LaPlatte Watershed Partnership

Water Quality Report
LaPlatte Watershed

2011 Data and Pilot Flow Study

Prepared for

Water Quality Section
Vermont Department of Environmental Conservation

and

The Town of Shelburne, Vermont
March, 2012

I. INTRODUCTION

The 2011 sampling season was unusual. Extensive spring flooding extending widely within the floodplain made access to the LaPlatte River and McCabe's Brook impossible at most locations until early June. The spring flooding gave way to very low flows which by August were not measurable in some locations. The dry summer was followed in late August by hurricane Irene with consequent flooding. Sampling following the hurricane was not possible until late October as a result of the closure of the LaRosa Laboratory. The overall result was that sampling was possible on only four of seven scheduled sampling dates.

II. RESULTS

A. LaPlatte River

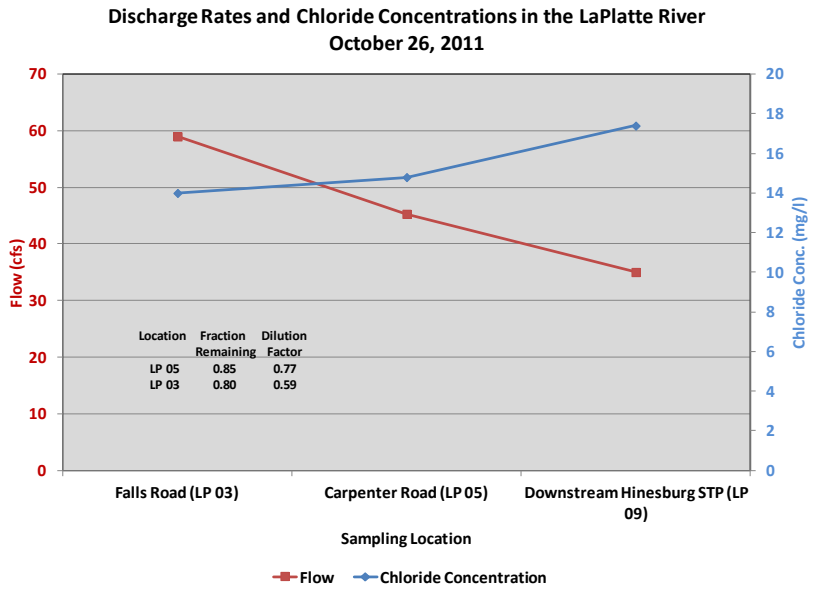
a. Chlorides

Chlorides were monitored at three locations on the LaPlatte River (LP 08, LP 05, and LP 03) during 2011 in order to assess how closely concentrations reflect dilution between the Hinesburg sewage treatment plant outfall (LP 08) and Falls Road (LP 03) in Shelburne. Analysis of past years' data had shown that nitrogen concentrations decreased in direct relation to chloride concentrations, suggesting that chloride concentrations could be used as a surrogate for dilution. The comparisons also indicated that there were no sources of nitrogen over and above a base background contribution entering the river between the sewage treatment plant and Falls Road. Comparison with phosphorus data indicated that significant sources of phosphorus entered the river downstream from the sewage treatment plant.

At low stream flows and sewage discharges during sample collection in 2011, chloride concentrations at all locations were very low.

Chloride Concentrations in the LaPlatte River - 2011				
Sampling Location	6/1/2011	7/13/2011	8/3/2011	10/26/2011
Falls Road	10	20	24	14
Carpenter Road	10.3	20.5	24.7	14.8
Downstream Hinesburg STP	14	22.8	27.7	17.4

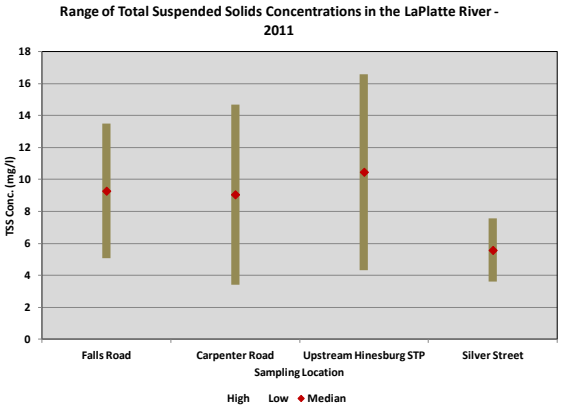
A comparison of chloride concentrations and flow was possible only on October 26, 2011 when the flow was at a low-moderate level. While chloride concentrations decreased as flow

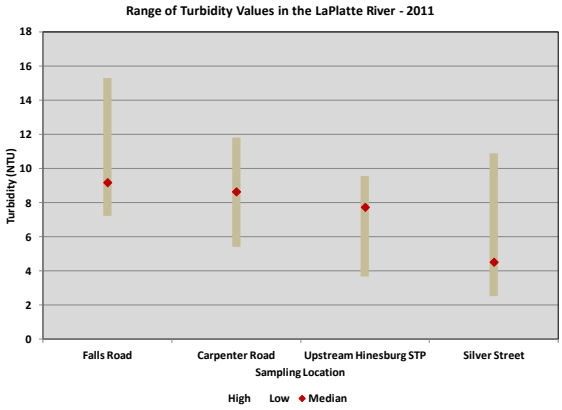


increased, the decrease was less than would be accounted for by dilution, probably because additions to the flow in the river contained background levels of chloride (typically 10-12 mg/l) approaching levels in the stream. A meaningful test of how well chloride levels reflected dilution in the river would have to include data obtained over a range of flows covering moderate and high flows.

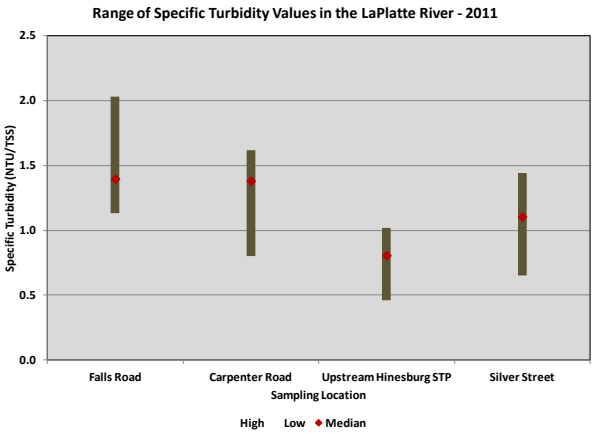
b. Suspended Sediment

Because solids levels in the LaPlatte River normally reflect stream bank erosion and mobilization of bottom sediments, and flow rates were low on the dates sampled during 2011,



