



WINTER RIVER - TRACADIE BAY WATERSHED ASSOCIATION

Final Report 2017-2018 Work Year

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1 Executive Summary

2017 was a very successful year for the Winter River - Tracadie Bay Watershed Association. We cleared debris from a total of 8.5 km of streams, planted 2984 trees, constructed 42 brush piles for wildlife, constructed or upgraded 33 brush mats, collected 2,530 kg of garbage, replaced two problem culverts, and removed one unused culvert!

We collaborated on an alewife tagging project with Ducks Unlimited and Sean Landsman, to collect data on how many of this fish species could make it up the fish ladder at Officer's Pond. This project was a huge hit with our crew as we not only had a lot of fun catching and releasing the fish but also had the opportunity to be a part of a study to help protect this fish species' population in the area.

All V-notch weirs on the Brackley Branch went dry between mid-July and August. They weren't documented as flowing again until spring of 2018, despite several trips in December and January looking for flow. The City of Charlottetown extracts a large amount of water from pumping stations located upstream and downstream of this branch. Now that the Miltonvale Pumping Station is up and running, we hope there will be less impact on our watershed due to water extraction.

2 Staff

Sarah Wheatley is WRTBWA's Watershed Coordinator and has been employed at the watershed since 2015. Vanessa Jackson and Emma Spence started working for the watershed in early May. Emma was the staff supervisor and Vanessa was an intern. Matt Barr was hired as an intern who focused on water monitoring. Elliott Christopher, Richard Redden, Blake DeJong, Sarah McBride, and Trent MacSwain were hired on as summer staff to help carry out multiple projects. Marcel was hired on as an agricultural intern, but after only four days he left. Richard Redden, our chainsaw operator, left for a full-time job in July so Tate Saulnier was then hired to help with the chainsaw work. Once the summer staff returned to their studies, Miranda Weed and Jennifer Whittaker joined the team for tree planting, soil sampling, and other projects. Miranda and Jennifer left in late fall when field work was complete. Matt's internship finished in January and Vanessa continued until the end of April.

Name	Total Contracted Hours
Sarah Wheatley	1840
Vanessa Jackson	1725
Matt Barr	1400
Emma Spence	640
Elliott Christopher	560
Blake DeJong	560
Sarah McBride	320
Trent MacSwain	320
Marcel Pellerin	32
Jennifer Whittaker	265
Miranda Weed	175
Tate Saulnier	160
Richard Redden	320

Table 1: Staff Employed Total Hours





Figure 1: Jean-Paul Arsenault, Matt, Elliott, Meghan McCarthy, Vanessa, Sarah, Tate, Sarah, and John Hughes on staff fun day canoe trip.

3 Projects Activities 2017

During the 2017-2018 work year there were many project activities for the crew at Winter River-Tracadie Bay Watershed Association to carry out. Everything from stream assessments to water monitoring to tree planting were keeping the crew busy! Stream assessments help us to document current conditions of the streams and riparian zones, including any major and/or minor work that could be undertaken to improve the health of the ecosystem. Water monitoring in this watershed is very important, since in 2017 all the City of Charlottetown's water was still extracted from the Winter River area.

Our goal is to have a thriving, diverse ecosystem that benefits wildlife, birds, fish and humans that occupy this area.

3.1 Tree Planting

In May, June, September and October the WRTBWA crew planted 3,000 trees and shrubs in various locations inside the watershed. A small portion of these shrubs were given to people who lived in the City of Charlottetown who participated in the water makeover project. The first step to tree planting is to see where trees are most needed in the area. This can usually be determined based on the previous year's stream assessment. Next, the site is visited to establish a decision on what trees and shrubs would thrive and be beneficial to the area. Tree planting helps create diversity, food sources, and habitat for many species in the watershed. Tree planting also helps stabilize stream banks and prevent erosion.

3.1.1 Black River

The Bysterveldt's farm along the Black River was selected for tree planting in 2017. The planting areas on the property included two ponds constructed by Ducks Unlimited, along with the riparian zone of Black River. More shrubs were planted in fall after a culvert replacement project was complete. The trees and shrubs provide habitat diversity for waterfowl, improve bank stability to prevent erosion, and decrease soil erosion from adjoining fields.

Name of Species	# of Species
Yellow Birch	36
White Spruce	74
Balsam Fir	18
Red Osier Dogwood	40
<i>Spirea tomentosa</i>	12
Sweet Gale	42
Northern Bayberry	66
Wild Rose	48
<i>Aronia melanocarpa</i>	24



<i>Aronia prunifolia</i>	18
Common elder	48
Mountain Holly	12
Meadowsweet	14

Table 2: Trees and shrubs planted on Bysterveldt's property in 2017.



Figure 2. Tree planting areas around Black River.



Figure 3: Richard and Elliott planting trees at Bysterveldt's property

3.1.2 Beaton's Creek

At Beaton's Creek on Pat Power's property there was planting done along the tree line and the riparian zone by the stream. This will help provide food, cover and habitat for wildlife and provide cover for fish.



Species Planted	# of Species
Sugar Maple	6
White Pine	6
Mountain Ash	6
White Spruce	6
Mountain Holly	6
Aronia prunifolia	6
Red Osier Dogwood	30

Table 3: Type and number of trees and shrubs planted at Beaton's Creek

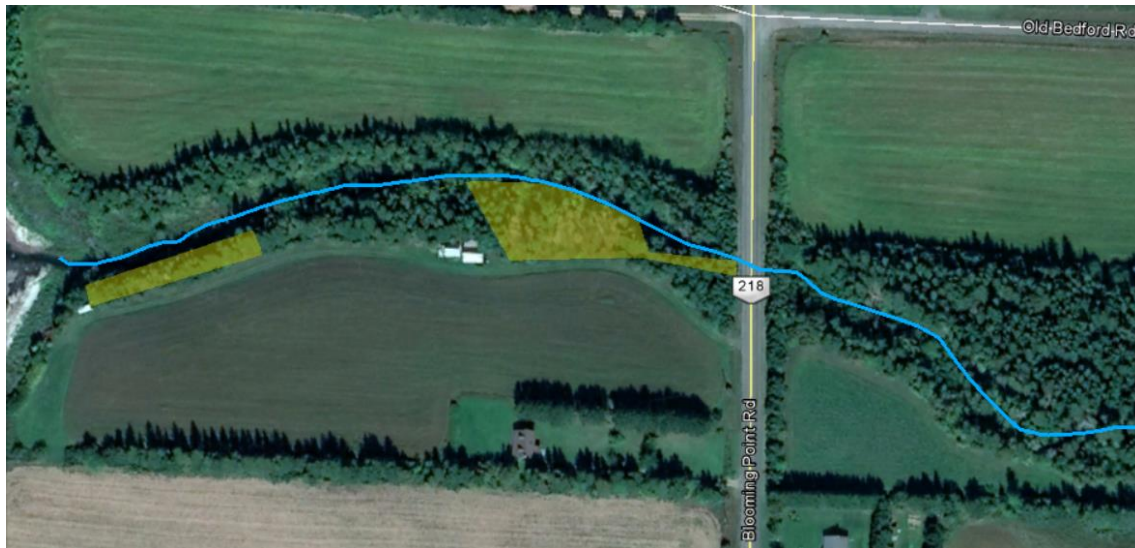


Figure 4: Beaton's Creek planting locations

3.1.3 Winter River Trail & Tim's Creek

After patch cuts were completed along the Winter River Trail and Tim's Creek, a plant species survey was conducted. Areas were then identified for replanting. Staff were assisted by some volunteers from Stantec Consulting. In each patch cut, we planted three Sugar Maples, two White Pines and one White Spruce. There were 18 patch cuts near the section of Winter River trail and seven upstream on Tim's Creek side. There were also shrubs and trees planted along stream banks and other openings along patch cut areas. The dense monoculture of small balsam fir that grew in this area wasn't allowing much room or light for diversity to occur. The forest is now more open and is planted with more young trees. Many small mammals, reptiles, and amphibians have been seen using the woodpiles from the fir for cover and habitat.

Species Planted	Number of Species
Sugar Maple	98
Yellow Birch	18
Eastern Hemlock	36
White Spruce (#15 plugs)	77
White Pine	56
Staghorn Sumac	24
Mountain Holly	30
Common Elder	24
Aronia melanocarpa	32
Aronia prunifolia	45

Table 4: Type and number planted of each species at Tim's Creek and Winter River trail.





Figure 5: Tim's Creek planting areas



Figure 6. Areas near Winter River Trail, where trees and shrubs were planted in 2017

3.1.4 929 Blooming Point Road

Cathy Corrigan described a family of foxes and a family of squirrels that live nearby 929 Blooming Point Road; both species would benefit from the cover provided by additional plants.

Species Planted	# of Species
White Birch	6
White Pine	6
Common Elder	18

Table 5: The type and numbers of trees planted at Cathy's





Figure 7. Richard and Blake planting on Cathy's shore.

3.1.5 Pater Branch

The Pater Branch silt fence prevents runoff from crop fertilizers and pesticides from entering the stream at the Pater Branch. Behind this silt fence trees have previously been planted. A well was installed, but is not in use, which causes the ground to be a very wet environment. Tree and shrub species that thrive in wet environments were planted.

Species Planted	# of species
Yellow Birch	12
Eastern Larch	9
Northern Bayberry	12
Heart leafed willow	24

Table 6: The type and numbers of trees planted at the Pater silt fence



Figure 8: The area planted along the Pater branch, near the silt fence

3.1.6 City Owned Land on Union Road

Several areas of land owned by the City of Charlottetown were just grassed, thus providing little habitat to native species were planted with trees and shrubs. The crew planted trees in the two locations to extend the forest on the section to the left of the road pictured, and to create forest habitat on the section to the right of the road pictured below. This mixture insured a mix of tall trees with ample understory cover from the shrubs, as well as a balance between hardwood and



softwood trees. The riparian zone was also planted to provide bank stability. Emma's crew planted here in summer and Vanessa's crew returned in the fall.

Species Planted	# of Species
Red Maple	18
Sugar Maple	29
Yellow Birch	5
White Pine	23
White Spruce	90
Northern Bayberry	40
Sweet Gale	36
Staghorn Sumac	30
Balsam Fir	20
Spirea Tomentosa	24
Common Elder	6

Table 7: The type and numbers of trees planted at the Union Pumping Station

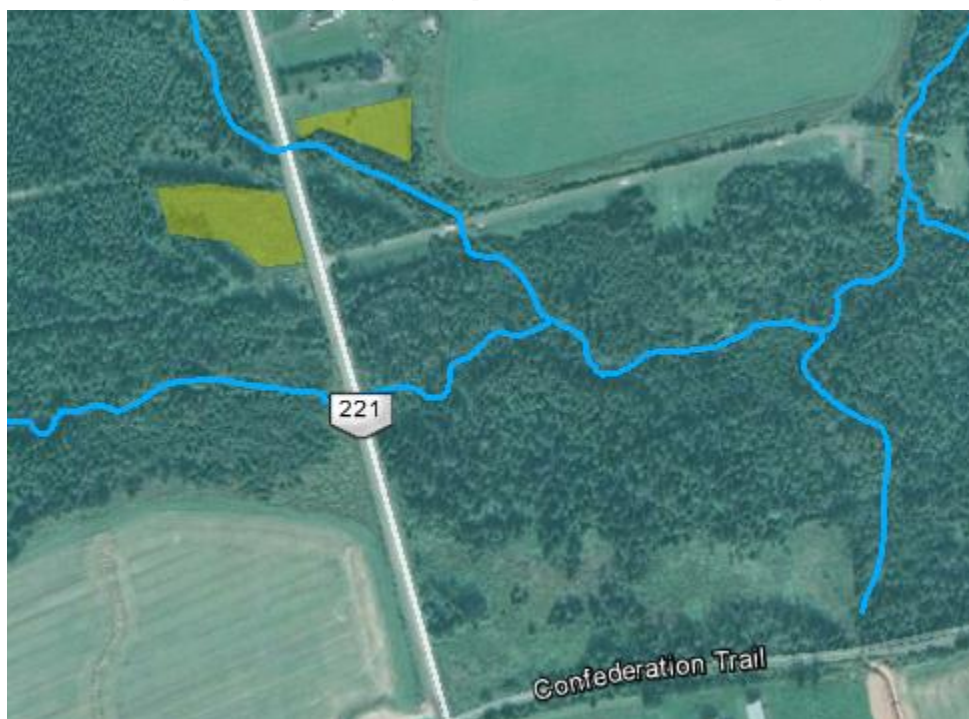


Figure 9: Tree planting areas on City of Charlottetown owned sites on Union Road

3.1.7 Union Rd Pumping Station Planted by student volunteers

During the Stonepark Junior High School visit (see also section Community Involvement) a large area near the Union Road pumping station was planted with 199 trees and shrubs by staff and student volunteers.

Species Planted	# of Species Planted
Sugar Maple	100
Mountain Ash	18
Balsam Fir	21
Eastern Larch	4
Northern Bayberry	22
Wild Rose	6
Common Elder	12
Mountain Holly	18

Table 8: The type and numbers of trees planted at the section of Union Road Pumping Station by student volunteers





Figure 10: Area planted by student volunteers



Figure 11: Student volunteers planting trees at Union Road pumping station

3.1.8 Blooming Point Road property

Scott Lyon’s property was previously planted in 2016 with a variety of trees and shrubs. The property is on Blooming Point Road and contains several ponds constructed by Ducks Unlimited. Willows were placed closer to the pond while taller trees (pine and birch) were planted more along the edge of the property to provide privacy from neighbors and to prevent large trees from blocking the property owner’s ocean view. The grass was also cut around previously planted trees to prevent them from being shaded over.



Species Planted	# of Species
Sugar Maple	4
Yellow Birch	24
White Pine	12
Eastern Larch	18
Willows	18
Mountain Holly	30
Wild Rose	6
Staghorn Sumac	12
Northern Bayberry	12

Table 9: The type and numbers of trees planted at Scott Lyon's property



Figure 12: Highlighted is planting area at Scott Lyon's property.

3.1.9 Suffolk Pumping Station

The Suffolk Pumping station area was planted in summer and fall of 2017 with various shrubs and trees along the riparian zone to create a diversity of plants in the area, to provide bank stability, to provide fish with more cover, and to create habitat for wildlife. Selected alder patch cuts were done, and other trees were planted in these locations.

Species Planted	# of Species
White Birch	24
White Pine	18
Common Elder	24
Aronia melanocarpa	22
Aronia prunifolia	24
Meadowsweet	12

Table 10: Total number of trees and shrubs planted at Suffolk Pumping Station





Figure 13: Area planted at Suffolk pumping station

3.1.10 Vanco Branch

Vanco Branch was planted in three different areas. This site borders a crop field along the larger section. The planted trees and shrubs will improve the buffer zone between the farmer’s field and the stream.

Species Planted	# of Species
Eastern Tamarack	66
Red Maple	48
Northern Bayberry	52
Common Elder	32

Table 11: Total number of species planted at Vanco in the spring 2017



Figure 14: Location where Vanco Branch was planted





Figure 15: WRTBWA summer staff planting a tree on Vanco branch.

3.1.11 Officer's Pond Clubhouse

Upon inspection, we found the site had many different tree species growing already on the property including multiple life stages of Balsam Fir, Sugar Maple, Red Maple, Red Oak, American Beech, Grey and White Birch, American Mountain Ash and Spruce. This area had wetland, shade and open area to plant a variety of shrubs and trees. There are several boat launches, a cottage, and an access road to the property, so we selected areas where these tree species would thrive, not close to the building or in anyone's way. Shrubs were planted to provide food for wildlife and help stabilize the bank. Officer's Pond is located on the Suffolk Road.

Species Planted	# of Species
White Pine	13
Sugar Maple	6
Yellow Birch	12
Mountain Ash	12
Aronia prunifolia	38
Common Elder	12
Sweet Gale	19

Table 12: Total number of species planted at Officer's Clubhouse





Figure 16: Forest enhancement areas at Officer’s Clubhouse – tree planting and cutting standing dead trees.

3.1.12 Friston South

Two large brush mats were constructed on both sides of the stream in 2016 to make the stream narrow again. In 2017, shrubs were planted near the stream banks where the brush mats were constructed, thus helping stabilize the banks. There was also tree planting along edge where there was recently a clear cut, and some between the edge and the stream.

Species Planted	# of species
White Pine	8
White Spruce (#15 plugs)	51
Mountain Ash	16
Mountain Holly	44
Aronia prunifolia	12

Table 13: Represents the number and type of species planted in Friston South



Figure 17: Represents the area planted at Friston South location fall 2017





Figure 18: Staff member, Vanessa, planting on top of successful brush mat in Friston South

3.1.13 Garden Lane

This property is located on 11 Garden Lane, just off the MacIntyre Shore Rd and is a waterfront property overlooking Tracadie Bay. This area is projected by the UPEI Climate Lab to experience a lot of erosion in future decades. The fall crew planted White Spruce along the banks to help stabilize and protect the banks from erosion. There were also native shrubs planted to feed the many birds and wildlife in the area.



Figure 19: This image highlights in yellow the area planted at the property on 11 Garden Lane

Species Planted	# of Species
White Spruce (#15 plugs)	30
Sugar Maple	18
Common Elderberry	24
Mountain Holly	18

Table 14: Represents the number and type of species planted at 11 Garden Lane



3.1.14 654 Suffolk Rd

The homeowner volunteered to help plant at this location. The planting was done along the hedgerow that separates this mainly agricultural property, from residential neighbors. Some shrubs were also planted close to the ditch for wildlife habitat.



Figure 20: Highlighted area show planting at 654 Suffolk Rd in fall 2017

Species Planted	# of Species
White Spruce	12
White Spruce (#15 plugs)	30
Spirea latifolia	12
Staghorn Sumac	4
Aronia prunifolia	24

Table 15: Represents both type and number of species planted at 654 Suffolk Road

3.1.15 630 Suffolk Rd

In a project to test the success of planting smaller trees, staff planted some #15 plug sizes of White Spruce along an existing hedgerow. This is a property that is regularly used as an experimental site, due to easy access and willing landowners. Leftover moisture-loving shrubs were planted near a ditch on the property and by the pond, for wildlife food and to help stabilize the pond bank.



Figure 21: Tree and shrub planting areas at 630 Suffolk Rd



Species Planted	# of Species
White Spruce	21
White Spruce (#15 plugs)	60
Sugar Maple	14
Red Maple	14
White Birch	7
Aronia prunifolia	6
Red Osier Dogwood	24

Table 16: Represents total number and type of species planted at 630 Suffolk Road



Figure 22: Miranda, staff member, planting at 630 Suffolk Rd

3.1.16 Hardy Mill Planting Area

The crew travelled by canoe, to access the property on the opposite side of the Hardy Mill Pond, to plant trees and shrubs within the 15m buffer zone. This will provide bank stability and cover for fish.



Figure 23: Map of area planted at Hardy Mill location.



Species Planted	# of Species
White Birch	24
White Pine	18
Common Elder	24
Aronia melanocarpa	12
Aronia prunifolia	24
Meadowsweet	12

Table 17: Type and number of species planted upstream of Hardy Mill Pond

3.2 Forest Enhancement by Winter River Trail and Tim's Creek

Monocultures were established many years ago, of White Spruce along Tim's Creek and Balsam Fir along the Winter River trail. Since the trees are all around the same age, large numbers of them are now dead or dying. While some standing dead trees can be beneficial for wildlife, the large quantities of small standing dead trees are more hazardous than beneficial. They pose a hazard for people using the popular Winter River Trail, and they also discourage biodiversity in the surrounding forest by reducing sunlight in the area. To open the forest floor to sunlight for other species of plants, many of the standing dead trees were removed. Seven patch cuts of approximately 10-meter by 10-meter in dimension were cut along Tim's Creek. Seventeen similar patch cuts were created on the Winter River trail section. Special attention was paid to remove the standing dead trees that could fall in the stream potentially blocking fish passage. The trees that could fall on the trail were also a priority.



Figure 24: Examples of debris piles for wildlife



Felled trees were piled whole, or cut into smaller sections and piled, creating debris piles for wildlife. A variety of piles were made, some able to cater to larger wildlife species, while others were constructed to create habitat for insects. Another reason for creating large piles is to prevent a fire hazard from leaving excessive amounts of dead trees spread throughout the forest floor. In the fall of 2017 these patch cuts were planted with a variety of tree species (see section 3.1.3 for more information on tree planting).



Figure 25: The standing dead trees along Tim's Creek



Figure 26: Emma chain sawing standing dead trees

3.3 Stream Clearing

The summer crew cleared 8.09 km of stream over the summer: 1.29 km at Beaton's Creek, 0.87 km at Vanco, 0.7 km at Friston North, 0.4 km at Black River, 0.1 km at Pater, 0.1 km at Friston Main, 0.63 km at Cudmore, 0.5 km at Friston South, 0.1 km at Pleasant Grove, 1.5 km at Tim's Creek, 0.1 km at MacAulay, 0.9 km at Winter River below Hardy's, 0.7 km at MacLauchlan and 0.2 km at Suffolk Pumping Station.



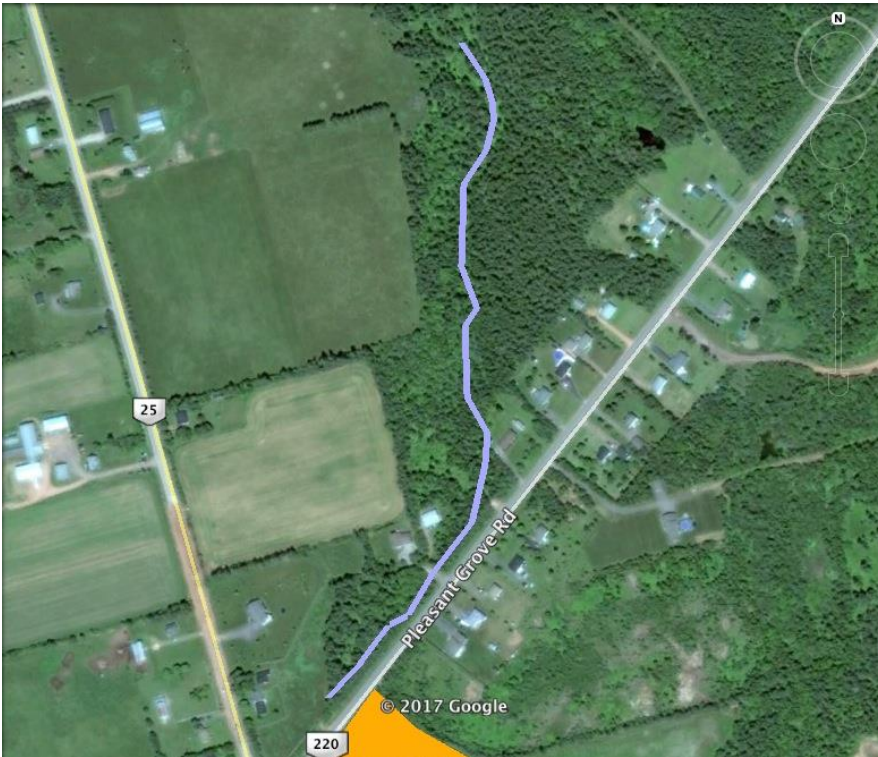


Figure 27: Section of MacLauchlan Branch cleared this summer season



Figure 28: Section of Beaton's Creek cleared



Figure 29: Two sections of Black River cleared



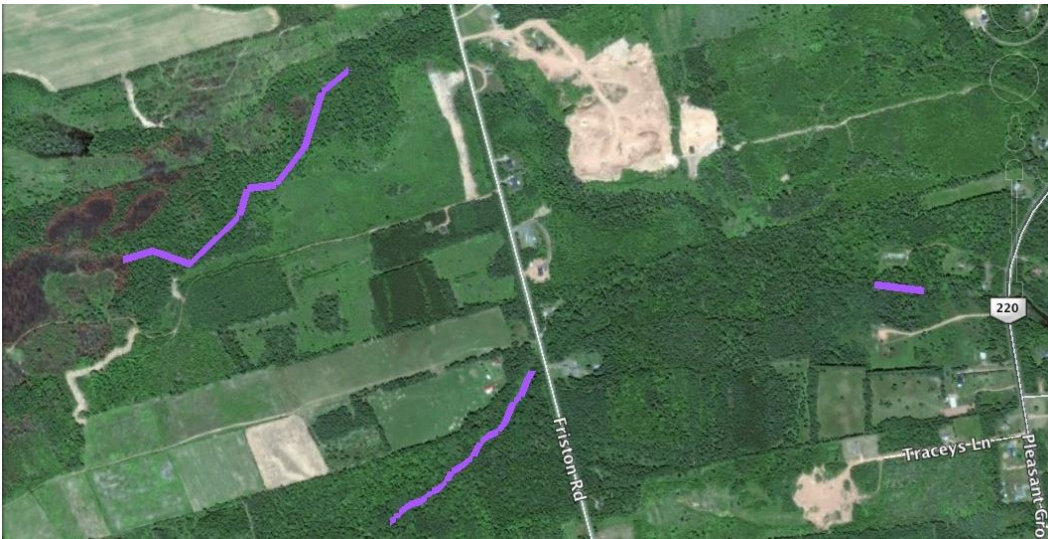


Figure 30: Sections of Friston Branch cleared this season

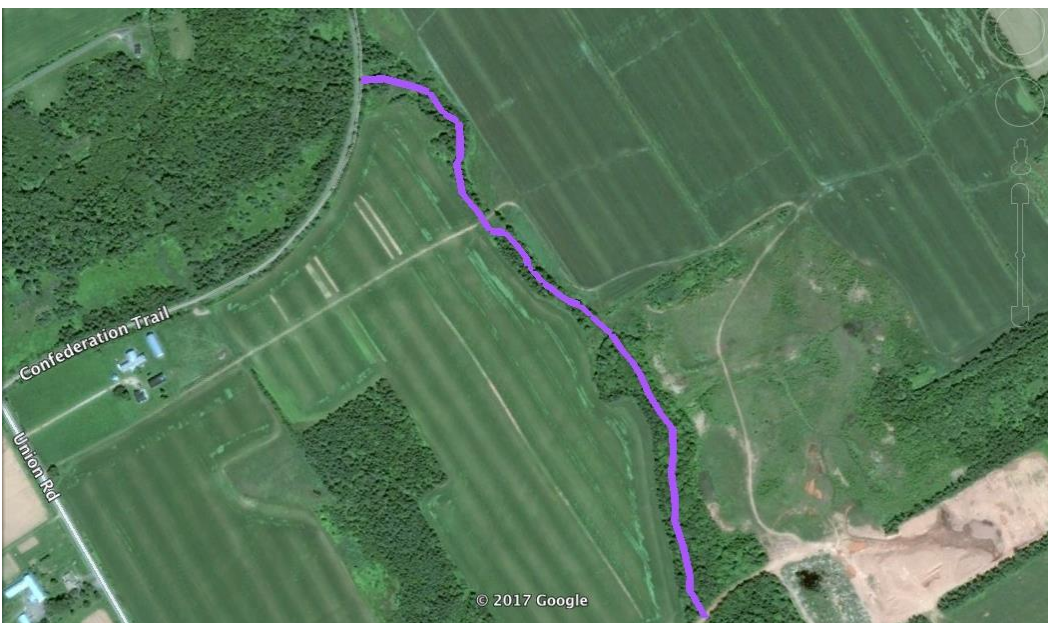


Figure 31: Section of Vanco Branch cleared.



Figure 32: Cudmore Branch clearing



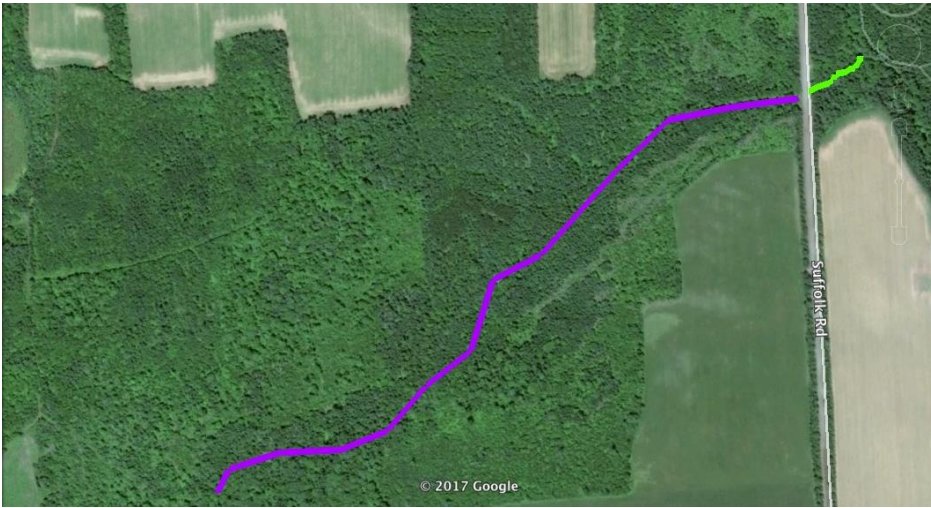


Figure 33: Section of Tim's Creek (upper) in purple and Tim's Creek (lower) in green that were cleared

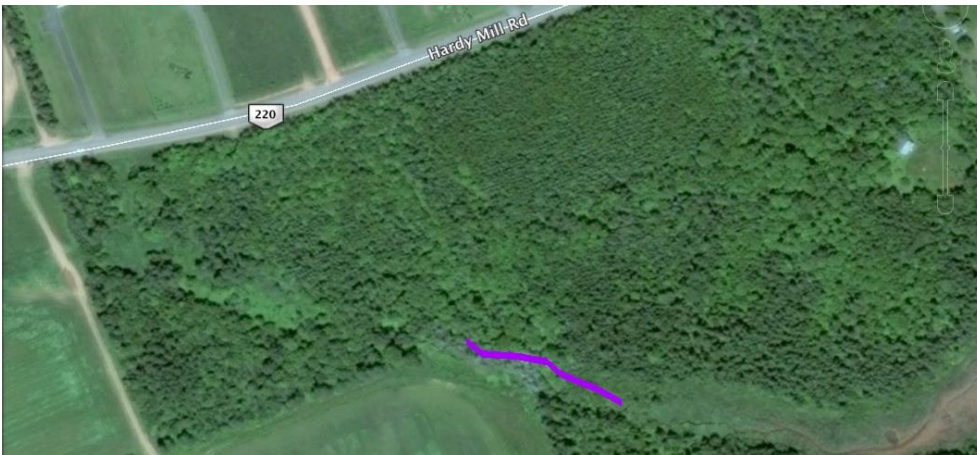


Figure 34: Pater Branch area that was cleared

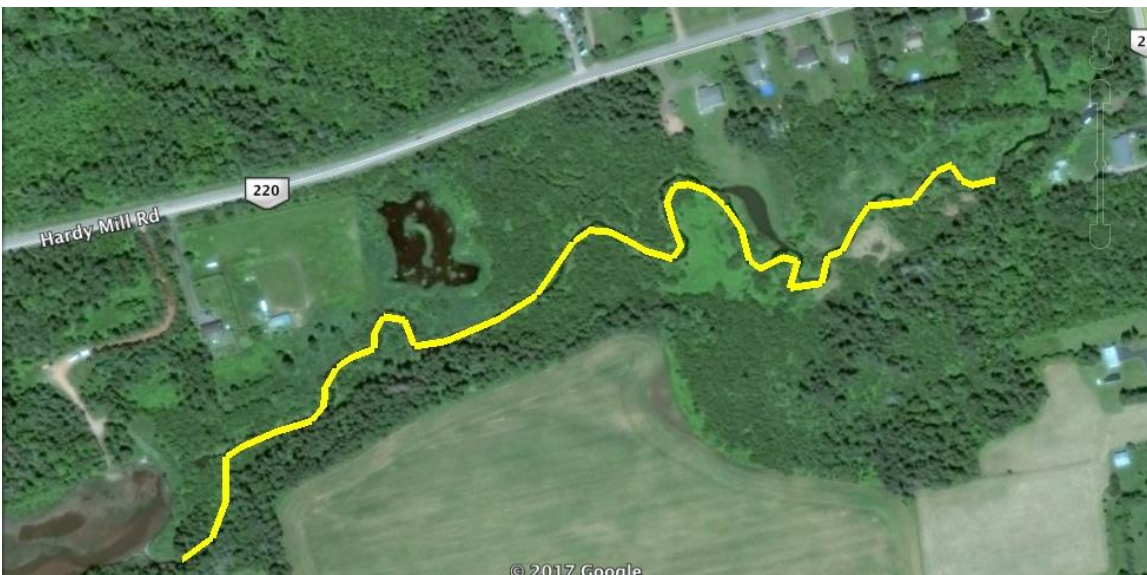


Figure 35: Winter River main branch maintenance clearing

Figure 28 through to Figure 36 show each section of stream that was cleared during the summer of 2017. Some sections had been cleared in previous years but required maintenance. Other sections, such as Beaton's Creek, were filled with many blockages as they had never had any enhancement work completed by WRTBWA. The difference in ease of fish passage and lack of blockages in previously cleared streams demonstrates the importance of stream clearing for riparian health. Figure 37 and Figure 38 show the major difference at Beaton's Creek before and after blockage removal.





Figure 36: Before and after a blockage removal at Beaton's Creek



Figure 37: Before and after another blockage removal at Beaton's Creek

3.4 Brush Mats

Over the summer season, the crew installed 25 new brush mats and updated 16 previously built brush mats. 15 brush mats were installed at Black River, 3 were installed at Cudmore, one at Winter River below Hardy's and one on the Winter River Main Branch. Three brush mats were upgraded at Friston North, one on Cudmore Branch, two on Friston South, five on MacLauchlan Branch in Pleasant Grove, three on Tim's Creek and two at MacAulay Creek.





Figure 38: The field crew placing brush and cutting stakes to build a brush mat along Friston North



Figure 39: An example of a brush mat constructed along Black River

Brush mats were constructed along the upstream and downstream end of a culvert along Black River. The culvert is being removed in the future, which may create temporary weak stream banks, leading to increased sediment in the water. The brush mats upstream will decrease the amount of sediment that is carried to the culvert area in the first place. The brush mats downstream from the culvert will trap some of the sediment created by the culvert removal.

