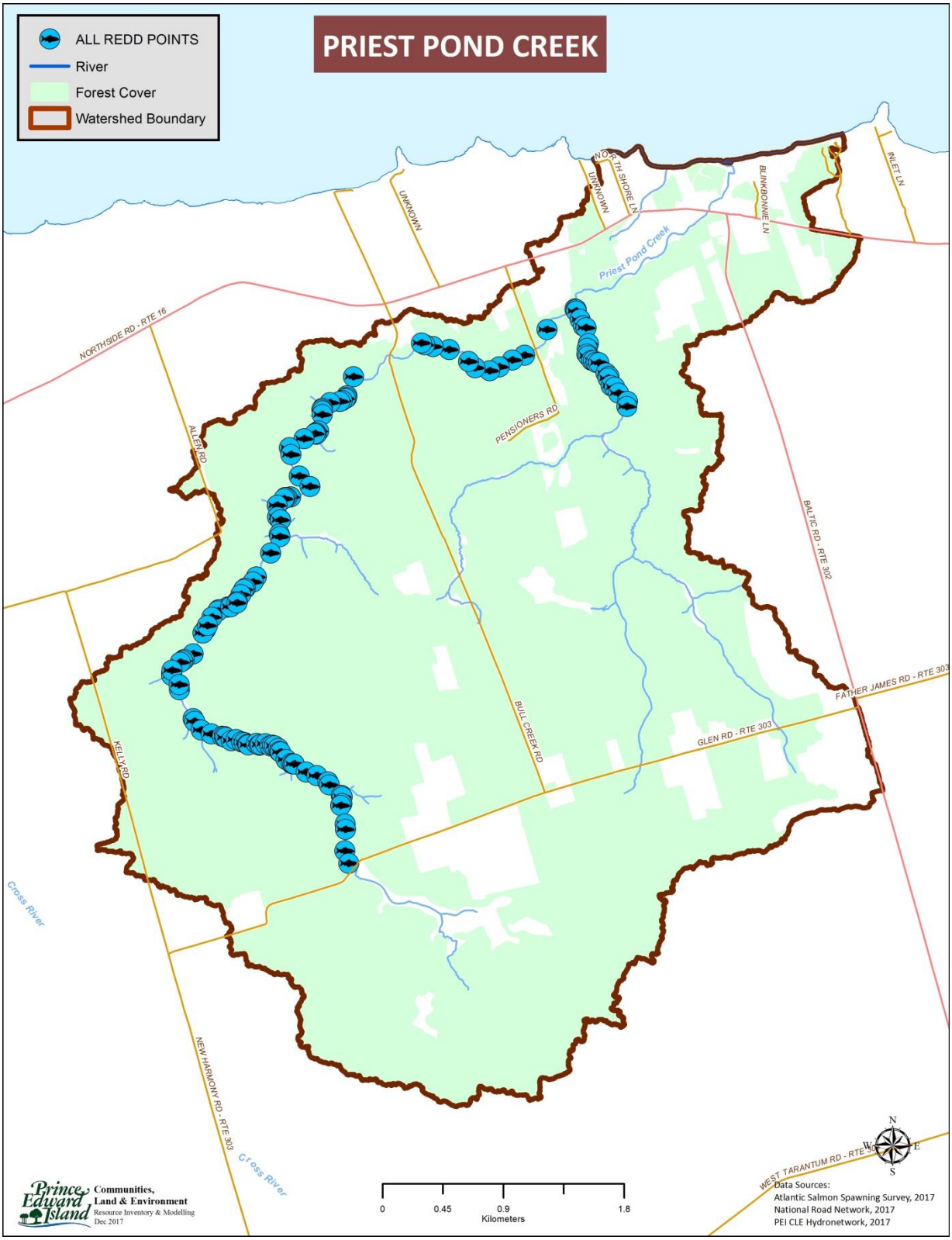

Figure 73. Location of salmon redds on Priest Pond Creek, 2017.

Figure 74. Digital Elevation Model (DEM) map of a section of Priest Pond Creek.

Discussion

There was considerable variation in salmon spawning activity between rivers surveyed. Some rivers appear to be maintaining consistent numbers of redds, some have dramatically declined from previous surveys, a few show increases. Atlantic salmon typically spawn in the same stream reaches and sites each year. Groups monitoring salmon populations can take note of any major changes in number and location of redds and determine potential causes – salmon run size, low water levels in autumn, blockages, change in habitat conditions (e.g. substrate).

