



conserving  
natural resources  
*for our future*

**Poultney-Mettowee Natural Resources Conservation District**

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## **METTOWEE WATERSHED WATER QUALITY REPORT 2013**



**BY HILARY SOLOMON, PMNRCD WATER QUALITY SPECIALIST  
REPORT COMPLETED DECEMBER, 2013**

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Introduction

The Poultney Mettowee Natural Resources Conservation District (PMNRCD) has participated for many years in the LaRosa Laboratory grant program. We have partnered with Green Mountain College, the Middletown Springs Conservation Commission, and other volunteers for sample collection and in 2009 Green Mountain College purchased equipment to take supplemental *E. coli* readings. This equipment was used in 2010 and the District plans to use it again in 2014.

During the 2013 sampling season, the District collected samples on six regularly-scheduled dates: June 24, July 8, July 22, August 5, August 19, and September 3. In addition, the District collected limited numbers of samples during rainfall events on July 3 and July 23. In all, the District collected 316 stream samples (with additional samples for quality control purposes), which were analyzed by the Vermont State LaRosa Analytical Laboratory for *E. coli*, Total Phosphorus, and Turbidity concentrations. The laboratory sample analyses costs were provided by the State through a LaRosa Partnership Grant.

The District generally collects samples from a number of rivers in the Poultney and Mettowee Basins. In response to funding through ANR's Ecosystems Restoration Program (ERP) that focused on project prioritization in the Mettowee Watershed, the District used our 2013 water quality monitoring program to support and identify projects in coordination with that grant.

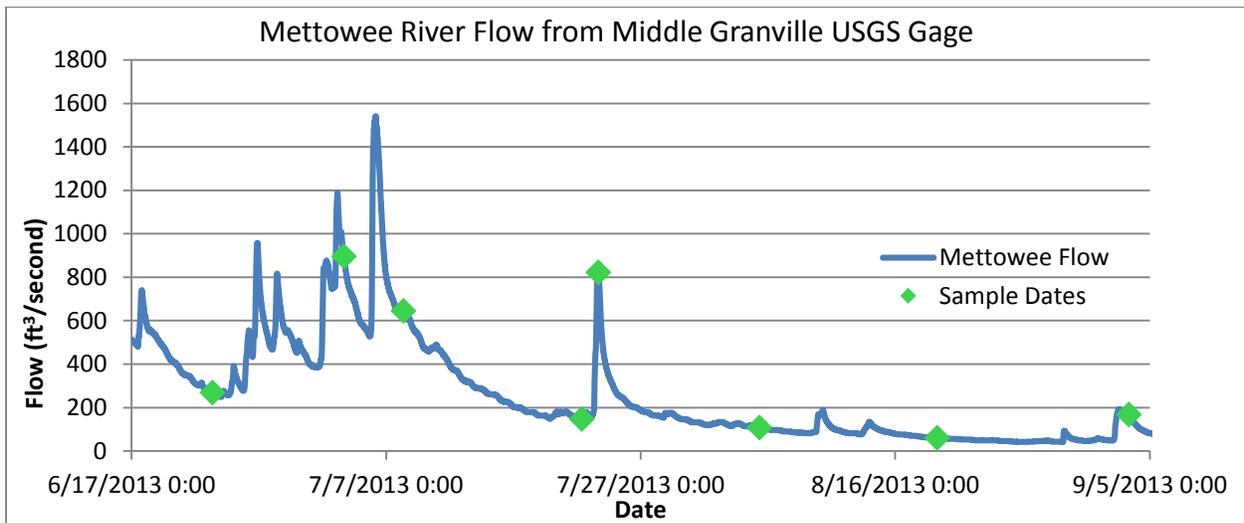
Streamflow and Rainfall Data

Streamflow and Rainfall data are important factors when considering nonpoint source pollution inputs to streams. Nutrients, fecal coliform, and excessive fine sediments in the water during periods of high streamflow may have originated through overland runoff and erosion associated with a rainfall event. Contaminants present in the water during periods of low streamflow may originate from groundwater, so high *E. coli* levels measured during low flow conditions may indicate seepage from septic systems. Rainfall data can help explain variations in streamflow, though rainfall in this area is very localized. The District collects rainfall data during the sampling season in Middletown Springs and uses data from the nearest official weather gage at the Rutland Airport.

The following chart shows the streamflow, or discharge rate, of the Mettowee River as measured by the USGS gage station located near North Granville, New York, for the 2013 sampling season. The sample dates are represented as green diamonds. The highest flow recorded during the sample season was 1,490 cubic feet per second (cfs) on July 6, 2013. This level is below bankfull flow (Q1.5), which according to VT DEC hydraulic curves for a stream this size is around 4,227 cfs (2002) (Q2 is 4,560 cfs, Olsen, 2002, table 2). Except for the storm

samples collected on July 23, the sample collection dates appear to fall during receding, not increasing, flows. The highest flows sampled were 896 cfs on July 3, 2013.

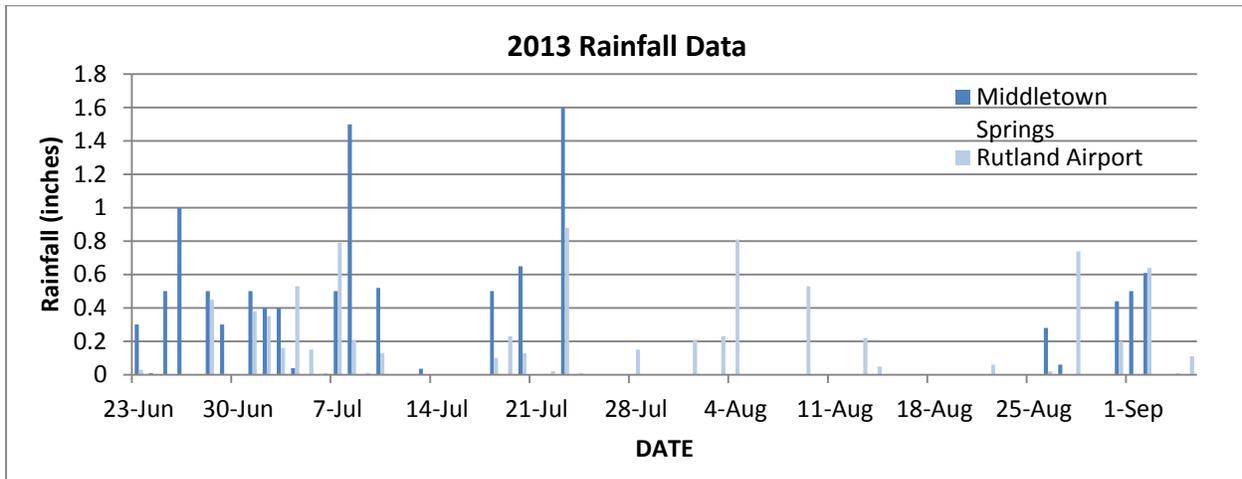
Chart 1: Flow data from USGS Middle Granville Gage and corresponding sample dates and times.