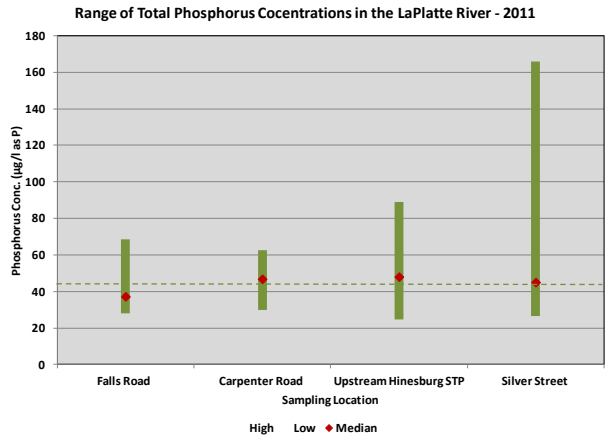


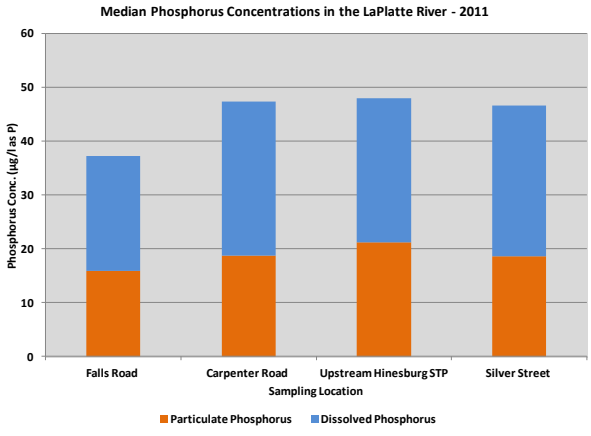
neither total suspended solids concentrations nor turbidity at the three downstream sampling locations reached high levels observed during previous years, although median solids concentrations tended to be slightly higher. Concentrations at Silver Street (LP 10) in Hinesburg were in general similar to those observed during previous years, turbidities tended to be lower. The river at this location was impounded as a result of the construction of a beaver dam downstream and there was construction at the Silver Street Bridge. These two factors would be expected to compensate each other, however, and no conclusions can be made regarding their individual effects on water quality. Differences between the patterns of total suspended solids and turbidity between the Hinesburg sewage treatment plant and Falls Road reflect increasing specific turbidity levels



c. Phosphorus

Phosphorus concentrations observed in the LaPlatte River during 2011 were in general lower than observed during previous years, but still exceeded proposed State criteria (which is <46 mg/l 90% of the time at low flows) in about





half the samples. This is consistent with the low flows on days sampled, the dominance of the dissolved phosphorus fraction, and with a general exceptionally low phosphorus burdens associated with suspended solids observed during previous years.

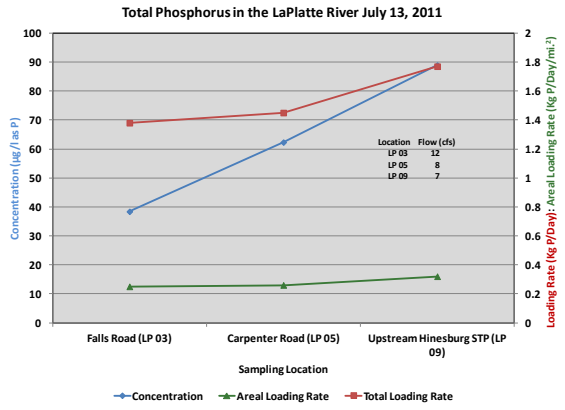
Specific Turbidity in the LaPlatte River, 2011

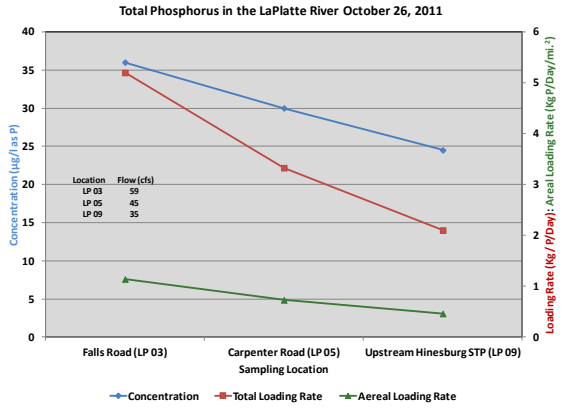
Station No.	6/1/2011	7/13/2011	8/3/2011	10/26/2011
LP 03	1.13	1.52	1.27	2.03
LP 05	0.80	1.62	1.58	1.18
LP 09	0.46	0.77	1.02	0.85
LP 10	0.65	1.44	1.24	0.97

d. Flow Measurement and Loadings

The monitoring of flow in the LaPlatte River during 2011 was limited by 1) low flows, and 2) at Silver Street (LP 10) by in inundation of the stream which at this point was located in the backwater of a beaver dam and was not free-flowing.

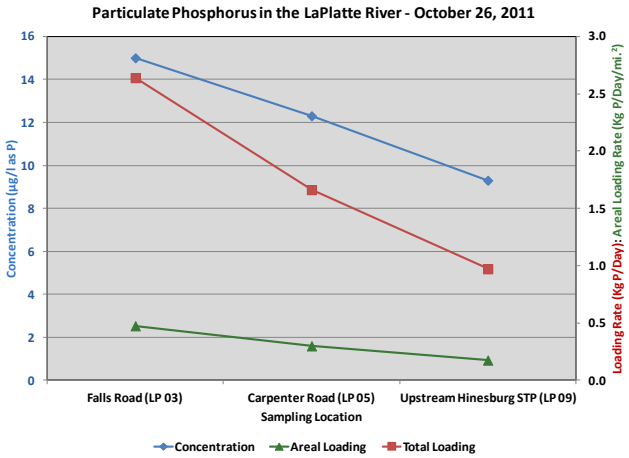
Phosphorus: Data for the all three downstream stations (LP 08, LP 05, and LP 03) were available on only two dates when flows were low and low-moderate. When flows were especially low on July 13, concentrations of total phosphorus decreased steeply downstream. Total loadings decreased less steeply as would be expected as flow increased. Loadings per square mile were low and decreased slightly downstream.



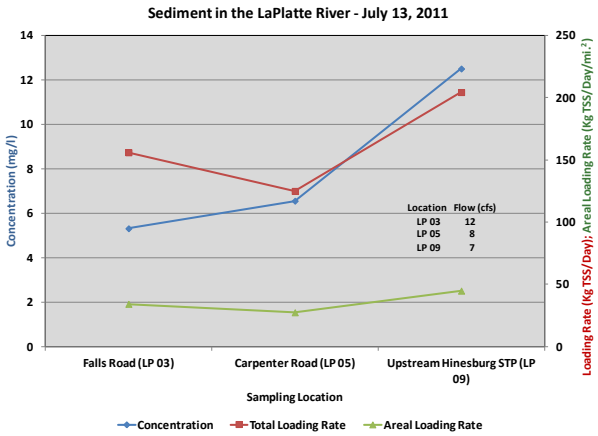


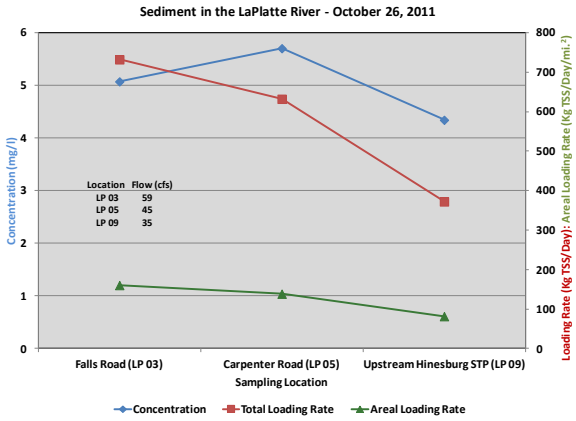
At a somewhat greater flow rate on October 26, total phosphorus concentrations increased downstream, and total loadings increased at a greater rate as would be anticipated since both flow and concentration increased. Loadings per square mile increased steadily downstream and from 1-1/2 times that at low flow at LP 09 in Hinesburg to 4-1/2 times that at low flow at LP

03 in Shelburne. Patterns of particulate phosphorus concentrations and loadings reflected those of total phosphorus.



