

APPENDIX 2

SUMMARY OF DATA COLLECTION

Several studies have been undertaken by BWA and partners to attempt to isolate sources of pollution entering streams in the lower Brodhead watershed. Creek walks identified outfalls and potential point sources of pollution. Studies included macroinvertebrate composition, thermal pollution, water chemistry and fecal coliform. A summary of the studies conducted to date is provided below.

Creek Walks – Volunteer groups led by BWA member Darryl Speicher and George Basila of the Monroe County Planning Commission (MCPC) have walked sections of the lower Brodhead, Pocono, and McMichael Creeks locating small tributaries, drainage pipes, and ditches – anything that could bring stormwater runoff to the streams. As a result of the creek walks, 67 pipes/ditches that discharge within the project area were identified. In addition, 27 erosion sites and other evidence of possible pollution entering the streams were also identified. Creek walkers took GPS coordinates for the points and photos of what they observed. MCPC GIS specialist George Basila created maps of the data and photos which are available at MCPC or from BWA.

The Monroe County Planning Commission has been conducting **Water Quality** studies throughout the County since 1985. For the Green Infrastructure Project, additional sites were added in the project area in the 2015 and 2016 studies. The data includes field surface water measurements, laboratory chemistry analysis, macroinvertebrate identification, and habitat assessment. A summary is provided below.

Longitudinal study of macroinvertebrates in the lower Brodhead – BWA Board member and aquatic biologist, Don Baylor, conducted a study of macroinvertebrates in the Brodhead Creek at 9 sites in the project area using the most recent PA DEP protocols. The study took place in the spring of 2014. The results from the study have been included in Appendix 1.

Temperature – The partners also conducted thermal monitoring of the streams in the project area. Twenty-four (24) HOBO temperature loggers were installed at several sites and collected data at 15 minute intervals. The temperature loggers collected data for two years in many locations. Analysis of the data from the HOBO loggers is on-going with plans to compare stream temperatures to the PA DEP temperature criteria for Cold Water Fish (025 PaCode Sec 93.7) and thus determine best locations for investment in green infrastructure, such as streamside plantings.

Fecal coliform monitoring by BWA volunteers in partnership with PA DEP was conducted in 2014 and 2015. Twenty-six (26) sites in the lower watershed were sampled 10 times each over the summer of 2014. See maps below. Each number is the geometrical mean of 5 samples taken over a 30-day period. Numbers in red show the mean is greater than the water quality standard for recreational use, >200 cfu/100 ml. Two sampling periods with counts >200 result in the stream being listed as impaired.

All the data collected for the Green Infrastructure Project can found on the BWA website – at <http://www.brodheadwatershed.org/GreenInfrastructure.htm>

**MONROE COUNTY WATER QUALITY STUDY
PROJECT AREA SITES, 2015 AND 2016**

Site ID	Stream Name	Location	Date	Temp.[°C]	Dissolved Oxygen %	IBI Score
BRODHEAD CREEK 2016						
BRODCR25	Brodhead Creek	Just above ForEvergreen Preserve	5/5/16	10.43	111.8	88.9
BRODCR17	Brodhead Creek	Above East Stroudsburg STP Discharge-above McMichael Creek	5/10/16	11.97	105.1	69.5
BRODCR24	Brodhead Creek	Above Rock-Tenn, below East Stroudsburg STP, below Glen Park	5/13/16	15.06	95.3	57
BRODHEAD CREEK 2015						
BRODCR17	Brodhead Creek	Above East Stroudsburg STP Discharge-above McMichael Creek	4/29/15	9.49	108.9	68.8
BRODCR24	Brodhead Creek	Above Rock-Tenn, below East Stroudsburg STP, below Glen Park	5/6/15	14.83	97.5	25.9* Poor habitat
POCONO CREEK 2016						
POCOCR18	Pocono Creek	Schafers Schoolhouse Road (above Wigwam Run)	5/13/16	14.91	95.7	81.4
POCOCR14	Pocono Creek	(Mouth) Above McMichael confluence	5/13/16	15.26	95.2	72.5
POCONO CREEK 2015						
POCOCR18	Pocono Creek	Schafers Schoolhouse Road (above Wigwam Run)	4/30/15	11.53	105.4	61.9
POCOCR14	Pocono Creek	(Mouth) Above McMichael confluence	5/5/15	14.61	106.6	62.3
McMICHAEL CREEK 2016						
MCMICR37	McMichael Creek	Hickory Valley Park, 50 yards upstream of parking lot	5/10/16	11.31	95.6	92
MCMICR20	McMichael Creek	30 yards upstream of its confluence with Pocono Creek	5/13/16	15.77	89.9	84.8