Rainfall data collected in Middletown Springs showed many consecutive rain dates in late June and early July. Rainfall at the Rutland Airport showed similarly consistent rainy days, but recorded less rainfall on most days, with the highest rainfall measured in early July at 0.79 inches. The Middletown Springs gage recorded several heavy rain events in July with 1.5 inches and 1.6 inches on July 8 and July 23, consecutively. Again, less rain was measured at the Rutland airport. In comparison, August was a relatively dry month in Middletown Springs, while Rutland received rain on nine days in August.

Rainfall in this area varies locally. During one sample event, the waters in the Mettowee Watershed were turbid, while the drive through the Poultney Watershed (on the way to the lab) revealed clear water. Another sample event had relatively clear water at all of the sites except Sykes01, which was cloudy. In both cases, local landowners confirmed heavy rains in the vicinity of the turbid sites the previous night.

Chart 2: Rainfall data from a private gage in Middletown Springs and from the Rutland Airport as reported by Weather Underground.



### Sample Results

The District has collected water quality samples in the Mettowee watershed since 2005. Monitoring locations on the Mettowee River ranged from Dorset, near the Mettowee River headwaters, to Deer Flats Farm, near Granville, NY. The District has four long-term sites on the Mettowee River that are sampled nearly every year. These include Mett1.5 at the fishing access in Rupert, Mett02 at Stonebroke Farm in Pawlet, Mett2.5 just below the Flower Brook confluence in Pawlet Village, and Mett03 at the Hughes-Muse Farm (formerly Pillemers, near P. Helmetag's property) north of Pawlet. These sites have four to six years of data each, including this year. Other long-term sites in the watershed include Flower01, on Flower Brook behind the Town Offices in Pawlet and Beaver01 at the Route 133 crossing over Beaver Brook (please refer to the attached map).

This year, in order to further understand how certain areas or properties were contributing to pollution loads, the District chose to add eleven new sample locations in the Mettowee Watershed. The District was a named partner in the Flower Brook *E. coli* TMDL and is currently prioritizing phosphorus-reducing projects in the watershed, funded through a Vermont ANR Ecosystems Restoration Grant (ERP). In addition to the long-term sites, the District sampled at one new site and one rotational site (not used on an annual basis) on the Mettowee River, added three new site locations on Flower Brook and sampled at one additional rotational site, and added two new sites on Beaver Brook. In addition, the District added monitoring locations on the Wells Brook and Sykes Hollow Brook for the first time. Table 1 lists the PMNRCD 2013 water quality monitoring site names and locations. The number of years sampled are listed in parenthesis after the site description ((1) indicates that the site has only been sampled in 2013).

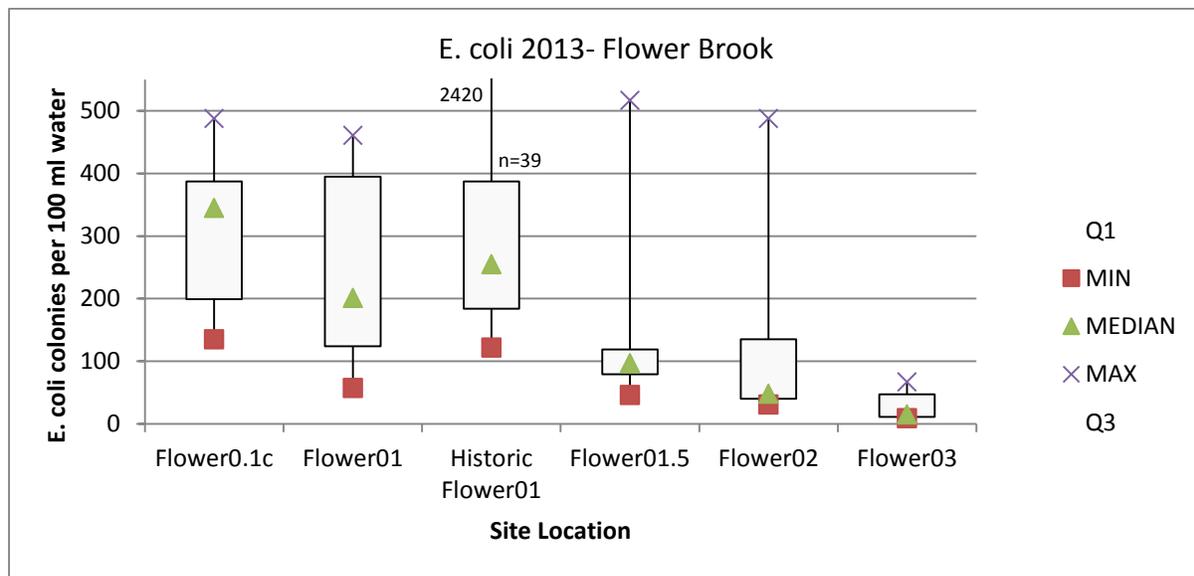
Table 1: PMNRCD water quality sampling site names and locations.