Total Suspended Solids: Although patterns of total suspended solids concentrations differed somewhat from those of total and particulate phosphorus, loading rates, and in particular areal loading rates behave in a similar fashion as flow increased.



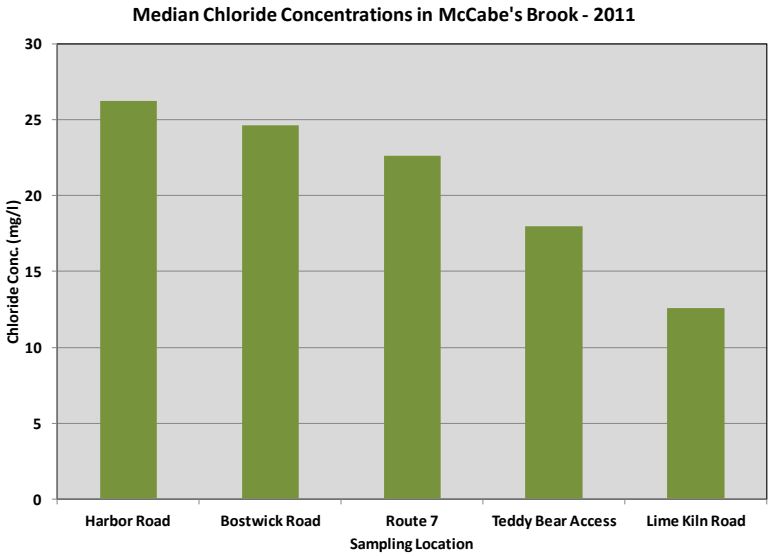


The value of these results was severely limited by the limited number of samples and the limited range of flows as real loading rates at high flows are those of most interest and greatest significance. The data suggest that flow data can be useful to understanding the relative importance of sources of sediment and nutrients, which will be useful for focusing efforts to reduce nutrient loadings to the lake, and in the long run, to assessing effectiveness of control efforts. Data at high flows is required, however, and funding should be sought to extend monitoring to include a wider range of flows.

B. McCabe's Brook

a. Chloride

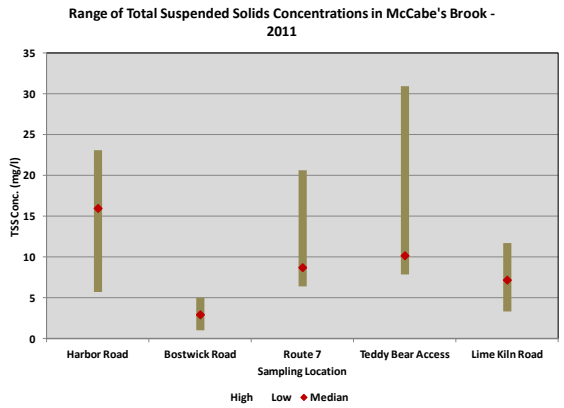
Chloride concentrations in McCabe's Brook increased steadily from Lime Kiln Road (MB 05) to Harbor Road (MB 02) as the stream received runoff from roads. This pattern is

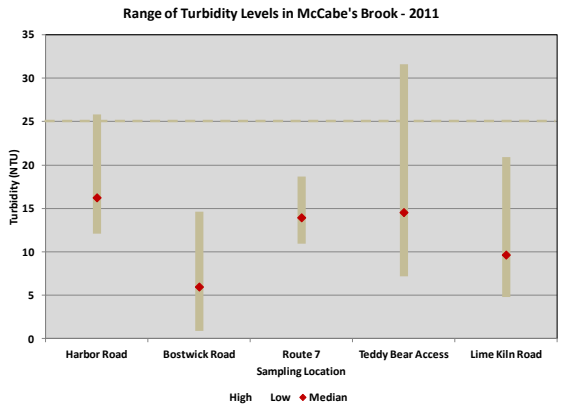


consistent with past records from McCabe's Brook and Munroe Brook in Shelburne. Chloride levels were consistently below those observed during previous years, probably as a result of the washing action of heavy spring rains and runoff

b. Suspended sediment

The general levels and patterns of suspended sediment in McCabe's Brook, as reflected in concentrations of total suspended solids and turbidity, resembled those observed during

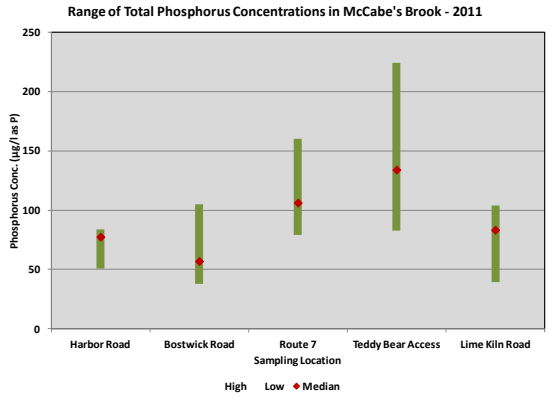


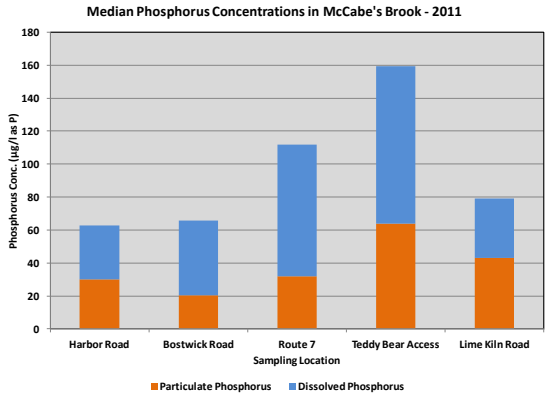


previous years. High levels observed did not reach those observed at downstream locations during previous years. Turbidity levels exceeded State Standards for warm water streams in only two samples. Concentrations increased between Lime Kiln Road and the Vermont Teddy Bear access road, reflecting impacts of agricultural land draining to this section of the stream.