Site ID	Stream Name	Location	Date	Temp.[°C]	Dissolved Oxygen %	IBI Score
McMICHAEL CREEK 2015						
MCMICR37	McMichael Creek	Hickory Valley Park, 50 yards upstream of parking lot	4/30/15	11.42	96.5	93.60
MCMICR20	McMichael Creek	30 yards upstream of its confluence with Pocono Creek	5/5/15	15.41	95.7	29.2* Poor habitat

DISCUSSION

The sites described in the chart above are at the most upstream and most downstream points for each stream in the project area – Brodhead Creek, Pocono Creek, and McMichael Creek. Results are given for studies done by the Monroe County Water Quality Program, led by the Monroe County Planning Commission, in 2015 and 2016. Sites are listed from upstream to downstream. Only a few of the parameters studied are shown in the chart:

TEMPERATURE

Although it would appear that stream temperature increases from upstream to downstream, because the temperatures were collected on different days, and air temperature was not recorded, no conclusion can be drawn from this data.

DISSOLVED OXYGEN %

Dissolved oxygen in the water is an important part of water quality because oxygen is essential to aquatic life. Dissolved oxygen in water enters from the atmosphere and groundwater discharges and is affected by water temperature, stream flow, and plants/aquatic life activities. In fact, dissolved oxygen is so affected by those variables that significant changes can often occur daily, as photosynthesis produces oxygen and respiration reduces oxygen.

Generally speaking, the Monroe County data may indicate a slight decrease in percent saturation of dissolved oxygen, but the high percentages of the data do not suggest impairment or poor water quality conditions. All readings are high, and variability is likely due to a wide range of factors which make a direct correlation very difficult if not impossible.

IBI – INDEX OF BIOTIC INTEGRITY

The 2016 IBI scores on the Brodhead Creek show significant decline through the project area, almost mirroring the decline shown in the 2014 Study (see Appendix 1). Pocono Creek scores show some decline in 2016, and no change in 2015.

The 2015 downstream sites on the Brodhead and the McMichael were improperly selected and the drastic decline shown is not an accurate result.

CONCLUSION

The impairment shown on the Brodhead Creek in 2014 still exists in 2016. IBI scores are not affected by fecal coliform levels, thus the Brodhead Creek impairment is real and must be addressed.