Site Number	Latitude	Longitude	Description (number of years sampled)
Mett01.5	43.29314	73.14050	VT DFW fishing access off of Route 30 south of Rupert (4)
Mett02	43.32130	73.17218	Fred Stone's stream crossing (5)
Met02.25	43.34667	73.18177	Upstream of the Flower Brook confluence (2)
Mett02.5	43.29314	73.18211	Downstream of the Flower Brook confluence (5)
Mett03	43.37370	73.19188	Hughes-Muse farm, upstream of Helmetag's (6)
Mett03.9	43.38590	73.22717	Mettowee Community School access at hydrants (1)
Sykes01	43.30148	73.14352	Sykes Hollow Brook at Ken Leach's farm (1)
Flower0.1c	43.34687	73.18189	Above the confluence with the Mettowee River (1)
Flower01	43.35345	73.17885	Behind the town offices, Pawlet (7)
Flower01.5	43.34778	73.17492	Pawlet Vol Fire Station, upstream of the mill pond (1)
Flower02	43.33345	73.14035	Downstream of Rte 133 crossing near Gould's farm (2)
Flower03	43.36848	73.10159	Downstream of Lilly Hill Road Bridge (1)
Beaver01	43.33345	73.14035	Beaver Brook at the 133 crossing North of Flower02 (6)
Beaver02	43.37284	73.13704	Beaver Brook at the Kelley Hill Road crossing (2)
Beaver03	43.38841	73.13258	Beaver Brook at Brimstone Road crossing (1)
Tadmer01	43.40699	73.14821	Tributary to Wells Brook from Tadmer Road, last crossing before Wells Brook confluence (1)
Wells01	43.40734	73.14734	Wells Brook Road crossing near Tadmer Rd (1)
Wells02	43.41381	73.18962	Gravel quarry driveway east of Wells Village off East Wells Rd (1)
Wells03	43.41632	73.20476	South Street crossing in Wells Village (1)
Wells04	43.41082	73.22546	At dry hydrants south of town on Route 30 (1)

### E. coli Concentrations

For many years the State of Vermont used 77 colonies of *E. coli* per 100 ml of water as their water quality standard. Recently, DEC is considering changing the standard to 235 colonies of *E. coli* per 100 ml of water to correspond to the US EPA standard and Vermont Health Department Standard. In past reports, the District compared the data results to both the 77 and 235 colony standards. This year the data will be compared to the 235 colony standard, however it is worth noting that there is a possibility of health consequences for recreational swimmers at far lower concentrations of fecal coliform in the water. Additionally, *E. coli* is the bacteria measured in the samples collected by the District, but many other bacteria are found in fecal matter.

Chart 3: *E. coli* levels for 2013 monitoring on Flower Brook with the historic Flower01 data (behind the Pawlet town hall) included for comparison.



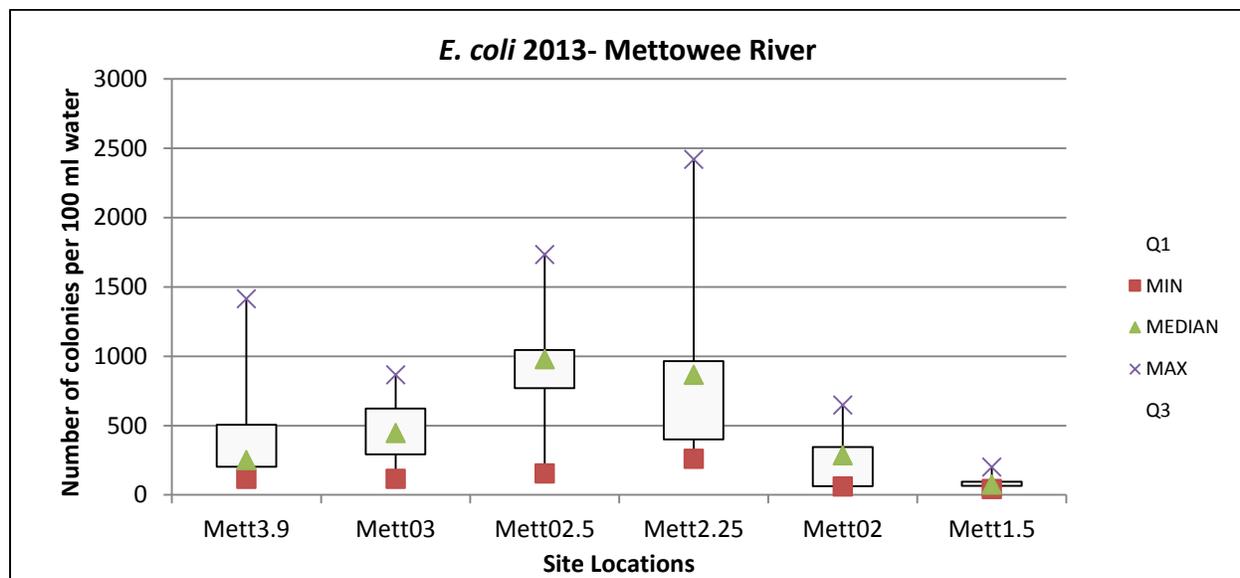
Analytical results from the new sites Flower0.1c, Flower1.5, and Flower03 are shown in Graph 3, along with rotational site Flower02 and long-term site Flower01. The historic data from Flower01 (39 sample results) was added to the figure to compare the range of samples collected during 2013 (6 results) with the historic range of data. The bulk of the data (Q25-Q75) represented by the box is within a similar range. *E. coli* concentrations increase downstream as water flows from the headwaters to the confluence with the Mettowee River. The Brook upstream of the village tends to have lower results than within the village, specifically, downstream of the Mill Pond. The *E. coli* TMDL is specifically for this segment of stream between the Mill Pond and the confluence.

The District has been working to exclude livestock from Flower Brook upstream of the Village and there are now two landowners with exclusion fencing (The District would like to credit Todd Mason for his proactive outreach and fencing expertise on these projects) along Flower Brook and one landowner along Beaver Brook. The District is working with a third landowner

upstream of the village, but there has been no agreement for exclusion fencing at that property to date.

Partially based on the 2013 sample results, the District plans to focus on delineating houses with working septic from those with inadequate or poorly-functioning septic systems in the Pawlet Village. Pending agreement by the Pawlet Select Board, this work will be proposed as part of the next round of ERP grant applications for 2014. The District would like to work with the Village to determine how to use the resulting septic and stormwater data to extend the availability of functioning septic to all residences in town.