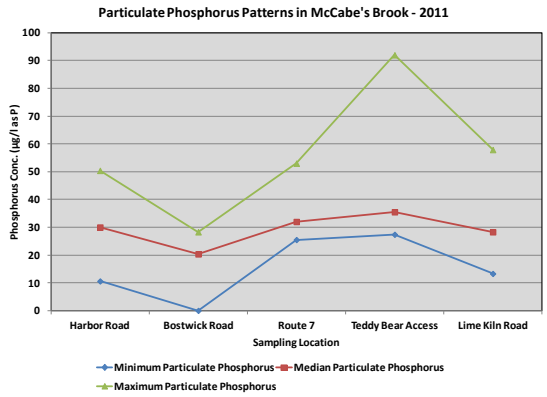
c. Phosphorus

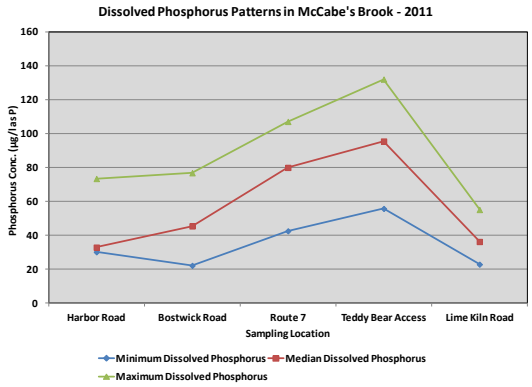
In general, the pattern of total phosphorus concentrations in McCabe's Brook during 2011 resembled those observed in previous years during which agricultural fields draining into





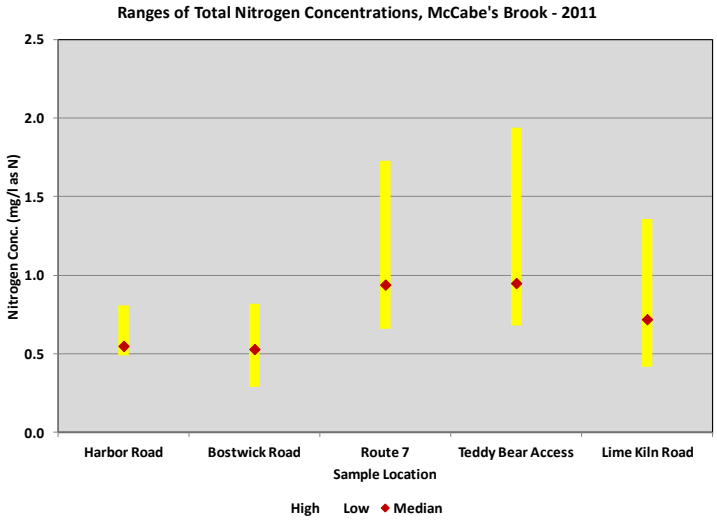
the section of the stream between Lime Kiln Road and the Vermont Teddy Bear access road were cultivated. Total Phosphorus concentrations increased between these two locations reflecting impact of the agricultural draining into this reach of the stream. Concentrations decreased to Bostwick Road as a result of dilution and filtration through upstream sands and gravels. Concentrations tended to increase again between Bostwick Road and Harbor Road as the stream flowed through the School Street neighborhood. It is noted that the increase in phosphorus concentration between Lime Kiln Road and the Teddy Bear access road was in primarily a result of an increase in the dissolved phosphorus which became the dominant fraction as the stream flowed downstream to Harbor Road. In contrast, increases between Bostwick and Harbor Roads were caused by increases in particulate phosphorus concentrations. This is illustrated also in the following graphs:





d. Nitrogen

Total nitrogen concentrations, like those of phosphorus, increased between Lime Kiln Road and the Vermont Teddy Bear access road, decreasing downstream from Route 7 as a result of dilution.



Increases between Lime kiln Road and Vermont Teddy Bear were in general higher than during previous years, but consistent with agricultural use of land draining to this section of the stream and concentrations of phosphorus.

e. Flow Measurement and Loadings

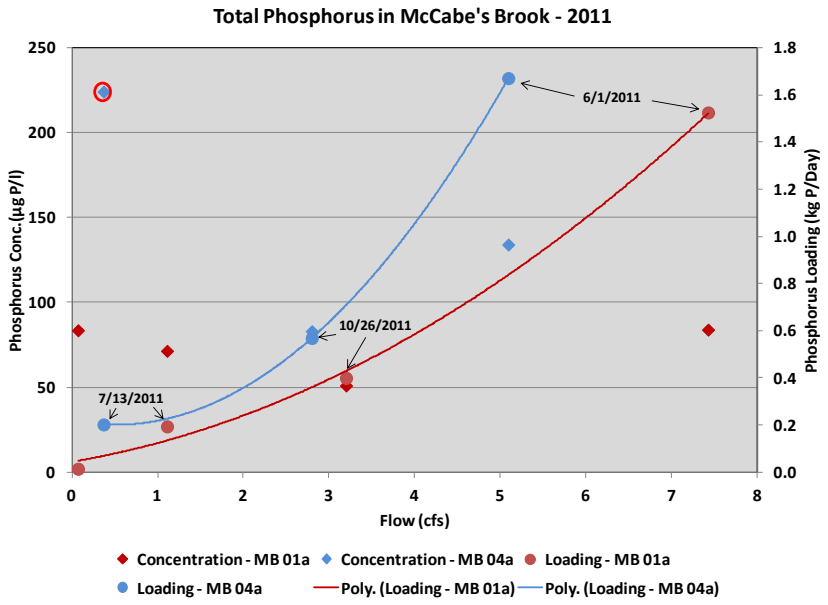
The monitoring of water quality in McCabe's Brook during 2011 was limited, as in the LaPlatte River, by spring flooding, hurricane Irene which caused further flooding and resulted in closure of the LaRosa Laboratory, and extremely low flows on scheduled sampling dates. However, while water quality analyses were therefore limited, and failed to add to an understanding of water quality during the important high flow periods, flow data available for the summer did add to an understanding of nutrient sources and loadings in this small and

complex direct-to-lake sub-watershed, and demonstrated the importance of extending flow monitoring to provide a data base including more high flow data.

Flow was measured for a second year at staff gages upstream from the Vermont Teddy Bear access road (MB 04a) and downstream from Harbor Road at MB 01a, and nutrient and sediment loadings were determined.

Flows measured in 2011 varied from extremely low to low-moderate, and failed to reach the highest flow observed in 2010 (14.44 cfs at MB 01a, itself far below the highest flow recorded during calibration, 46.3 cfs). On August 3, 2011, there was no flow at Vermont Teddy Bear, and very low flow at Harbor Road. It is of note that there was no discharge from the culvert at Bostwick Road (MB 03), and the low temperature in the stream below the culvert indicated that the stream was being fed from groundwater (16.2ºC compared to 20ºC at Vermont Teddy Bear). This has been observed during previous years as well when there was no flow through the culvert.