Upgrading older brush mats allows them to continue to collect sediment and secure stream banks from erosion. As brush mats age they lose the needles that are best at collecting sediment and are only left with the twigs and branches. New brush is placed on top, sticking the brush into the stream with the stem end facing upstream. The new brush is then tied to new or previously placed stakes with jute twine (which will eventually decompose). Stakes are often used, but in certain locations alders are cut into stakes instead.



Figure 41 shows the positive long-term effects of brush mats. This section of the stream was too wide and contained a lot of sediment, and the banks were exposed. Fish prefer to spawn in areas free of sediment and with more cobble or rocks. The brush mat collects sediment which provides a rich substrate for plants to begin to grow. The picture shows jewel weed taking root in the old brush mat. The bank is now extended further into the stream and the sediment functions as soil instead of creating silt to cover stream bottoms.



Figure 40: From left to right: A) stream with stakes in 2016 B) immediately after brush mat construction in 2016, and C) one year after construction (2017).

3.5 Private Culvert Removal

In July 2017, the crew removed an old unused culvert from Piper's Creek off Blooming Point Road. The culvert was impeding fish passage and causing blockages to build up near the upstream section of the culvert. First the team removed trees and shrubs from the area around the culvert. Then they dug down to the culvert. The dirt that was removed was placed in bins that were drug to either side of the stream to create piles that would be less likely to wash back into the stream. The culvert was removed from the stream. The banks were excavated to create a stable shape with a 30-degree angled slope. Then the banks and dirt piles were covered with jute mesh to temporarily hold the loose soil in place. Grass seed was applied to both banks and dirt piles for longer term stabilization.





Figure 41: Before culvert removal, the trees have been removed from the area.



Figure 42: The removal of the culvert





Figure 43: After culvert removal, jute mesh covers the banks until grass is established.

3.6 Private Culvert Replacements

During stream assessments in 2015, staff identified many culverts that were a problem for fish passage. One problem culvert was located on Black River and over the course of 2016 staff worked with the landowner to plan a project that would meet their needs as well as improve fish passage. We helped the landowner to secure partial funding for this project through the Department of Agriculture for construction to occur during 2017. Sarah Wheatley, the watershed coordinator, managed this project planning including research, designs, and permitting. In September, Sarah was onsite during the whole construction period to supervise the contractors and make sure that the resulting culvert would meet fish passage design parameters and the needs of the farmer. Matt and Vanessa assisted with transporting materials to the site and helping with grass seeding and hay mulching for site stabilization after construction was complete.





Figure 44. Before, during, and after culvert replacement - upstream side.





Figure 45. Before, during, and after culvert replacement - downstream side.



3.7 Natural Fishway Project – Phase 1

Preliminary project planning has started for a natural fishway to be constructed at Officer's Pond. We have hired an engineer to complete a feasibility assessment. A surveyor was hired to take some measurements. Our staff plotted out the line to be surveyed, marking a possible path for the fishway, along with a series of cross sectional lines, then cut and pruned trees in these areas to ensure that the surveyor would have adequate sight lines to complete his work (without hiring his own chainsaw operator at a higher cost). During 2018, a decision will be made whether or not to proceed to the next phase of the project.

3.8 Shoreline and Roadside Cleanup

Over the summer the crew cleaned 2.02 tons of garbage from 38.3 km of road and shorelines. Of that total, 1.58 tons was from shorelines around the Tracadie Bay area. Most of the garbage collected from shoreline cleanups was aquaculture waste such as Styrofoam buoys and mussel socks. The majority of roadside cleanup garbage was takeout meal containers and wrappers. Certain areas, such as Hardy Mill pond, had garbage more typical of partying and vandalism such as beer cans. There were also areas of illegal dumping – staff found a barbeque and the remains of a demolished wooden shed.

3.9 Community Involvement

This summer season we held events to get the community and youth involved in our work for the environment. On Saturday June 10, 2017 the annual Lady's Slipper hike was attended by 35 community members and several board members. The hike was held on the Winter River Trail and volunteers provided educational facts on plants and animals present along the trail. It was a great opportunity for community members to learn about how the watershed improves streams, forests and other environments. The hikers were treated to views of PEI's provincial flower, the Lady's Slipper.

On World Oceans Day (June 8th, 2017) 26 students and 3 teachers from the Green Team at Stonepark Junior High School came for a field day of hands-on learning and volunteering. The students planted 207 trees and shrubs around the Union Road water pumping station. The students were taught how to identify the tree and shrub species planted, how to properly plant the trees, and how to apply hare guards to protect them.



Figure 46: Students gathered around to watch a tree-planting demonstration by Sarah.





Figure 47: Staff members helped individual students with tree planting

In the afternoon, the students collected garbage along Tracadie Bay. Over 400kg of garbage was collected, primarily buoys and other fishing waste. The students learned about the importance of keeping our oceans and shorelines clean.

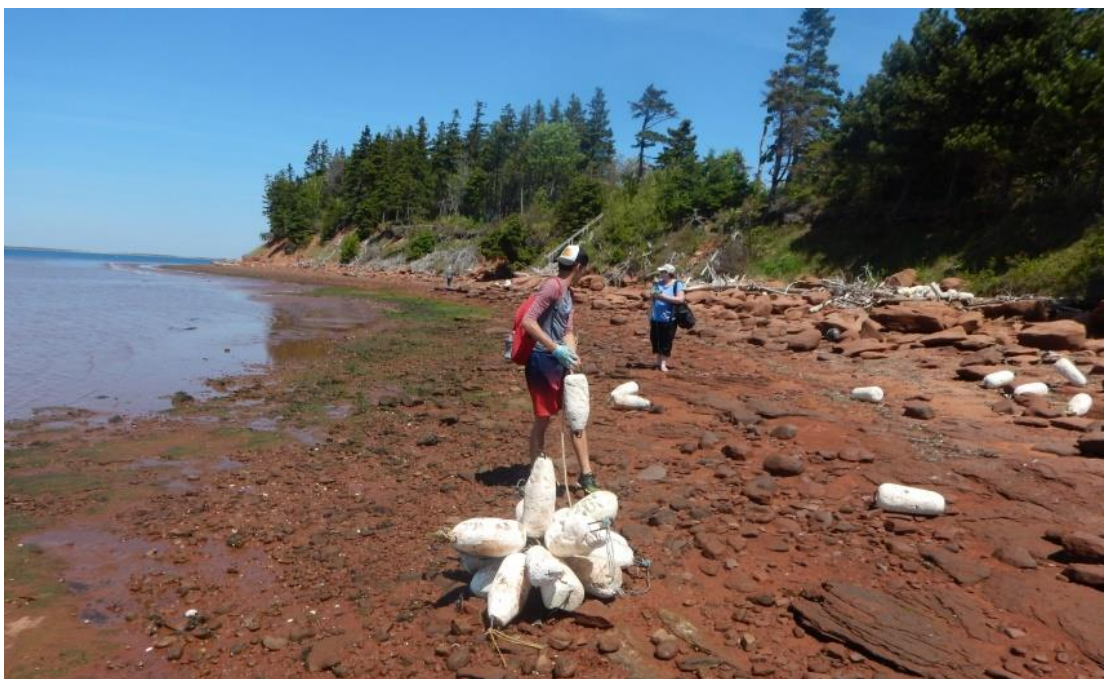


Figure 48: Students tied buoys together with ropes for easier removal





Figure 49: Students removed a large tractor tire from the shore



Figure 50: The students with the garbage they collected from the shoreline

4 Monitoring and Assessments

4.1 Stream Assessments

2017 stream assessments were conducted at Deroche Pond, Anderson Branch, Winter River Main Branch, Peters Creek, Court's Island, Beaton's Creek and Mazer's Branch. When walking the stream, observations are prioritized under the following categories: fish passage issues, fish habitat features, fish spawning areas, blockages, beaver activity, wildlife, vegetation, springs, siltation deposits, planting areas, erosion, buffer zone violations and redds. While these are the primary areas of concern, there is also an "other" category for other features of interest. As crew are walking through and observing the stream and surrounding area needing work, a GPS waypoint is made and notes are taken describing the waypoint; a total of 311 GPS waypoints were entered through the season. All GPS waypoints are uploaded onto maps in the office and notes are organized into a spreadsheet. Depending on time of year, crew available, and urgency it is then determined when to fix the issue. Most work to the stream is done in the most natural way possible, so as not to disturb flora or fauna. For further details on the 2017 stream assessments please refer to google earth and excel file.



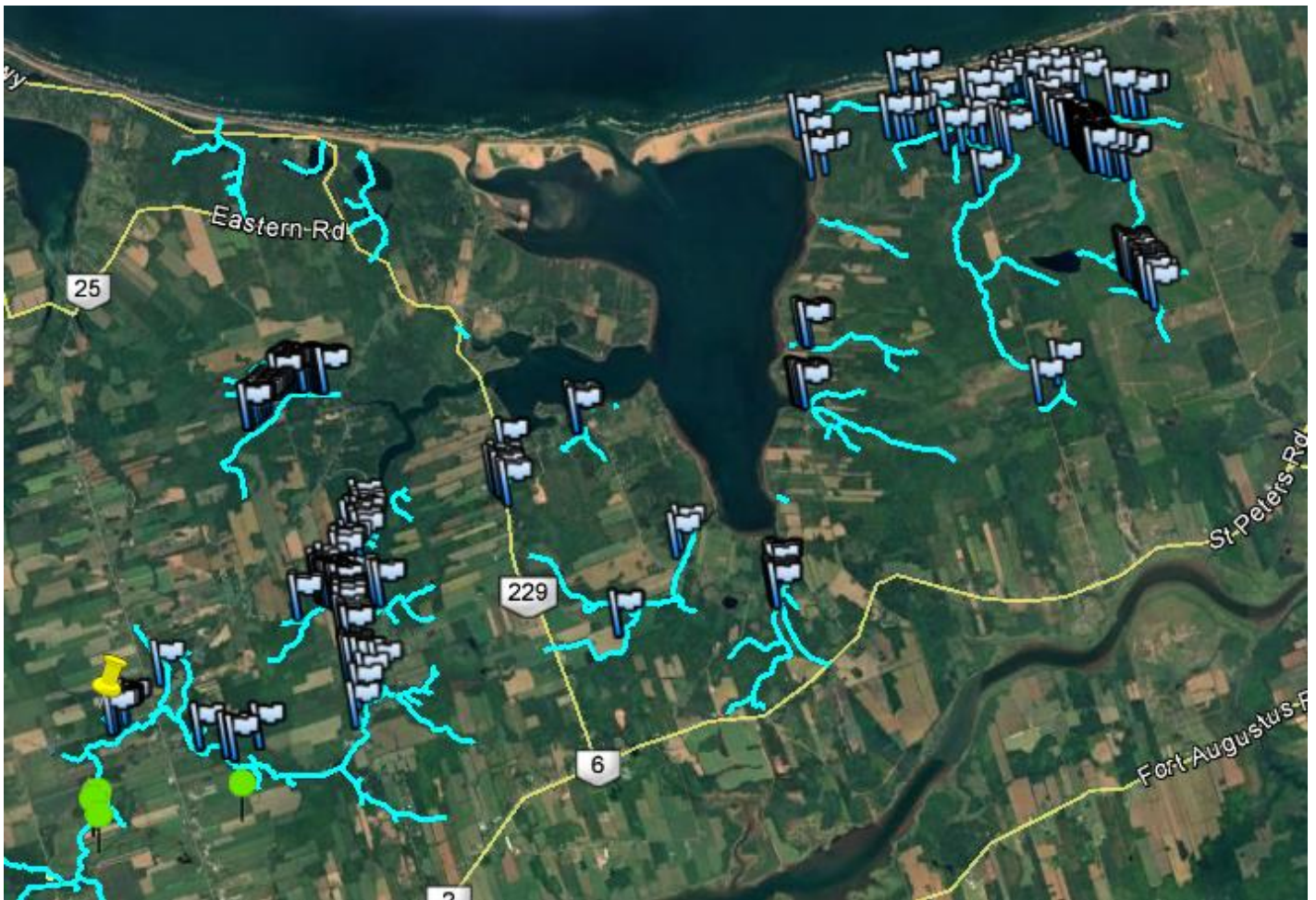


Figure 51. All waypoints of stream assessments carried out in 2017 work year

4.1.1 Ideas for 2018 and beyond

**Some of this information was taken from Hilary Shea's 2015 and 2016 reports.

4.1.1.1 Pipers Creek

- Dig out sediment built up on the upstream side of the culvert with shovel to allow easier fish passage.
- Plant tree species resistant to beavers to increase shade cover along beaver clear cut
- Check area where culvert was removed to ensure grass is growing, plant shrubs to help stabilize banks.
- Plant trees and shrubs near private crossing (PR-009)

4.1.1.2 MacAulay's Creek

- Plant native shrubs and trees in buffer zone
- Create and/or maintain existing brush mats

4.1.1.3 Cudmore Branch

- Talk to farmer about expanding buffer zone in area of concern
- Address erosion issues
- Alder clearing and replanting
- Try to plant at old field along Confederation trail, behind BJ's Trucking

4.1.1.4 Black River

- Remove blockages along the SE tributary *****be careful as wild parsnip in area
- Plant more shrubs and trees in buffer zone along left bank



- Fix left bank erosion fascines, geotextile and live stakes
- Maintenance and/or creation of brush mats
- Remove old metal bridge
- Place hay bales in three large gullies formed from two pipes coming out of field

4.1.1.5 *Vanco*

- Continue to monitor silt fence on pit road, possibly add more hay bales
- Explore ways to remove invasive nightshade vine found in branch
- Create a new hedgerow
- Plant shrub and trees to extend riparian forest zone

4.1.1.6 *York*

- Plant trees in headwaters
- Stream clear
- Fix headwater gully with hay bales

4.1.1.7 *Hardy Mill*

- Plant only trees or shrubs that beavers won't eat.

4.1.1.8 *Campbell's Pond*

- Collect background info on all Parks Canada activities

4.1.1.9 *Peter's Creek*

- Do culvert assessment of culvert on Donaldston Road
- Remove several blockages, beaver rake and chainsaw needed

4.1.1.10 *Deroche Pond*

- Explore options to address purple loosestrife and wild cucumber found in this branch
- Collect background information on Island Nature Trust activities or any other groups conducting surveys
- Plant beaver-resistant trees around riparian area, and at hedgerow to blueberry field

4.1.1.11 *Beaton's Creek*

- Brush mats to be installed

4.1.1.12 *Pater Branch*

- Complete a stream assessment
- Plant more trees or shrubs

4.1.1.13 *Lowes Creek*

- Complete stream assessment

4.1.1.14 *Wheatley Branch*

- Assess outlet to private pond for possible improvements
- Check on silt fence near pit

4.1.1.15 *VanWesterneng Branch*

- Expand buffer zone in area of concern and plant native shrubs
- Stabilize high bank erosion just below headwater field



4.1.1.16 Friston Branch

- Explore ways to narrow the stream just north of Pleasant Grove Rd besides brush matting – there is bedrock near the surface, so it isn't possible to add stakes needed to construct a brush mat.
- Check on Road crossing (PR-010), which plugs up with sediment and rocks - maintenance if necessary
- Check pit on the North branch for silt runoff

4.1.1.17 Tim's Creek

- Plant native shrubs in headwater area in old fields
- Conduct fish population assessment to check resident trout in summer
- Install hay bales to collect silt and gravel runoff
- Thin dying trees from woodlots and underplant

4.1.1.18 Winter River Main

- Remove any new blockages collecting debris
- Plant more shrubs for bird and wildlife

4.2 Beaver Assessments

When walking through the Winter River- Tracadie Bay streams, beaver activity is quite common. Below are maps with waypoints which indicate beaver activity. Beaver activity can be defined as any area where nature's engineers have altered the stream to suit their needs. The beaver-free zone located in the Winter River and tributaries will be walked every fall to ensure there are no new beaver settlements. This will ensure that if there are any beavers moving in they can be trapped before causing too much damage to the area.

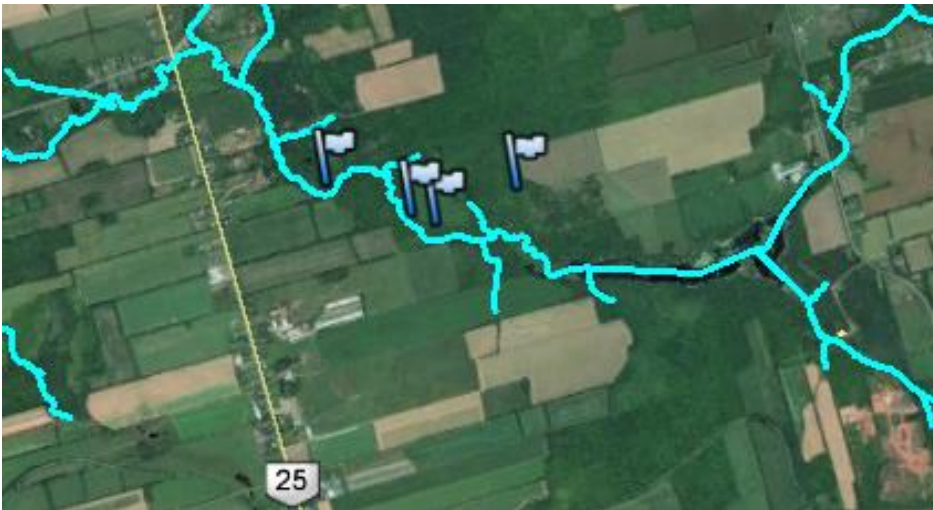


Figure 52. Main branch of Winter River near Officer's Pond beaver waypoints





Figure 53. Anderson Branch beaver activity waypoints



Figure 54. Deroche Pond area, off Donnie's Road – beaver dam in man-made channel flowing into Tracadie Bay.



Figure 55. Afton Branch beaver activity





Figure 56. Beaver lodge located in Anderson Branch



Figure 57. Beaver dam located in Anderson Branch





Figure 58. Beaver activity in Anderson Branch

4.3 Redd Surveys

“Redds” are areas on the stream bed that appear red in color, where debris on the stream bed has clearly been moved. Salmonids lay their eggs on redds. Redd surveys are completed annually usually around mid to late November. These surveys are done to determine the number of spawning areas in the watershed. Afterwards, the data is added to a database to compare year to year. Every time a redd is located, a GPS waypoint is marked, notes are made on cover, any fish observed, how large the red may be, any water cress present, etc. These surveys can prove to be very subjective since, depending on experience level, one may overestimate or underestimate the actual number of redds. The best practice in identifying a redd is to make sure you go out in mid to late November; make sure you are not marking a clear spot where the water channel goes through the stream as it may look similar to a redd; look for circular patterns and trout nearby; and use polarized glasses to help the redd appear more clearly in the stream bed.



Figure 59. MacLauchlan Branch, brook trout





Figure 60. Matt looking at brook trout redd



Figure 61. Pipers Creek reds 2017



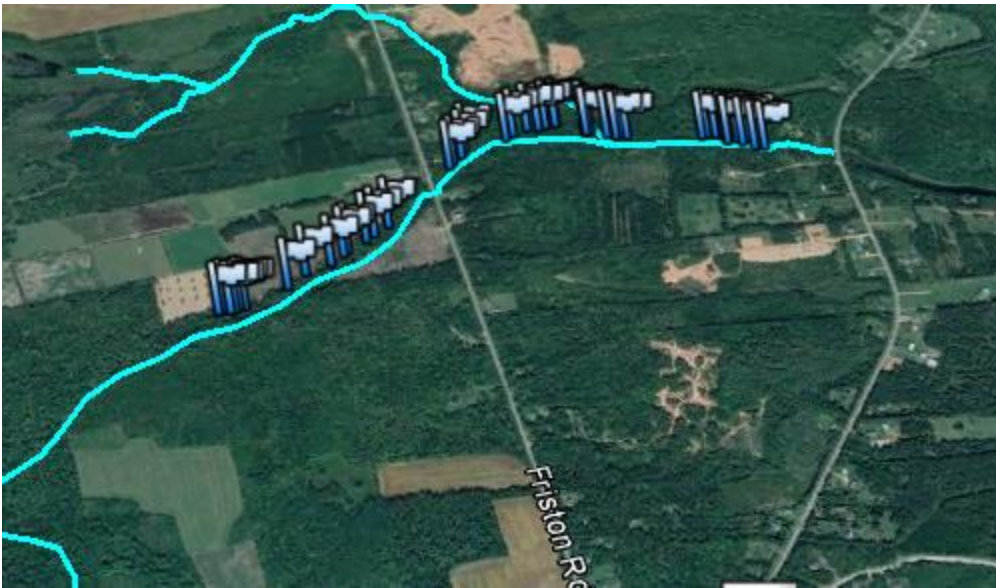


Figure 62. Friston Branch reds 2017

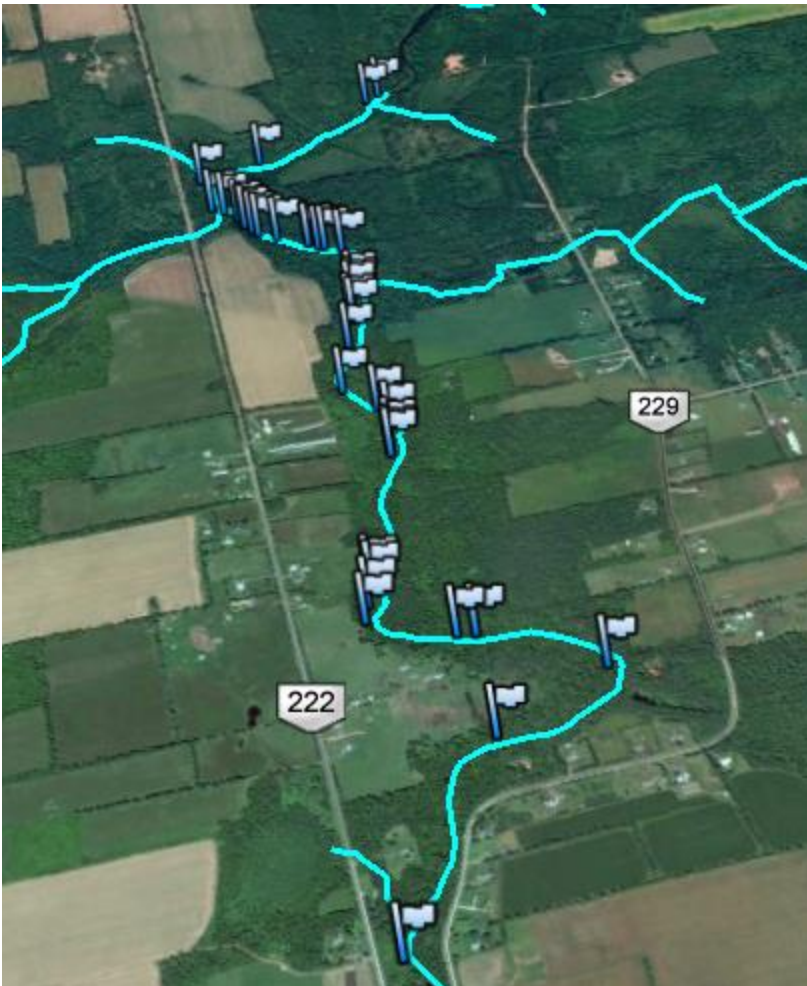


Figure 63. Possible reds at Winter River Main 2017



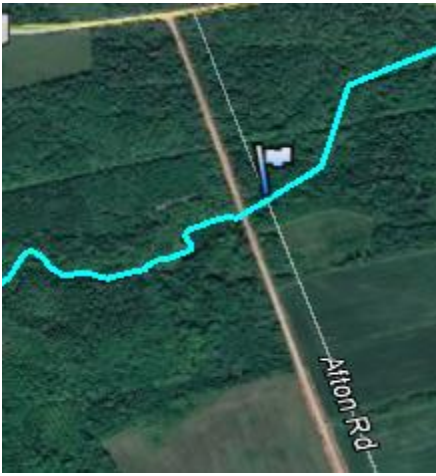


Figure 64. Afton Road branch redds 2017



Figure 65. Anderson Branch redds 2017



Figure 66. MacAulay's Creek redds





Figure 67. Hardy Mill Pond area reds 2017

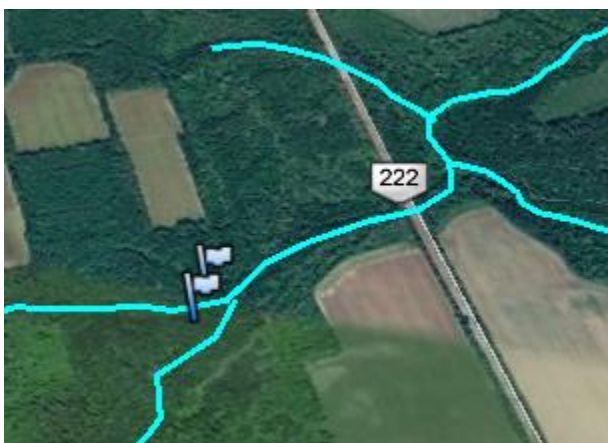


Figure 68. Tim's Creek reds 2017



Figure 69. Van Westerneng Branch reds.



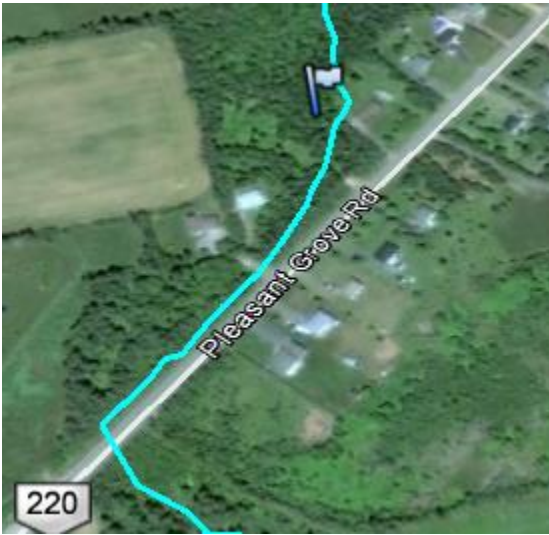


Figure 70. MacLauchlan Branch redd



Figure 71. Black River redds

Branch Name	Number of Redds
Friston	47
Winter River Main	37
Piper's	10
Afton	1
Anderson	7
MacAulay's	8
Hardy Mill Pond	11
Tim's Creek	2
MacLauchlan	3
Black River	4
Van Westerneng	3

Table 18: Shows the total number of redds found in each stream or river branch in the watershed



4.4 CABIN Monitoring

CABIN stands for Canadian Aquatic Biomonitoring Network and is a program that was created to monitor the health of freshwater ecosystems. It involves the collection of benthic invertebrates – bugs that live on the bottom of the stream – to identify the water quality in the sampling area. Areas with only very hardy bugs are likely to be experiencing problems, while areas that have lots of bugs that are sensitive to pollution or other impacts indicate that the stream is not experiencing pollution or other issues. Both Matt and Vanessa received CABIN certifications to participate in monitoring. Sarah Wheatley completed the course the year previous. CABIN assessments are completed in the fall. Fifteen locations were sampled in 2017 for CABIN assessments. Sites are selected based on accessibility and sections of stream that will represent what is happening in several areas. Since the raw data from this project wasn't received until spring 2018, analysis will continue in 2018.



Figure 72. Matt using kick net to collect invertebrates.



Figure 73. Looking at substrate





Figure 74. Miranda and Sarah using sieve to rinse benthic macroinvertebrates from rocks and leaves in sample.

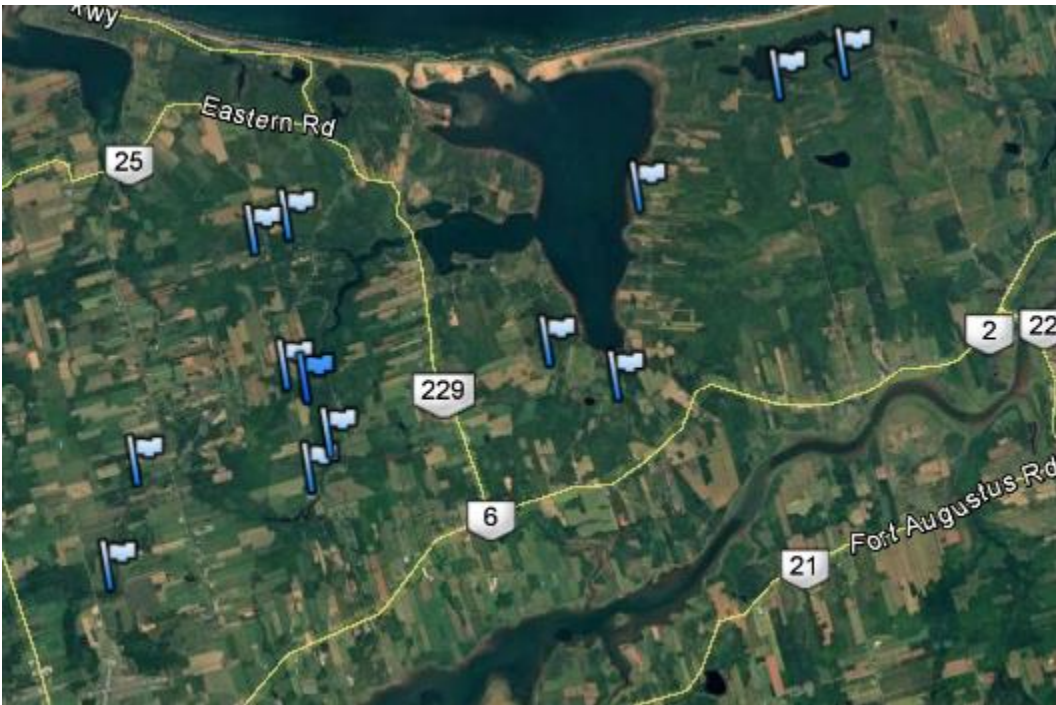


Figure 75. All 15 CABIN sampling locations

4.5 Gaspereau Project at Officer's Pond

In spring 2017, the staff at WRTBWA joined Sean Landsman from the University of Prince Edward Island, and Ducks Unlimited Canada to research gaspereau movement. This project was created to monitor how many gaspereau were passing through the fish ladder owned by Ducks Unlimited into Officer's Pond. To measure fish passage, 1,000 gaspereau were PIT tagged and monitored using a series of receivers in the stream and fish ladder. Our staff contributed to the project by catching the fish below the dam with dip nets, and transporting them downstream to Sean, who inserted the PIT



tags and recorded identifying details to a computer file. Once tagged, the fish were released back into the water just upstream of the Suffolk Road. A detailed report of this project written by Sean Landsman is available upon request.



Figure 76: Receiver placed in fishway, to collect signals from PIT tags



Figure 77: Gasperneau in cooler waiting to be tagged





Figure 78: Vanessa with net and Emma at computer assisting Sean Landsman who is tagging fish

4.6 Crop Data

Vanessa and Blake drove and walked throughout the watershed to record which crops were growing in agricultural fields that were visible from public roads. After creating a map with crops in each field, information was entered in Google Earth, by creating a series of polygons and recording the crop grown. Crops were color-coded to allow a quick overview of major crops by area. This information can be helpful when looking into the health of streams or finding sources of erosion. Plotting this information in Google Earth allows for quick visual checks of how crops change over the years.

The only issue with this method of gathering data is that if we were, for example, to record that there were potatoes growing in the same field for a second year, perhaps a contravention of the *Crop Rotation Act*, it may be difficult to prove. Data collection for crop data is carried out by watershed staff that have different skill sets year after year, and therefore results could end up being, in some cases, subjective. Essentially, this type of issue may be hard to report.

The use of drones to obtain crop data in the watershed would provide us with solid results each year. However, since we are so close to the airport, there would be restrictions. This may be something to look further in to in the future.



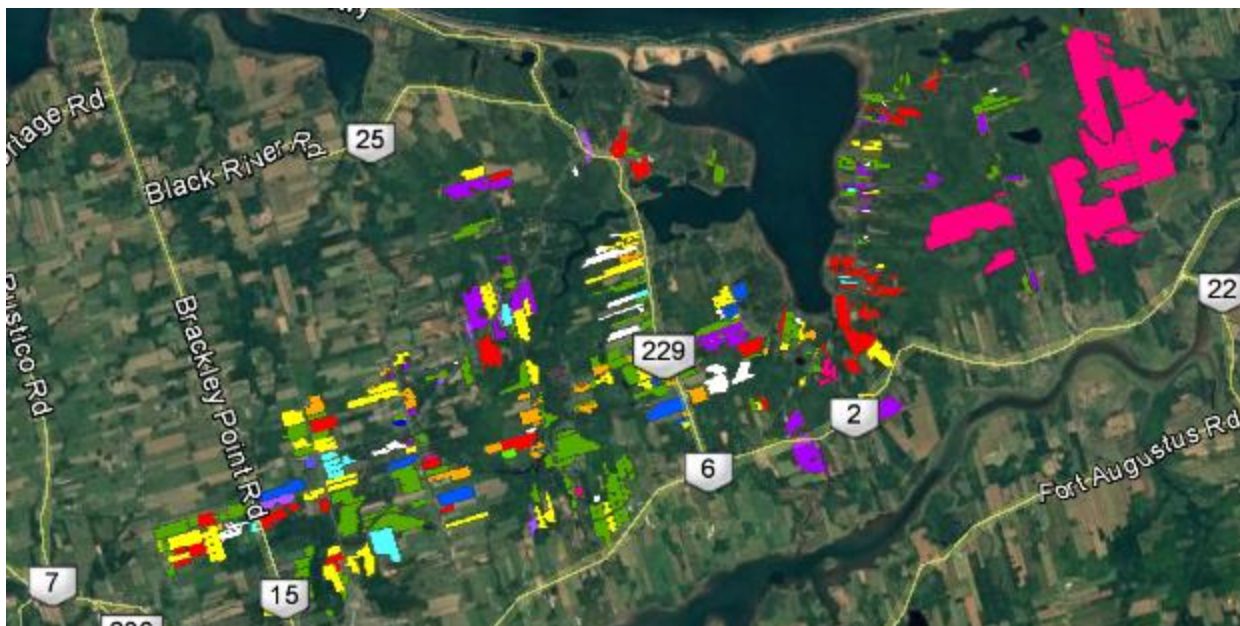


Figure 79: Map of crops, each color represents type of crop growing on that piece of land

Crop Name	Color
Corn	Blue
Soy	Purple
Potato	Red
Perennials: blueberries, apples, raspberries	Pink
Other: Peas, Pumpkin, Buckwheat, Radish	Aqua
Hay	Green
Grain	Yellow
Pasture	Orange
Unused	Grey

Table 19: Shows the crop growing on property and the color is was given to appear on the map

4.7 Water Level Loggers

4.7.1 Methods

Water-level loggers were installed in the same locations as 2016 for the Officer's Pond outlet, Friston Branch, Hardy Mill Pond outlet, and Union sites. The loggers located at Tim's outlet and below the Apple Orchard were moved slightly from their 2016 locations. They were installed in June and removed in December. Each site was checked regularly by measuring the wetted width, the distance from the left bank to the logger, water depth at the logger, water depths and velocities across the width of the stream, and water chemistry.