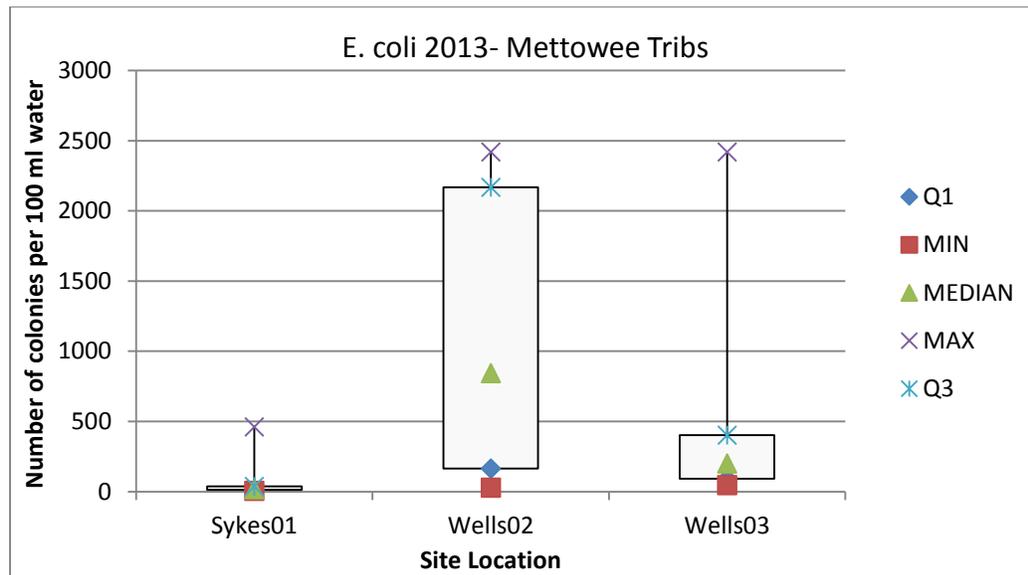
Chart 4: Mettowee River *E. coli* results. Note the increase in bacteria levels in the vicinity of Pawlet Village and the decrease in downstream waters.



Historic Water Quality monitoring results for the Mettowee River showed relatively low levels of *E. coli* upstream of the fishing access in Rupert, Mett1.5 (2005). Generally, concentrations of *E. coli* increase through Pawlet Village and then decrease downstream of the Village. This data serves to emphasize the importance of reducing *E. coli* inputs from stormwater and septic in the Village area.

In addition to the work on Flower Brook, livestock exclusion projects were recently completed, or are in progress, on the Mettowee River and several of its tributaries.

Chart 5: E. coli results of Mettowee River tributaries, Wells Brook and Sykes Hollow Brook.



As noted earlier, the District monitored Wells Brook and Sykes Hollow Brook for the first time as part of the 2013 water quality monitoring program. The analytical results for Wells Brook were relatively high, especially for Well02, upstream of the village. With only one year of data it is difficult to draw conclusions, but the District will follow up with samples next year at these sites and two additional sites, one upstream of Wells02 and one downstream of Wells03.

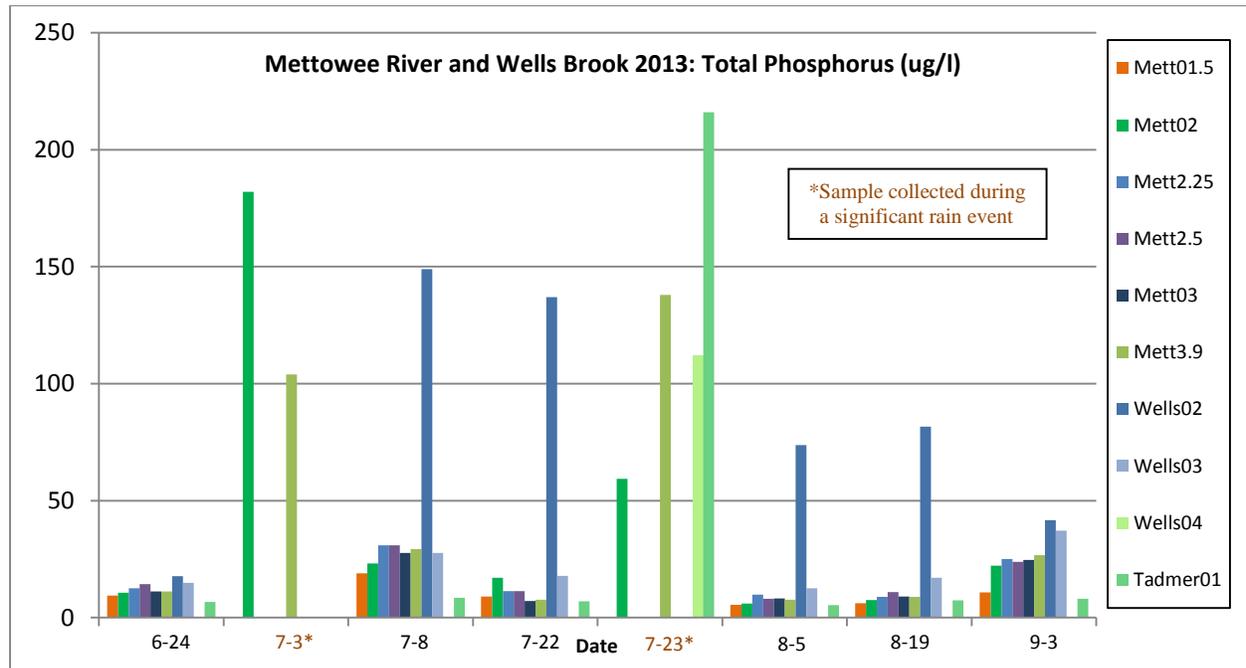
### Phosphorus Concentrations

The Vermont Water Quality Standards state “in all waters, total phosphorus loadings shall be limited so that they will not contribute to the acceleration of eutrophication or the stimulation of growth of aquatic biota, in a manner that prevents the full support of uses (p. 21, 2011 WQS).”

The WQS for South Lake B is 0.054 mg/L (p. 22, 2011, WQS), though the District expects that our results from samples collected a significant distance upstream of South Lake B to be far lower than that value. I believe that the number for coldwater medium-gradient streams (likely the streams measured in this study) is being developed.