There is some evidence that salmon returning from sea may not always go up the same river to spawn. If a river blockage is present, for example a malfunctioning fish ladder, beaver dam or low water conditions, the salmon may choose to enter a nearby river to spawn. This behaviour has been observed for Atlantic salmon in Anticosti Island, where researchers describe "genetic exchange between reproducers from rivers on the Island" and "gene flow of salmon from the rivers located in the surrounding areas." (Amélie Gilbert, Biologist, SEPAQ – Presentation to Ministerial Advisory Committee on Atlantic Salmon 2014). For this reason, we have separated the salmon rivers in PEI into clusters. Redd numbers in one river can be surprisingly low while a neighbouring system may see a boost in that spawning year. It is possible that salmon may leave a river because of unsuitable conditions or a blockage and enter a nearby system. This has important management implications for sea-run trout as well as Atlantic salmon. If salmon populations are to be maintained and enhanced, we need to manage rivers as a group rather than on an individual basis.

As in previous surveys, beaver blockages appear to be having a major impact on salmon spawning activity. Quite often, the first major dam marks the upper limit of salmon spawning. This is most evident in low water conditions, when there is no defined flow over the dam and insufficient water to allow passage around the blockage. Even if the salmon can get around or over the dam, the flooded waters within the impoundment do not offer suitable spawning habitat. Large portions of some rivers are "cut off" and unavailable or unsuitable for use by Atlantic salmon. Recent research carried out by Dr. Royce Steeves and a team of scientists at DFO Moncton is providing much needed information on the food sources available for salmon in various rivers. Early results indicate that the insect species found in headwater streams tend to be an excellent match for the food requirements of juvenile salmon. Deterioration of stream habitat in the second and third order streams and the inability of fish to reach and use these headwater streams may be forcing salmon to spawn in sub-optimal habitat in the main branches of many rivers and could be a major factor in the decline of salmon in PEI. A greater emphasis on headwater streams when planning and carrying out stream restoration projects would be beneficial.

Figure 75. Morell River, 2017. [Photo: J. MacEachern]

Land use continues to have a major impact on the quality of river habitat and the status of Atlantic salmon. The Digital Elevation Model (DEM) maps are valuable in identifying first and second order tributaries which may have a mix of land use activities. A major limiting factor for salmon populations, sedimentation, often originates from inappropriate land close to these small streams. The rivers with primarily wooded drainage basins continue to outperform more cleared drainage basins in terms of salmon production.

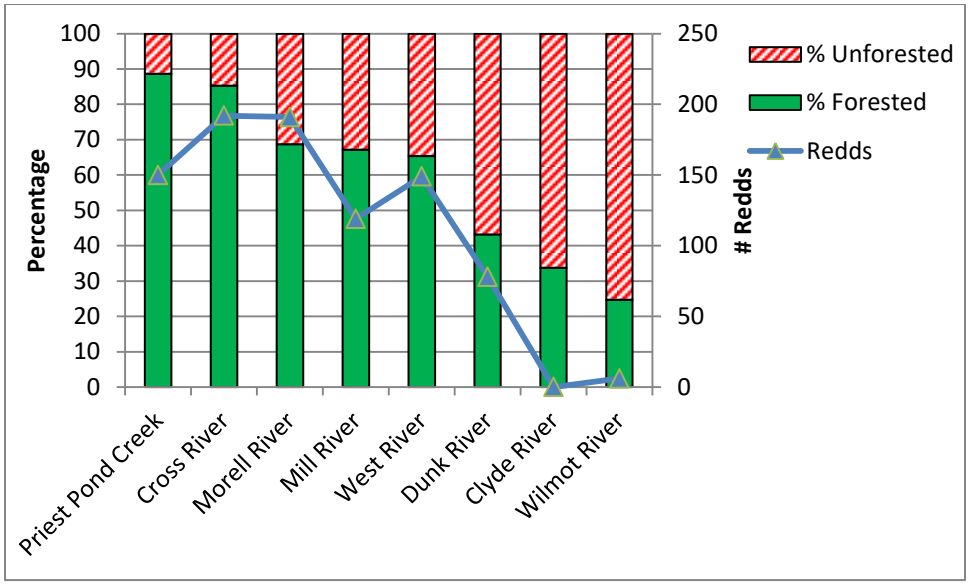

Figure 76. The percentage of forested and unforested land in eight watersheds and the number of redds counted in 2017.