Flashiness: "The flashiness is counted by the number of times in the season that the discharge reaches 3x that of the median flow. The term 'flashiness' refers to the frequency and rapidity of short-term changes in stream flow during runoff events and changes in the flashiness of streams can greatly affect the presence and distribution of stream biota" (Hawkins, 2014).

R-B Index: "The 'R-B Index' is a measure of flow variability and flashiness. The index measures oscillation in discharge relative to total discharge, and a result, characterizes the way a catchment processes inputs into its stream flow outputs" (Hawkins, 2014). "It measures oscillations in flow (or discharge) relative to total flow (or discharge), and as such, appears to provide a useful characterization of the way watersheds process hydrologic inputs into their streamflow outputs" (Baker, 2004).

Results are shown in the tables and graphs below, and a discussion of findings follows.



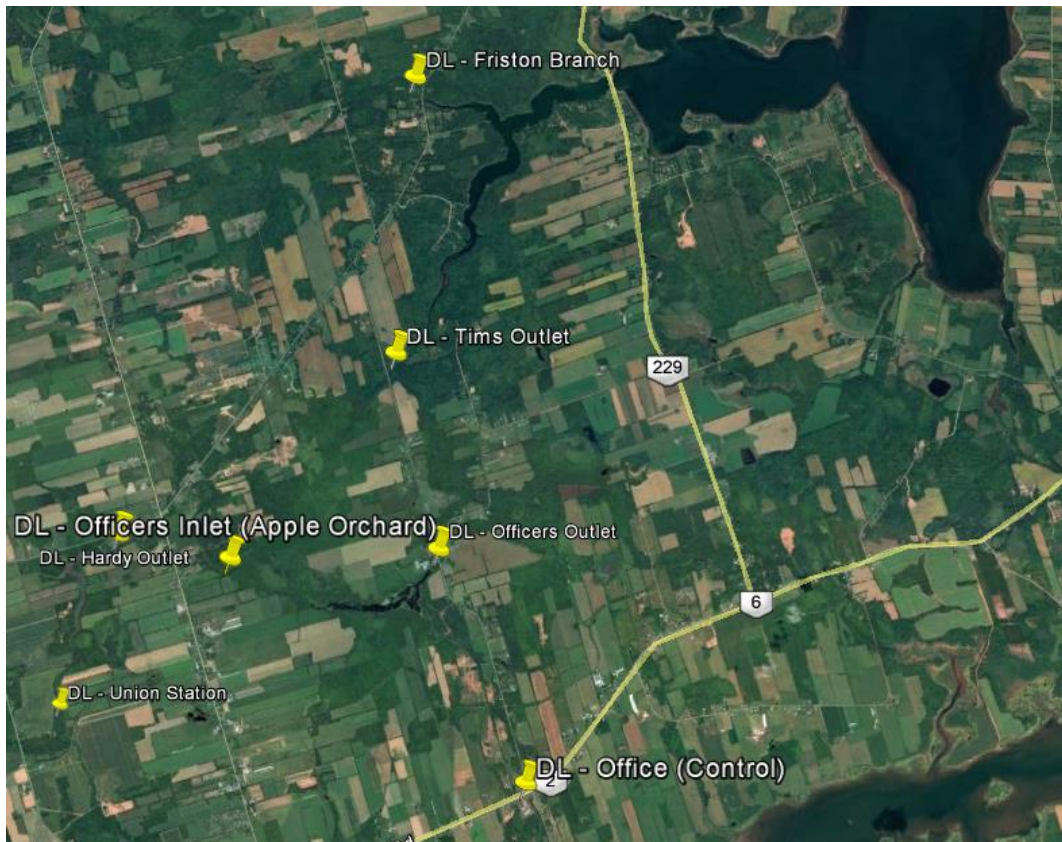


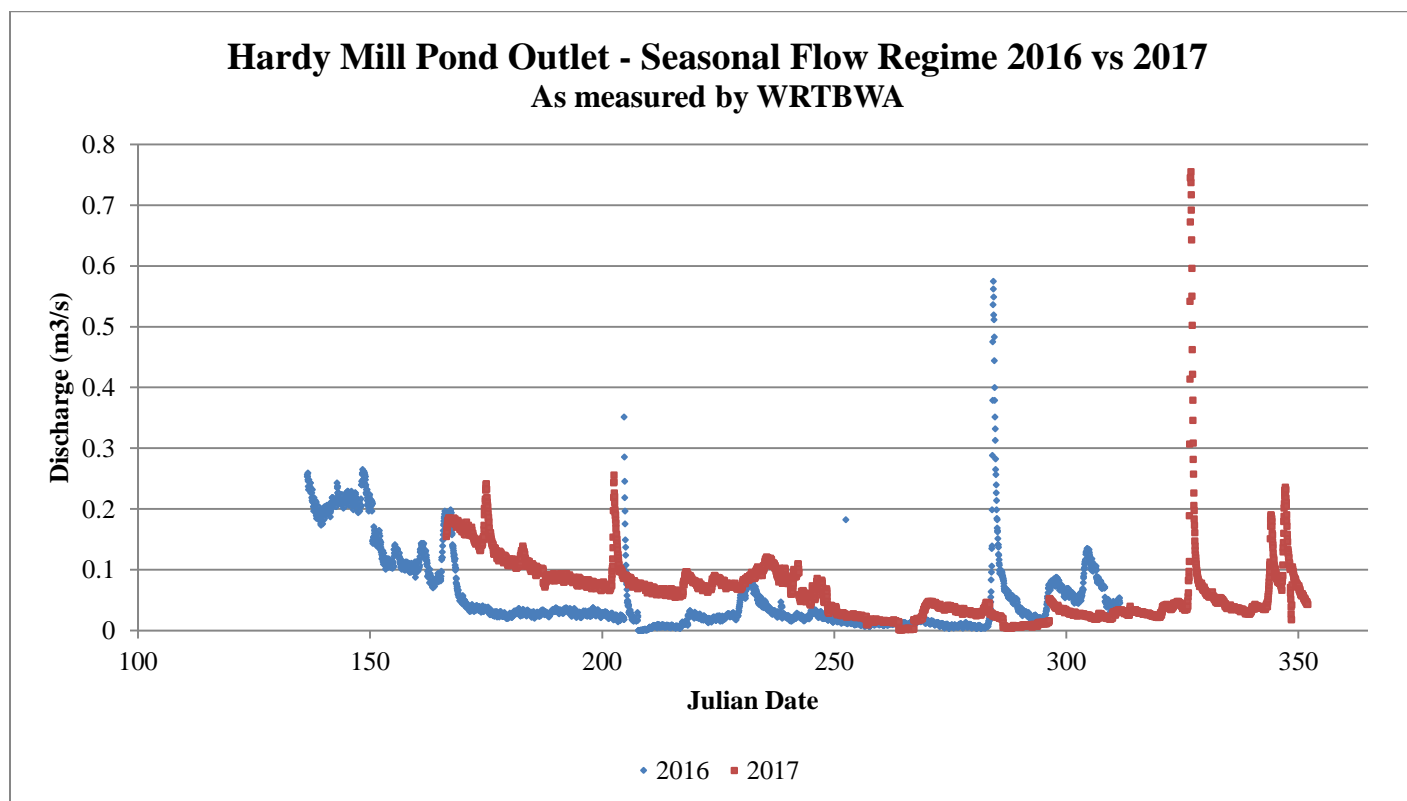
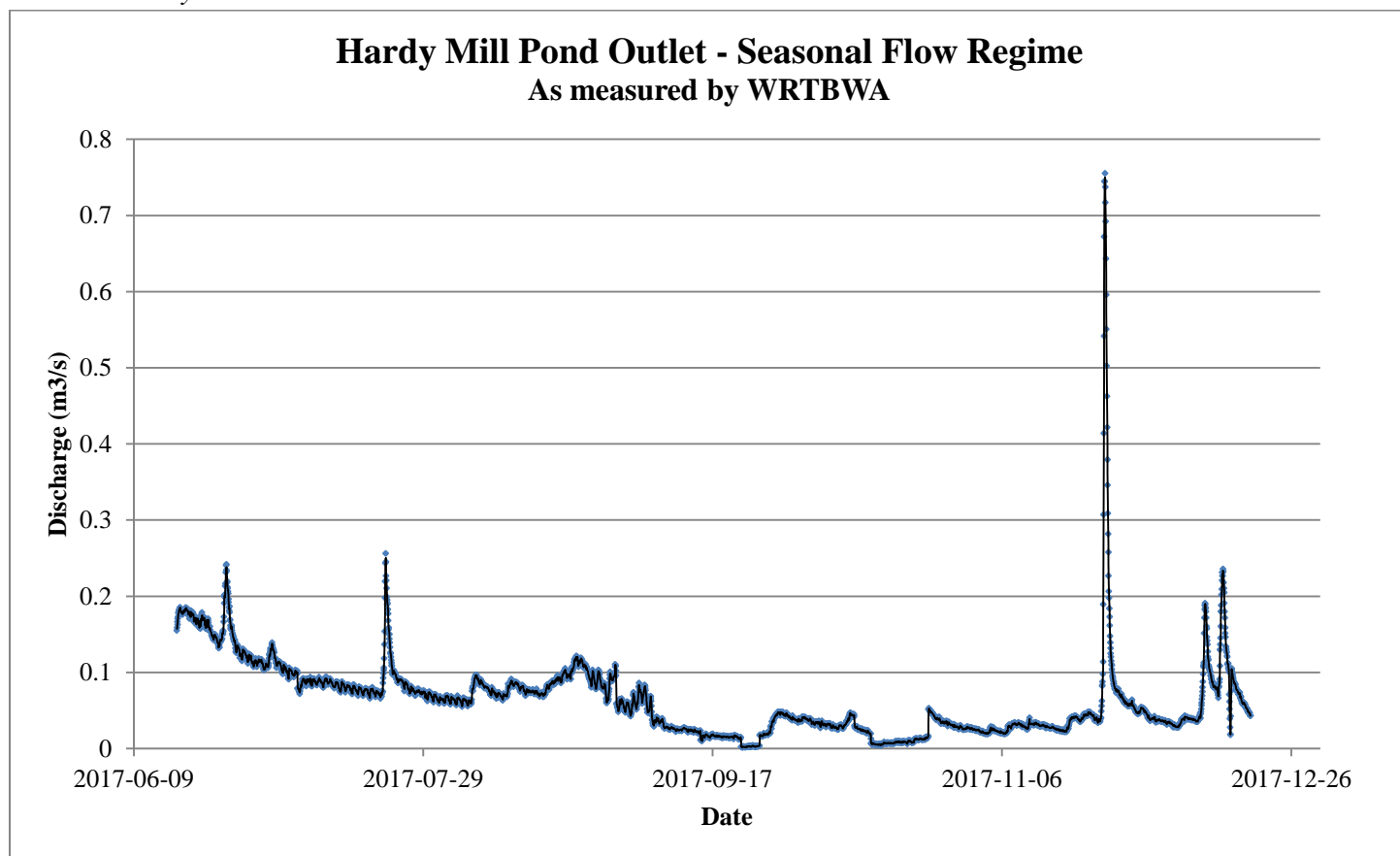
Figure 80. Depth logger locations in 2017.

2017 Depth Logger Locations			
Name	Coordinates	Serial Number	Notes
WR @ Union Station	46°18'58.11"N 63° 7'19.10"W	10685267	Below EC station
WR @ Hardy Mill Outlet	46°19'59.82"N 63° 6'48.20"W	10685268	Below Hardy dam
WR @ Officer's Inlet (Apple Orchard)	46°19'50.85"N 63° 5'47.99"W	10685271	Below Apple Orchard
WR @ Tim's Creek Outlet	46°21'7.15"N 63° 4'18.56"W	10685272	Below tributary outlet
WR @ Officer's Outlet	46°19'54.17"N 63° 3'55.49"W	10685269	Below Suffolk dam
Friston Branch	46°22'50.11"N 63° 4'7.99"W	10685270	Above culvert



4.7.2 Results

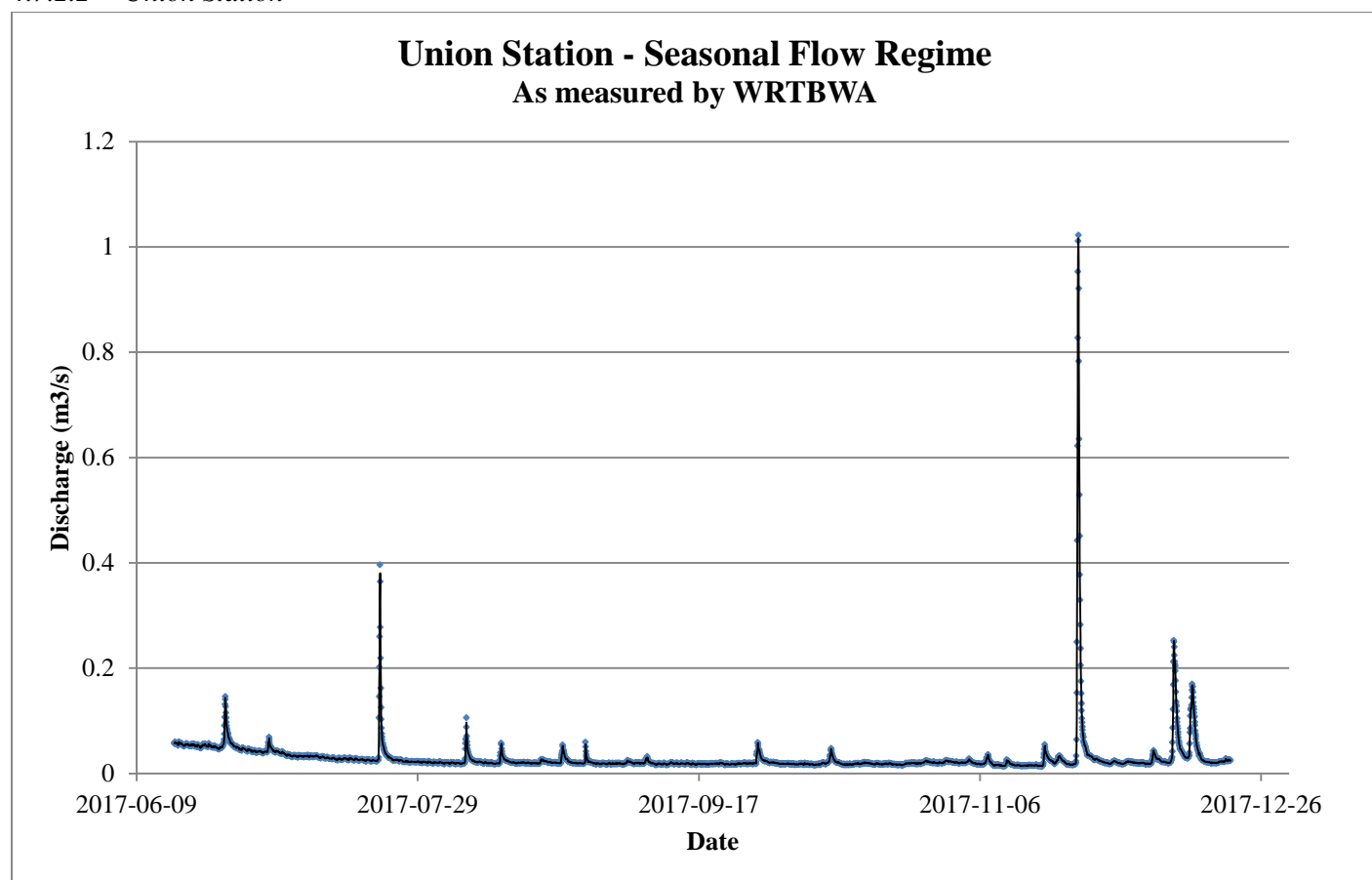
4.7.2.1 Hardy Mill Pond Outlet



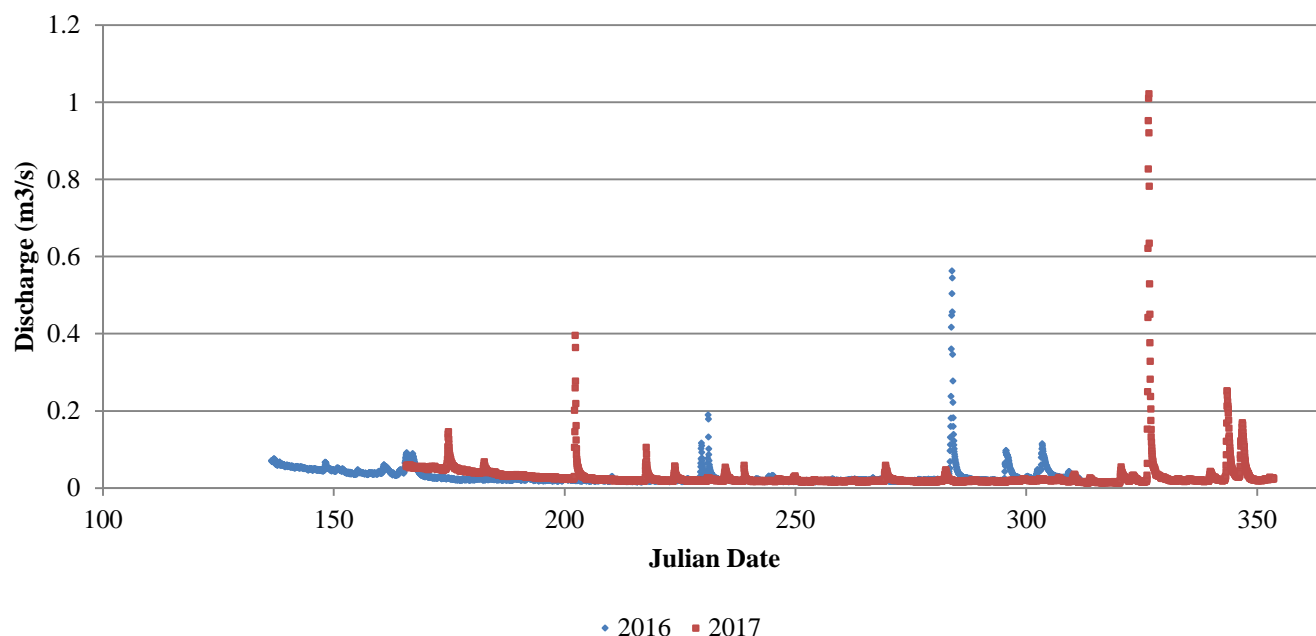
	2017			2016		
	Discharge (L/s)	Water level (m)	Date (yyyy-mm-dd)	Discharge (L/s)	Water level (m)	Date (yyyy-mm-dd)
Minimum Flow	1.411	0.017	2017-09-22	0.002	0.001	2016-07-26
Median Flow	55.899			28.652		
Maximum Flow	755.124	0.534	2017-11-23	574.731	0.156	2016-10-11

	2017	2016
R-B Index:	0.167	0.219
Flashiness (# of high flow pulses):	13	23
High flow threshold (L/s):	167.697	86
R ² Value for water level discharge rating curve	0.591	0.857

4.7.2.2 Union Station



Union Station - Seasonal Flow Regime 2016 vs 2017 As measured by WRTBWA

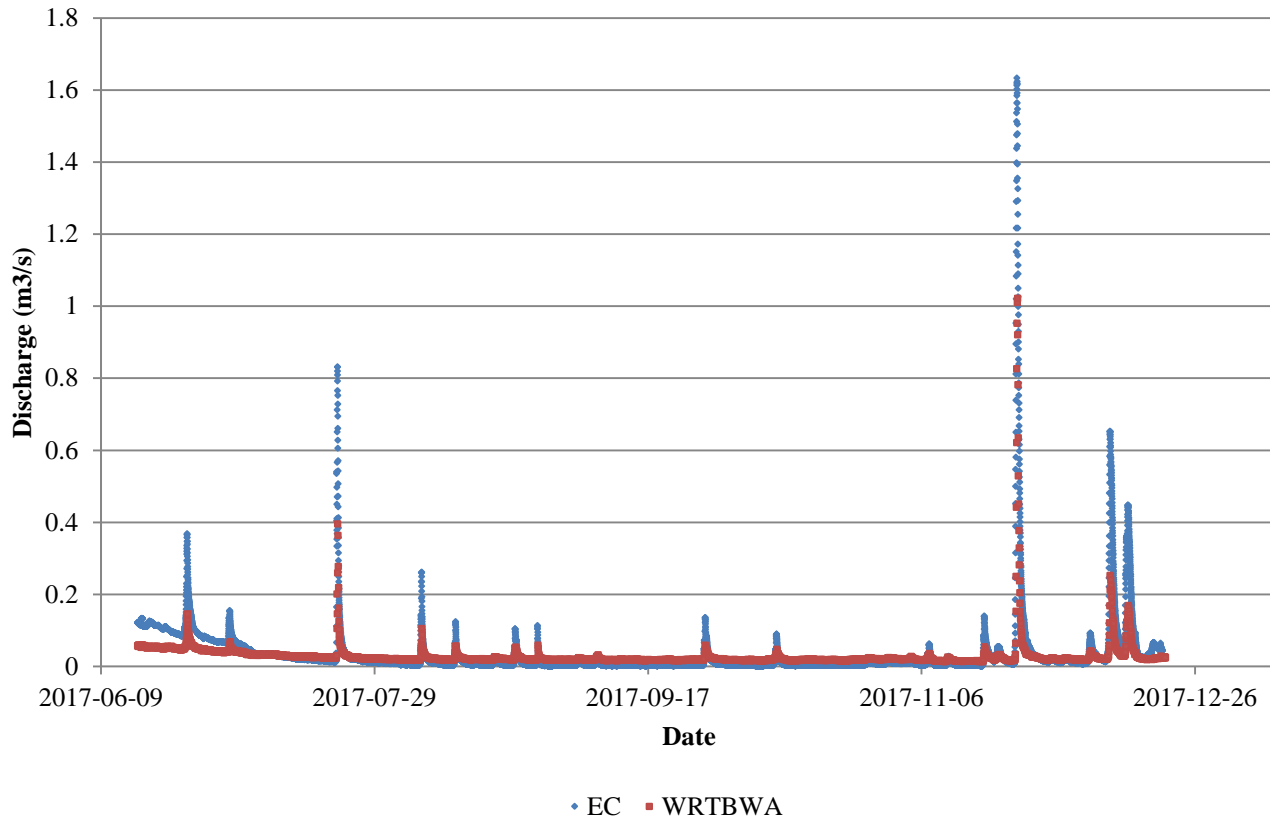


	2017			2016		
	Discharge (L/s)	Water level (m)	Date (yyyy-mm-dd)	Discharge (L/s)	Water level (m)	Date (yyyy-mm-dd)
Minimum Flow	13.638	0.242	2017-11-17	15	0.258	2016-08-04
Median Flow	21.017			21.841		
Maximum Flow	1022.197	0.899	2017-11-23	563.061	0.733	2016-10-10

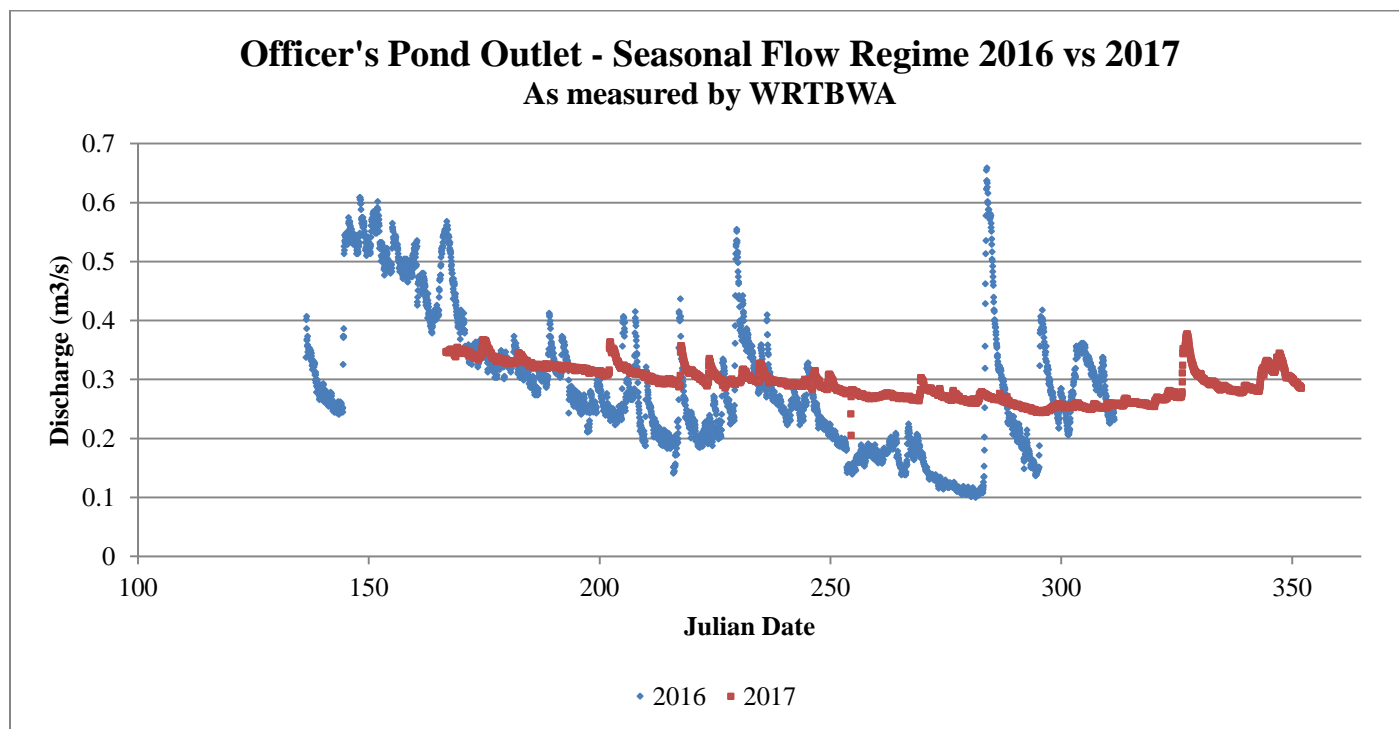
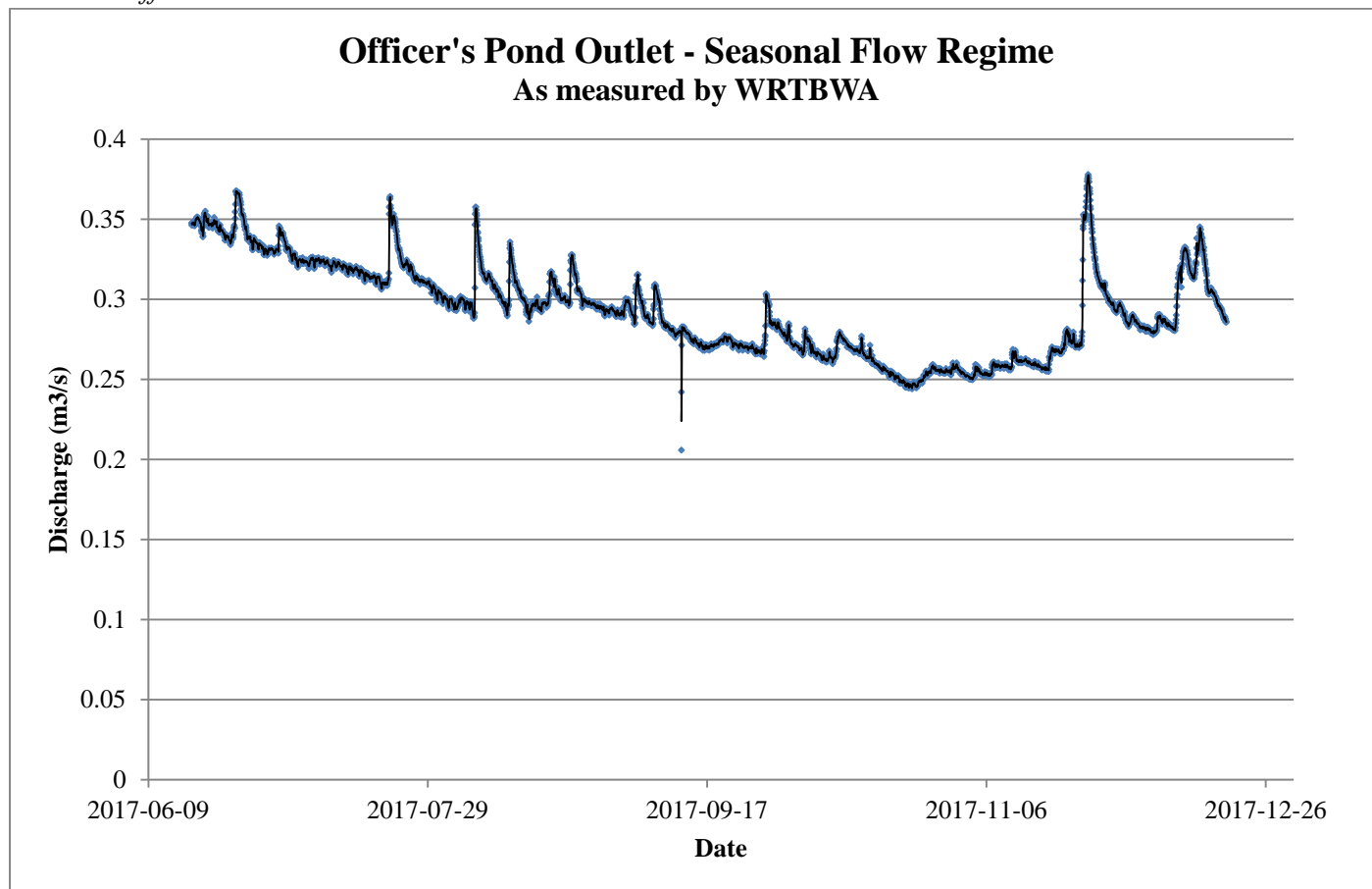
	2017	2016
R-B Index:	0.333	0.188
Flashiness (# of high flow pulses):	7	9
High flow threshold (L/s):	63.05	66
R ² Value for water level discharge rating curve	0.401	0.284