In the past, the PMNRCD has used 10 ug/L (0.010 mg/L) as a conservative measure of ‘high’ phosphorus in our streams; however, this year the phosphorus measured in the Mettowee Watershed samples is consistently higher than in past years.

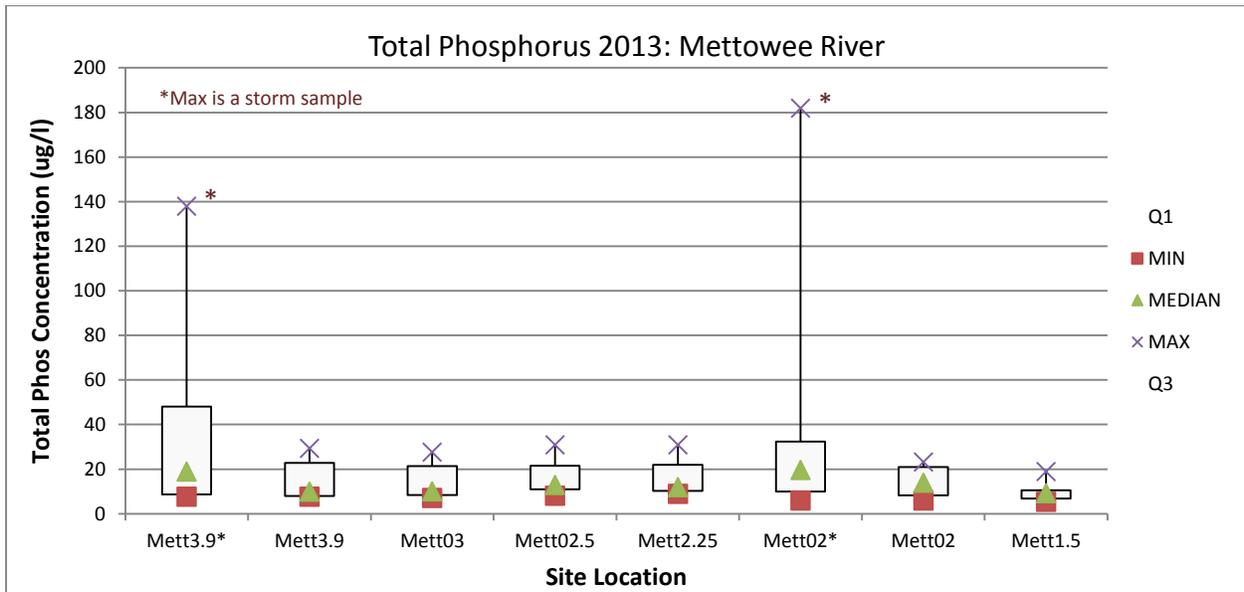
Chart 6: Total Phosphorus levels in the Mettowee River and select tributaries. The storm sample results are in green and Wells Brook East of the Village are the blue, high measurements.



Phosphorus concentrations at the sample locations were largely affected by the amount of runoff flowing into the rivers. The sample dates, July 8<sup>th</sup> and September 3<sup>rd</sup>, corresponded to rain events, which increased overland runoff and the expectation that phosphorus will be present in the waters in higher than average amounts. In addition, the District collected samples at limited sites during two rain events in July. The first was on July 3<sup>rd</sup> and the other was on July 23<sup>rd</sup>. Both of these dates had turbid waters in part, or all, of the watershed. The results for the sites sampled during these rain dates were relatively high. The sites sampled on July 3<sup>rd</sup> were Mett02 at Stonebroke Farm and Mett3.9 at the Mettowee Community School. The sites sampled on July 23<sup>rd</sup> were Mett3.9, Sykes01 on Sykes Hollow Road, Tadmer01 on Tadmer Road, and Wells04 off of Route 30.

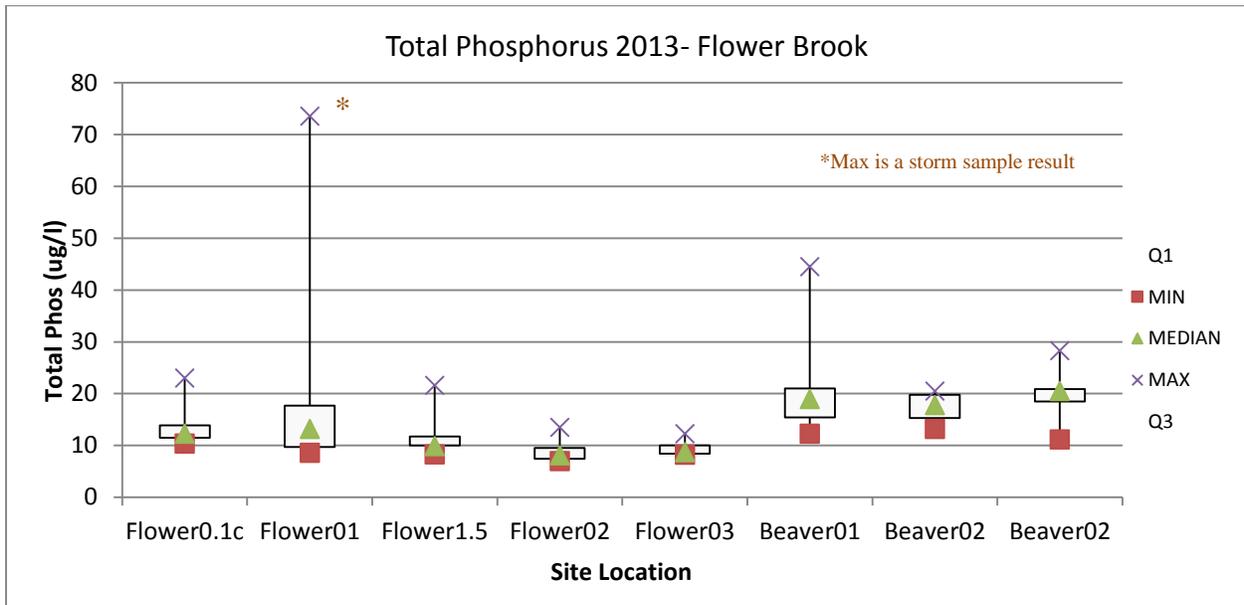
Through our Mettowee Watershed Project Prioritization Grant, the District is focusing on developing and implementing phosphorus-reducing projects. In 2013, the District identified 13 phosphorus-reducing projects, based largely on geomorphic and water quality data. The phosphorus data from 2013 specifically supported project identification in the Flower Brook headwaters, Flower Brook main stem through the Village of Pawlet, and the Sykes Hollow Brook headwaters. The data also points to future phosphorus-reducing projects on the Wells Brook and a tributary to Wells Brook.