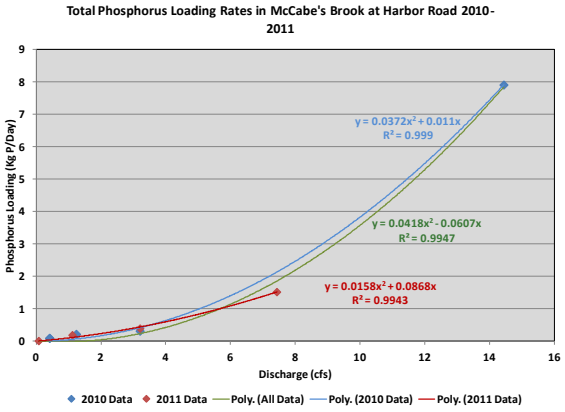
Loadings of total nitrogen, of total, particulate, and dissolved phosphorus, and of total suspended solids were determined (see attachment E). Of particular interest were decreases in the nitrogen and phosphorus loadings at Vermont Teddy Bear and Harbor Road. A probable explanation lies

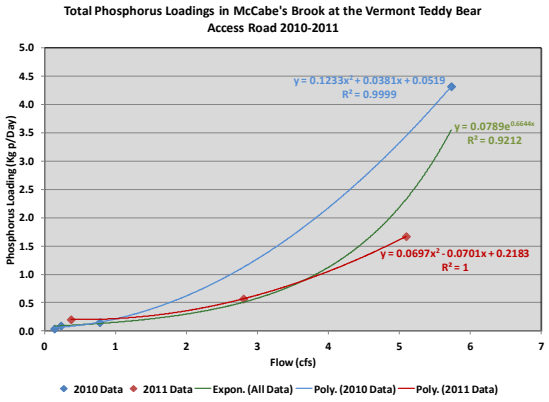


in filtration of stream water which flows through sand a gravel upstream from Bostwick Road. At higher flows, the filtration effect would be less as surface flow would exceed subsurface flow (as suggested by nutrient concentrations which remain high at downstream locations at high flows).

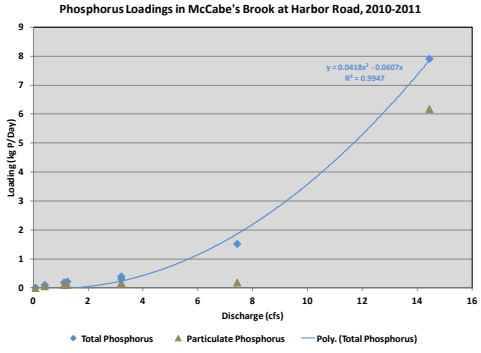
While on the one hand more data over a wider range of flow measurements are needed to assess the value of these data, the initial data available in the low to moderate range suggest that at low to moderate flow rates:

- Total phosphorus loadings at Vermont Teddy Bear tend to exceed loadings downstream at Harbor Road (see discussion above). Total phosphorus concentrations are not a good indicator of phosphorus loadings transported by McCabe's Brook. Total, particulate, and dissolved phosphorus loadings in particular appear to be related primarily to flow rate.
- At Harbor Road, the relation of phosphorus to flow appeared to be relatively consistent from year to year.

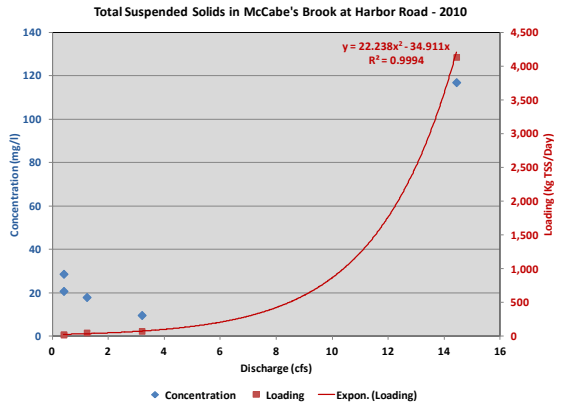


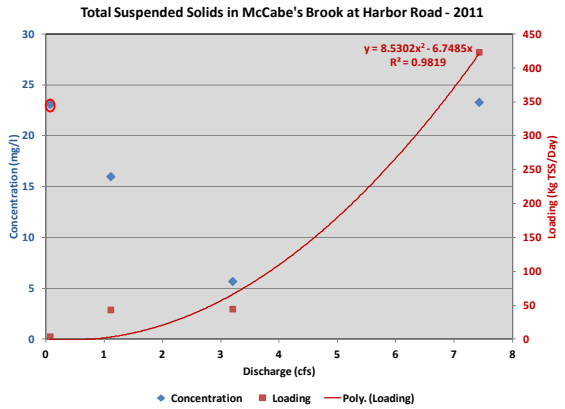


- At the Teddy Bear access road, although the relation between phosphorus loadings appeared to be consistent within a single year, it may differ from year to year. The variation from year to year might be anticipated in view of land management practices which may vary from year to year, and spring flow history which varied substantially from 2010 to 2011.
- Particulate phosphorus loading rates remained low comprising a small fraction of the total phosphorus loading rates below about 8 cfs, while at the higher 14.44 cfs flow rate, the particulate phosphorus loading rate increased to constitute a major proportion of the total phosphorus loading, suggesting that there is a critical flow above which sediment is brought into suspension as suggested in earlier reports on larger watersheds.



Of interest during the 2011 monitoring season was the lack of a consistent relation between particulate phosphorus and total suspended solids concentrations and loadings.





Furthermore, in contrast to observations of total and particulate phosphorus, sediment loads were higher at Harbor Road than at the Vermont Teddy Bear access road. At the same time, and consistent with observations of phosphorus loadings, total suspended solids concentrations did not always correlate well with flow rate, while in contrast, loadings correlated well with flow rates.

III. CONCLUSIONS and RECOMMENDATIONS

Results of water quality monitoring in 2011 were limited by both the number of samples, and range of flow conditions and concentrations, and conclusions, and well as re commendations are those elucidated in previous reports. Of importance are observations of loadings related to flow.

Monitoring of Flow

Results of flow monitoring improved following further training of samplers and constitute a useful adjunct to water quality data. On the other hand, flow measurement using staff gages was subject to certain limitations and constraints. These included:

- A beaver dam caused back-up of the LaPlatte River at one location (Silver Street) making measurement of flow at that location impossible.
- Suitable locations for gages are limited in McCabe's Brook. But flow data, together with geomorphology, enhanced interpretation of water quality data in this sub-watershed and enhance understanding of the importance of low gradient near-lake watersheds discharging to Lake Champlain and its bays.

- The cost of site selection, initial installation, and calibration of staff gages was about $1,165 per gage, and cost of gages $40 apiece.
- Staff gages require maintenance with associated costs. One staff gage (of five) over the winter. All require checking, and resetting if they have been disturbed by high flows and ice, at the start of the new sampling season. The cost of checking staff gages was $ 500, and the cost of a staff gage was $40.
- Inability to install staff gages to record low flows at certain locations.