Union Station Discharge 2017 Environment Canada vs WRTBWA

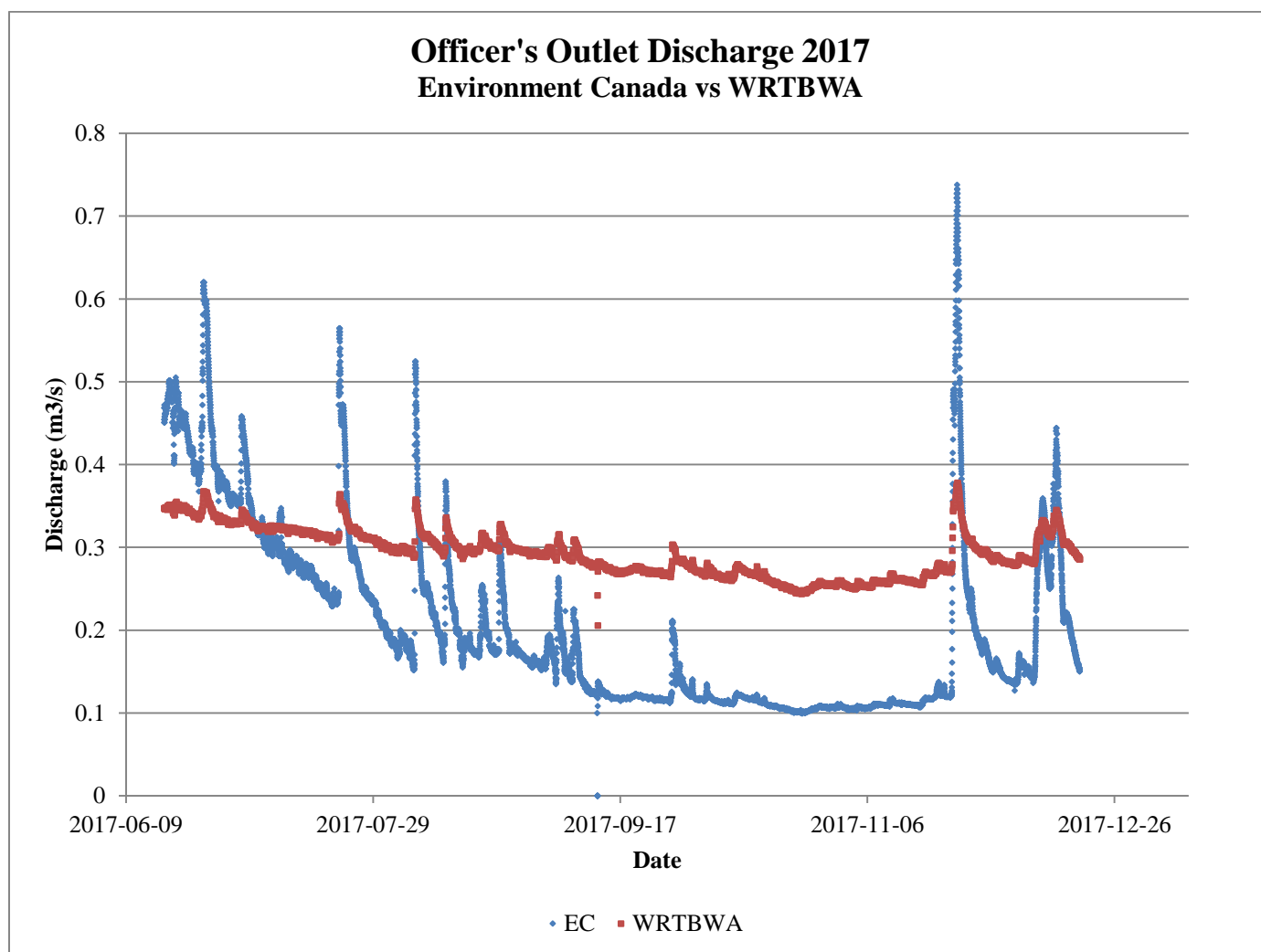


4.7.2.3 Officer's Outlet

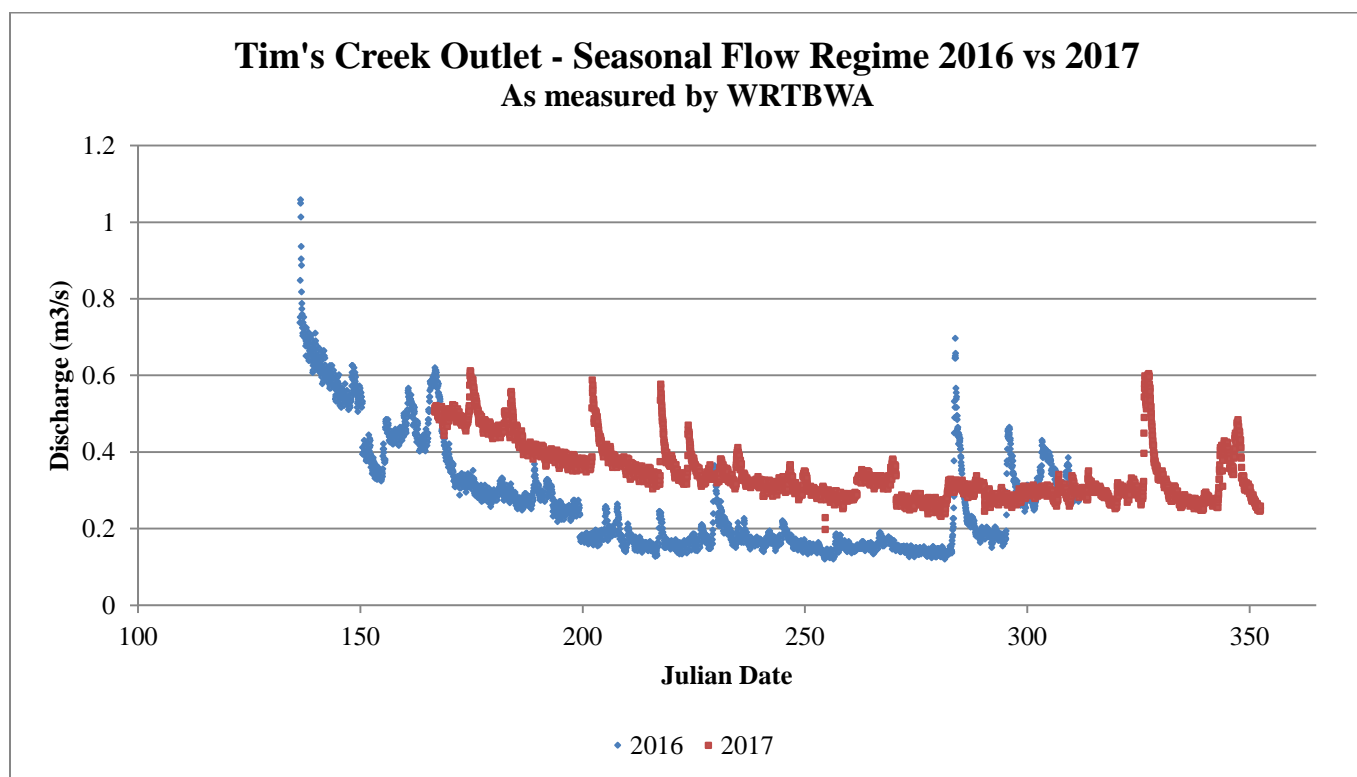
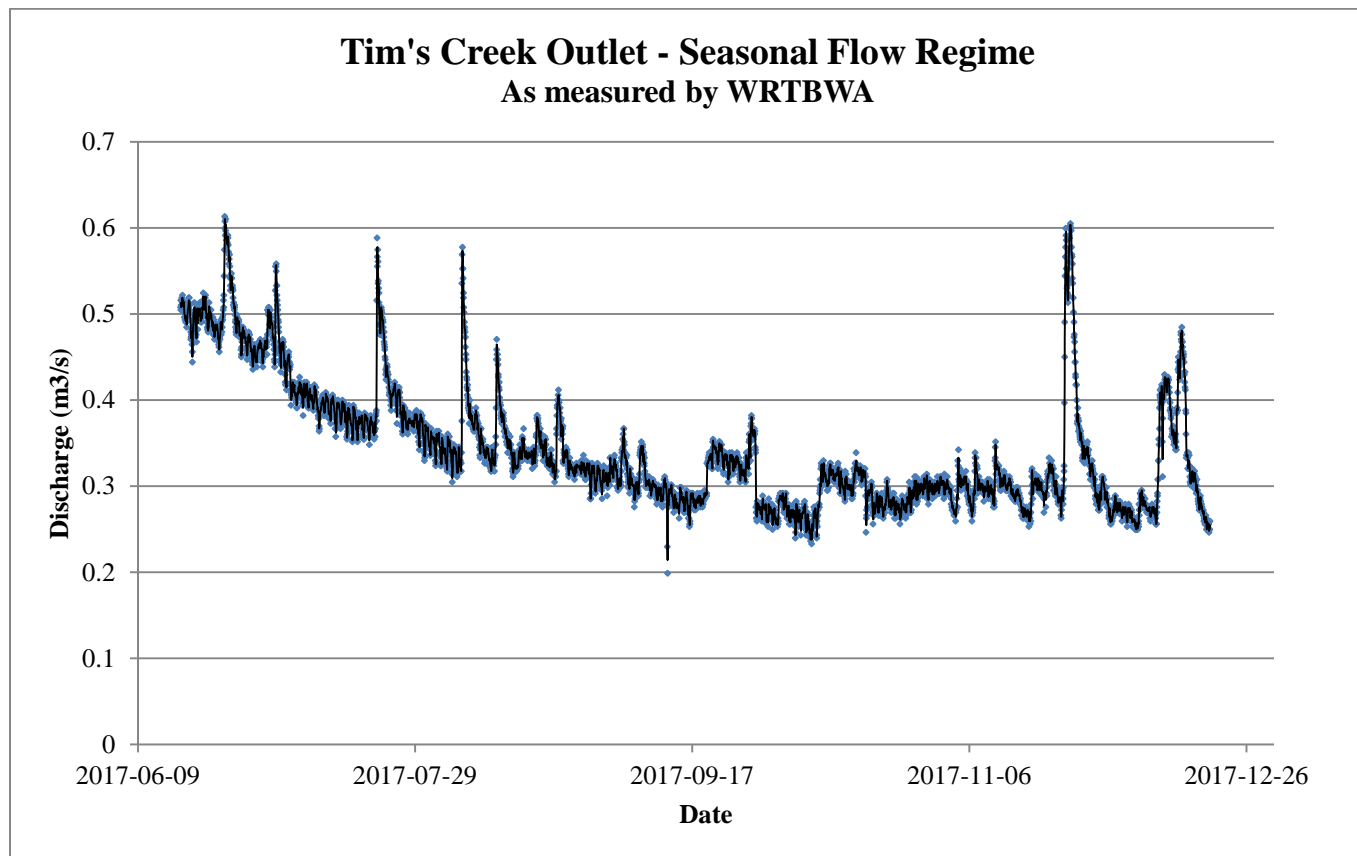


	2017			2016		
	Discharge (L/s)	Water level (m)	Date (yyyy-mm-dd)	Discharge (L/s)	Water level (m)	Date (yyyy-mm-dd)
Minimum Flow	205.843	0.262	2017-09-12	100.552	0.304	2016-10-08
Median Flow	293.036			270.250		
Maximum Flow	378.011	0.622	2017-11-24	658.938	0.557	2016-10-10

	2017	2016
R-B Index:	0.017	0.100
Flashiness (# of high flow pulses):	0	0
High flow threshold (L/s):	879.107	811
R ² Value for water level discharge rating curve	0.058	0.623



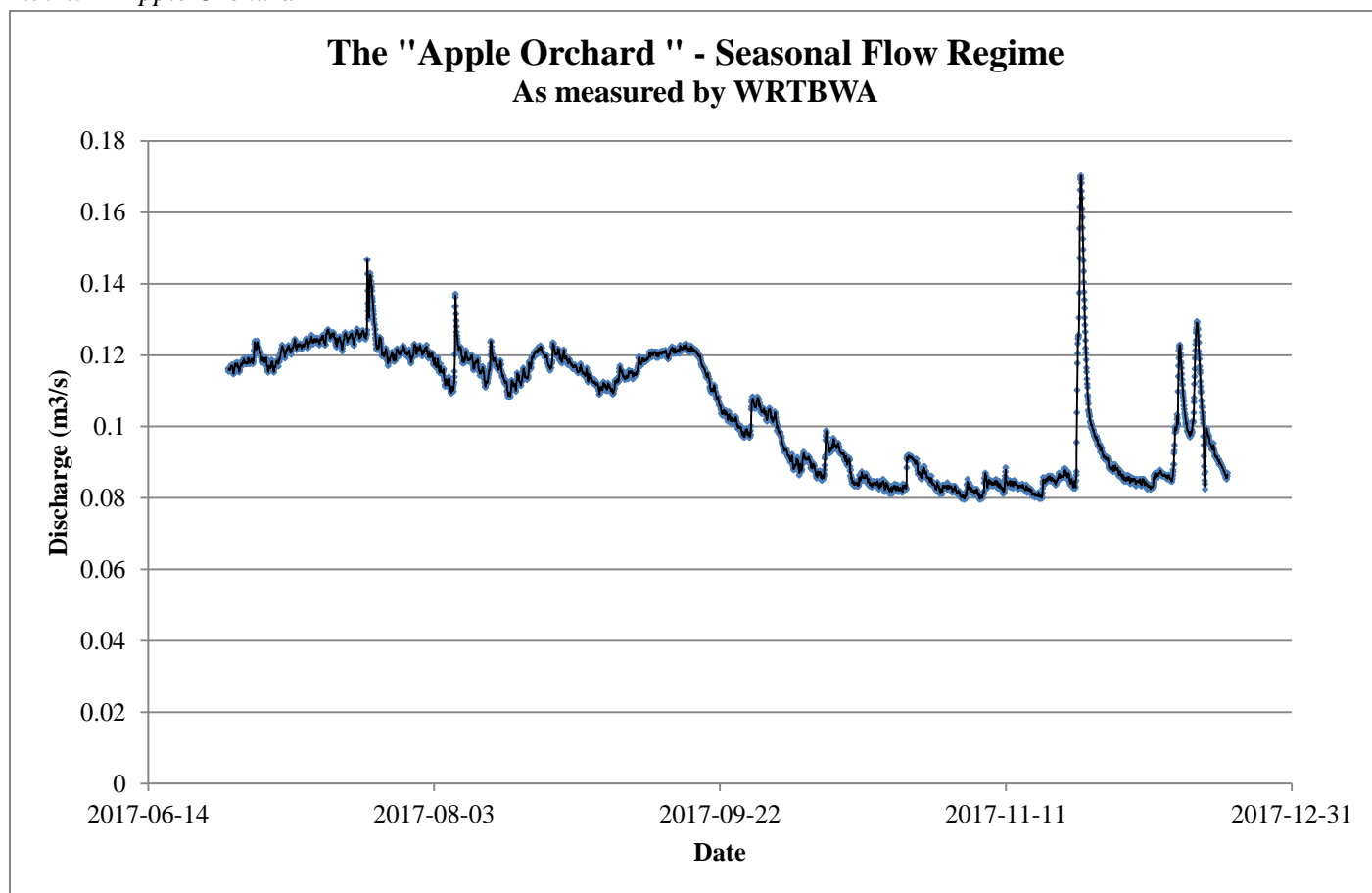
4.7.2.4 Tim's Outlet



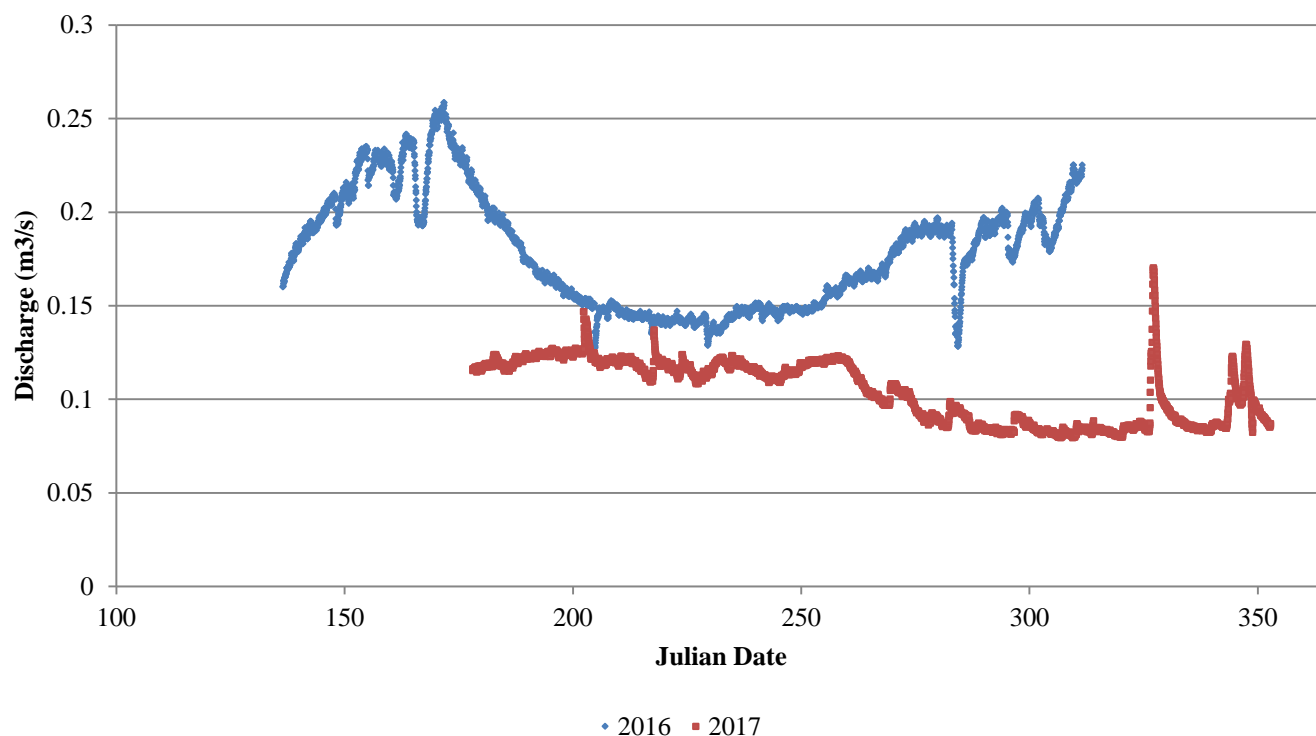
	2017			2016		
	Discharge (L/s)	Water level (m)	Date (yyyy-mm-dd)	Discharge (L/s)	Water level (m)	Date (yyyy-mm-dd)
Minimum Flow	198.923	0.047	2017-09-12	120.840	0.25	2016-09-11
Median Flow	320.554			215.666		
Maximum Flow	613.277	0.185	2017-06-24	1059.139	0.44	2016-05-16

	2017	2016
R-B Index:	0.050	0.083
Flashiness (# of high flow pulses):	0	11
High flow threshold (L/s):	961.663	647
R ² Value for water level discharge rating curve	0.248	0.552

4.7.2.5 Apple Orchard



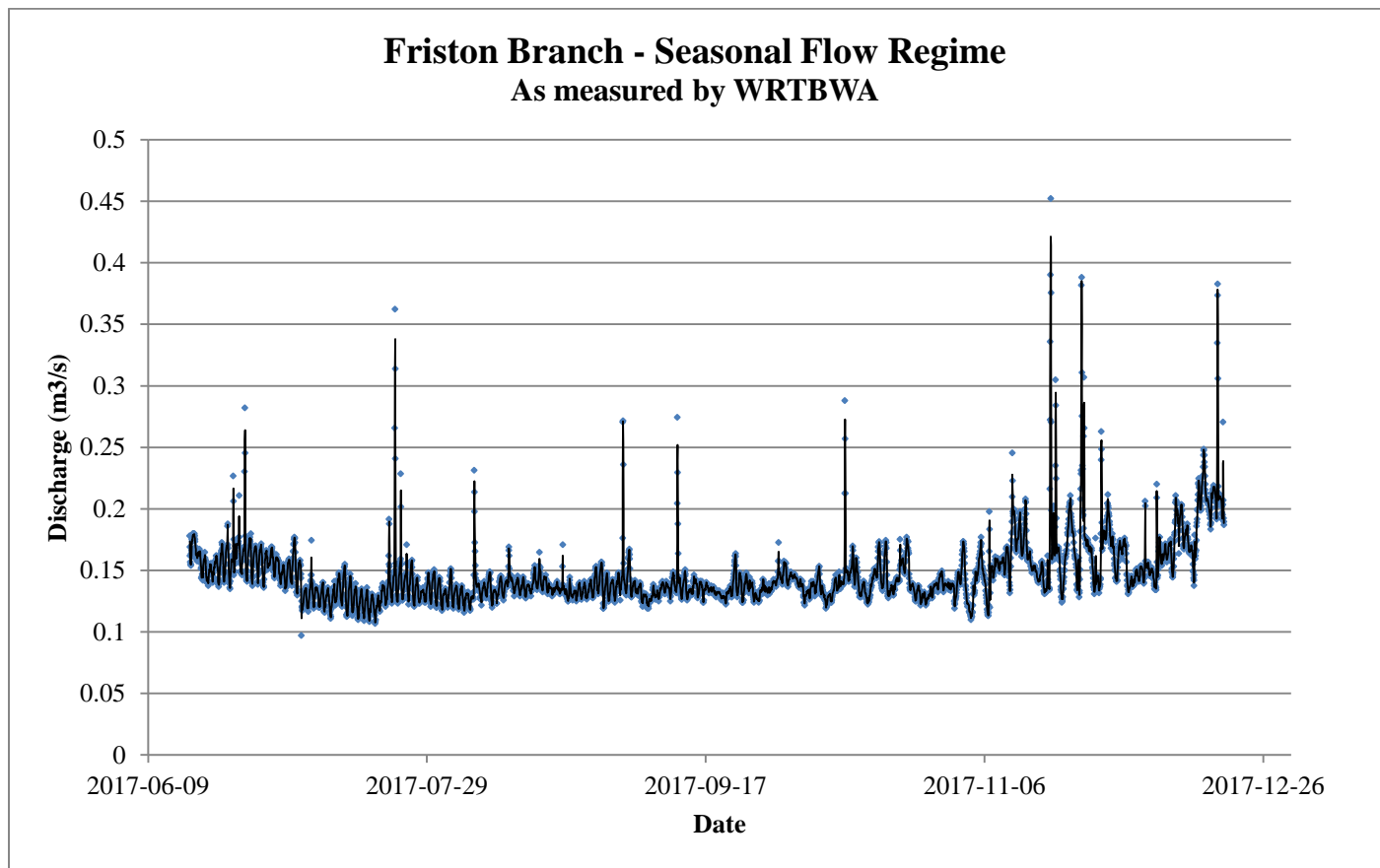
The "Apple Orchard " - Seasonal Flow Regime 2016 vs 2017 As measured by WRTBWA



	2017			2016		
	Discharge (L/s)	Water level (m)	Date (yyyy-mm-dd)	Discharge (L/s)	Water level (m)	Date (yyyy-mm-dd)
Minimum Flow	79.557	0.126	2017-11-03	127.602	0.667	2016-07-23
Median Flow	110.082			176.821		
Maximum Flow	170.398	0.549	2017-11-24	258.630	0.362	2016-06-20

	2017	2016
R-B Index:	0.027	0.023
Flashiness (# of high flow pulses):	0	0
High flow threshold (L/s):	330.247	530
R ² Value for water level discharge rating curve	0.106	0.297



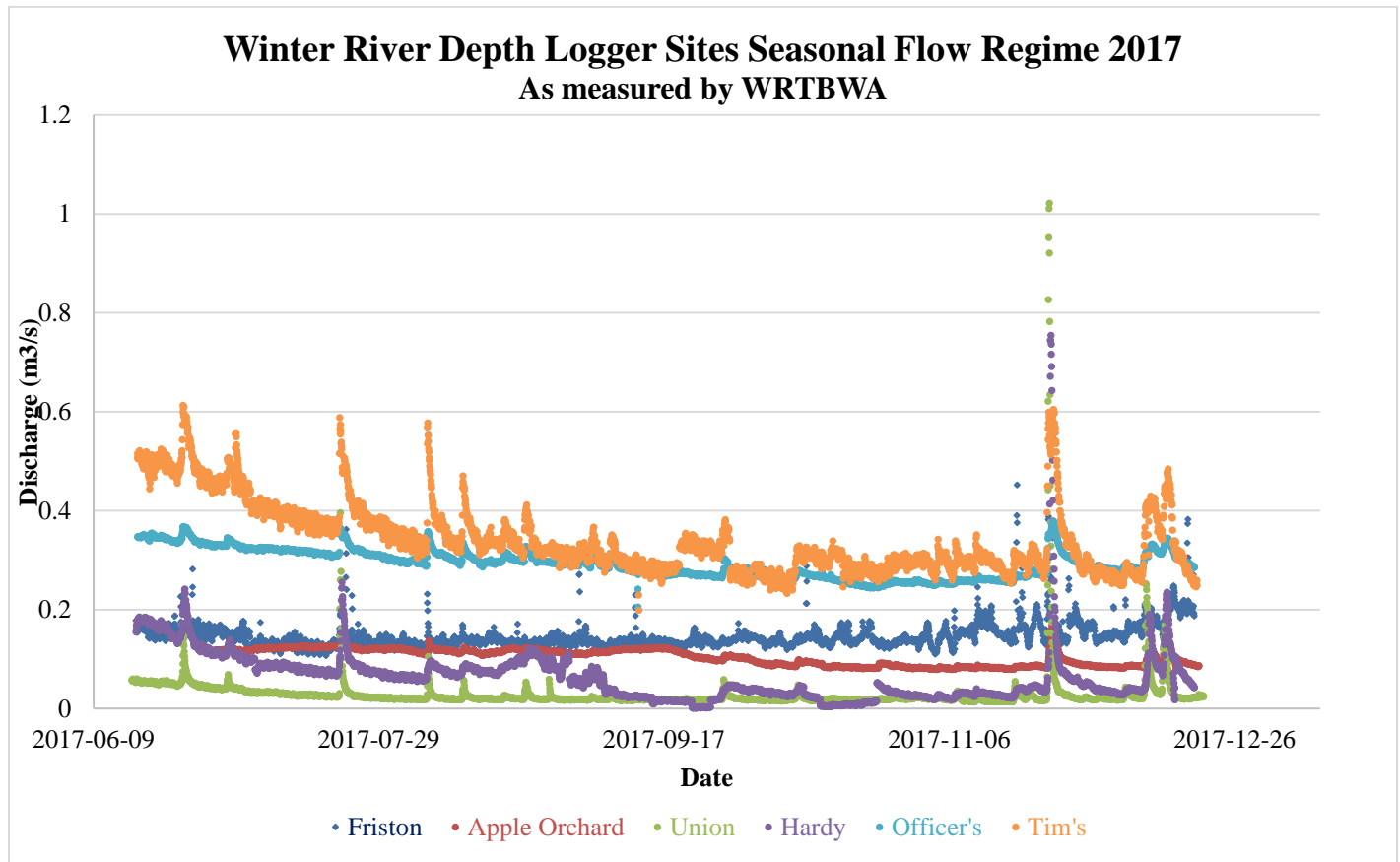


	2017		
	Discharge (L/s)	Water level (m)	Date (yyyy-mm-dd)
Minimum Flow	97.12	0.149	2017-07-06
Median Flow	139.458		
Maximum Flow	452.389	0.521	2017-11-17

	2017
R-B Index:	0.059
Flashiness (# of high flow pulses):	1
High flow threshold (L/s):	418.373
R ² Value for water level discharge rating curve	0.141

*The R² value for the Friston site in 2016 was too low to obtain reliable results, therefore no flow data was calculated in 2016 for this site.





4.7.3 Discussion

The flow at the Hardy's Pond outlet location was normally sufficient to use the flow meter, however in the late fall there were times when the stream was so shallow it was difficult for the flow meter to float without scraping along the stream bed. At times, there were issues measuring the flow at the "Union Station" location, as the flow was so slow that the flow meter was unable to detect movement. At this location we have even seen the orange float upstream while using the "orange method". Officer's Pond outlet had an abnormal sudden drop in flow on September 12 at 10 am. This may be due to people working on the fish ladder just upstream of the logger, or perhaps interference from a buildup of debris on the logger, as this location had an abundance of algae collecting on the logger over the season. The logger at Tim's Creek outlet was placed in a location where flow was difficult to measure properly across the full width of the stream, as it was too shallow and often had debris and rocks blocking flow on one side. In the next season it may be beneficial to measure the cross section and flow at a location near the logger which has consistent flow across the full width of the stream. It is recommended that the loggers be kept at the same location in the following years to increase the R^2 value and have more reliable data.

4.8 Temperature Loggers

4.8.1 Methods

The temperature loggers were deployed in June and removed near the end of November. They recorded temperature values every hour throughout this period. Ten loggers were deployed this season, however only three managed to successfully gather data.

Results are shown in the tables and graphs below, and a discussion of findings follows.



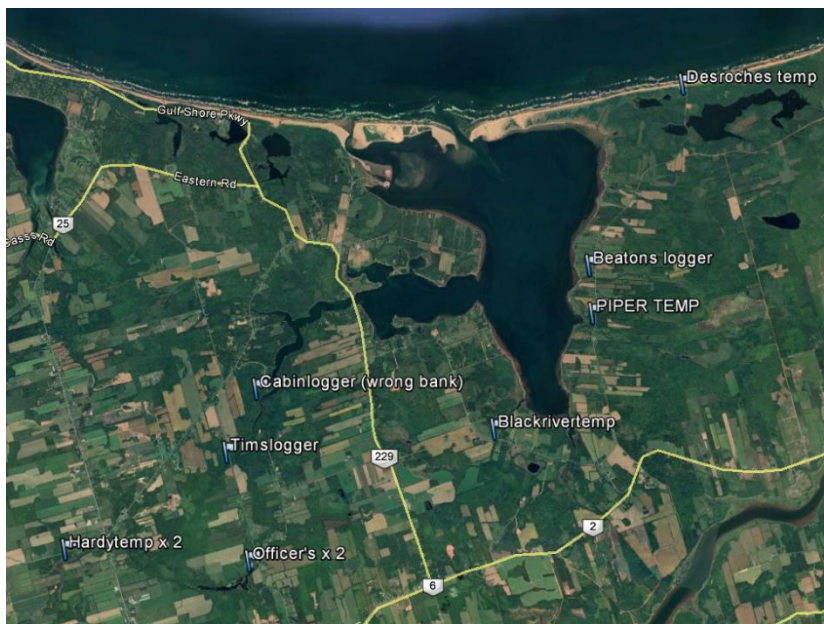


Figure 81. Temperature logger locations 2017.

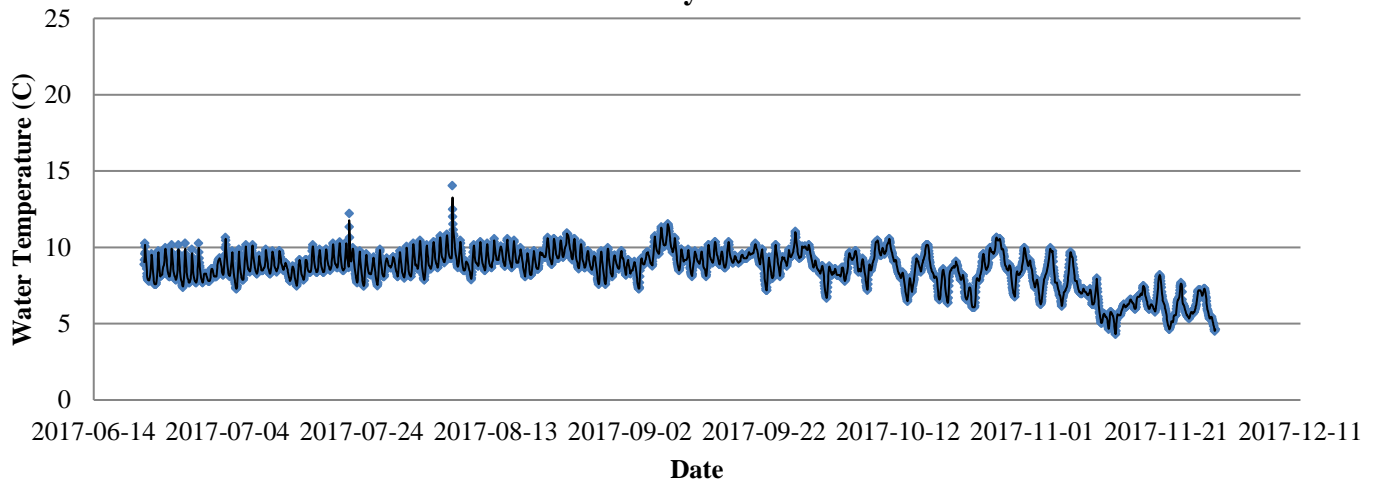
2017 Temperature Logger Locations			
Name	Coordinates	Serial Number	Notes
Beaton's Creek	46°23'9.62"N 62°58'24.15"W	10731629	Downstream of culvert
Black River	46°21'18.71"N 62°59'57.36"W	10880491	Upstream of culvert
CABIN logger	46°21'45.87"N 63° 3'51.01"W	LOST	Near bank closer to cabin (lost)
Deroche Pond Outlet	46°25'12.40"N 62°56'52.02"W	10731605	Under bridge
Hardy Mill Pond (x2)	46°19'56.92"N 63° 6'58.52"W	Surface: 10880486 Bottom: 10880488	Upstream of dam
Officer's Pond (x2)	46°19'49.36"N 63° 3'58.28"W	Surface: 10880487 Bottom: 10880492	Halfway between farm and fishing lodge
Piper's Creek	46°22'37.09"N 62°58'20.96"W	10880490	Upstream of culvert
Tim's Creek	46°21'2.95"N 63° 4'20.19"W	10731604	Upstream of culvert