Climate change will pose additional challenges for those trying to restore populations or even maintain present levels of Atlantic salmon in the rivers on PEI. In April 2014, a 1/100 year rainfall event washed out roads in PEI, including a section of the Eliot River Road on the West River. A second flood in December 2014 washed the road out a second time. Electrofishing data from Howells Brook branch of the West River in 2014 showed few rainbow trout and likely no Atlantic salmon survived the spring flood while the autumn flood appeared to wash out recently deposited Atlantic salmon eggs and many brook trout redds in the Quinn Brook tributary. On January 12, 2018, heavy rains occurred in the western part of Prince Edward Island. With little snow cover and deeply-frozen ground, the area received extensive flooding. The resulting high water and runoff of sediment can cause major damage to developing trout and salmon eggs when they are extremely vulnerable. A salmon redd recorded in the North River in November 2017 was obliterated after one of several winter thaws in February 2018. The increasing frequency and intensity of storm events could have major repercussions on future habitat rehabilitation and salmon management in PEI. Riparian zone and stream restoration activities will need to counterbalance the impact of more severe and unpredictable storms in the future.

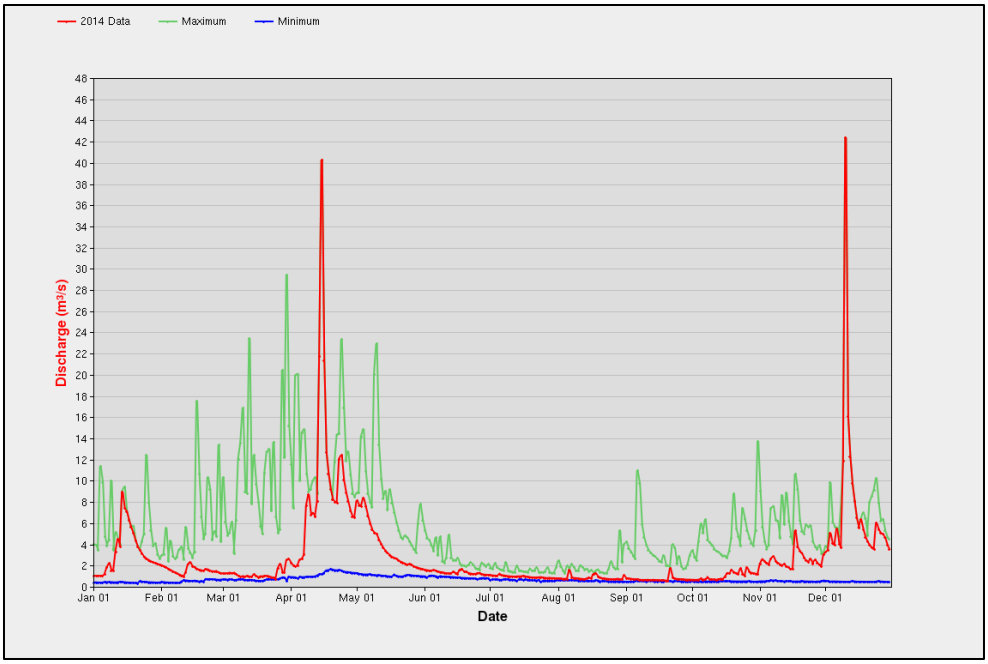

Figure 77. Hydrograph for West River 2014 (Environment Canada). Values in April and December were highest recorded for those dates. Note: Previous maximum values are shown in green and previous minimum values in blue.

It should be noted that juvenile salmon have been found in both Cardigan River and Murray River. It is believed that the salmon in these rivers originated from private fish hatcheries in Cardigan and Dover. Although redd surveys were not completed on these rivers in 2017, primarily due to time and weather constraints, they should be surveyed for juvenile salmon and redds in future years.

Acknowledgements

Carrying out a red survey on twenty-six rivers is a huge undertaking that could only be completed with a great deal of assistance and support. Funding for this survey was provided by the PEI Wildlife Conservation Fund. The organizations and individuals listed in Appendix I provided the person-power needed to walk/canoe over 175 km of stream. The assistance of the GIS section of Forests, Fish and Wildlife Division, in particular the contribution of Mary Lynn McCourt in providing mapping support for this document was greatly appreciated.

Many thanks to the photographers who contributed photographs for this report: Clay MacLean, Rosie MacFarlane, Cathy Gallant, Sandra Meade, Jason MacEachern, Riley Flynn.

Appendix I

Participants in the 2017 Salmon Spawning Survey

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Matt McIver
Mary Lynn McCourt
Andrew Ing
Mitch MacMillan
Rosie MacFarlane

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Atlantic Salmon Federation
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