Over the long run, to be useful for analyzing trends and impacts of measures taken to reduce nutrient loadings on Lake Champlain, measurements at high flows will be useful, and even required. Flow data for McCabe's Brook have enhanced our understanding of factors influencing water quality in this complex stream, and have provided insight into loadings from direct-to-lake small watersheds, but measurements must be extended to a higher range of flows. Furthermore, monitoring should be continued to provide a base for assessing impacts of efforts to reduce loadings at hot spots in this watershed. Data obtained at the USGS gage located on the LaPlatte River at Falls Road may be sufficient to assess trends within the LaPlatte watershed upstream from the backwater from Lake Champlain and its confluence with McCabe's Brook, but measurements at sentinel stations may be important to assess the effectiveness of measures undertaken to reduce nutrient loadings within the watershed.

Recommendations

It is recommended that funds be sought for monitoring of flow rates be continued for at least 1 to 2 years in order to:

1) extend data over a greater range of flows, including high flows,
2) record daily staff gage readings to document the range and extent of high flows,
3) establish the consistency of the relationship between loadings and flow rates, and
4) assess the value of this relationship, and more specifically monitoring of flow, as a tool for estimating nutrient loadings from small direct-to-lake watersheds.

IV. ATTACHMENTS

A. Sampling Stations

Sampling Locations – LaPlatte River, 2011

Site Location	Site Latitude	Site Longitude	Parameter						
			Flow	Temp.	Chloride	TSS	Turbidity	Total P	Diss. P
LP 03 - LaPlatte River at Falls Road	44.37022	-73.21577	X	X	X	X	X	X	X
LP 05 - LaPlatte River at Carpenter Road	44.34176	-73.18383	X	X	X	X	X	X	X
LP 08 - LaPlatte River below Hinesburg STP Outfall	44.33887	-73.14931			X				
LP 09 - LaPlatte River above Hinesburg STP Outfall	44.33395	-73.12598	X	X		X	X	X	X
LP 10 - LaPlatte River at Silver Street	44.32524	-73.11015	X	X		X	X	X	X

Sampling Locations – McCabe's Brook, 2011

Site Location	Site Latitude	Site Longitude	Parameter								
			Flow	Temp.	TSS	Turbidity	Chloride	Total P	Diss. P	Total N	NOx
MB02 - McCabes Brook at Harbor Road	44.38305	-73.23853	X	X	X	X	X	X	X	X	X
MB03 - McCabes Brook at Bostwick Road	44.36892	-73.23586		X	X	X	X	X	X	X	X
MB04 - McCabes Brook at Route 7	44.36230	-73.23461		X	X	X	X	X	X	X	X
MB04a - McCabes Brook at Teddy Bear Access Road	44.36086	-73.23405	X	X	X	X	X	X	X	X	X
MB05 - McCabes Brook at Lime Kiln Road	44.34582	-73.22868		X	X	X	X	X	X	X	X

B. Water Quality Data

Chloride Concentrations in the LaPlatte River - 2011

Sampling Location	6/1/2011	7/13/2011	8/3/2011	10/26/2011	Median	Minimum	Maximum
Falls Road	10	20	24	14	17	10	24
Carpenter Road	10.3	20.5	24.7	14.8	17.65	10.3	24.7
Downstream Hinesburg STP	14	22.8	27.7	17.4	20.1	14	27.7

Solids Concentrations in the LaPlatte River - 2011

	Station No.	6/1/2011	7/13/2011	8/3/2011	10/26/2011	Median	Minimum	Maximum
TSS	LP 03	13.5	5.31	5.68	5.07	5.495	5.07	13.5
	LP 05	14.7	6.55	3.42	5.7	6.125	3.42	14.7
	LP 09	16.6	12.5	7.69	4.34	10.095	4.34	16.6
	LP 10	3.89	7.56	4.49	3.6	4.19	3.6	7.56
Turbidity	LP 03	15.3	8.08	7.22	10.3	9.19	7.22	15.3
	LP 05	11.8	10.6	5.42	6.7	8.65	5.42	11.8
	LP 09	7.66	9.57	7.83	3.68	7.745	3.68	9.57
	LP 10	2.53	10.9	5.57	3.49	4.53	2.53	10.9
Specific	LP 03	1.13	1.52	1.27	2.03	1.40	1.13	2.03
Turbidity	LP 05	0.80	1.62	1.58	1.18	1.38	0.80	1.62
	LP 09	0.46	0.77	1.02	0.85	0.81	0.46	1.02
	LP 10	0.65	1.44	1.24	0.97	1.10	0.65	1.44

Phosphorus Concentrations in the LaPlatte River - 2011

	Station No.	6/1/2011	7/13/2011	8/3/2011	10/26/2011	Median	Minimum	Maximum
TP	LP 03	68.5	38.4	27.9	36	37.2	27.9	68.5
	LP 05	62.6	62.3	31.3	30	46.8	30	62.6
	LP 09	49.4	88.9	46.6	24.5	48	24.5	88.9
	LP 10	39.2	166	50.8	26.4	45	26.4	166
PP	LP 03	23.6	16.9	12.2	15	15.95	12.2	23.6
	LP 05	27.2	25.2	9.5	12.3	18.75	9.5	27.2
	LP 09	19.9	35.2	22.6	9.3	21.25	9.3	35.2
	LP 10	6.3	79.6	27.7	9.6	18.65	6.3	79.6
DP	LP 03	44.9	21.5	15.7	21	21.25	15.7	44.9
	LP 05	35.4	37.1	21.8	17.7	28.6	17.7	37.1
	LP 09	29.5	53.7	24	15.2	26.75	15.2	53.7
	LP 10	32.9	86.4	23.1	16.8	28	16.8	86.4
% DP	LP 03	65.55	55.99	56.27	58.33	57.30	55.99	65.55
	LP 05	56.55	59.55	69.65	59.00	59.28	56.55	69.65
	LP 09	59.72	60.40	51.50	62.04	60.06	51.50	62.04
	LP 10	83.93	52.05	45.47	63.64	57.84	45.47	83.93
TSS	LP 03	13.5	5.31	5.68	5.07	5.50	5.07	13.5
	LP 05	14.7	6.55	3.42	5.7	6.13	3.42	14.7
	LP 09	16.6	12.5	7.69	4.34	10.10	4.34	16.6
	LP 10	3.89	7.56	4.49	3.6	4.19	3.6	7.56
PP/TSS	LP 03	1.75	3.18	2.15	2.96	2.55	1.75	3.18
	LP 05	1.85	3.85	2.78	2.16	2.47	1.85	3.85
	LP 09	1.20	2.82	2.94	2.14	2.48	1.20	2.94
	LP 10	1.62	10.53	6.17	2.67	4.42	1.62	10.53

Chloride Concentrations in McCabe's Brook - 2011

Station No.	6/1/2011	7/13/2011	8/3/2011	10/26/2011	Median	Minimum	Maximum
MB 02	14.8	31.5	35.4	21	26.25	14.8	35.4
MB 03	12.4	30.3	36.4	19	24.65	12.4	36.4
MB 04	11.2	27.1	55.9	18.2	22.65	11.2	55.9
MB 04a	9.94	18.7	35.8	17.3	18	9.94	35.8
MB 05	8.09	9.92	52.2	15.2	12.56	8.09	52.2