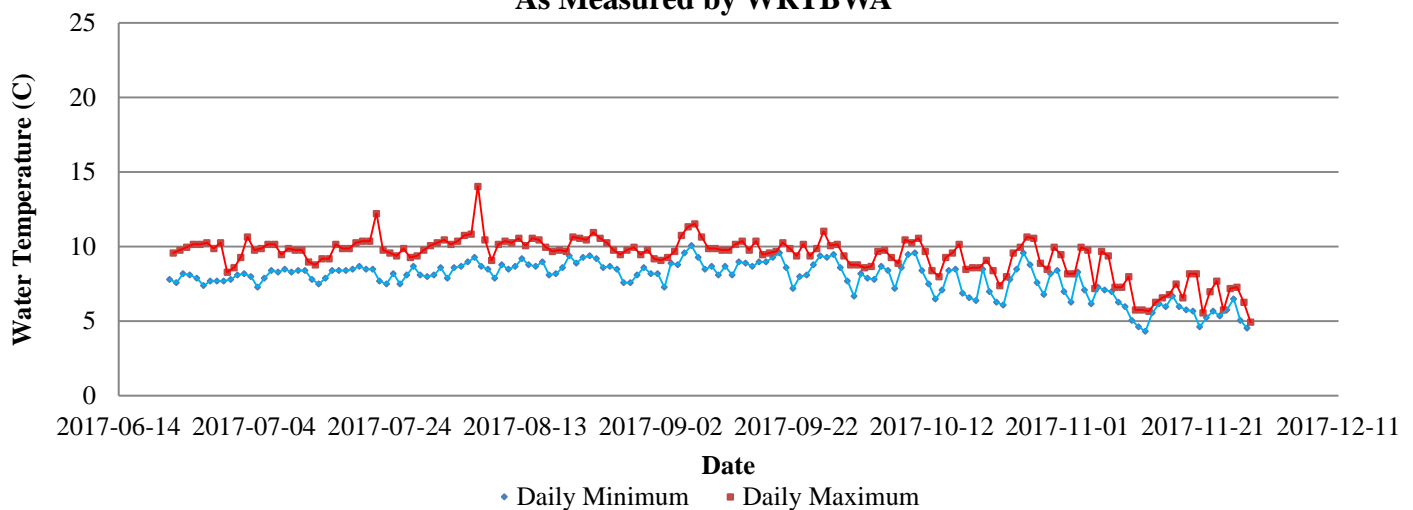
4.8.2 Results

4.8.2.1 Tim's Creek

Seasonal Temperature Regime @ Tim's Outlet
As Measured by WRTBWA



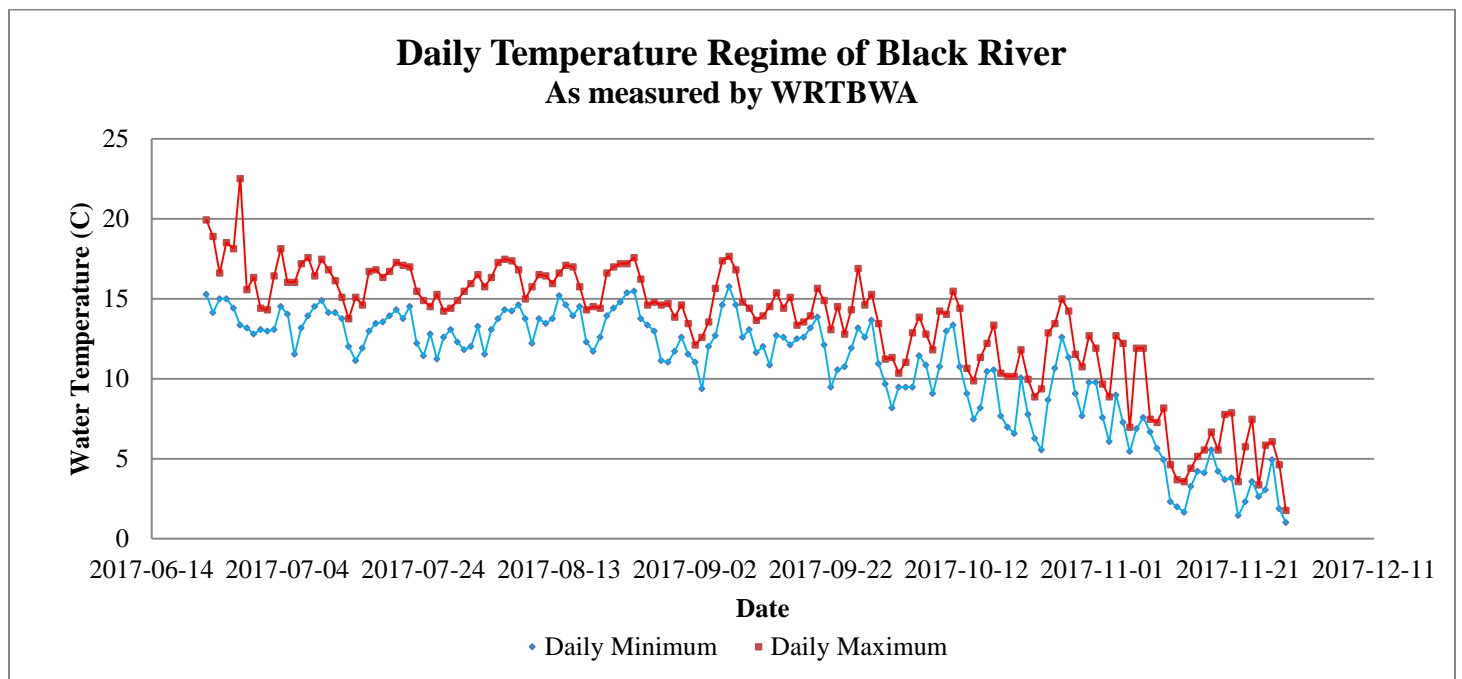
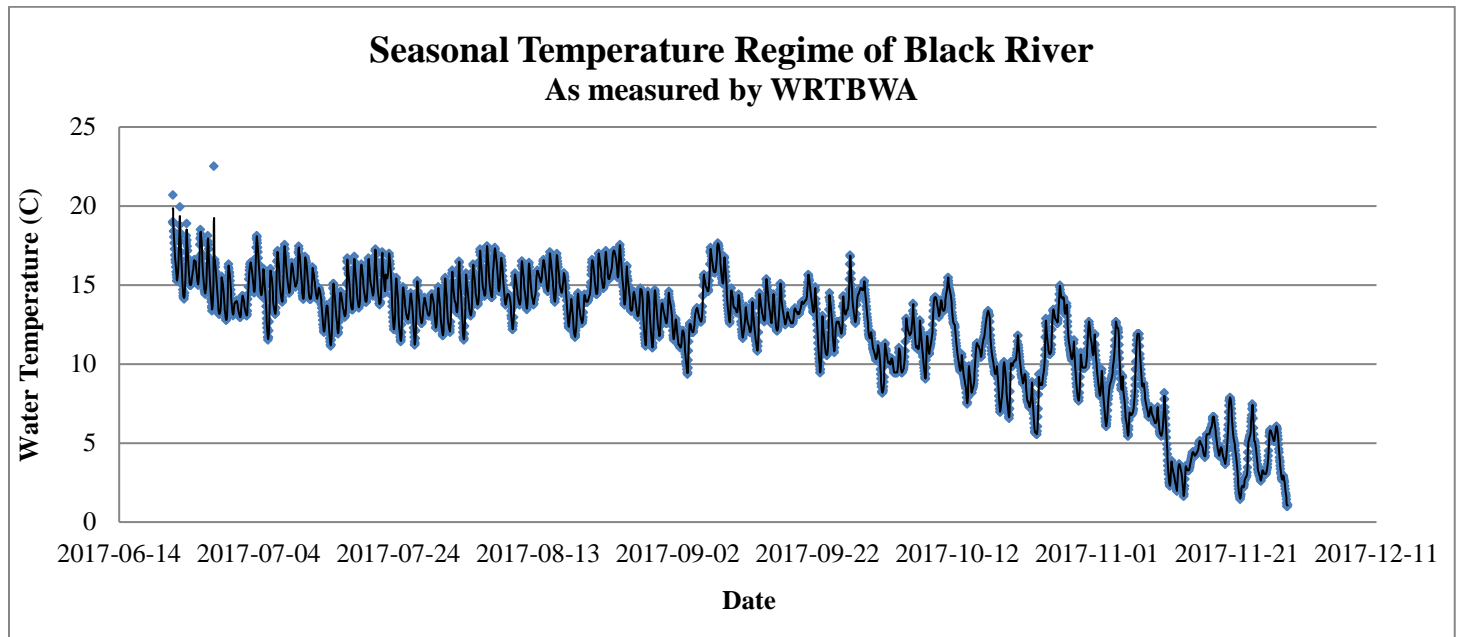
Daily Temperature Regime @ Tim's Outlet
As Measured by WRTBWA



	Temperature (°C)	Date
Maximum	14.038	2017-08-06
Average	8.535	
Minimum	4.311	2017-11-13

	Percentage of hourly temperature measurements
Optimal Growth for Brook trout (11-18 °C)	0.521%
Tolerant Brook trout range (0-20 °C)	100%
Stress Zone (>20°C)	0%
Longest # of Hours in Stress Zone: 0	



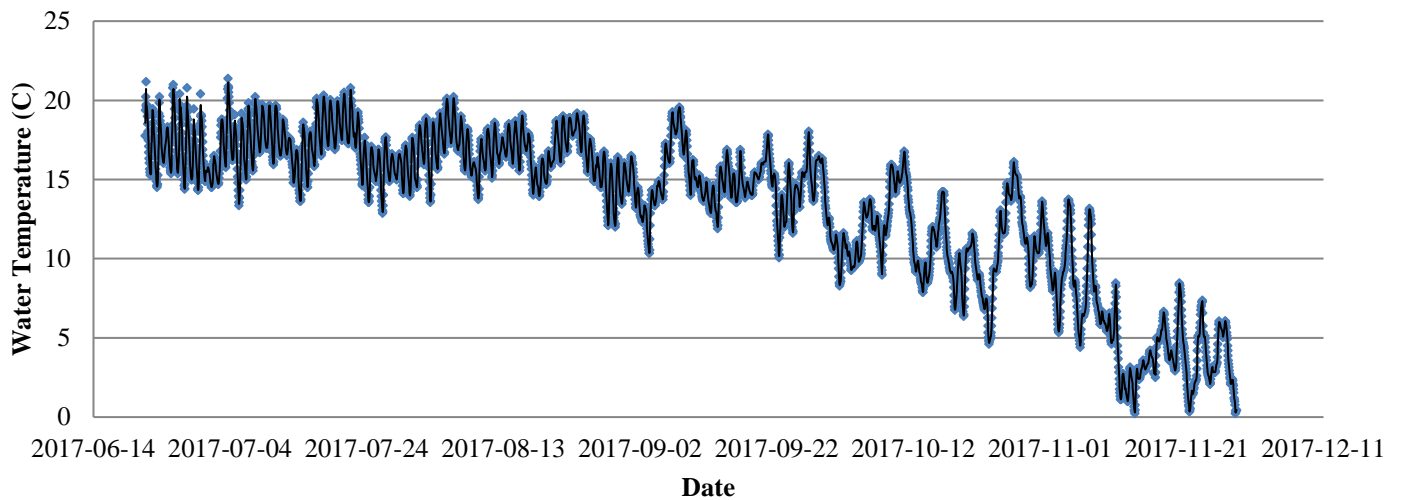


	Temperature (°C)	Date
Maximum	22.525	2017-06-27
Average	12.045	
Minimum	1.003	2017-11-28

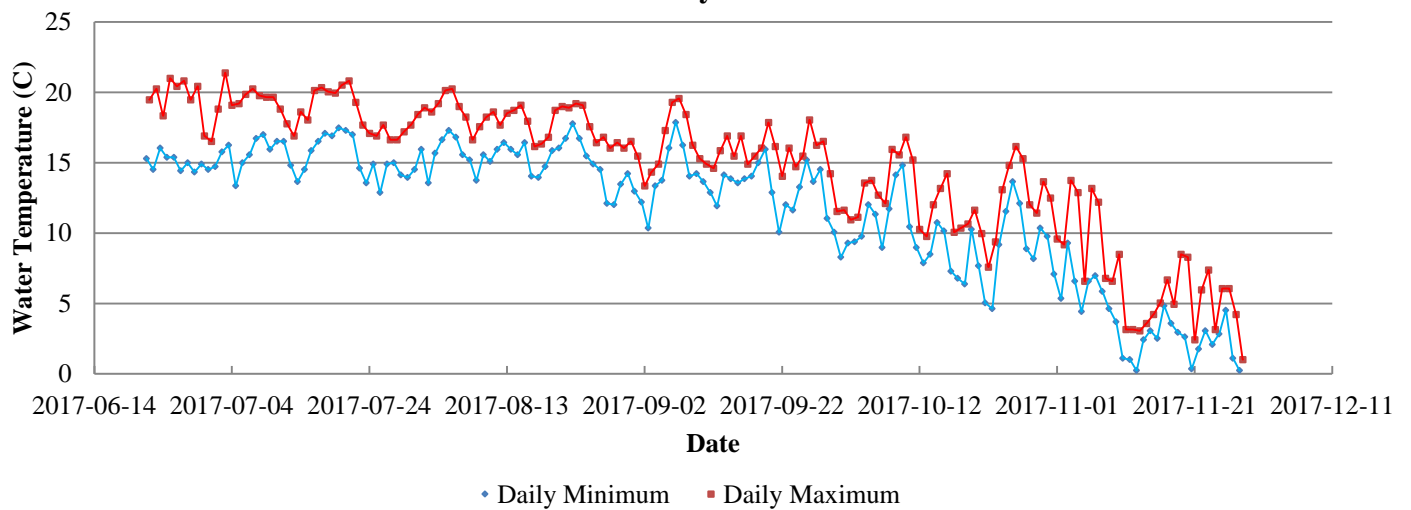
	Percentage of hourly temperature measurements
Optimal Growth for Brook trout (11-18 °C)	69.945%
Tolerant Brook trout range (0-20 °C)	99.948%
Stress Zone (>20°C)	0.052%
Longest # of Hours in Stress Zone: 1	



Seasonal Temperature Regime of Beaton's Creek As measured by WRTBWA



Daily Temperature Regime of Beaton's Creek As measured by WRTBWA

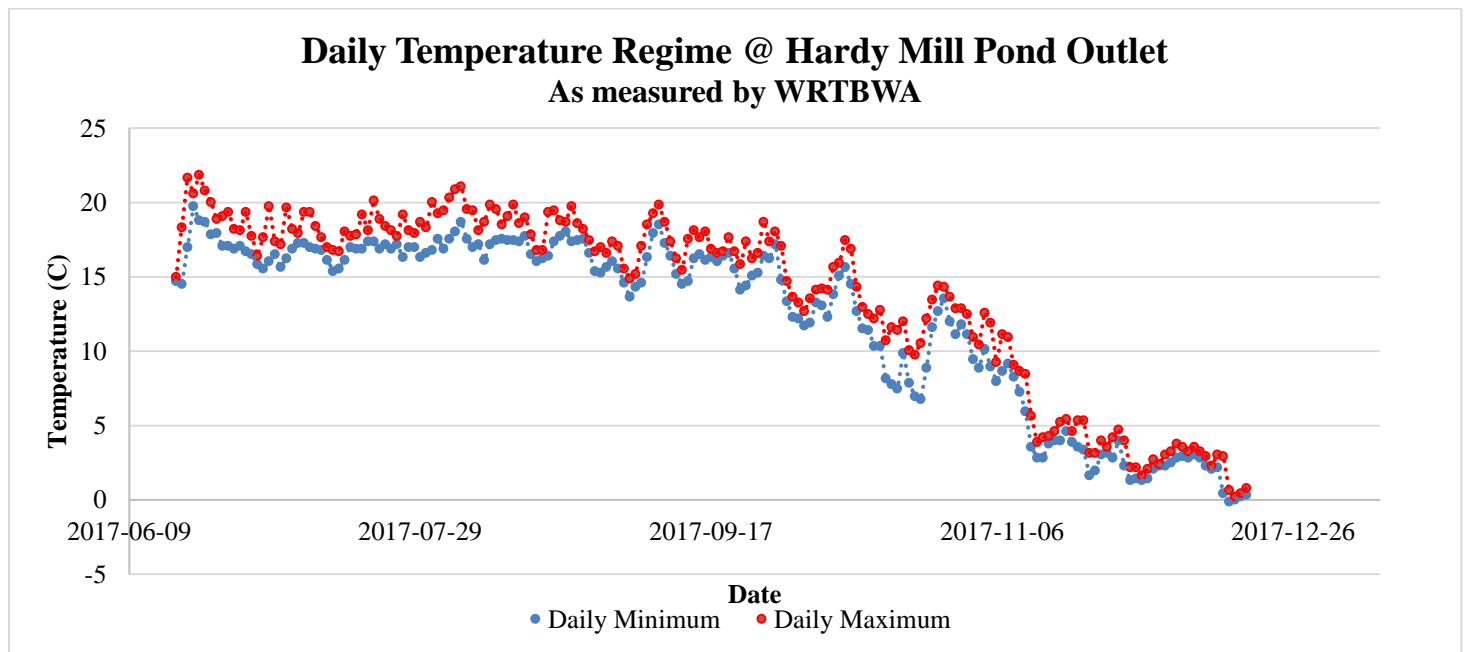
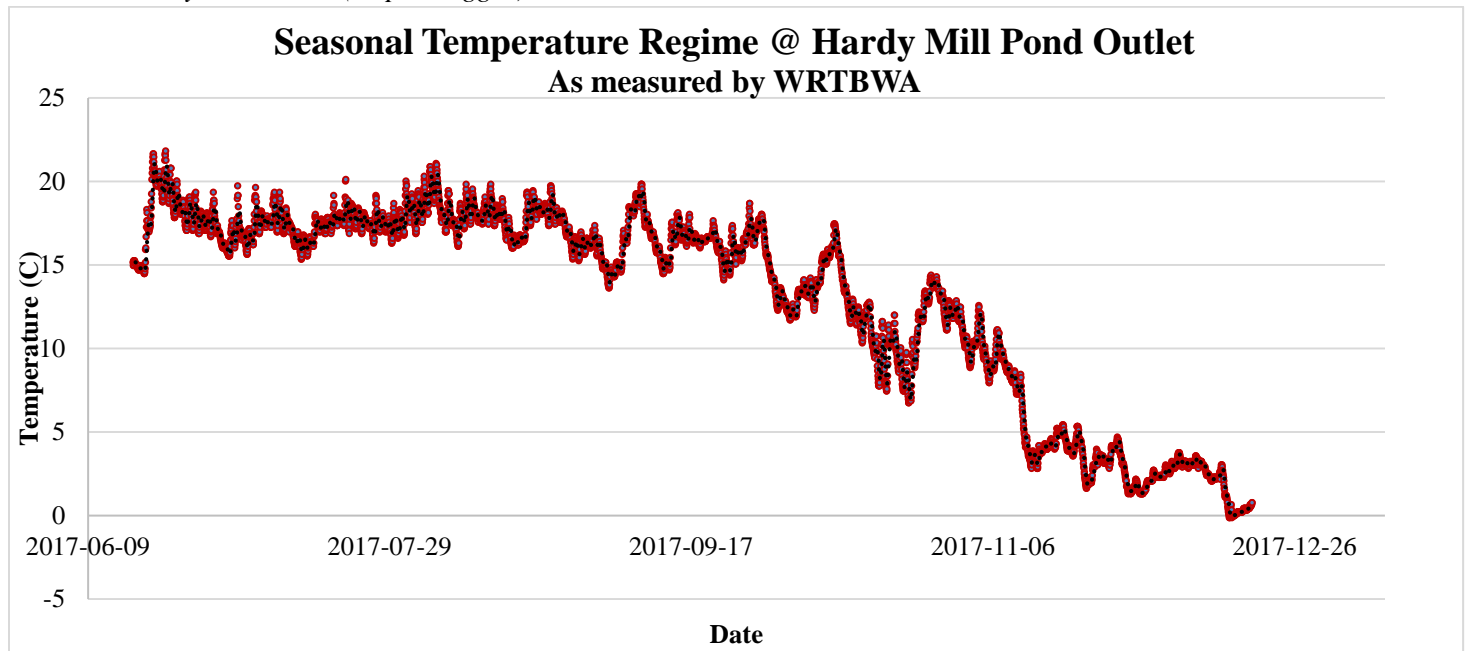


	Temperature (°C)	Date
Maximum	21.378	2017-07-03
Average	13.331	
Minimum	0.232	2017-11-13

	Percentage of hourly temperature measurements
Optimal Growth for Brook trout (11-18 °C)	60.913%
Tolerant Brook trout range (0-20 °C)	98.931%
Stress Zone (>20°C)	1.069%
Longest # of Hours in Stress Zone: 7	



4.8.2.4 Hardy Mill Outlet (Depth Logger)

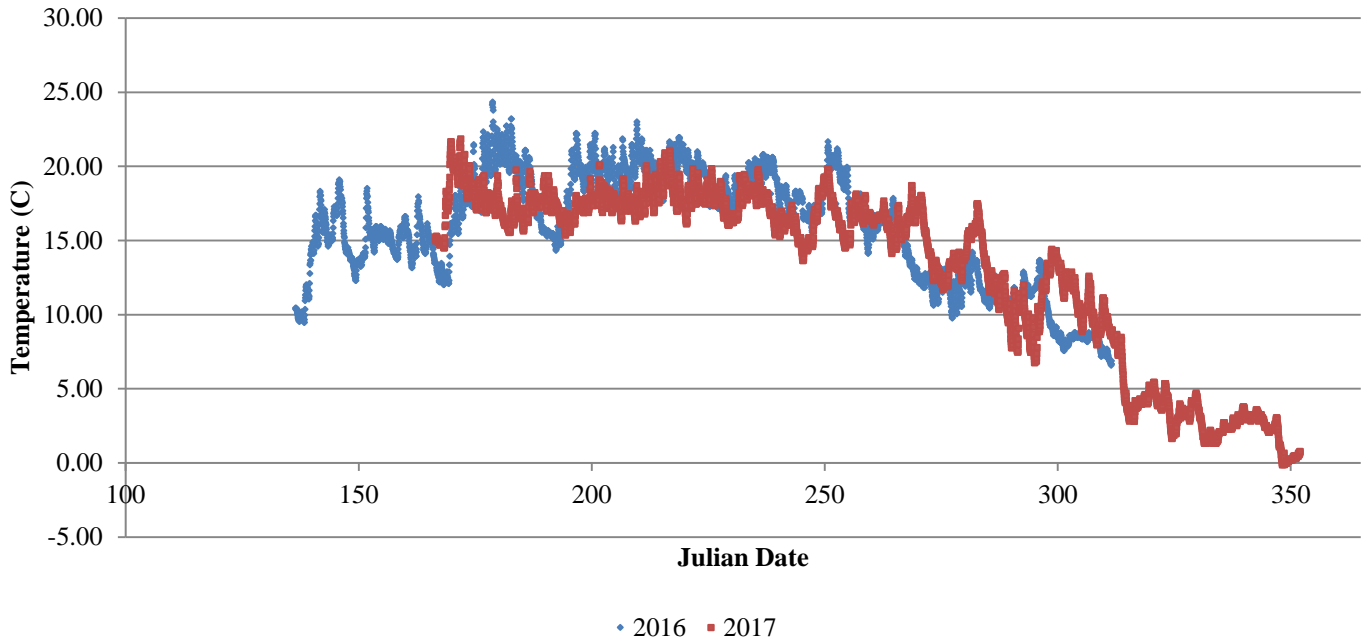


	Temperature (°C)	Date
Maximum	21.855	2017-06-21
Average	13.047	
Minimum	-0.102	2017-12-15

	Percentage of hourly temperature measurements
Optimal Growth for Brook trout (11-18 °C)	54.390%
Tolerant Brook trout range (0-20 °C)	98.428%
Stress Zone (>20°C)	1.527%
Longest # of Hours in Stress Zone: 16	

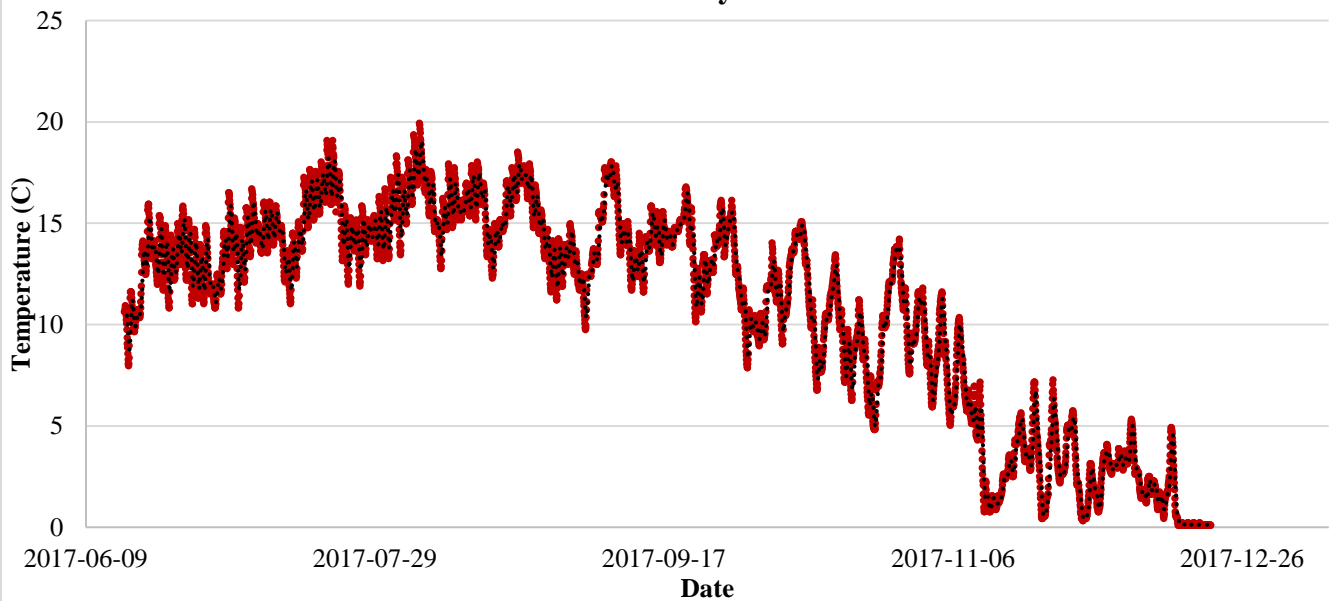


Seasonal Temperature Regime @ Hardy Mill Pond Outlet 2016 vs 2017 As measured by WRTBWA

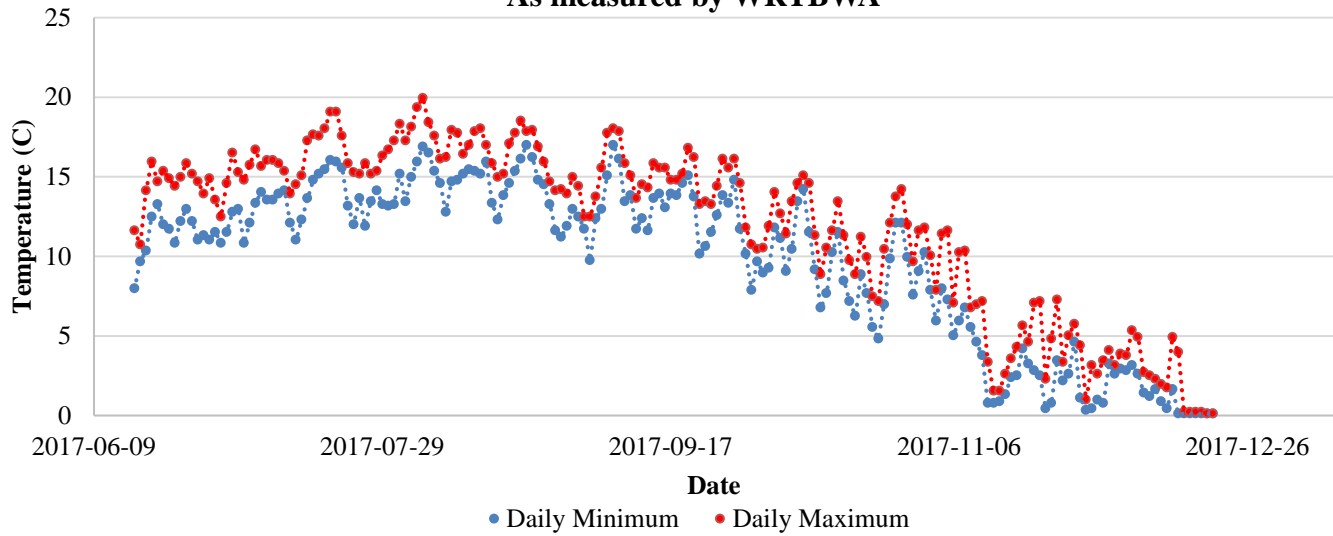


4.8.2.5 Union Station (Depth Logger)

Seasonal Temperature Regime of the Union Branch As measured by WRTBWA



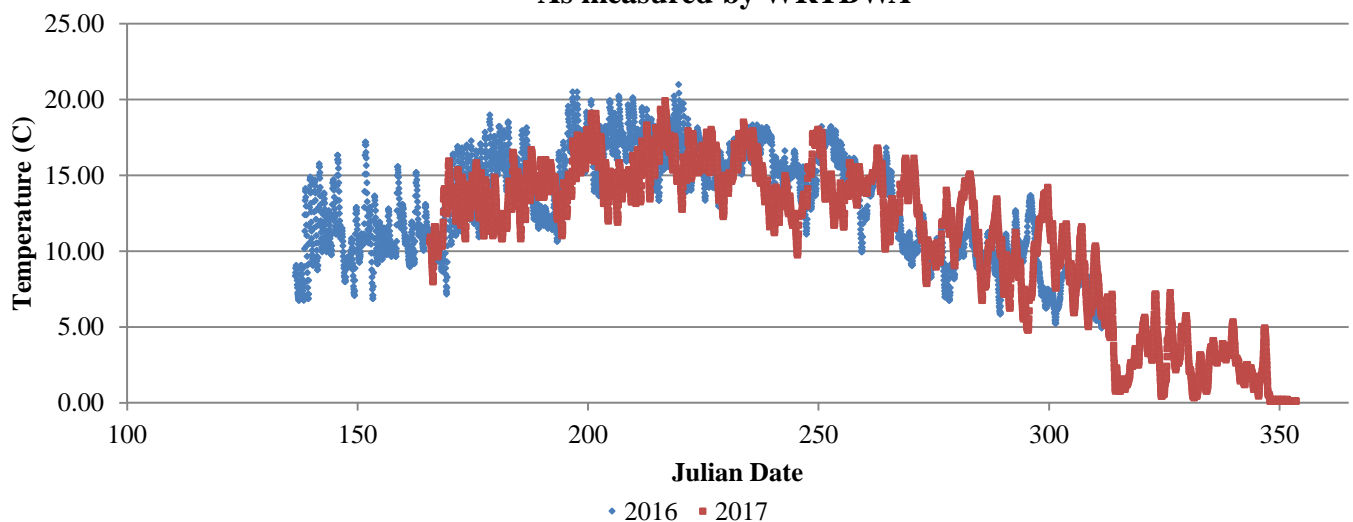
Daily Temperature Regime of the Union Branch As measured by WRTBWA



	Temperature (°C)	Date
Maximum	19.948	2017-08-05
Average	10.865	
Minimum	0.121	2017-12-14

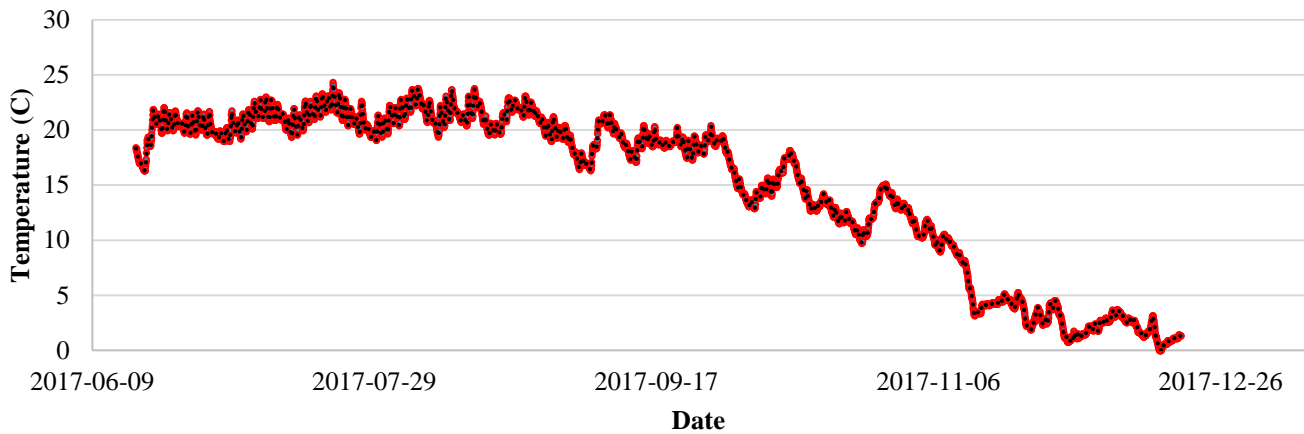
	Percentage of hourly temperature measurements
Optimal Growth for Brook trout (11-18 °C)	60.142%
Tolerant Brook trout range (0-20 °C)	100%
Stress Zone (>20°C)	0%
Longest # of Hours in Stress Zone: 0	

Seasonal Temperature Regime of the Union Branch 2016 vs 2017 As measured by WRTBWA