Chart 7: Total phosphorus box plots for the Mettowee River sites. Sites Mett3.9 and Mett02 are shown twice(see text below).



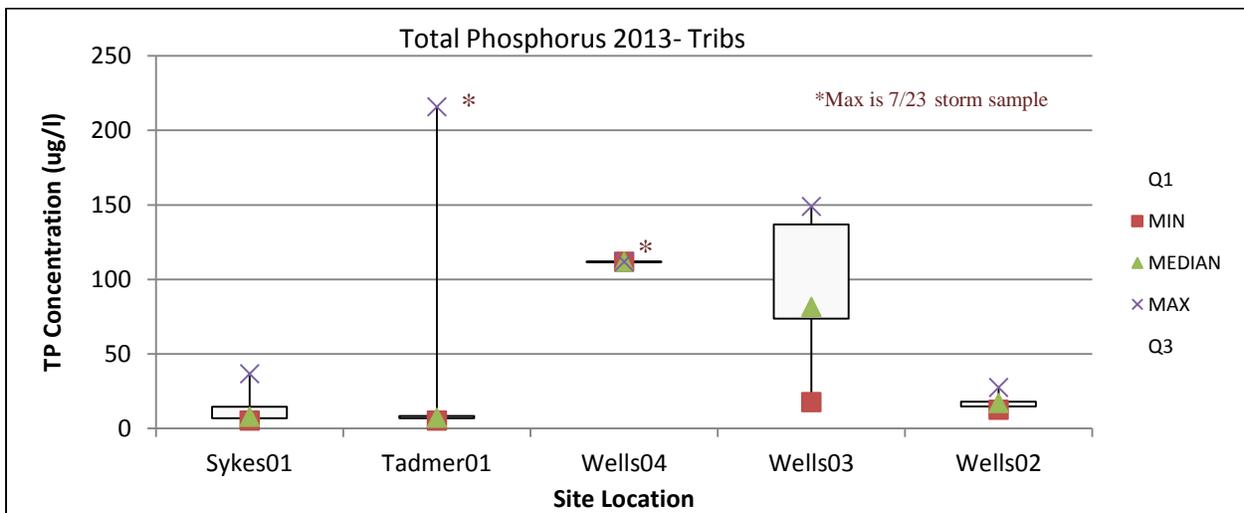
The phosphorus data for the Mettowee River was roughly double the concentrations measured in previous years, likely due to the high rainfall during much of the summer. All of the historic data combined shows Q3 values less than 15 ug/l for the Mettowee Watershed sites, and the median of the data for each site less than 10 ug/l, except for Beaver Brook, which was 20 ug/l. The asterisk indicates data with the storm samples included, while the unmarked data does not include any storm samples. This allows all of the sites to be compared on the basis of data collected during the regular sample dates, while still providing a visual of the data with the storm concentrations included.

Chart 8: Total phosphorus concentrations for Flower Brook. The Flower01 maximum was 73.6 ug/l, collected during the storm sampling event on July 23, 2013.



Similar to past years, phosphorus results for Flower Brook were roughly half the concentration of the results for Beaver Brook. New sites added this year include, Flower0.1c just above the confluence with the Mettowee River, Flower1.5 at the Fire Station, Flower03 at the Lilly Hill Road bridge, Beaver02 at Kelley Hill Road, and Beaver03 at Brimstone Road. There is a map attached for reference.

Chart 9: Total phosphorus concentrations for several Mettowee River tributaries.



The sites in this chart are all new sites in 2013. The Tadmer01 is located on a tributary to Wells Brook that flows along Tadmer Road to its confluence near Wells Brook Road. This site was



only sampled during one rain event and had the highest result of all those measured for the season with a concentration of 216 ug/l. The District has been monitoring this site visually for years due to high turbidity after rain events and hopes to sample at this location next year. The other storm event result from this collection of sites was collected at Wells04, at the dry hydrants west of town at the Route 30 crossing, and was 112 ug/l, on July 23, 2013. Sykes Hollow Brook was also sampled on July 23<sup>rd</sup>, but the result was higher on the regular sample date July 22<sup>nd</sup>, where waters were noted as being highly turbid on the sample collection sheet. Wells03 was also high that day, at 149 ug/l.

*Photo 1: This small tributary to the Wells River consistently has highly turbid waters after rainfall events. This photo was taken in 2005 at the site Tadmer01.*

### Turbidity Levels

The Vermont Water Quality Standards state that the maximum turbidity level for coldwater fish habitat in Class B streams in Vermont is 10 NTUs (VTDEC, WQS, p. 32). For the first time in the history of the PMNRCD water quality monitoring program several results were above 10 NTUs. Those measurements are as follows: July 22, 2013, Sykes01, 21.7 NTU, and Wells02, 16.6 NTU; July 23, 2013, Mett3.9, 13.8 NTU. Measurements between 5 and 10 NTU include on July 8, 2013, Flower02, 5.66 NTU; Mett2.25, 6.34 NTU; Mett2.5, 6.44 NTU; Mett03 6.76 NTU, and Mett3.9, 8.4 NTU, and on July 22, 2013, Beaver03, 6.27 NTU, and Flower01, 5.54 NTU. The high rainfall and water levels, which contributed to increased overland runoff and instream erosion was likely the source of increased turbidity within the watershed. Please refer to the data tables at the end of this report for all water quality monitoring values.