Solids Concentrations in McCabe's Brook - 2011

Parameter	Station No.	06/01/11	07/13/11	8/3/2011*	10/26/11	Median	Minimum	Maximum
TSS	MB 02		16.00	23.1	5.7	16	5.7	23.1
	MB 03	5	1.52	1**	4.4	2.96	1	5
	MB 04	8.48	20.60	6.43	9	8.74	6.43	20.6
	MB 04a	7.87	30.90	11.8	8.6	10.2	7.87	30.9
	MB 05	7.21	11.70	***	3.3	7.21	3.3	11.70
Turbidity	MB 02	13.4	19.1	25.8	12.1	16.25	12.1	25.8
	MB 03	9.68	2.28	0.93**	14.6	5.98	0.93	14.6
	MB 04	11.9	18.7	10.9	16	13.95	10.9	18.7
	MB 04a	11.8	31.6	7.21	17.3	14.55	7.21	31.6
	MB 05	9.66	20.9	***	4.82	9.66	4.82	20.9
Specific	MB 02		1.19	1.12	2.12	1.19	1.12	2.12
Turbidity	MB 03	1.94	1.50	0.93	3.32	1.72	0.93	3.32
	MB 04	1.40	0.91	1.70	1.78	1.55	0.91	1.78
	MB 04a	1.50	1.02	0.61	2.01	1.26	0.61	2.01
	MB 05	1.34	1.79	***	1.46	1.46	1.34	1.79
PP	MB 02	10.6	39	50.4	21	30	10.6	50.4
	MB 03	28.3	-1.5	15.9	24.8	20.35	-1.5	28.3
	MB 04	26	53	38	25.5	32	25.5	53
	MB 04a	35.5	92	***	27.4	35.5	27.4	92
	MB 05	28.3	57.9	***	13.3	28.3	13.3	57.9
PP/TSS	MB 02		2.44	2.18	3.68	2.44	2.18	3.68
	MB 03	5.66	-0.99	15.90	5.64	5.65	-0.99	15.90
	MB 04	3.07	2.57	5.91	2.83	2.95	2.57	5.91
	MB 04a	4.51	2.98	11.84****	3.19	3.19	2.98	4.51
	MB 05	3.93	4.95	2.30****	4.03	4.03	3.93	4.95

*Extreme low flow

**No flow from upstream

***Values apparently affected by disturbed bottom sediments

****Based on solids and particulate phosphorus data apparently affected by disturbed bottom sediments

Phosphorus Concentrations in McCabe's Brook - 2011

	Station No.	6/1/2011	7/13/2011	8/3/2011*	10/26/2011	Median	Minimum	Maximum
TP	MB 02	83.9	71.4	83.5	51	77.45	51	83.9
	MB 03	105	45.3	37.9	68.6	56.95	37.9	105
	MB 04	132	160	80.4	79.2	106.2	79.2	160
	MB 04a	134	224	***	83	134	83	224
	MB 05	83.3	104	***	39.4	83.3	39.4	104
PP	MB 02	10.6	39	50.4	21	30	10.6	50.4
	MB 03	28.3	-1.5	15.9	24.8	20.35	0	28.3
	MB 04	26	53	38	25.5	32	25.5	53
	MB 04a	35.5	92	***	27.4	35.5	27.4	92
	MB 05	28.3	57.9	***	13.3	28.3	13.3	57.9
DP	MB 02	73.3	32.4	33.1	30	32.75	30	73.3
	MB 03	76.7	46.8	22	43.8	45.3	22	76.7
	MB 04	106	107	42.4	53.7	79.85	42.4	107
	MB 04a	98.5	132	92.3	55.6	95.4	55.6	132
	MB 05	55	46.1	22.7	26.1	36.1	22.7	55
% DP	MB 02	87.37	45.38	39.64	58.82	52.10	39.64	87.37
	MB 03	73.05	103.31	58.05	63.85	68.45	58.05	103.31
	MB 04	80.30	66.88	52.74	67.80	67.34	52.74	80.30
	MB 04a	73.51	58.93	***	66.99	66.99	58.93	73.51
	MB 05	66.03	44.33	***	66.24	66.03	44.33	66.24
TSS	MB 02		16.00	23.1	5.7	16	5.7	23.1
	MB 03	5	1.52	1**	4.4	2.96	1	5
	MB 04	8.48	20.60	6.43	9	8.74	6.43	20.6
	MB 04a	7.87	30.90	11.8	8.6	10.2	7.87	30.9
	MB 05	7.21	11.70	***	3.3	7.21	3.3	11.70
PP/TSS	MB 02		2.44	2.18	3.68	2.44	2.18	3.68
	MB 03	5.66	-0.99	15.90	5.64	5.65	-0.99	15.90
	MB 04	3.07	2.57	5.91	2.83	2.95	2.57	5.91
	MB 04a	4.51	2.98	11.84****	3.19	3.19	2.98	4.51
	MB 05	3.93	4.95	2.30****	4.03	4.03	3.93	4.95

*Extreme low flow
**No flow from upstream

***Values apparently affected by disturbed bottom sediments

****Based on solids and particulate phosphorus data apparently affected by disturbed bottom sediments

Nitrogen Concentrations in McCabe's Brook - 2011

	Station No.	6/1/2011	7/13/2011	8/3/2011	10/26/2011	Median	Minimum	Maximum
TN	MB 02	0.81	0.49	0.55	0.49	0.55	0.49	0.81
	MB 03	0.82	0.53	0.29	0.61	0.53	0.29	0.82
	MB 04	0.94	1.73	0.69	0.66	0.94	0.66	1.73
	MB 04a	0.95	1.94	0.95	0.68	0.95	0.68	1.94
	MB 05	0.65	0.72	1.36	0.42	0.72	0.42	1.36
Nox	MB 02	0.09	0.06	<0.05	0.06	0.06	<.05	0.09
	MB 03	0.08	0.11	0.09	0.09	0.01	0.08	0.11
	MB 04	0.07	0.75	<0.05	0.08	0.08	<.05	0.75
	MB 04a	< 0.05	0.66	<0.05	0.07	0.33	<.05	0.66
	MB 05	< 0.05	<0.05	0.11	<0.05	<.05	<.05	0.11
TN-Nox	MB 02	0.72	0.43	.55*	0.43	0.49	0.43	0.72
	MB 03	0.74	0.42	0.2	0.52	0.47	0.2	0.74
	MB 04	0.87	0.98	.69*	0.58	0.78	0.58	0.98
	MB 04a	.95*	1.28	.95*	0.61	0.95	0.61	0.95
	MB 05	.65*	.72*	1.25	.42*	0.69	0.42	1.25