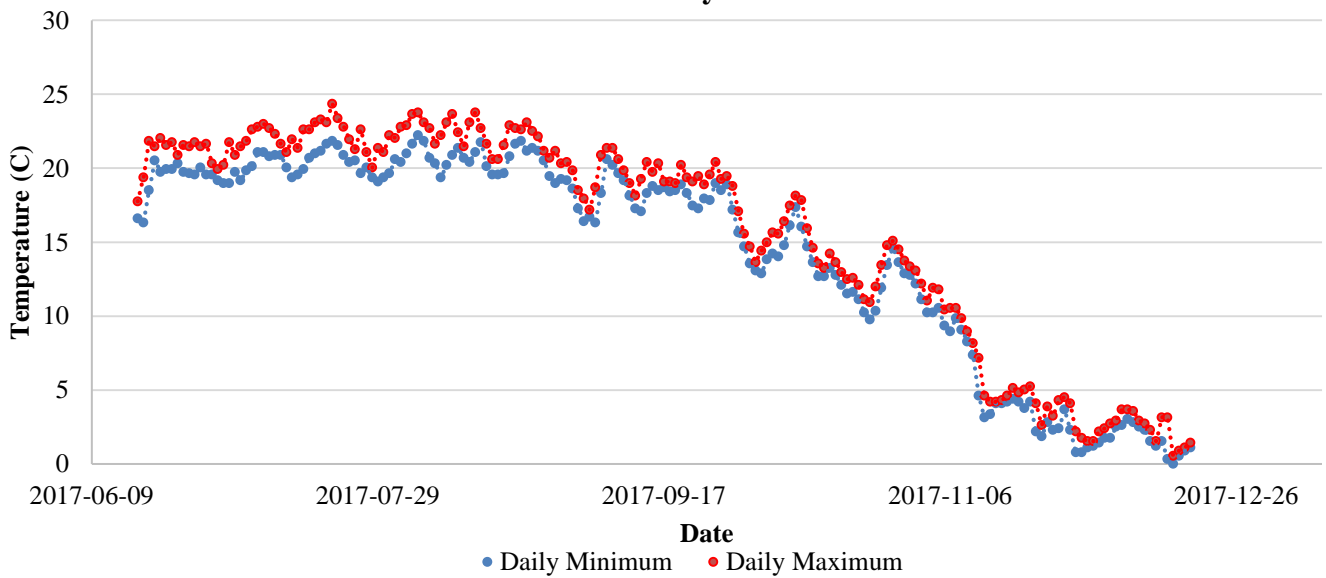


4.8.2.6 Officer's Pond (Depth Logger)

Seasonal Temperature Regime @ Officers Pond Outlet
As measured by WRTBWA



Daily Temperature Regime @ Officers Pond Outlet
As measured by WRTBWA

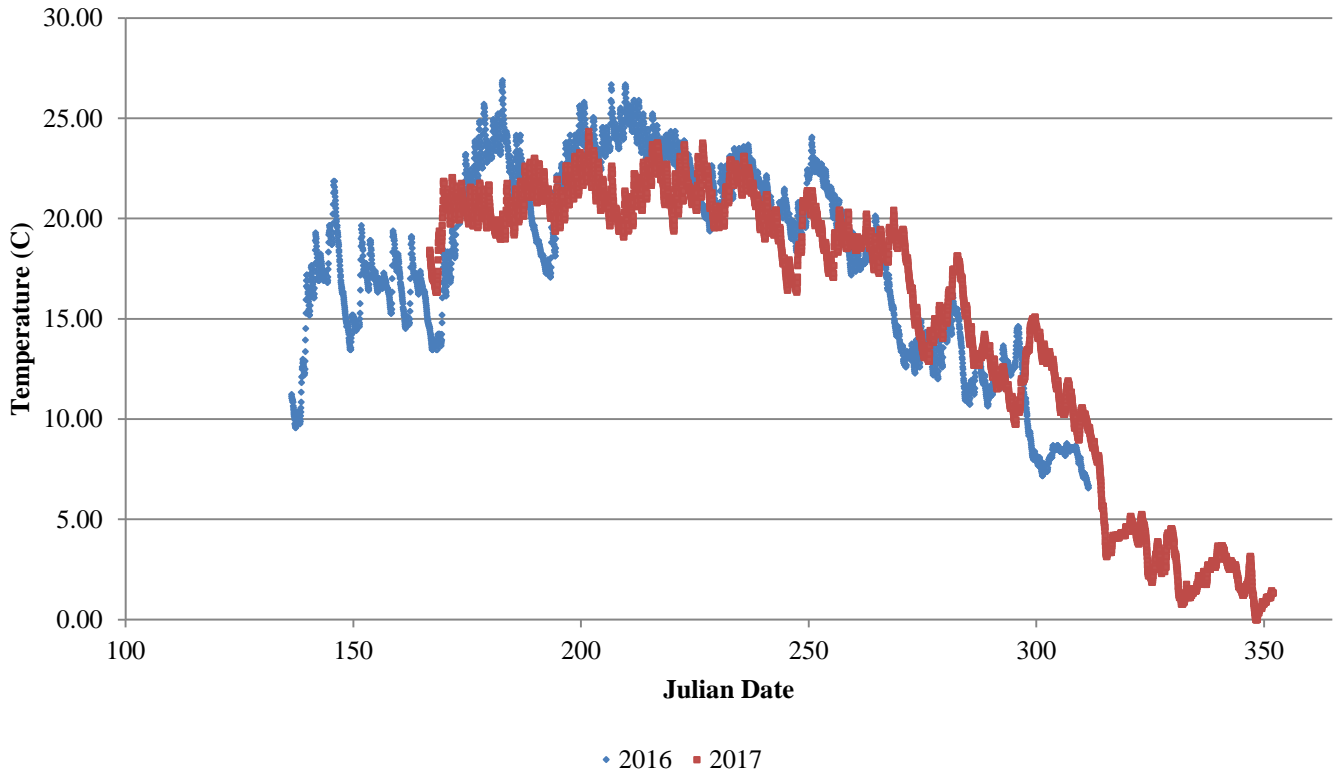


	Temperature (°C)	Date
Maximum	24.351	2017-07-21
Average	15.074	
Minimum	0.01	2017-12-15

Optimal Growth for Brook trout (11-18 °C)	21.453%
Tolerant Brook trout range (0-20 °C)	65.033%
Stress Zone (>20°C)	34.967%
Longest # of Hours in Stress Zone: 236	

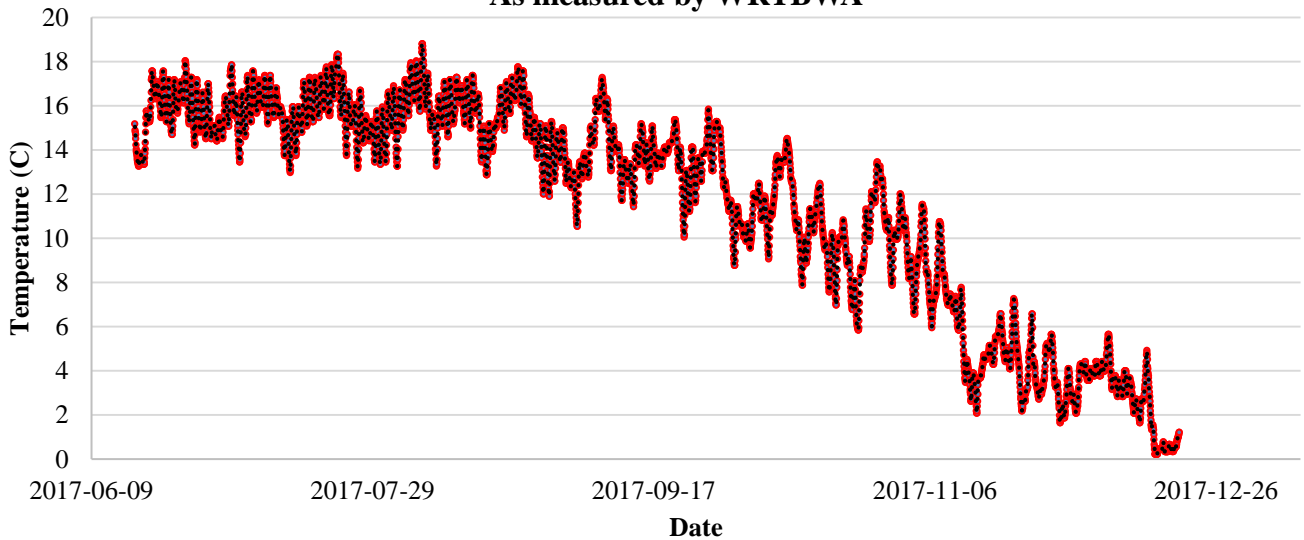


Seasonal Temperature Regime @ Officers Pond Outlet 2016 vs 2017 As measured by WRTBWA

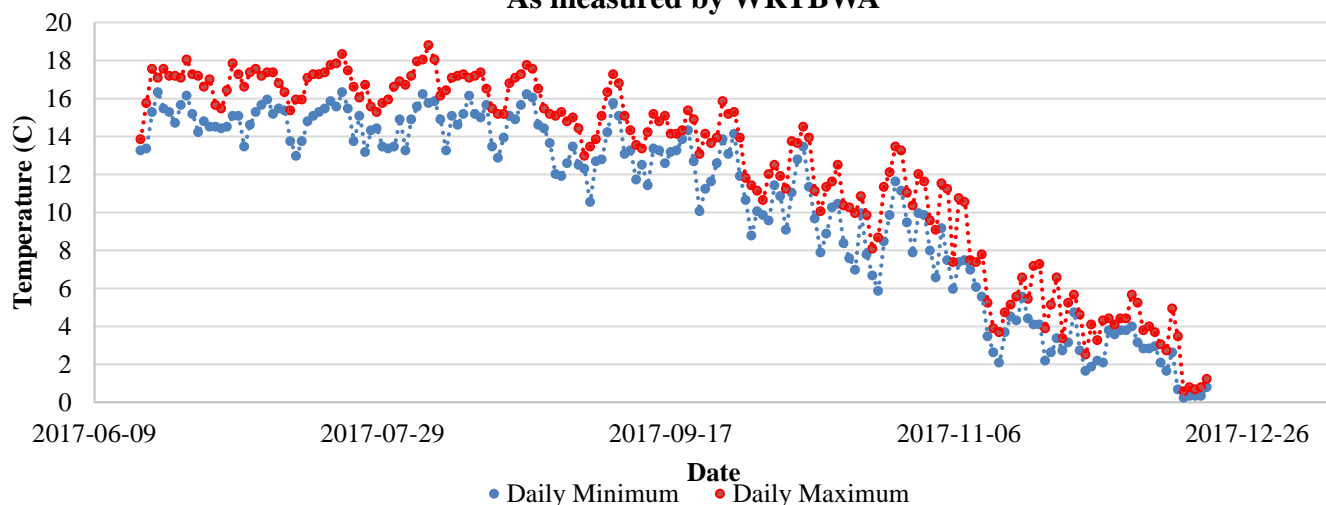


4.8.2.7 Tim's Outlet (Depth Logger)

Seasonal Temperature Regime @ Tim's Creek Outlet As measured by WRTBWA



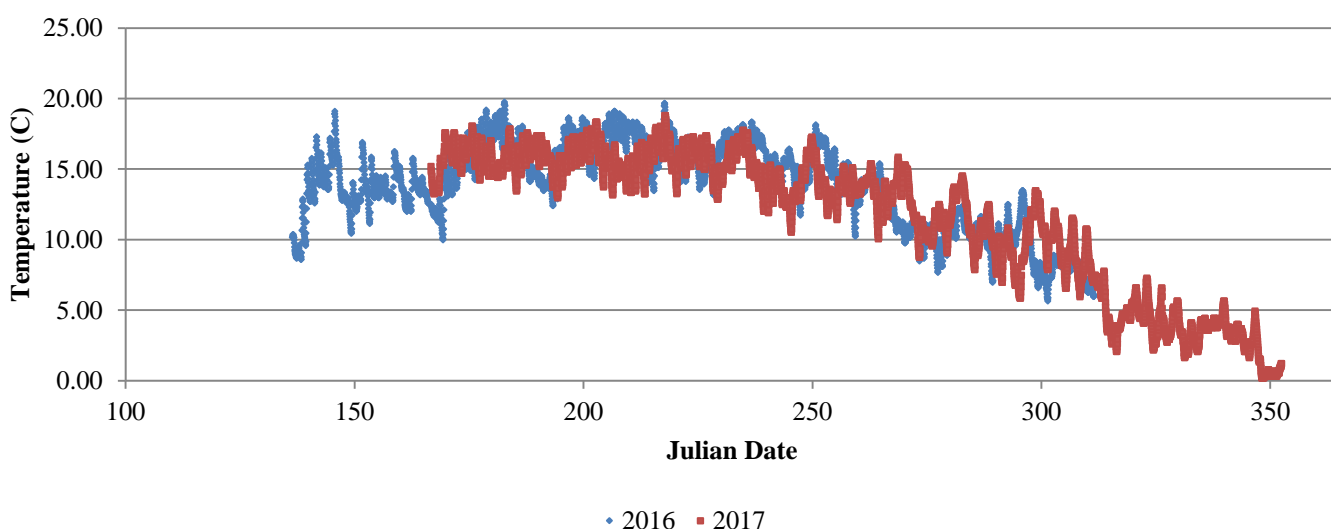
Daily Temperature Regime @ Tim's Creek Outlet As measured by WRTBWA



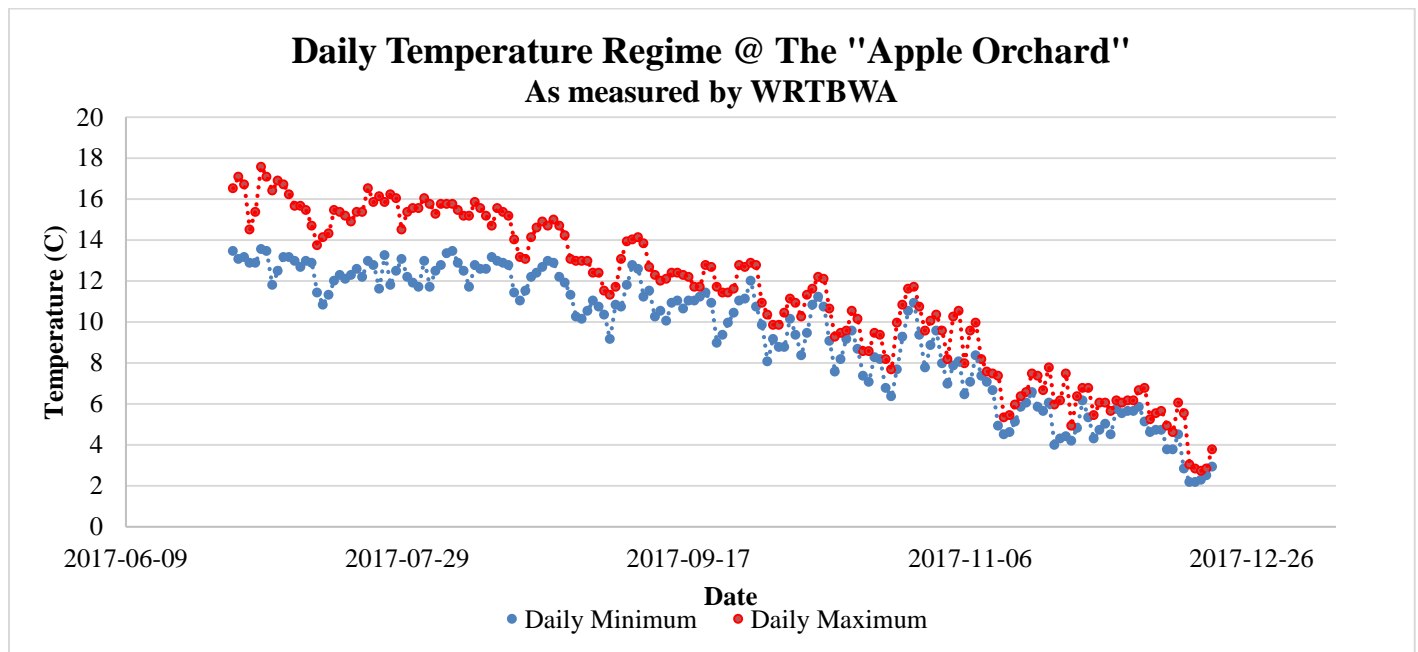
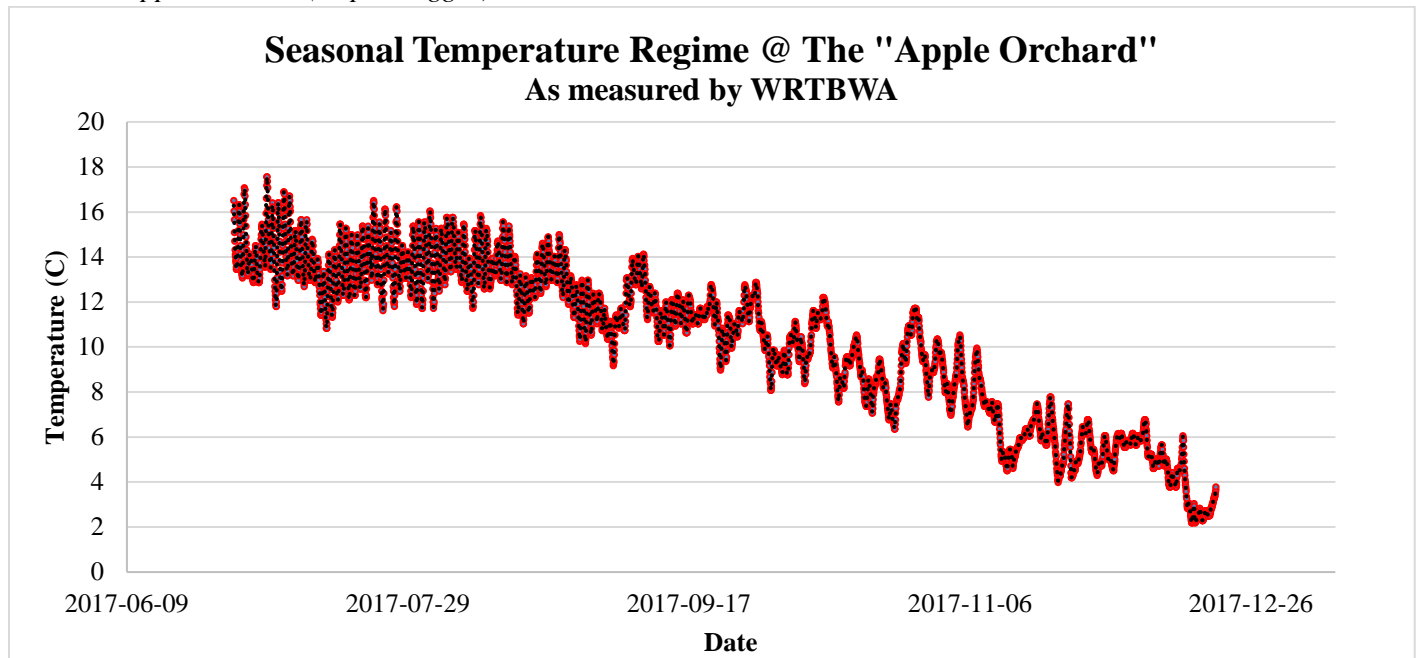
	Temperature (°C)	Date
Maximum	18.806	2017-08-06
Average	11.554	
Minimum	0.232	2017-12-15

	Percentage of hourly temperature measurements
Optimal Growth for Brook trout (11-18 °C)	62.996%
Tolerant Brook trout range (0-20 °C)	100%
Stress Zone (>20°C)	0%
Longest # of Hours in Stress Zone: 0	

Seasonal Temperature Regime @ Tim's Creek Outlet 2016 vs 2017 As measured by WRTBWA



4.8.2.8 Apple Orchard (Depth Logger)

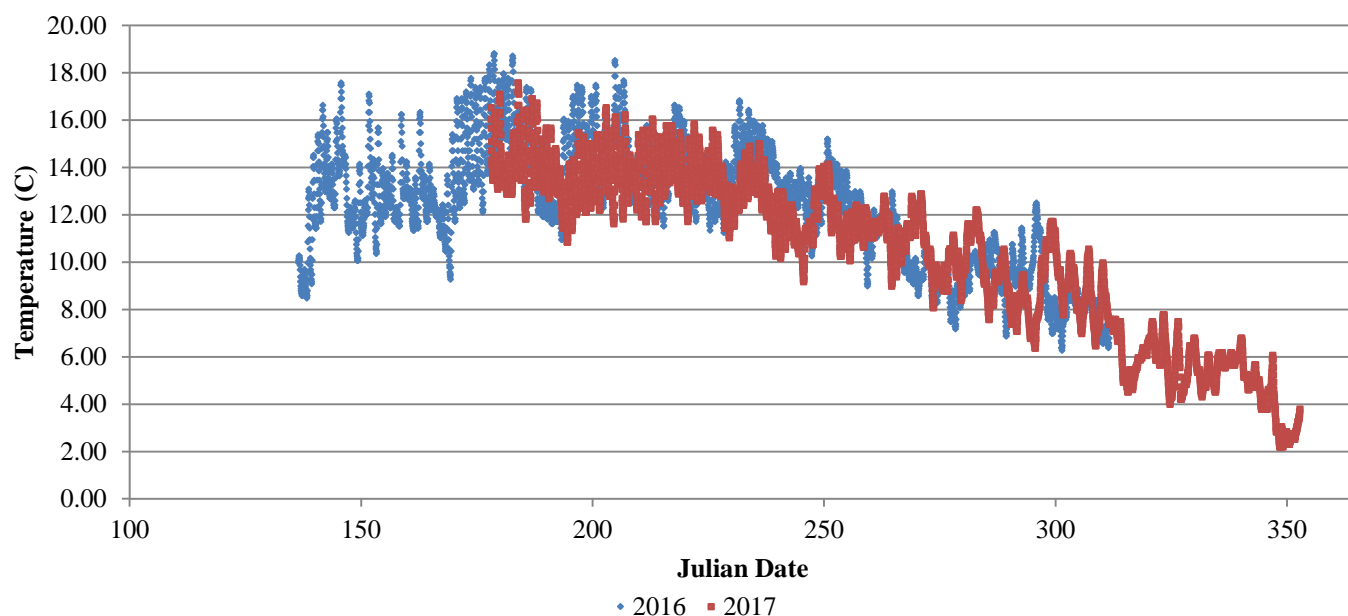


	Temperature (°C)	Date
Maximum	17.57	2017-07-03
Average	10.313	
Minimum	2.195	2017-12-15

	Percentage of hourly temperature measurements
Optimal Growth for Brook trout (11-18 °C)	51.347%
Tolerant Brook trout range (0-20 °C)	100%
Stress Zone (>20°C)	0%
Longest # of Hours in Stress Zone: 0	

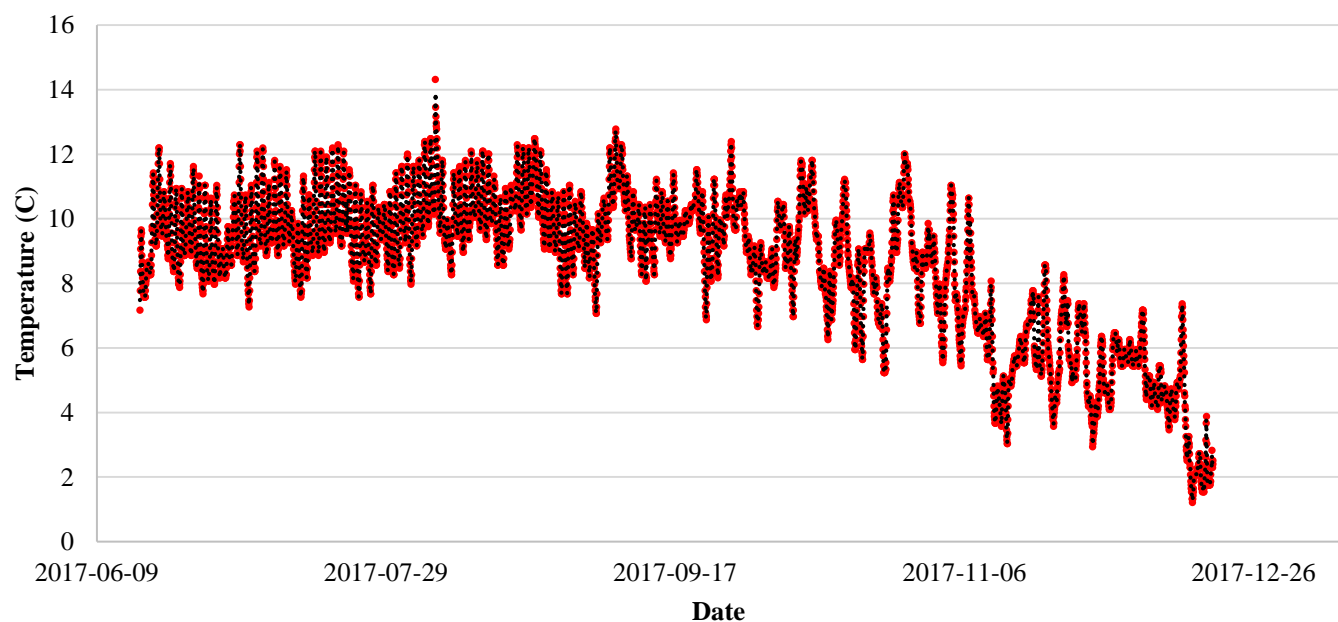


Seasonal Temperature Regime @ The "Apple Orchard" 2016 vs 2017 As measured by WRTBWA

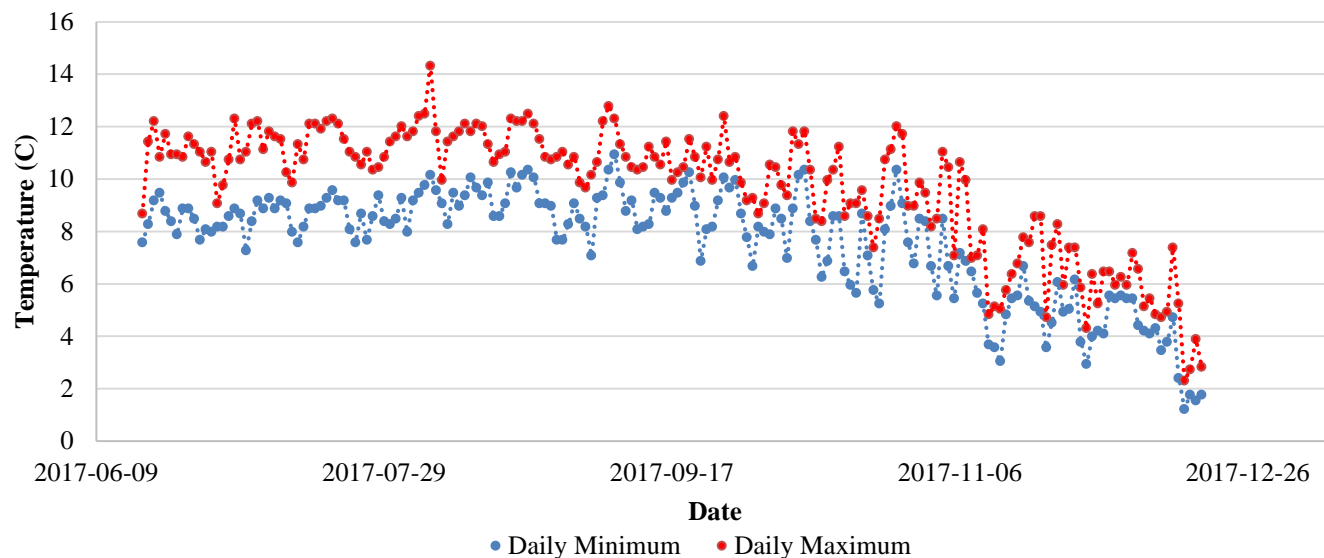


4.8.2.9 Friston (Depth Logger)

Seasonal Temperature Regime @ Friston Branch As measured by WRTBWA



Daily Temperature Regime @ Friston Branch As measured by WRTBWA

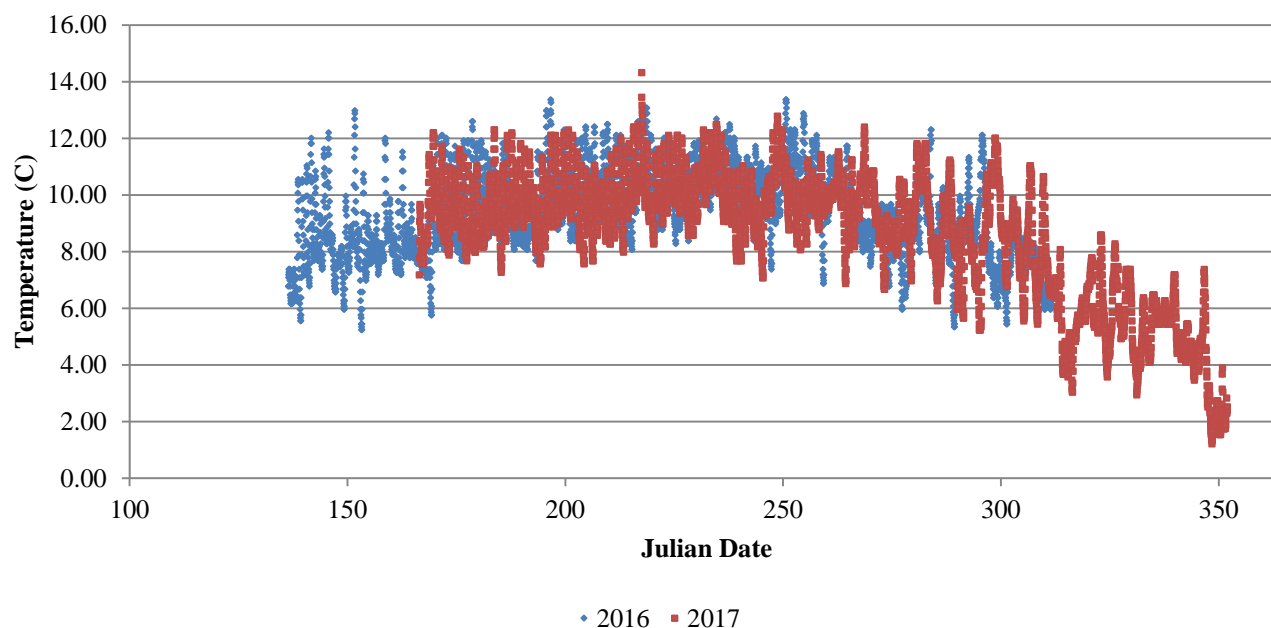


	Temperature (°C)	Date
Maximum	14.325	2017-08-06
Average	8.595	
Minimum	1.221	2017-12-15

	Percentage of hourly temperature measurements
Optimal Growth for Brook trout (11-18 °C)	10.463%
Tolerant Brook trout range (0-20 °C)	100%
Stress Zone (>20°C)	0%
Longest # of Hours in Stress Zone: 0	



Seasonal Temperature Regime @ Friston Branch 2016 vs 2017 As measured by WRTBWA



4.8.2.10 Beaton's Creek Temperature Logger Comparison June 21- October 24:

Beaton's Creek	Percentage of hourly temperature measurements	
	2017	2016
Optimal Growth for Brook trout (11-18 °C)	72.567%	44.884%
Tolerant Brook trout range (0-20 °C)	98.638%	77.243%
Stress Zone (>20°C)	1.362%	22.757%
Longest # of Hours in Stress Zone	7	91

4.8.2.11 Depth Logger Temperature Comparison 2016-2017 During overlapping Julian Dates

Hardy Mill Pond outlet	Percentage of hourly temperature measurements	
	2017	2016
Optimal Growth for Brook trout (11-18 °C)	69.980%	44.173%
Tolerant Brook trout range (0-20 °C)	98.035%	83.639%
Stress Zone (>20°C)	1.965%	16.361%
Longest # of Hours in Stress Zone	16	67

Union pumping station	Percentage of hourly temperature measurements	
	2017	2016
Optimal Growth for Brook trout (11-18 °C)	77.937%	64.926%
Tolerant Brook trout range (0-20 °C)	100%	99.658%
Stress Zone (>20°C)	0%	0.342%
Longest # of Hours in Stress Zone	0	3

Officer's Outlet	Percentage of hourly temperature measurements	
	2017	2016
Optimal Growth for Brook trout (11-18 °C)	27.564%	26.676%
Tolerant Brook trout range (0-20 °C)	55.071%	49.180%
Stress Zone (>20°C)	44.929%	50.820%
Longest # of Hours in Stress Zone	236	804

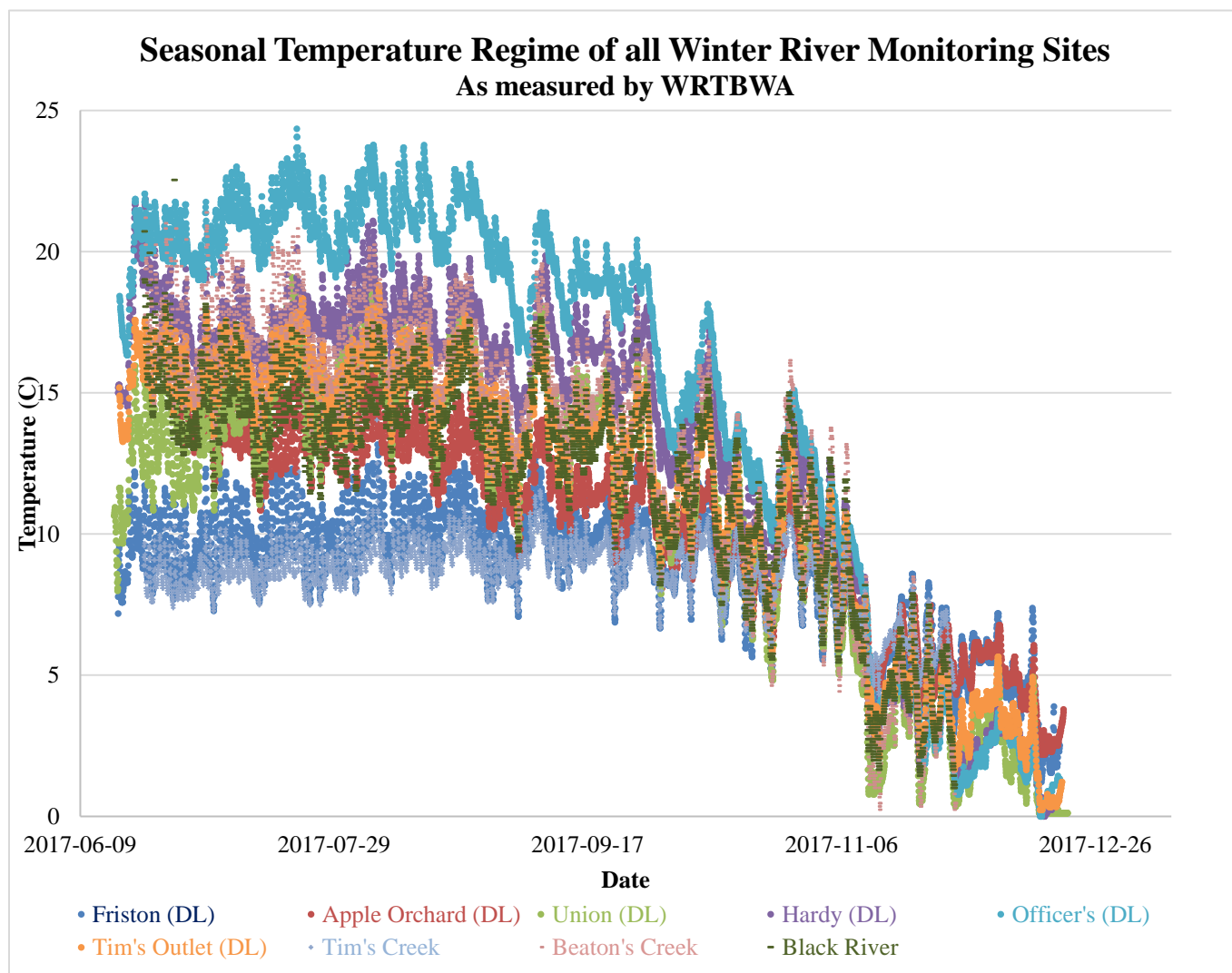


Tim's Outlet	Percentage of hourly temperature measurements	
	2017	2016
Optimal Growth for Brook trout (11-18 °C)	81.350%	70.003%
Tolerant Brook trout range (0-20 °C)	100%	100%
Stress Zone (>20°C)	0%	0%
Longest # of Hours in Stress Zone	0	0

Apple Orchard	Percentage of hourly temperature measurements	
	2017	2016
Optimal Growth for Brook trout (11-18 °C)	67.715%	65.253%
Tolerant Brook trout range (0-20 °C)	100%	100%
Stress Zone (>20°C)	0%	0%
Longest # of Hours in Stress Zone	0	0

Friston	Percentage of hourly temperature measurements	
	2017	2016
Optimal Growth for Brook trout (11-18 °C)	13.464%	17.887%
Tolerant Brook trout range (0-20 °C)	100%	100%
Stress Zone (>20°C)	0%	0%
Longest # of Hours in Stress Zone	0	0

4.8.2.12 All Sites



Location	Optimal Growth for Brook trout (11-18 °C)	Tolerant Brook trout range (0-20 °C)	Stress Zone (>20°C)	Longest # of Hours in Stress Zone
Tim's Creek	0.521%	100%	0%	0
Black River	69.945%	99.948%	0.052%	1
Beaton's Creek	60.913%	98.931%	1.069%	7
Hardy Mill Outlet DL	54.390%	98.428%	1.527%	16
Union Station (DL)	60.142%	100%	0%	0
Officer's Outlet (DL)	21.453%	65.033%	34.967%	236
Tim's Outlet (DL)	62.996%	100%	0%	0
Apple Orchard (DL)	51.347%	100%	0%	0
Friston (DL)	10.463%	100%	0%	0

*Analyses were done for the temperature preferences of brook trout, but other species of fish also use these waters. The table below describes temperature ranges for other species in these waters:

Species	Minimum Temperature (°C)	Optimal Temperature Range (°C)	Maximum Temperature (°C)
Striped Bass	10	12-18	24
Rainbow Trout		10-22	25+
Atlantic Salmon*	Spawning: 4 Adult (migrating): 8	Spawning: 5-8 Adult (migrating): 14-20	Spawning: 12 Adult (migrating): 23
Rainbow Smelt		6-13	20
Alewife	11		19
Blueback Herring	2 17 (spawning)		17 26 (spawning)
American Eel	4		25

*Atlantic salmon used to be found in these waters but are no longer present.