### Discussion

The District is currently working on many projects to decrease E. coli, phosphorus, and turbidity levels in the watershed. This water quality data is used to pinpoint problem areas and plan appropriate projects to improve water quality. The District is currently working with many farms in the area to improve barnyards and fence animals out of streams, and continues to focus on Pawlet Village contributions to water quality impairments in Flower Brook. The District plans to evaluate several Mettowee River headwater tributaries for gully stabilization projects and plant trees in riparian buffer areas, with the hope of decreasing sediment and phosphorus levels in area streams. Additionally, the District will participate in culvert replacement and road improvement projects where appropriate. We will also continue to act as a liaison between the State and property owners to promote corridor easements and other important water quality projects.

Data Tables

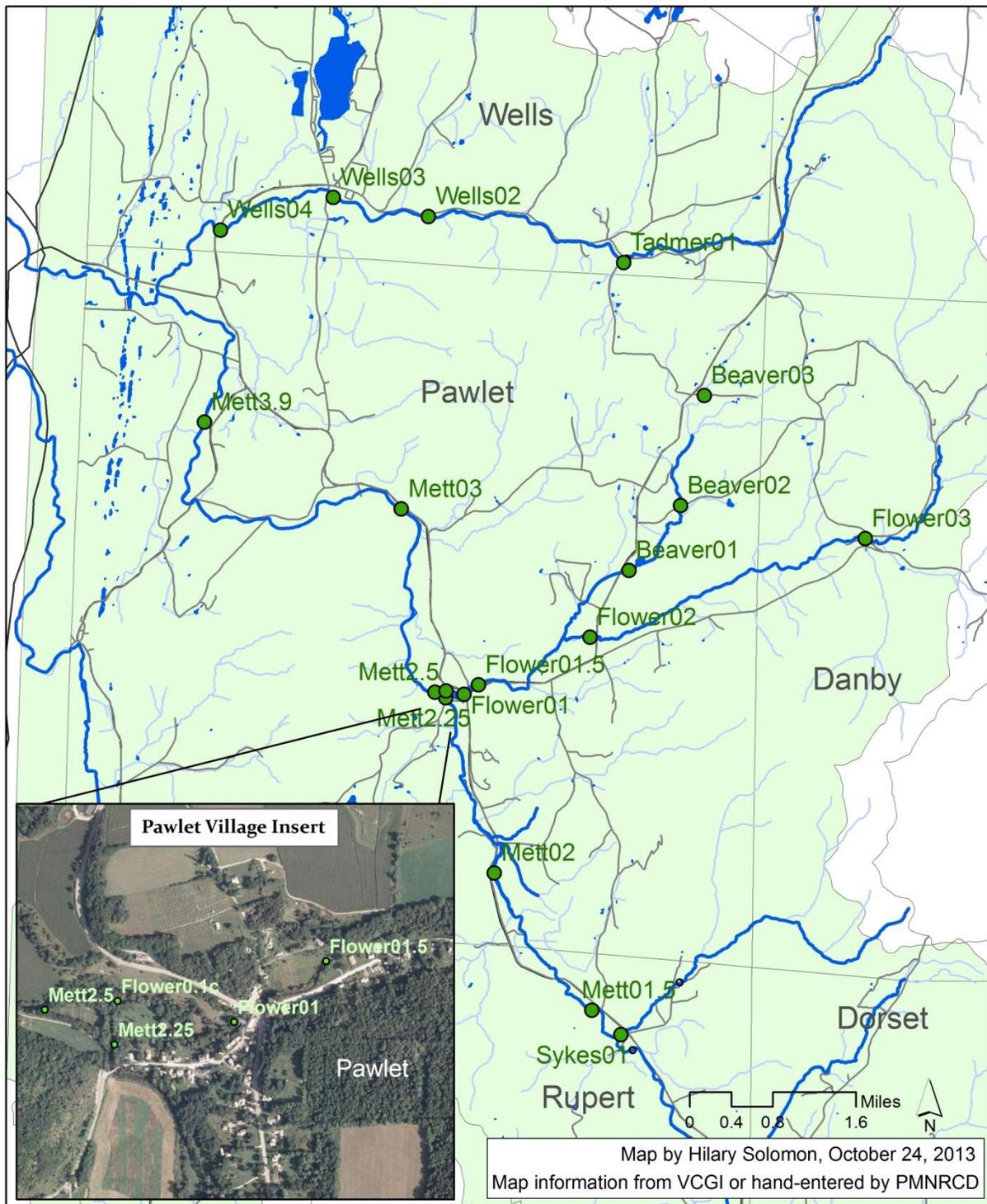
<i>E. coli</i>	6/24/2013	7/3/2013	7/8/2013	7/22/2013	7/23/2013	8/5/2013	8/19/2013	9/3/2013
Beaver01	73	261		184		33	135	727
Beaver02	102	124		201		85	219	186
Beaver03	144	411		186		34	39	153
Flower0.1c	135			488		199	345	387
Flower01	57	124		435		125	276	461
Flower01.5	75	124		517		91	46	102
Flower02	31	38		488		162	44	52
Flower03	13	57		67		10	16	9
Mett01.5	64	69		201		79	43	102
Mett02	285	345				60	64	649
Mett2.25	921	261		2420		980	260	816
Mett2.5	980	155		1733		770		1046
Mett03	649	345		276		548	115	866
Mett3.9	579	201		291		210	117	1414
Sykes01	16	7		461		18	11	43
Wells02	28	2420		1414		276	127	2420
Wells03	179	461		225		47	64	2420

TP	6/24/2013	7/3/2013	7/8/2013	7/22/2013	7/23/2013	8/5/2013	8/19/2013	9/3/2013
Beaver01	17.2		22.4	19.6	44.5	12.3	13.5	19
Beaver02	19.8		20.5	19.8		15.1	13.2	15.7
Beaver03	11.2		17.9	21		20.4	20.6	28.3
Flower0.1c	12.3			11.5		10.4	23	13.9
Flower01	10.5		21.7	13.6	73.6	8.6	8.93	13.2
Flower01.5	10.1		21.6	9.63		8.76	8.3	12.2
Flower02	8.13		13.5	8		7.03	7.17	10
Flower03	8.53		12.3	8.92		8.18	8.41	10.4
Mett01.5	9.47		19	9.02		5.44	6.12	10.8
Mett02	10.7	182	23.2	17.1	59.4	5.99	7.47	22.2
Mett2.25	12.6		30.9	11.3		9.87	8.96	25.1
Mett2.5	14.4		30.9	11.4		8.05	10.9	23.8
Mett03	11.2		27.7	7.14		8.24	8.98	24.7
Mett3.9	11.2	104	29.3	7.64	138	7.65	8.88	26.7
Sykes01	5.43		7.96	36.8	18.2	7.01	6.79	10.7
Tadmer01	6.67		8.46	6.98	216	5.41	7.43	8.07
wells04					112			
Wells02	17.7		149	137		73.7	81.6	41.7
Wells03	14.9		27.7	17.9		12.6	17.1	37.2