*TN

C. Quality Assurance

Completeness of Sampling and Field Duplicates

	No. of Stations	Date	No. of Stations Sampled	Chloride	Turbidity	TSS	Total P	Diss. P	Total N	NOx
No. Scheduled	63			56	63	63	63	63	35	35
	9	**5/5/2010**	0	0	0	0	0	0	0	0
	9	**6/1/2010**	9	8	9	9	9	9	5	5
	9	**7/13/2010**	9	8	9	9	9	9	5	5
	9	**8/3/2010**	9	8	9	9	9	9	5	5
	9	**9/7/2010**	0	0	0	0	0	0	0	0
	9	**10/26/2010**	9	8	9	9	9	9	5	5
	9	**11/2/2010**	0	0	0	0	0	0	0	0
Total No. of Stations	63		36	32	36	36	36	36	20	20
Percent				57.14	57.14	57.14	57.14	57.14	57.14	57.14
Target Percent				≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%
Number of Duplicates				12	12	12	12	12	4	4
Percent of Total				37.5	33.3	33.3	33.3	33.3	20.0	20.0
Target Percent				10%	10%	10%	10%	10%	10%	10%

Sampling was not possible in May, September, and early October as a result of spring flooding and hurricane Irene (flooding and closure of laboratory), respectively. Samples were taken on October 26, 2011 as a compromise between scheduled October and November samples.

A review of data resulted in the rejection of three total suspended solids results, one turbidity result, and two total phosphorus results for McCabe's Brook as follows:

Sampling Location	Date	Parameters
MB 02	6/1/2011	TSS
MB 04a	8/3/2011	TP
MB 05	8/3/2011	TSS, Turbidity,TP
MB 05 DUP	10/26/2011	TSS

Rejection of these results was based on inconsistency with related results, and may be attributed to disturbing of bottom sediment during sampling at extreme low flow conditions resulting in high solids and particulate phosphorus concentrations.

Summary of Percent Differences

Parameter	Target Precision	Mean RPD
Chloride	10%	1.41
Turbidity	15%	5.54
TSS*	15%	17.01
Total P	15%	3.61
Diss. P	15%	3.43
Total N	15%	4.43
NOx	10%	9.55

*Includes 2 sample-duplicate pairs one of member of which was rejected

D. Flow Measurements

LaPlatte River Flow Measurements - 2011

Sampling Location	Flow (cfs) 6/1/2011	7/13/2011	8/3/2011	10/26/2011
Falls Road	172	12	3	59
Carpenter Road	-	8	-	45
Downstream Hinesburg STP	-	7	1	35

McCabe's Brook Flow Measurements - 2011

Sampling Location	Flow (cfs) 6/1/2011	7/13/2011	8/3/2011	10/26/2011
MB 01a	7.43	1.11	0.07	3.20
MB 04a	5.09	0.37	-	2.80

E. Loading Rates - 2011

Nutrient and Total Suspended Solids Loadings in the LaPlatte River, 2011

Date	Sampling Station	Flow (cfs)	Flow (Subjective)	Total Phosphorus			Particulate Phosphorus			Dissolved Phosphorus			Total Suspended Solids		
				Conc. (mg/l)	Load (Kg/day)	Areal Load (kg/day/mi2)	Conc. (mg/l)	Load (Kg/day)	Areal Load (kg/day/mi2)	Conc. (mg/l)	Load (Kg/day)	Areal Load (kg/day/mi2)	Conc. (mg/l)	Load (Kg/day)	Areal Load (kg/day/mi2)
6/1/2011	LP 03	172	high mod	0.07	28.83	6.31	0.02	9.93	2.17	0.04	18.90	4.13	5.07	5681.58	1243.23
	LP 05	-		0.06						0.04			5.7		
	LP 09	-		0.05						0.03			4.34		
7/13/2011	LP 03	12	low	0.04	1.13	0.25	0.02	0.50	0.11	0.02	0.63	0.14	5.31	155.91	34.12
	LP 05	8		0.06	1.19	0.26	0.03	0.48	0.11	0.04	0.71	0.15	6.55	124.85	27.32
	LP 09	7		0.09	1.45	0.32	0.04	0.58	0.13	0.05	0.88	0.19	12.5	204.31	44.71
8/3/2011	LP 03	3	very low	0.03	0.23	0.05	0.01	0.10	0.02	0.02	0.13	0.03	5.68	45.86	10.04
	LP 05	-		0.03			0.01			0.02			3.42		
	LP 09	1		0.05	0.12	0.03	0.02	0.06	0.01	0.02	0.06	0.01	7.69	20.13	4.41
10/26/2011	LP 03	59	low-mod	0.04	5.20	1.14	0.02	2.17	0.47	0.02	3.03	0.66	5.07	731.93	160.16
	LP 05	45		0.03	3.33	0.73	0.01	1.36	0.30	0.02	1.96	0.43	5.7	631.94	138.28
	LP 09	35		0.02	2.10	0.46	0.01	0.80	0.17	0.02	1.30	0.29	4.34	371.99	81.40

Nutrient and Total Suspended Solids Loadings in McCabe's Brook, 2011

Date	Sampling Station	Flow (cfs)	Flow (Subjective)	Total Nitrogen			Total Phosphorus			Particulate Phosphorus			Dissolved Phosphorus			Total Susp. Solids		
				Conc. (mg/l)	Load (Kg/day)	Areal Load (kg/day/mi2)	Conc. (mg/l)	Load (Kg/day)	Areal Load (kg/day/mi2)	Conc. (mg/l)	Load (Kg/day)	Areal Load (kg/day/mi2)	Conc. (mg/l)	Load (Kg/day)	Areal Load (kg/day/mi2)	Conc. (mg/l)	Load (Kg/day)	Areal Load (kg/day/mi2)
6/1/2011	MB 01a	7.43	high-mod	0.81	14.72	3.22	0.08	1.52	0.33	0.01	0.19	0.04	0.07	1.33	0.29	-		
	MB 04a	5.09		0.95	11.84	3.78	0.13	1.67	0.53	0.04	0.44	0.14	0.10	1.23	0.39	7.87	98.09	31.34
7/13/2011	MB 01a	1.11	low	0.49	1.33	0.29	0.07	0.19	0.04	0.04	0.11	0.02	0.03	0.09	0.02	16	43.45	9.51
	MB 04a	0.37		1.94	1.75	0.56	0.22	0.20	0.06	0.09	0.08	0.03	0.13	0.12	0.04	1.52	1.37	0.44
8/3/2011	MB 01a	0.07	very low	0.55	0.09	0.02	0.08	0.01	0.00	0.05	0.01	0.00	0.03	0.01	0.00	23.1	3.96	0.87
	MB 04a	-		0.95	-	-	0.23	-	-	0.14	-	-	0.09	-	-	1	-	-
10/26/2011	MB 01a	3.20	low-mod	0.49	3.84	0.84	0.05	0.40	0.09	0.02	0.16	0.04	0.03	0.23	0.05	5.7	44.63	9.77
	MB 04a	2.80		0.68	4.66	1.49	0.08	0.57	0.18	0.03	0.19	0.06	0.06	0.38	0.12	4.4	30.15	9.63