TEMPERATURE DATA FOR BRODHEAD CREEK AND TRIBUTARIES

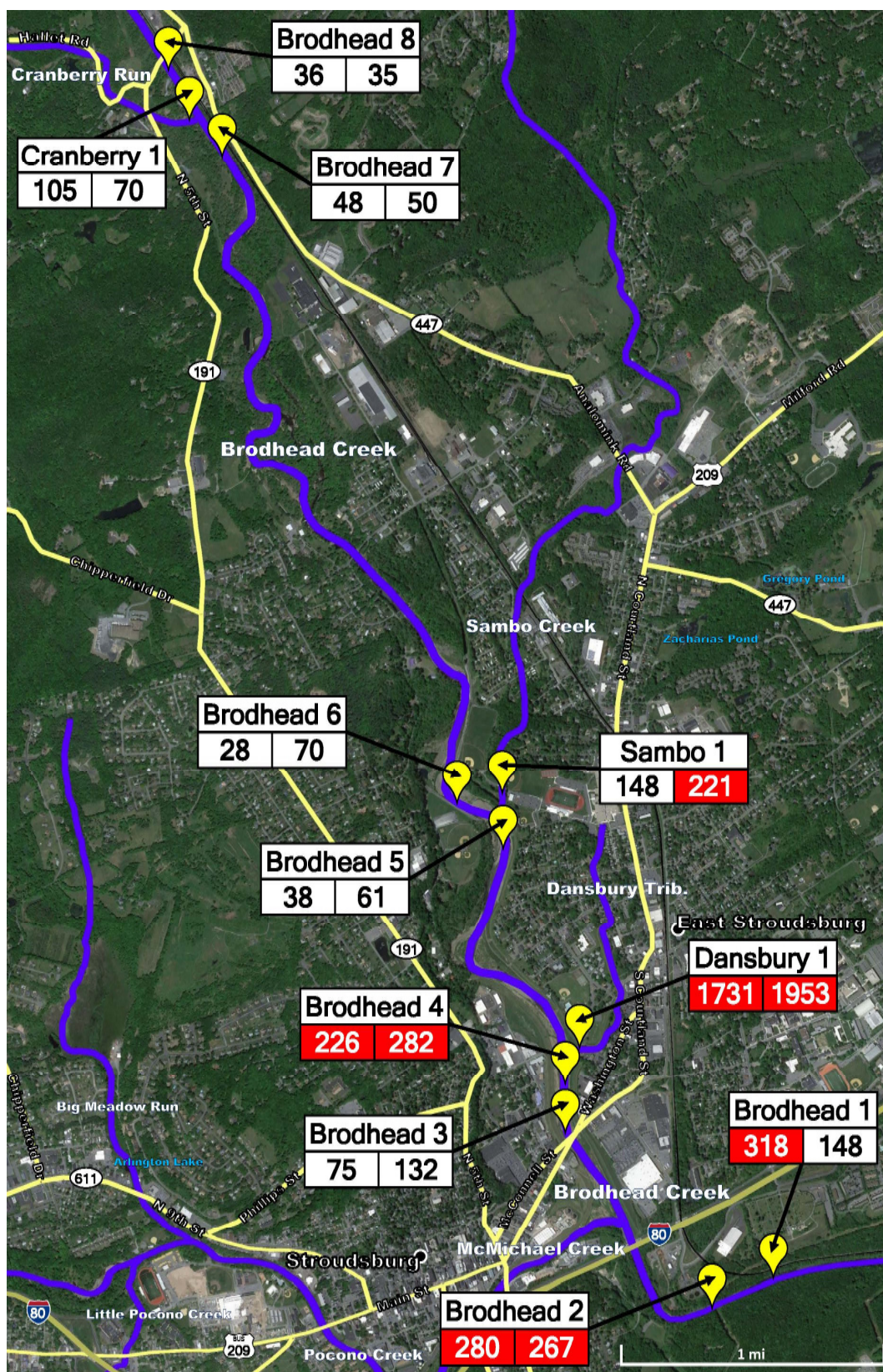
Data loggers were installed at 24 sites in the project area. Useable data was retrieved from 21 loggers. The loggers recorded temperature at 15 minute intervals and checked regularly. Occasionally, loggers were lost to high water, or vandalism, and some were replaced. Locations are listed below.