Turbidity	6/24/2013	7/3/2013	7/8/2013	7/22/2013	7/23/2013	8/5/2013	8/19/2013	9/3/2013
Beaver01			2.25	3.05		0.69	0.63	1.33
Beaver02			4.93	2.79		0.62	0.54	2.1
Beaver03			1.31	6.27		1.05	1.58	1.91
Flower0.1c				4.63		0.46	0.59	1.64
Flower01			3.91	5.54		0.38	0.36	1.54
Flower01.5			4.57	0.06		0.23	0.26	1.19
Flower02			5.66	2.93		0.44	0.34	0.84
Flower03			2.71	1.23		0.23	<0.2	0.41
Mett01.5			4.01	1.49		0.24	0.23	1.05
Mett02			4.63	2.14		0.42	0.35	1.07
Mett2.25			6.34	2.95		0.84	0.27	1.81
Mett2.5			6.44	2.92		0.66	0.34	2.33
Mett03			6.76	1.48		1.07	0.4	3.16
Mett3.9			8.4	2.38	13.8	1.25	0.74	4.07
Sykes01			1.39	21.7	2.81	<0.2	0.25	1.05
Tadmer01					3.81			
Wells02			4.73	16.6		0.44	0.62	1.76
Wells03			3.12	1.35		<0.2	0.23	1.64
Wells04					3.05			

\*Highlighted cells indicate values above a historic District goal, and/or State or Federal Standard (see text for more information).

### Mettowee Watershed 2013 Monitoring Site Locations Poultney Mettowee Natural Resources Conservation District



**DATA VALIDATION**

*PMNRCD 2013 Water Quality Monitoring Program*

Field Blanks

Sample	Date	E. coli	Ttl Phos	Turbidity
Field Blank	6/24/2013	< 1	< 5	
Field Blank	7/8/2013	< 1	7.56	1.25
Field Blank	7/22/2013	< 1	< 5	< 0.2
Field Blank	8/5/2013	< 1	< 5	< 0.2
Field Blank	8/19/2013	< 1	< 5	< 0.2
Field Blank	9/3/2013	<1	<5	1.04

Discussion: Other programs received positive readings for TP and turbidity around the same time we did. They noted white particles in the DI water. We are assuming that the problem was with the DI water and/or lab error and as such, does not affect our sample results. We will continue to follow up with the lab about these results.

Duplicates

- 1) E. coli field duplicate results and percent difference calculations

Date	Site	E. coli	Dup	%D
6/24/2013	Flower02	31	29	6.67
6/24/2013	Mett1.5	64	78	19.72
7/8/2013	Flower02	38	40	5.13
7/8/2013	Mett1.5	69	71	2.86
7/22/2013	Flower1.5	517	727	33.76
7/22/2013	Beaver03	186	326	54.69
8/5/2013	Beaver03	34	38	11.11
8/19/2013	Beaver02	219	172	24.04
8/19/2013	Sykes01	11	7	44.44
9/3/2013	Flower 1.5	102	96	6.06
9/3/2013	Beaver03	153	238	43.48

%D      Mean      **22.91**

The E. coli mean RPD meets the EPA goal of <125% RPD for individual samples and the laboratory mean for all duplicate samples. PMNRCD will accept these results and chooses to NOT apply data flags.

2) Total Phosphorus duplicate results and percent difference calculations

Date	Site	TP	Dup	%D
6/24/2013	Flower02	8.13	7.56	7.27
6/24/2013	Mett1.5	9.47	9.62	1.57
7/8/2013	Flower02	13.5	23.2	52.86
7/8/2013	Mett1.5	19		
7/22/2013	Flower1.5	9.63	10.1	4.76
7/22/2013	Beaver03	21	22.2	5.56
8/5/2013	Beaver03	20.4	21.8	6.64
8/19/2013	Beaver02	13.2	13.1	0.76
8/19/2013	Sykes01	6.79	6.73	0.89
9/3/2013	Flower 1.5	12.2	12	1.65
9/3/2013	Beaver03	28.3	28.1	0.71

%D    *Average*    **8.27**

The Total Phosphorus laboratory mean for all duplicate RPDs is below the EPA standard of 30%; however, one duplicate sample from 7/8/13 had a RPD of 52.86%. PMNRCD will accept these results and chooses to NOT apply data flags.

3) Turbidity duplicate results and percent difference calculations

Date	Site	Turb	Dup	%D
6/24/2013	Flower02			
6/24/2013	Mett1.5			
7/8/2013	Flower02	5.66	5.48	3.23
7/8/2013	Mett1.5	4.01	3.95	1.51
7/22/2013	Flower1.5	2.06	1.55	28.25
7/22/2013	Beaver03	6.72	2.37	95.71
8/5/2013	Beaver03	1.05	1.32	22.78
8/19/2013	Beaver02	0.54	0.55	1.83
8/19/2013	Sykes01	0.25	0.2	22.22
9/3/2013	Flower 1.5	1.19	0.8	39.20
9/3/2013	Beaver03	1.91	3.95	69.62

%D    *Average*    **31.60**

Three turbidity duplicates, Beaver 03 from 7/22/13, Flower1.5 and Beaver03 from 9/3/13, were higher than the 30% EPA standard for this method. PMNRCD will continue to discuss these results with the lab, but does not anticipate applying data flags.

Appendix A: Temperature Recordings from USFS T-graphs in the Mettowee River. Graphs and data provided by Sue Stats at the US Forest Service Rochester Office