4.8.3 Discussion

Loggers at six of the locations (Hardy Mill Pond (2 loggers), Officer's Pond (2 loggers), Piper's Creek, and Deroche Pond) did not launch properly and did not record any data. The logger installed in the Winter River estuary near the cabin on the Winter River trail was unable to be found at the end of the season. The locations in which the loggers successfully gathered data (Tim's Creek, Black River, and Beaton's Creek) demonstrated that very minimal time throughout the season was spent outside the tolerant brook trout temperature range (>20°C). Tim's Creek and Black River were new sites as of 2017, so cannot be compared to previous years. However, Beaton's Creek demonstrated an overall decrease in average temperature compared to the same dates in 2016. This resulted in a significantly larger percentage of time spent in the optimal and tolerable temperature range for brook trout, and less time spent in the stress zone. This may be attributed due to the removal of a beaver dam upstream of the temperature logger early in the 2017 season, as well as a difference in air temperature.

4.9 V-Notch Weirs

4.9.1 Methods

This year, the v-notch weirs were installed in early June and monitored until mid-December. Measurements were taken using a ruler to measure the height of water trickling over the v-notch in centimeters. This measurement was then correlated to John te Raa's Excel file to determine the flow coming from the spring in litres per second.





Figure 82. A spring with flow at the Cudmore Branch.



Figure 83. A dry spring at Brackley.



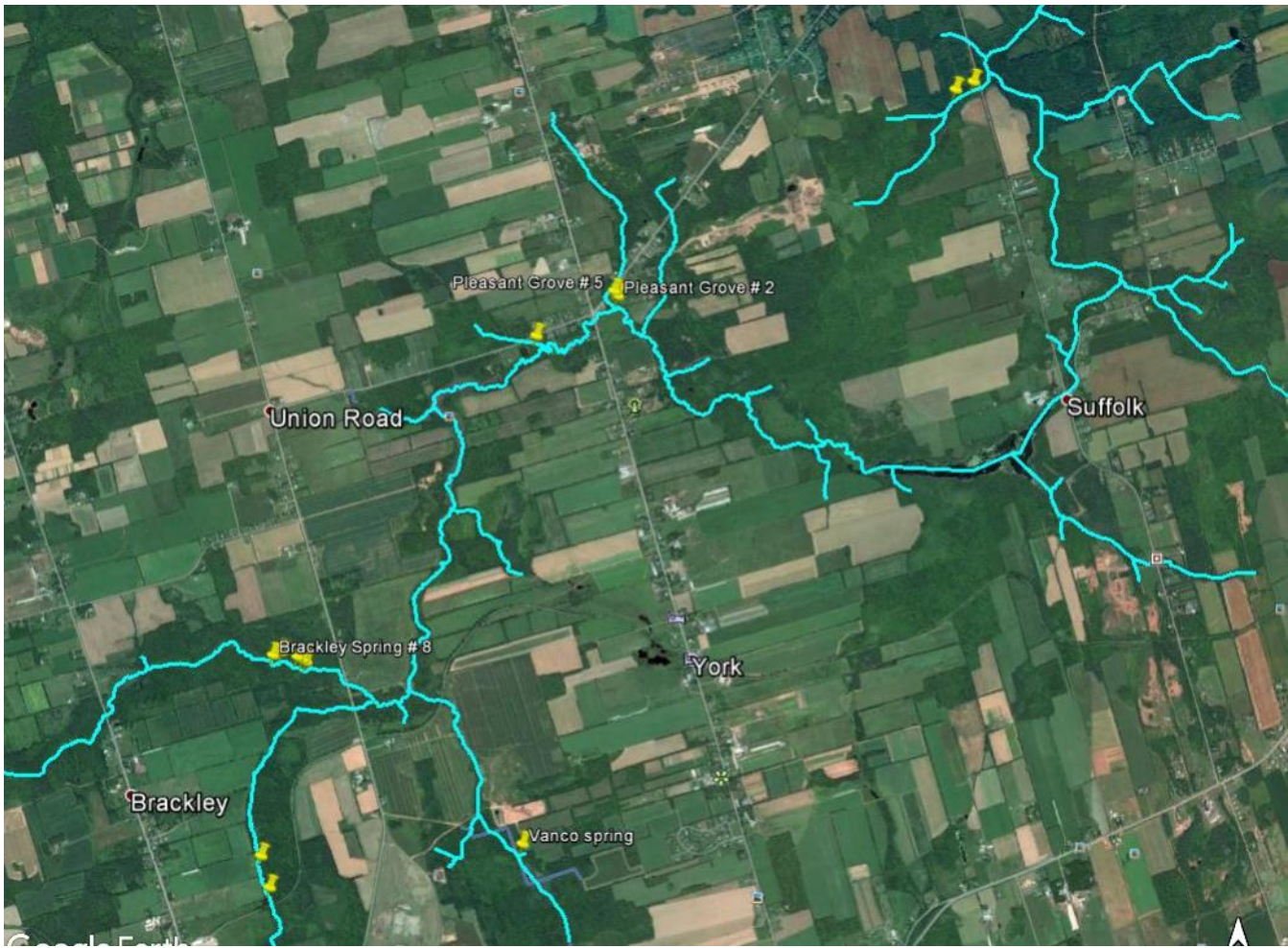


Figure 84. V-notch weir locations for the 2017 monitoring season.

4.9.2 Results

*Note: The following trend graphs have a degree of error with weather impacts from rain and snow, although best efforts were made to take measurements at least a few days after a precipitation or snow-melt event. Daily variation from morning to late afternoon must also be factored in because of evaporation from increased air temperatures in the summer months. This is a trend-line visualization of seasonal groundwater fluctuations from selected springs to show how the increase in water extraction affects the springs and stream base flow (as shown from the water-level loggers) of Winter River.



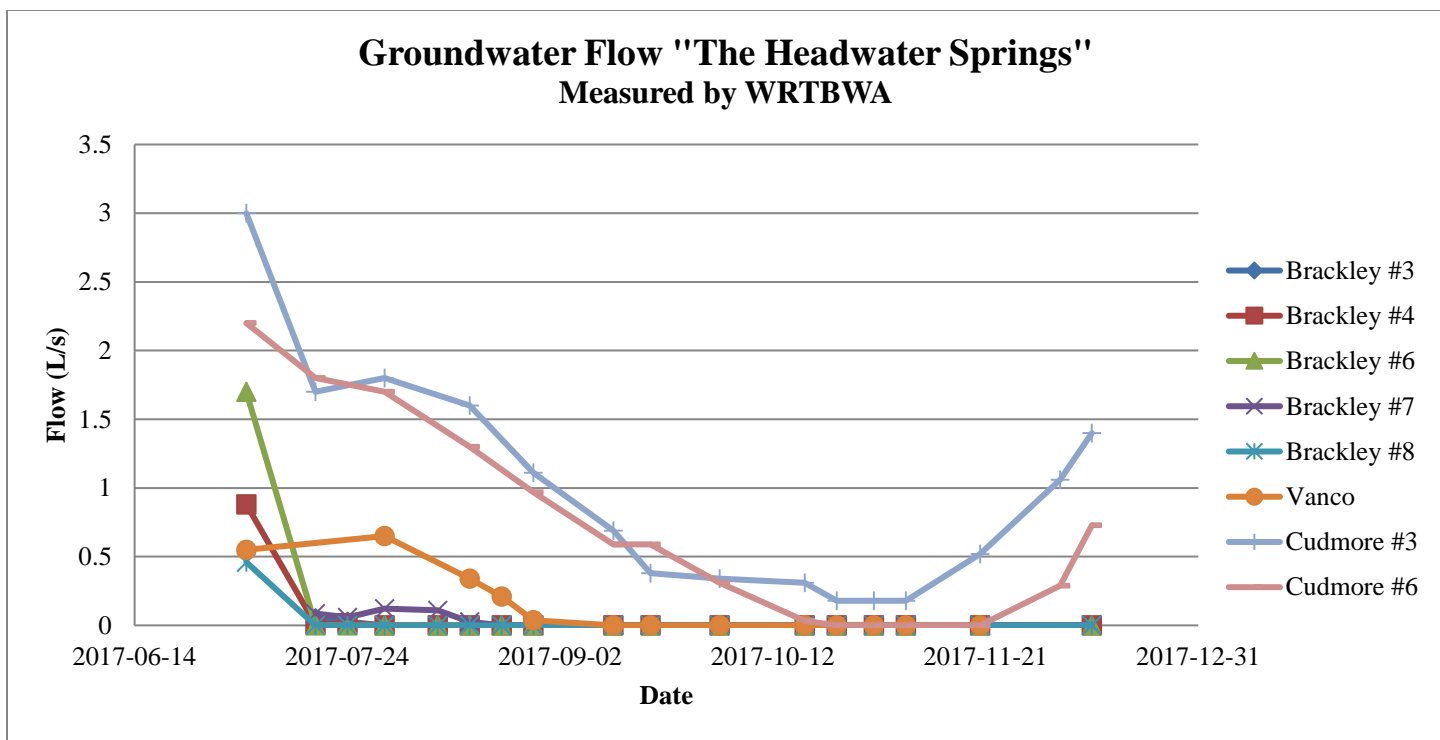


Figure 85. Flow measured from the headwater springs over the 2017 season.

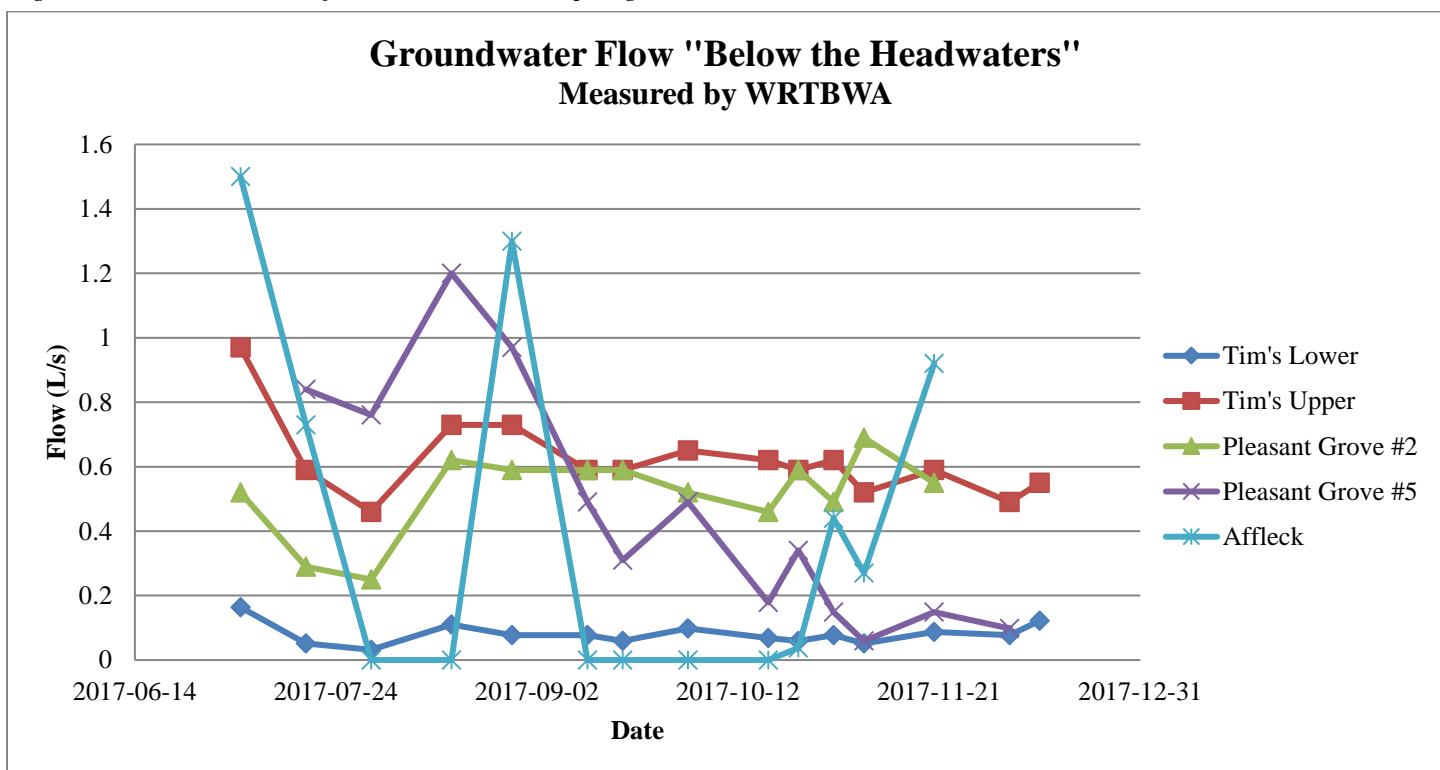


Figure 86. Flow measured from the springs below the headwaters over the 2017 season.



Table 20 Summary of groundwater levels observed in 2017 season.

Groundwater Spring Monitoring 2017																							
		July				August				Sept		Oct				Nov		Dec		Jan		Feb	
Spring Location	Wellfield Distance (m)	2017-07-05	2017-07-18	2017-07-24	2017-07-31	2017-08-10	2017-08-16	2017-08-22	2017-08-28	2017-09-12	2017-09-19	2017-10-02	2017-10-18	2017-10-24	2017-10-31	2017-11-06	2017-11-20	2017-12-05	2017-12-11	2018-01-12	2018-01-17	2018-02-01	
Brackley #3	698	X	W	W	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Brackley #4	736	W	W	W	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Brackley #6	764	W	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Brackley #7	871	X	W	W	W	W	W	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Brackley #8	932	W	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Vanco	1386	W	X	X	W	X	W	W	W	D	D	D	D	D	D	D	D	X	D	W	X	X	X
Cudmore #6	1572	W	W	X	W	X	W	X	W	W	W	W	W	W	W	W	D	D	W	W	X	X	X
Cudmore #3	1710	W	W	X	W	X	W	X	W	W	W	W	W	W	W	W	W	W	W	X	X	X	X
Affleck's Upper	2472	W	W	X	W	X	W	X	W	W	W	W	W	W	W	W	W	W	X	X	X	X	X
Tim's Creek Lower	2692	W	W	X	W	X	W	X	W	W	W	W	W	W	W	W	W	W	W	X	X	X	X
Tim's Creek Upper	2696	W	W	X	W	X	W	X	W	W	W	W	W	W	W	W	W	W	W	X	X	X	X
Pleasant Grove #2	2926	W	W	X	W	X	W	X	W	W	W	W	W	W	W	W	W	W	X	X	X	X	X
Pleasant Grove #5	2927	W	W	X	W	X	W	X	W	W	W	W	W	W	W	W	W	W	W	X	X	X	X
W	Water																						
D	Dry																						
X	Not monitored																						

Spring Location	# of days dry in 2017 season
Brackley #3	185+
Brackley #4	185+
Brackley #6	198+
Brackley #7	163+
Brackley #8	198+
Vanco	61
Cudmore #6	29
Cudmore #3	0
Affleck's Upper	0
Tim's Creek Lower	0
Tim's Creek Upper	0
Pleasant Grove #2	0
Pleasant Grove #5	0

4.9.3 Discussion

Weirs located at Pleasant Grove #5, Affleck, and Vanco had issues with leaks throughout the season due to highly erodible banks and stream beds, which accounts for their abnormal flow patterns. For this reason, it is recommended that a shovel, long gloves, and silt fencing material (and possibly rock/gravel) be brought along while checking weirs in case



they need repair. The Brackley springs followed the same pattern as previous years; going dry towards the end of July. The exception was Brackley #7, in which flow remained until the middle of August. Water was not found in the Brackley springs again until spring 2018. The Vanco weir was dry from early September until mid-December, and Cudmore #6 also went dry from mid-October to early December.

4.10 Groundwater Monitoring

4.10.1 Methods

Early in the season, various crew members were sent out to walk sections of the streams, marking out spring locations and testing the water chemistry with the YSI meter. The stream itself was also tested with the YSI approximately once every 200 m, to compare spring water to the regular channel. Nitrates were the parameter of most interest, but other data including temperature, dissolved oxygen, pH, and conductivity were also recorded.



Figure 87. A crew member checking the water chemistry of a spring using the YSI.

4.10.2 Results



Figure 88. Beaton's Creek groundwater and surface water monitoring locations 2017.





Figure 89. Afton groundwater monitoring locations 2017.

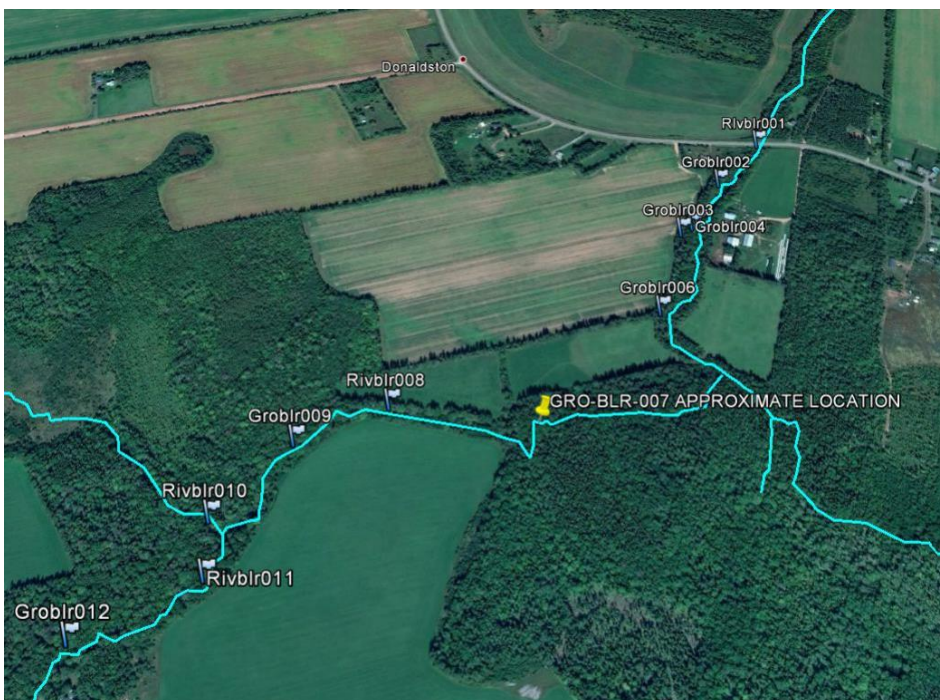


Figure 90. Black River groundwater and surface water monitoring locations 2017.



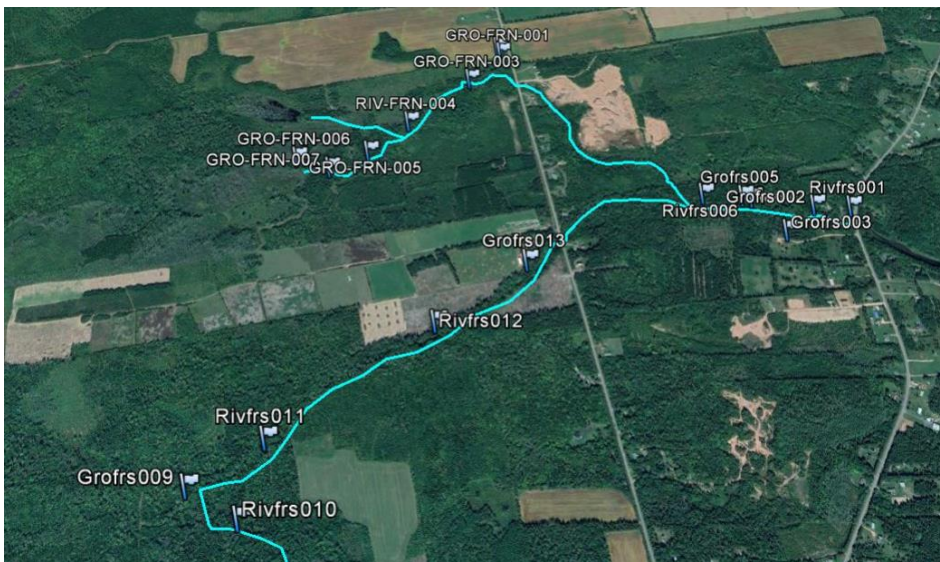


Figure 91. Friston groundwater and surface water monitoring locations 2017.



Figure 92. MacAulay's groundwater and surface water monitoring locations 2017.

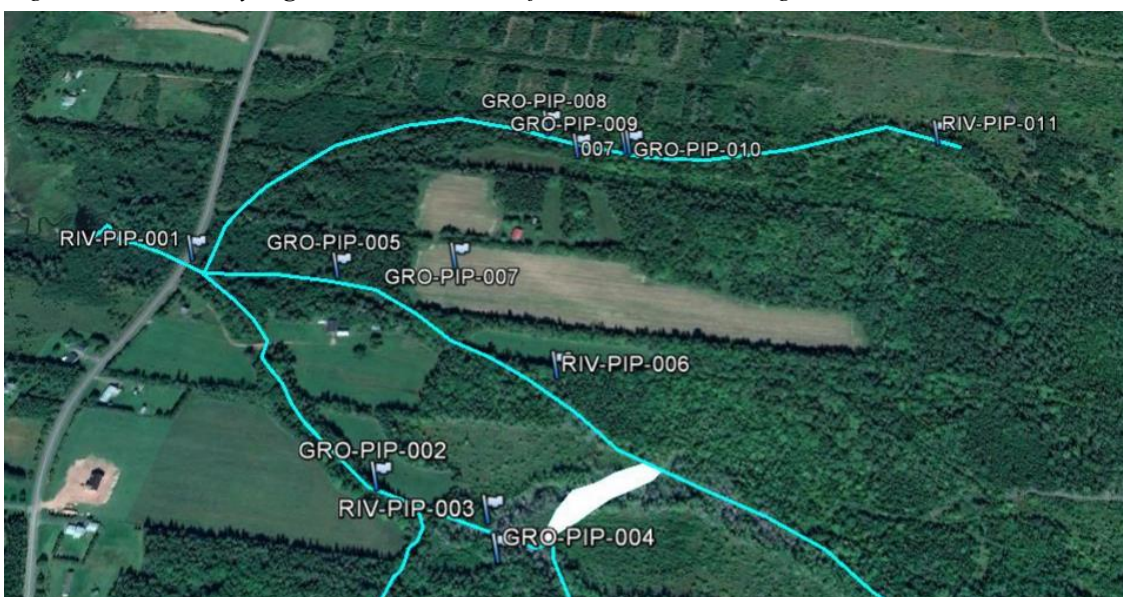


Figure 93. Piper's Creek groundwater and surface water monitoring locations 2017



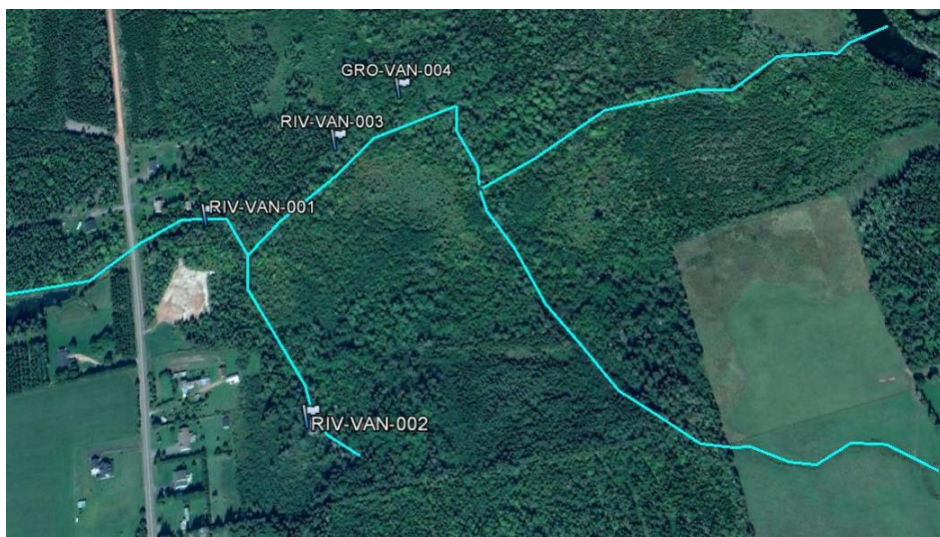


Figure 94. VanWesterneng groundwater and surface water monitoring locations 2017

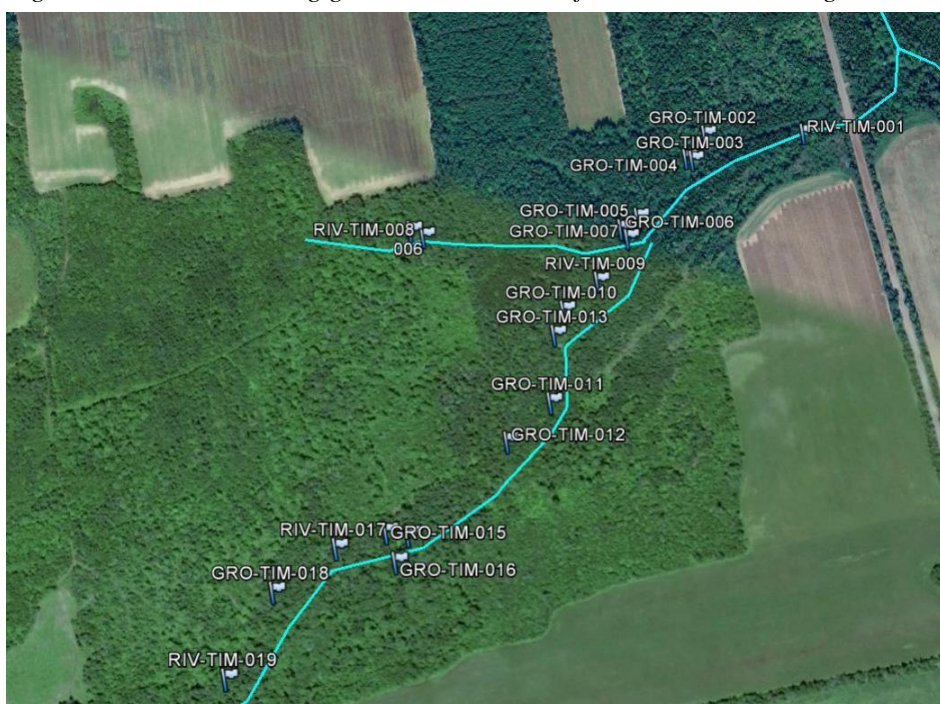


Figure 95. Tim's Creek groundwater and surface water monitoring locations 2017.



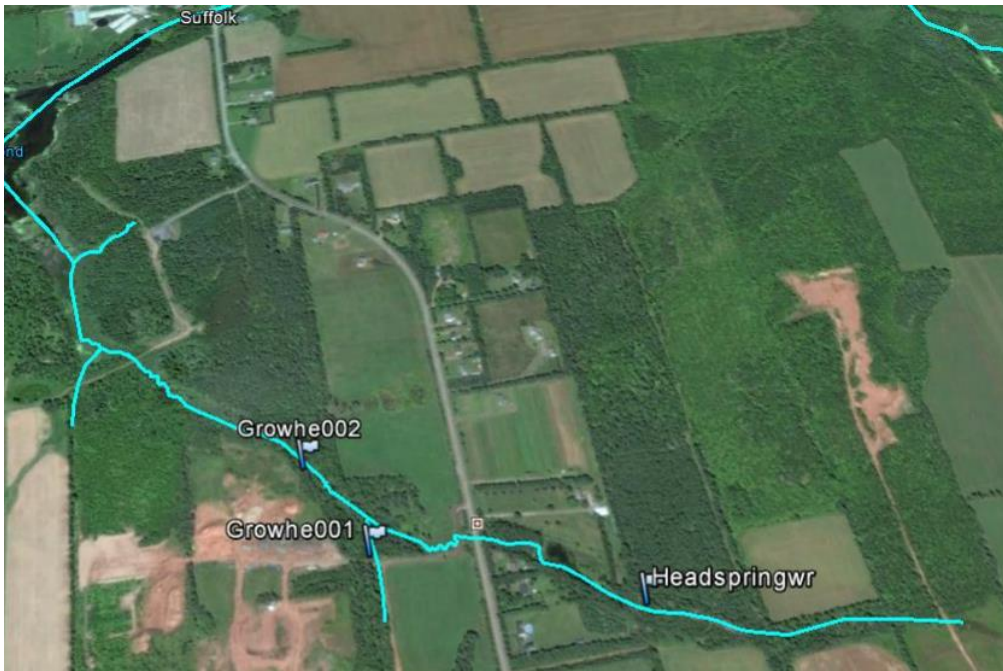


Figure 96: Wheatley groundwater monitoring locations 2017.

4.10.3 Discussion

Out of all the sites checked this year, Black River, MacAulay's Creek, Friston North, and Afton had the highest levels of nitrates present. For this reason, it is recommended these areas be checked again in the following year. Black River was checked in early July, and showed to have very high nitrates, but when checked again in the fall the nitrates were not nearly as high. It would be beneficial to check this location at the same times during the following year to determine if there is a pattern in the fluctuating nitrate levels. Friston North had higher nitrate levels at the first three springs which, as seen in the map above, are closer to an agricultural field. MacAulay's Creek had similar issues, with the 5th and 6th spring having higher nitrates while also being closer to an agricultural field. These areas may benefit from tree planting to reduce runoff from these fields. The first two springs of the Afton location showed to have higher nitrate levels, but the rest of the springs were dry and unable to obtain a reading. It is recommended that these springs be checked earlier than early July in the following year so that there may still be spring flow present.

4.11 Estuary Watch Survey

4.11.1 Methods

As soon as it was reported that the Winter River had gone anoxic, the crew began conducting an estuary watch survey once every two weeks to determine the severity of the anoxic conditions. The survey involved canoeing the estuary from the Corran Ban bridge near Tracadie Bay, to the end of tidal influence upstream. Every 200 m, conditions such as water clarity, water color, sea lettuce coverage, sea lettuce condition, and odor were scored according to the Estuary Watch Log sheet (Appendix 2). Water chemistry data was also recorded at each point using the YSI meter (nitrate probe must be removed due to salt water). The scores of each condition were then added up to determine the overall quality of the water at that section of the estuary.





Figure 97. Estuary watch scoring locations 2017.



Figure 98. The estuary with healthy oxygen levels.





Figure 99. Anoxic conditions in the Winter River estuary.

4.11.2 Results

Results require further study before presentation.

4.12 Headwater Surveys

4.12.1 Methods

Headwater surveys must be conducted between May 1-15 and September 1-15, without any significant rainfall or snowmelt events occurring in the previous 3 days. The headwater streams are assessed visually to document changes in surface water connectivity and water velocity throughout the length of the stream. Sections of the stream are classified into one of five categories: 0 – no surface water, 1 – surface water in pools only, 2 – surface water present but no visible flow, 3 – flow only interstitial, 4 – surface flow continuous. By obtaining this data year after year, it aids in understanding how water extraction as well as other natural conditions are affecting water levels and flow.

4.12.2 Results

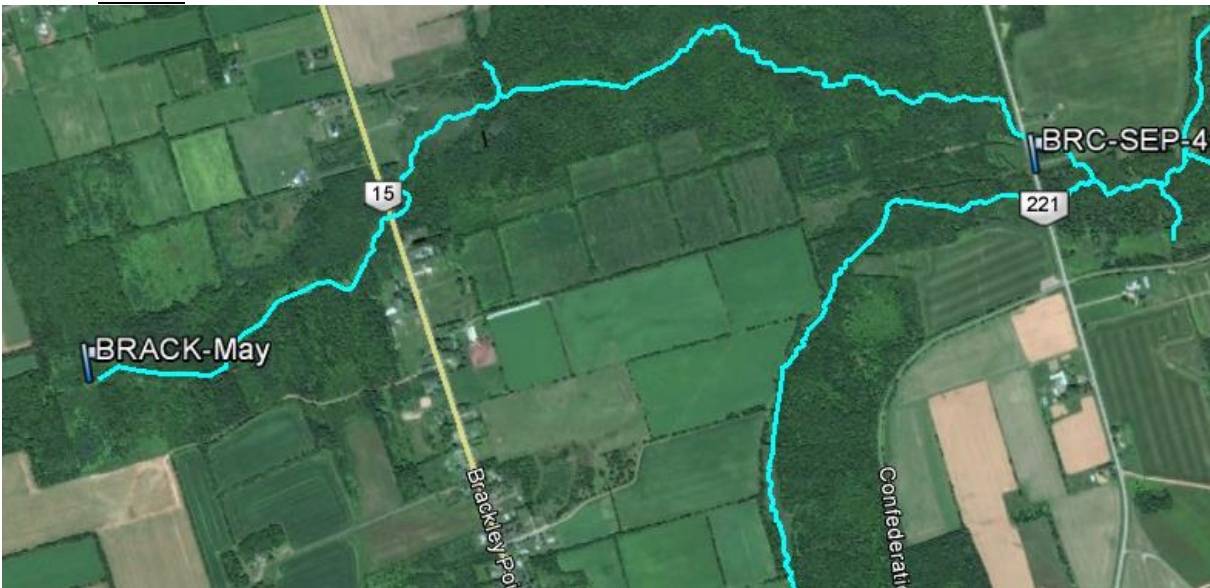


Figure 100. Brackley headwater survey 2017, 3.27 km became dry.