On-going analysis will compare each data point for the maximum in-stream temperature for cold water fish on that date and time as given in state regulation. The regulations are based on what temperatures are needed for fish to survive. The preferred temperature range for trout is between 50 and 60 degrees Fahrenheit (F) [10-15.6 Celsius (C)]. The upper limit is about 78 F [25.6 C] for brown and rainbow trout and 72 F [22.2 (C)] for brook trout.¹

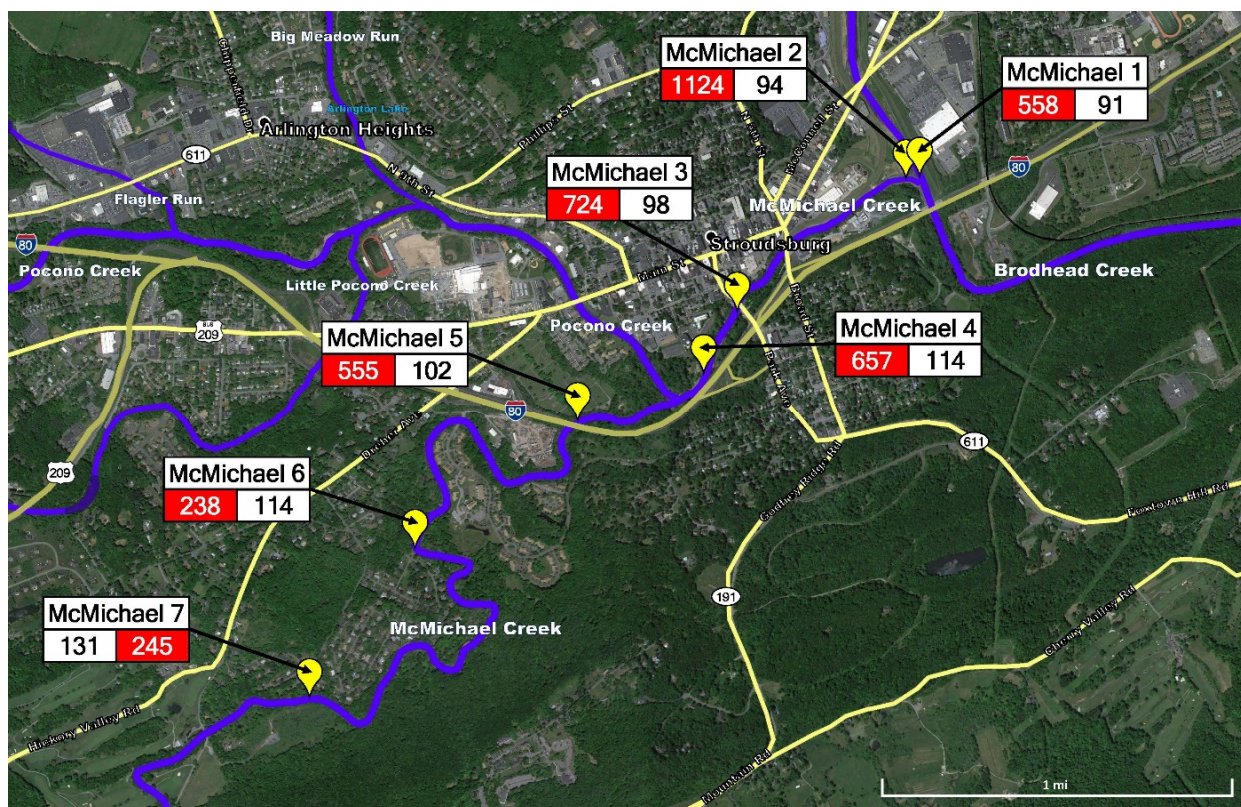
LATITUDE	LONGITUDE	STREAM	LOCATION	Data Range
40.993345	-75.212552	Big Meadow Run	Upstream of Arlington Diner at Javelyn Lane	12/30/2015 @ 5pm - 11/16/2016 @ 4:38pm
41.061477	-75.214919	Brodhead Creek	Back right corner of Forevergreen Preserve	12/21/2015 @ 1:42pm - 5/24/2016 @ 5:41pm
41.034738	-75.208643	Brodhead Creek	Below 191 Bridge at Pinebrook Park	9/14/2014 @ 11pm - 1/15/2016 @ 11:30am; 8/10/2016 @ 11pm - 11/23/2016 @ 4:08pm
41.023542	-75.205302	Brodhead Creek	Brodhead Creek Park adjacent to parking lot	9/14/2014 @ 11pm - 7/23/2015 @ 2:45pm; 12/21/2015 @ 1:47pm - 8/24/2016 @ 6:32pm
40.984356	-75.179133	Brodhead Creek	Below E.burg STP from Glen Park (1/4 mi down trail)	9/14/2014 @ 11pm - 1/15/2016 @ 1:15pm; 5/20/2016 @ 11:30am - 11/22/2016 @ 4:53pm
41.034267	-75.208462	Cranberry Run	Honey Locust trail footbridge from Pinebrook Park	9/14/2014 @ 11pm - 11/23/2016 @ 4:01pm
40.99525	-75.18651	Dansbury Tributary	Inside levee from Dansbury Park in E.burg	9/14/2014 @ 11pm - 11/30/2016 @ 12:14pm
40.96921	-75.213259	McMichael Creek	304 Norton Drive	2/6/2016 @ 5pm - 11/22/2016 @ 2:30pm
40.979189	-75.20041	McMichael Creek	Above Pocono confluence at Stroud Cemetery	9/14/2014 @ 11pm - 9/1/2016 @ 10:30am