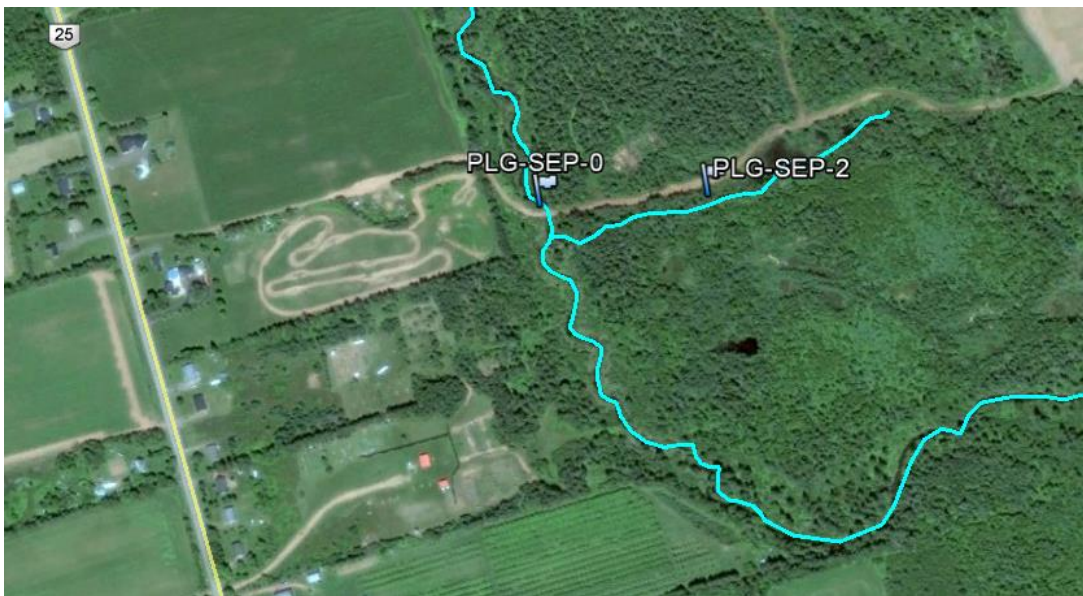


Figure 101. Laken Lewis Branch (by BMX park) headwater survey September 2017, 0.18 km became dry.

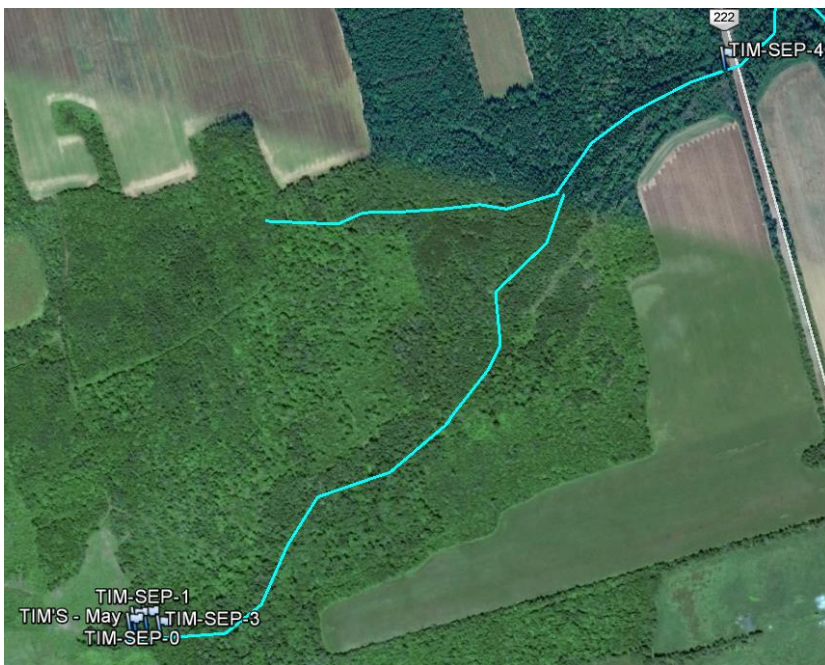


Figure 102. Tim's Creek headwater survey 2017, 0 km dry.

4.12.3 Discussion

It appears the streams which are located closer to high capacity wells have a longer portion of stream becoming dry. For example, Brackley has 9 high capacity wells located within 1 km of the stream and had 3.27 km go dry, whereas Tim's Creek only has 5 high capacity wells within 3 km and was not found to go dry. The Pleasant Grove branch was found to have 0.18 km go dry and has 10 high capacity wells within 3 km (none of which were within 1 km).

4.13 Culvert Assessments

4.13.1 Methods

Various culverts were assessed throughout the Winter River – Tracadie Bay watershed, beginning in August and continuing into the fall. Each culvert was assigned an ID, and the stream name, road name, and GPS coordinates were noted. The culvert was then checked for its type, baffles, armor, bottom material, fill line, rust line, diameter, obstructions, undercutting, overtopped, hanging, and crushed percentage. Road information was also noted, along with bridge



information if applicable. Various stream measurements were then taken upstream, downstream, and at the culvert itself, as well as photos of each of these areas.



Figure 103. Locations of culverts assessed in 2017 east of Tracadie Bay.

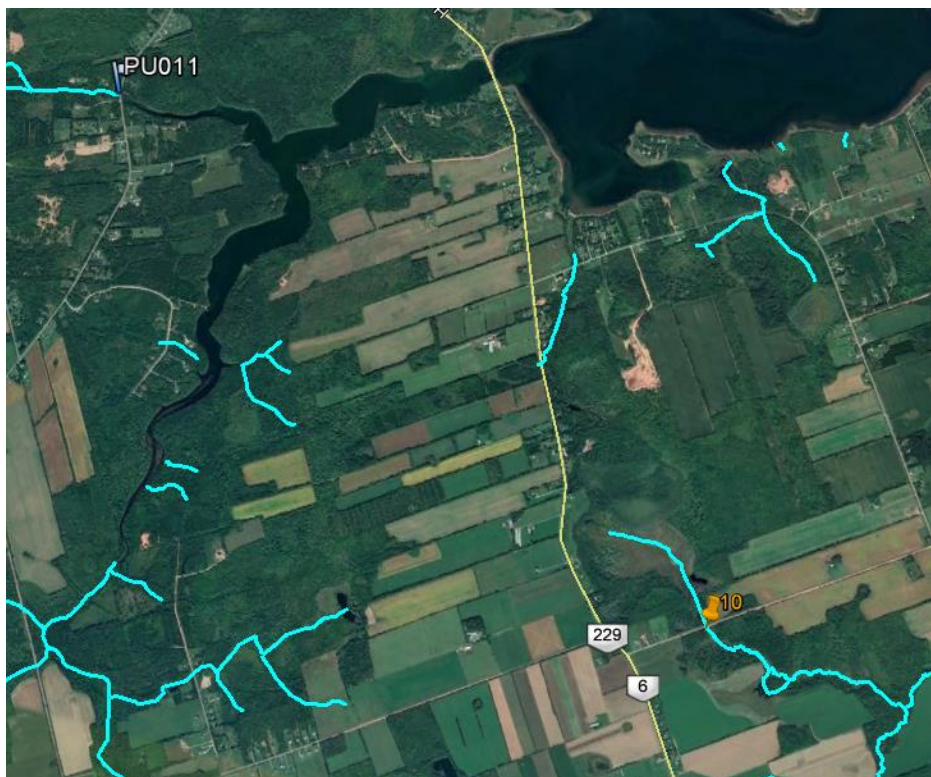


Figure 104. Location of culverts assessed in 2017 south of Tracadie Bay.



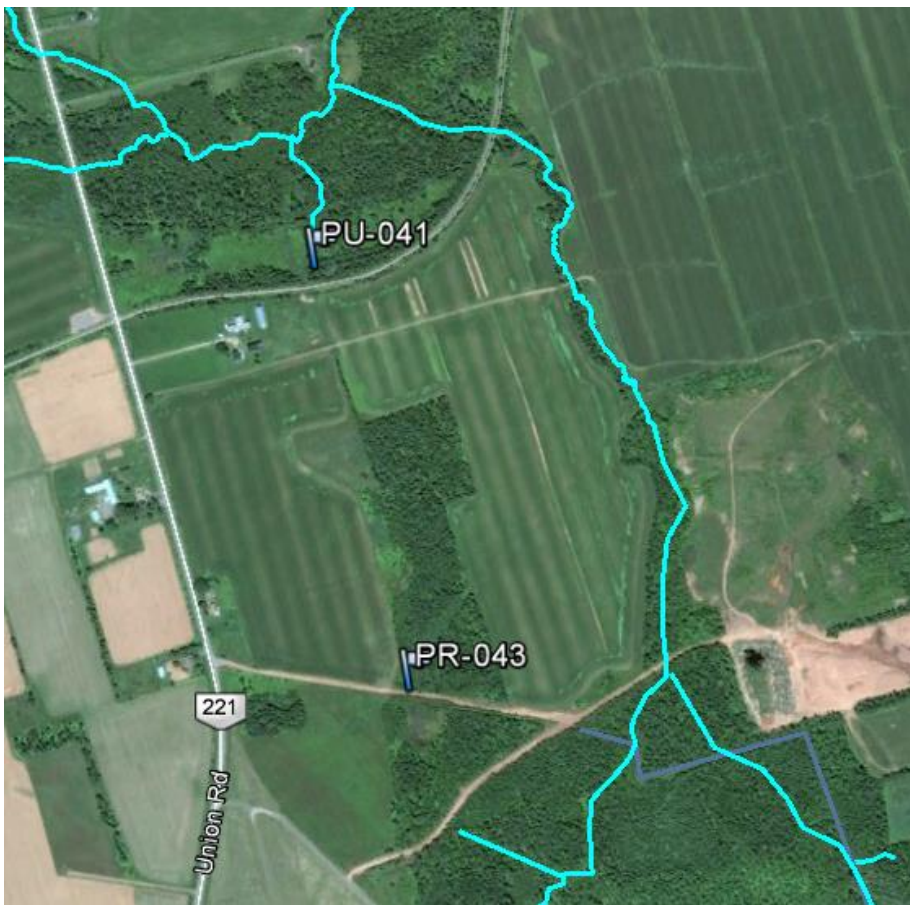


Figure 105. Location of culverts assessed in 2017 near the Vanco drainage ditch.

4.13.2 Results

ID	Stream Reach above (km)	Stream Name	Road Name	Culvert Type	Obstruct	Under cut	Crush	Over topped	Hanging distance (cm)	Rust Line (%)
PU-050	20.48	Deroche Pond (12)	MacDonald	Bridge	no	no	no	no	no	n/a
PU-051	0.11	Deroche Feeder South (13)	Point Deroche Rd	CMP	no	yes	no	no	18 cm	20
PU-052-A	6.62	Trout River (14)	Afton	CMP	no	no	no	no	no	40
PU-052-B		Trout River (14)	Afton	CMP	yes	no	no	no	no	N/A
PU-053	0.96	Trout River (15)	Afton	CPP	no	no	no	no	no	N/A
PU-055	2.79	Trout River (17)	Old Bedford Rd	Bridge	yes	no	no	no	no	n/a
PU-057A	1.48	Trout River (19)	Afton	CMP	no	no	no	no	no	40
PU-057B		Trout River (19)	Afton	CMP	no	no	20%	no	no	70%
PU-059	0.15	Trout River (21)	Afton	CPP	yes	no	no	no	no	30



PU-060	1.02	Lawton Branch (22)	Point Deroche Rd	CMP	yes	no	10%	no	10	60
PU-061	0.38	Lawton Branch (24)	Anderson	CPP	no	no	no	no	13	30
PU-062	0.49	Lawton Branch (23)	Anderson	CPP	yes	no	50%	no	no	80
PU-066A	0.82	Black River (10)	Dougan	CMP	no	no	5-10%	no	no	60
PU-066B		Black River (10)	Dougan	CMP	yes	no	20%	no	no	100
PU-011	5.26	Friston Main	Pleasant Grove Rd	CMP	no	yes	no	no	12	35
PU-041	0.6? Ditch	Vanco ditch	Confederati on Trail	CPP	no	no	no	no	no	70
PR-054	0.25	Trout River	Driveway off Afton	CPP	no	no	no	no	9	n/a
PR-056	2.32	Trout River (18)	Driveway off Afton	Bridge	no	no	no	no	no	n/a
PR-058	0.6	Trout River (20)	Dirt rd off Afton	CPP	no	no	no	no	no	40
PR-063	0.25	Trout River (25)	Farm rd off Anderson	CMP	no	no	100%	no	no	n/a
PR-064	0.53	Trout River (26)	Farm rd off Anderson	CPP	no	no	no	no	no	n/a
PR-065	1.68	Trout River (27)	Afton side road	Concrete	no	no	no	no	no	20
PR-043	0	Vanco ditch	Vanco pit road	CMP	no	yes	20	no	0.14	70

Legend: CMP – Corrugated metal pipe, CPP – Corrugated plastic pipe

4.13.3 Discussion

In 2017, 20 culvert sites were assessed, compared to approximately 70 in 2015 and 8 in 2016. Culvert PU-011 was a reassessment of a culvert checked in 2015. It was determined that the hanging distance had increased from 10 cm to 12 cm, as well as the development of some undercutting where the boards along the bottom of the culvert are beginning to rot. Repairs are recommended to allow for better fish passage, possibly by adding baffles to the inside of the culvert. Repairs are also recommended for culverts labeled PU-066, PU-059, and PU-062. Culvert site PU-066 has two culverts side by side which both have a rust line over 50% and are becoming crushed. This site would benefit from a larger culvert which could better handle the volume of water running through it. Culvert site PU-059 is almost entirely obstructed on the upstream side, and there is evidence of beaver activity. This could be an easy fix by removing the beaver and clearing the blockage. The culvert at site PU-062 is now mostly exposed, and this should either be fixed or the culvert removed entirely. The road appears to be abandoned, and there is evidence of beaver activity nearby.

4.14 Recommendations

It is recommended that the water-level loggers be installed in the exact same locations in 2018 as they were in 2017, as this will increase the reliability of the data. However, at Tim's Creek the flow is unable to be measured across half of the width of the stream as it becomes too shallow and obstructed later in the season, resulting in an inaccurate representation of the stream's discharge. It may be beneficial to measure the flow and cross section at a location close to the logger which has measurable flow across the whole width of the stream. Rebar should be installed at this location as well to keep measurements consistent.



When installing temperature loggers in the upcoming season, it may be beneficial to do a trial run to ensure all loggers are recording properly. In 2017, many of the loggers which were deployed were not actively taking temperature readings. A trial run might determine which loggers are functioning properly prior to deploying them for the entire season.

Certain weirs had recurring issues this season which resulted in inaccurate discharge calculations. While checking V-notch weirs, it is important to make note of issues such as leaks or damage to the weir, so that the necessary tools to repair it can be brought the next time it is checked.

Groundwater monitoring should be repeated at Black River, MacAulay's Creek, Friston North, and Afton in the following season, as these locations were found to have the highest levels of nitrates in 2017. It would be helpful to factor in any change in crops from surrounding agricultural fields to determine if they affected nitrate levels in the groundwater.

It would be beneficial to continue performing estuary watch surveys in 2018, to determine any trend in the anoxic events of the Winter River estuary. Determining which areas have the highest abundance of sea lettuce could help determine where nutrient runoff is occurring, and preventative actions could be recommended.

If the weather permits, more headwater surveys should be performed in 2018. They help give a better understanding of which sections of the watershed are being affected the worst, and where to prioritize work for the following season.

Repair is recommended for culverts at sites labeled PU-066, PU-059, and PU-062. PU-066 should be replaced by a larger culvert that can hold more water to allow a better flow to pass through. PU-059 needs a blockage cleared, and possibly a beaver removed. PU-062 is an old culvert that has been beaten out of shape, and should be removed entirely as it appears the road is no longer used.

4.15 Soil testing

Sampling locations and results from our soil testing projects will not be made public, except in summary form, to respect the privacy of the farmers who agreed to participate. This year the sample sizes were too low for summaries to be meaningful.

4.15.1 Soil Health

We tested a new technique of soil sampling – Comprehensive Assessment of Soil Health at Cornell University, with help from Kyra Stiles at the Department of Agriculture. We also had a staff member who had experience in this method from previous work experience with Department of Agriculture and through her research for her M.Sc. in Agriculture. We tested four fields for soil health, to learn the techniques before completing more testing in 2018. Information on methods available online: <https://soilhealth.cals.cornell.edu/>

4.15.2 Soil Chemistry

We also collected 11 samples for regular soil chemistry testing at the PEI Analytical lab, for the same landowners who participated in the soil health pilot.

5 Water Use Makeover Program

During the 2017 work year, Vanessa and Sarah continued work on the Water Use Makeover Program. This program was created to reduce water extraction from wellfields in the watershed. Since all the City of Charlottetown's water is extracted from our watershed, the streams have been in poor health, some even drying up in the summer. This program was available to residents and business owners that had water meters installed. It provided low flow toilets, low flow showerheads, rain barrels, faucet aerators, etc. at subsidized rates.

Vanessa and Sarah advertised this program with Facebook ads, word-of-mouth, posters, brochures, Kijiji ads, and by participating in public events. Potential participants first complete an online survey to see if they qualified for our program. Those who met the program criteria were contacted to schedule a visit of their residence or business, during



which we measured the water usage of various items (litres of water per flush of the toilet, litres per minute of shower use, etc.). Their most recent water bill was reviewed and copied or photographed for filing.

Items that were not water efficient were recommended for replacement. Replacement items were available on this visit, so participants would have all the material they needed to start saving water by the time the visit was complete. Water saving tips and instructional documents such as how to install a new toilet or how to plant native shrubs were provided in pamphlets. Anyone who was interested in native flowering shrubs was instructed to email Sarah with their requests by spring.

Product	Cost
Low flow toilets	\$50
Rain barrels	\$25
Shower timers	\$5
Low flow showerheads	\$5
Water jugs	\$5
Faucet aerators	\$1
Native shrubs	\$2

Table 21: Products available from the water makeover program and the suggested fee for each item.

Item	#		Item	#
Toilets	54		Water jugs	6
Shower heads (4L/min)	12		shrubs	57
Shower heads (7L/min)	7		Rain barrels	43
Shower timers	14		lawn signs	11
Faucet aerator	39			

Table 22. Items distributed by 2018-03-31

Participants were asked to contribute financially toward the cost of the items they received. A suggested amount was established for each item, but all participants were advised that this amount was very flexible. Anyone who seemed hesitant to purchase the items because of financial limitations was asked to suggest a different amount that they would be able to pay, such as 50% of the suggested amount. Some participants felt the prices were very low, and contributed extra money to help us expand the project.

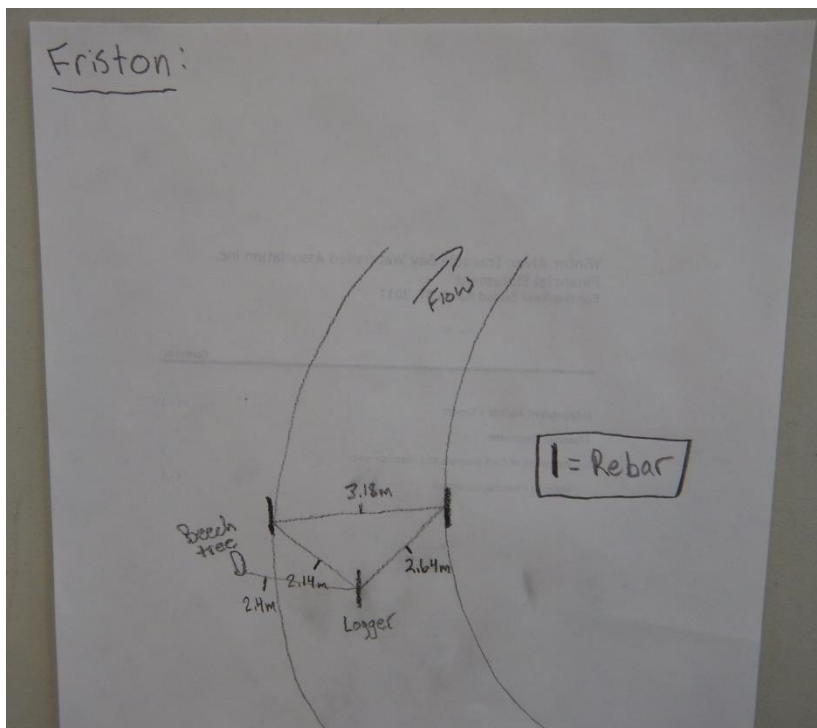
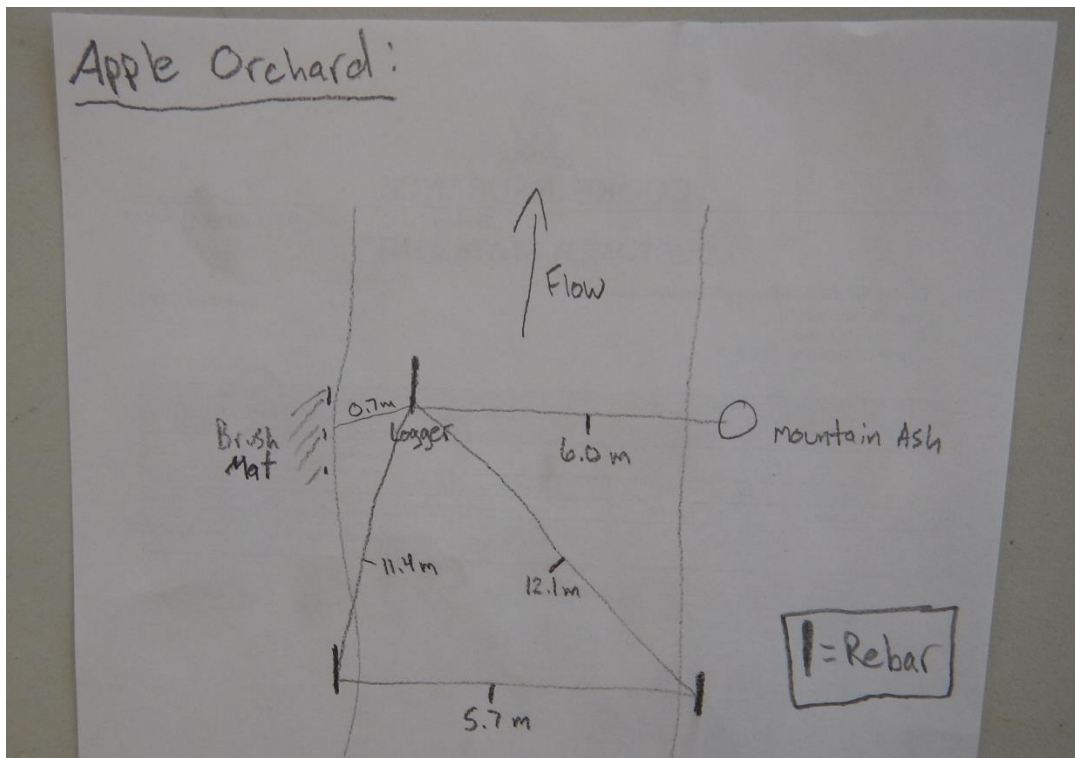
Data on all water-using devices was saved to a spreadsheet for trend analysis. Approximately one year after each makeover, each participant will be contacted again to provide another water bill and answer another short survey about water use within the residence. Before-and-after water bills were used to calculate how much water was saved because of the makeover.



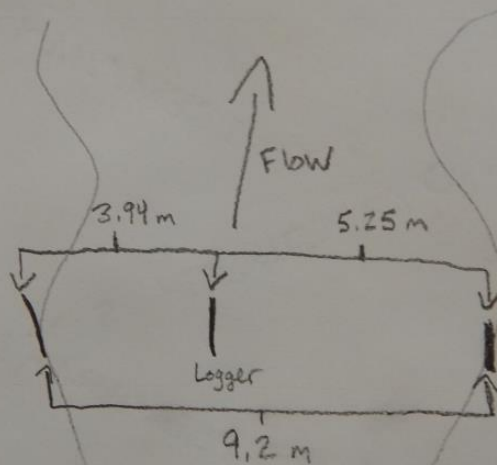
6 Appendices

6.1 Depth Logger Location Information

In case of the loss of a depth logger's rebar over the winter, measurements were taken to enable future staff to replace this rebar in the same location. Some rough sketches are shown below:

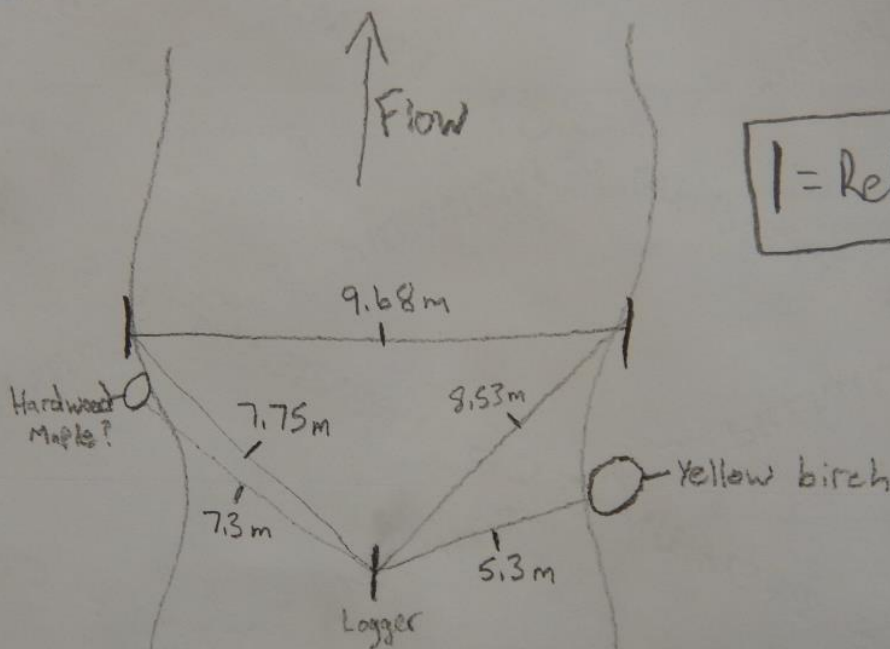


Officer's:



| = Rebar

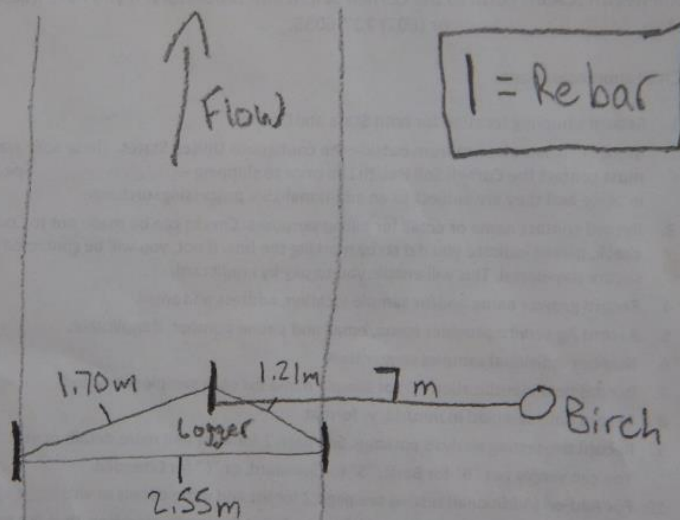
Tim's:



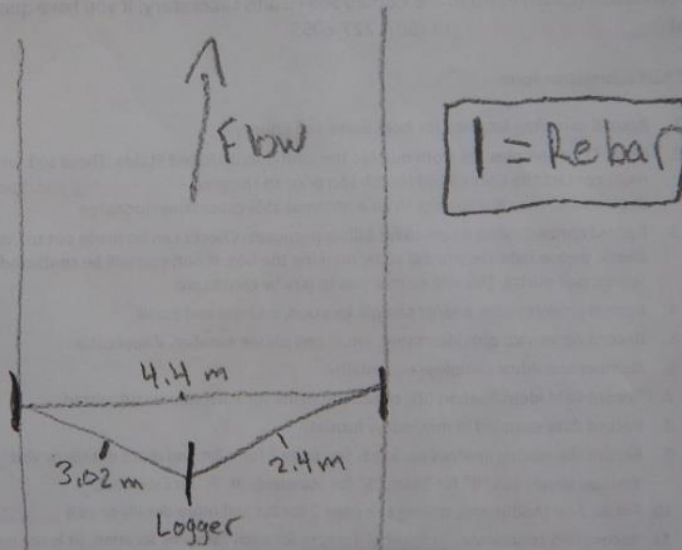
| = Rebar



Hardy:



Union:



6.2 Estuary Watch Log sheet

Logsheet

PEI Estuary Watch Program - Data Sheet

Mo./Yr.		Location		Volunteer				
Day of Week	Day of Month <small>e.g. July 14, 2013 = 14</small>	Time <small>e.g. 11:30 am</small>	Weather <small>general condition last 24 hours e.g. cloudy, rainy, clear</small>	Tide <small>L (Low), M (Mid), H (High)</small>	Appearance of Water <small>(Y/N in first box then check all that apply)</small>	Sea Lettuce Amount and Appearance <small>(check all that apply)</small>	Odor <small>(H2S only)</small>	Fish & Shellfish Condition
					<input type="checkbox"/> Clear (y/n) <input type="checkbox"/> Red <input type="checkbox"/> Green <input type="checkbox"/> Cloudy Green <input type="checkbox"/> Milky White <input type="checkbox"/> Other	<input type="checkbox"/> None <input type="checkbox"/> Small amount <input type="checkbox"/> Large mats <input type="checkbox"/> On bottom <input type="checkbox"/> Floating <input type="checkbox"/> Healthy <input type="checkbox"/> Some die off <input type="checkbox"/> Mostly dead	<input type="checkbox"/> No odor <input type="checkbox"/> Mild odor <input type="checkbox"/> Strong odor	<input type="checkbox"/> None dead or distressed <input type="checkbox"/> Few dead or distressed <input type="checkbox"/> Some Dead or Distressed <input type="checkbox"/> Many dead or distressed <input type="checkbox"/> Not known/not observed
Sun.								
Mon.								
Tue.								
Wed.								
Thur.								
Fri.								
Sat.								
Sun.								
Mon.								
Tue.								
Wed.								
Thur.								
Fri.								
Sat.								

Notes (include any unusual conditions observed including weather and the extent and duration of anoxic events. Please call 368-5044 or email cscrane@gov.pe.ca to report anoxic events)



6.3 Culvert Assessment Form



WINTER RIVER - TRACADIE BAY
WATERSHED ASSOCIATION

CULVERT ASSESSMENT

Assessment completed by: _____ and _____

Date completed: _____ Time completed: _____

SITE INFORMATION

Culvert ID		Ownership	<input type="radio"/> Public Road ROW <input type="radio"/> Private
Stream Name		GPS Coordinates (include units)	
Road Name			

STREAM CROSSING INFORMATION

ADDITIONAL NOTES:

Type	BOX	BRIDGE	CMP	CPP	PIPE	FORD	Other:
Baffles	Yes	No		Fill Line		%	
Armour	Yes	No		Rust Line		%	
Bottom Material	Natural	Unnatural		Diameter		m	

DAMAGED CULVERT INFORMATION

Obstructions?	Yes	No	Overtopped?	Yes	No
Undercut?	Yes	No	Hanging?	Yes	No
Crushed	%		Hanging Distance	m	

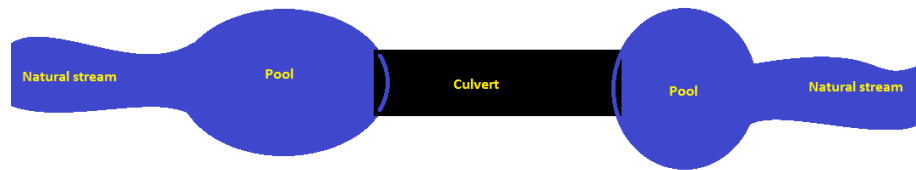
BRIDGE INFORMATION

Span Length	m	Height	m
Span Width	m	Surface	Good Fair Poor

ROAD INFORMATION

Road Surface	Pavement	Gravel	Dirt
Condition	Well maintained	Poorly maintain	Very poorly maintained Abandoned
Issues	Wash out	Fallen trees	Rutting Flooding Decommission
Width (Optional)	m		





STREAM INFORMATION

	Upstream			Culvert		Downstream		
	Pool	Riffle	Run	UP	DOWN	Pool	Riffle	Run
Depth of Water (m)								
Wetted Width (m)								
Bankfull Width (m)								
Average Velocity (m/s)								

Total Stream Reach - Upstream of Culvert (m): _____

PHOTOS: 1) Inlet 2) Outlet 3) Left and Right bank UPSTREAM 4) Left and right bank DOWNSTREAM 5) OTHER

Recommend full survey? Yes No

ADDITIONAL INFORMATION/DIAGRAM:



7 References

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