40.98135	-75.194299	McMichael Creek	Below Pocono confluence behind ESSA off Ann Street	12/30/2015 @ 5pm - 11/22/2016 @ 2:55 pm
40.987848	-75.186022	McMichael Creek	Below S.burg STP	1/9/2016 @ 5pm - 11/22/2016 @ 4pm
41.011088	-75.286201	Pocono Creek	Pocono Drive	1/10/2016 @ 5pm - 11/16/2016 @ 3pm
40.991146	-75.255506	Pocono Creek	Above USGS Station	2/6/2016 @ 5pm - 11/16/2016 @ 3pm
40.990716	-75.254128	Pocono Creek	Below WigWam Run	2/6/2016 @ 5pm - 11/16/2016 @ 3pm
40.98509	-75.23197	Pocono Creek	Rip rap bank on Tanite Road (1/4 mi down Tanite Road)	9/14/2014 @ 11pm - 1/18/2016 @ 12pm
40.986027	-75.219361	Pocono Creek	Retro Fitness	12/30/2015 @ 5pm - 11/16/2016 @ 4pm
40.982222	-75.19802	Pocono Creek	Above McMichael confluence at Earth Light	9/14/2014 @ 11pm - 1/18/2016 @ 1:30pm
41.005242	-75.190733	Sambo Creek	Levee Loop trail from E.burg High School	9/14/2014 @ 11pm - 1/15/2016 @ 2:15pm; 9/9/2016 @ 11pm - 11/30/2016 @ 1:52pm
40.992167	-75.255036	WigWam Run	Beech Street downstream of bridge	1/9/2016 @ 5pm - 1/18/2016 @ 11:45am; 7/16/2016 @ 5pm - 11/16/2016 @ 3:18pm
40.98731	-75.22052	Flagler Run	Below Stroud Mall/Rt. 611 at old Office Max building	9/14/2014 @ 11pm - 11/16/2016 @ 4:16pm
40.98394	-75.21041	Little Pocono Creek	Behind S.burg High School football stadium	9/14/2014 @ 11pm - 11/22/2016 @ 2:04pm

¹ Piper, R. G., I. B. McElwain, L. E. Orme, J. P. McCraren, L.G. Fowler, and J. R. Leonard. 1982. Fish Hatchery Management. US Fish and Wildlife Service, Washington, D.C.

FECAL COLIFORM DATA FOR BRODHEAD CREEK 2014



FECAL COLIFORM DATA MCMICHAEL CREEK 2014



FECAL COLIFORM DATA FOR POCONO CREEK 2014

