

South Chittenden River Watch

Water Quality in Thorp, Kimball, and Holmes Brooks

2013 Summary Report

**Prepared for
VT DEC Watershed Management Division
Volunteer Water Quality Monitoring
LaRosa Analytical Services Partnerships**

**Prepared by
South Chittenden River Watch
April __, 2016**

Water quality in Thorp and Kimball Brooks has been monitored since 2008. Following initial watershed level monitoring, sampling was limited to stations located at Greenbush Road upstream from the backwater of Lake Champlain.

Water quality in Holmes Brook and its southern tributary was initiated in 2010. Sampling has been spotty during dry periods as a result of lack of flow.

Chloride

Analysis for chlorides was initiated in 2013, but samples were taken on only two dates, limiting their value as indicators of factors influencing water quality in the streams and

| Location | Date | Chloride Conc. (mg/l) |
|--|-------------|----------------------------------|
| T 01 - Thorp Brook at Greenbush Road | 5/27/2013 | 53 mg/L |
| T 01 - Thorp Brook at Greenbush Road | 10/8/2013 | 28.2 mg/L |
| K 02 - Kimball Brook at Greenbush Road | 5/27/2013 | 10.9 mg/L |
| K 02 - Kimball Brook at Greenbush Road | 10/8/2013 | 27.8 mg/L |

contributing to the wider interpretation of water quality results in the watersheds. The concentration of chloride in Thorp Brook detected on May 27 was consistent with concentrations commonly observed in streams impacted by runoff from roads during the spring., Similarly, the lower level observed on October 8 is consistent with reductions commonly observed in late summer and fall resulting from washout during summer rains.

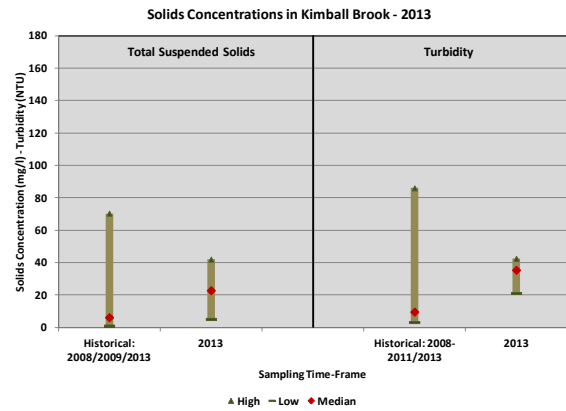
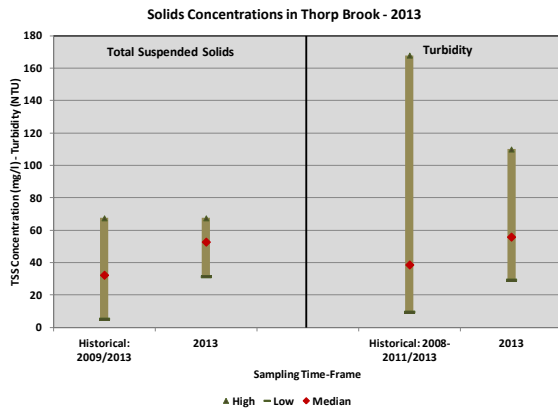
The results observed in Kimball Brook were low, on May 27 in the range of background levels, and consistent with the location of the sampling point upstream from Greenbush Road, and as a result, unaffected by road runoff containing salt.

Suspended Solids

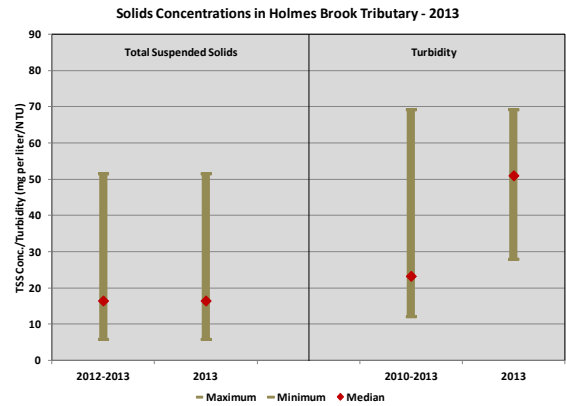
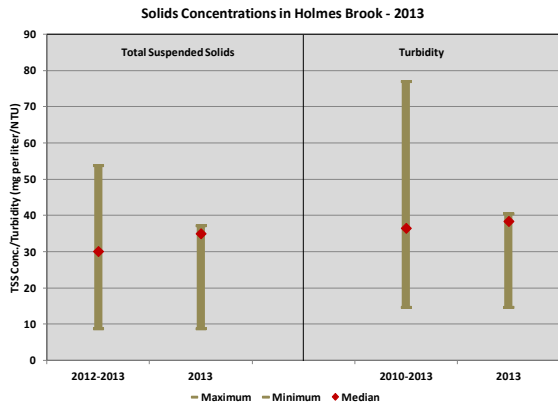
Concentrations of suspended solids observed in both Thorp and Kimball Brooks in 2013 were, on average, higher than those observed over the period of record, but fell well within the range of historical highs and lows. The increased levels of suspended sediment probably reflect higher flow rates sampled in 2013.

Concentrations in Thorp Brook were significantly higher than in Kimball Brook, reflecting the influence of road runoff transporting solids discharging to the stream. In contrast, samples from Kimball Brook are taken upstream from Greenbush Road, and were therefore not

influenced by runoff from the road, and consistent with observations of chloride discussed above.



Holmes Brook and its tributary from the south drain mainly agricultural land. As in Thorp and Kimball Brooks, however, solids levels in Holmes Brook and its main tributary (measured as turbidity) were, on average, generally higher than observed over the period of

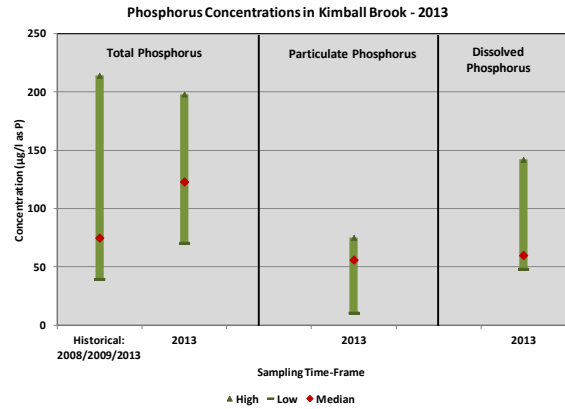
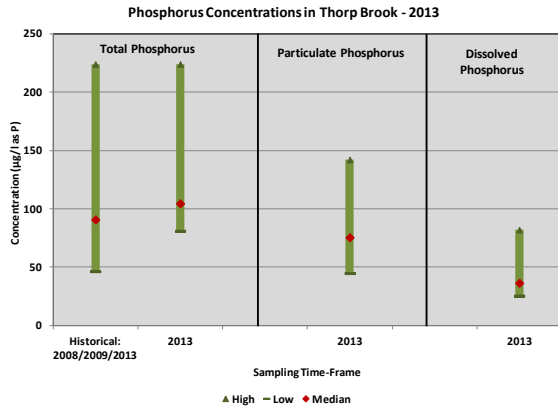


record. Although reported median turbidity levels in the southern tributary appeared to be significantly higher in 2013 than in previous years, no increase was observed from the 2012-2013 median of suspended solids concentrations. Furthermore, suspended solids in the tributary tended to be lower than in Holmes Brook itself. In general, solids concentrations appeared not to be greatly impacted by erosion or bottom scour.

Phosphorus

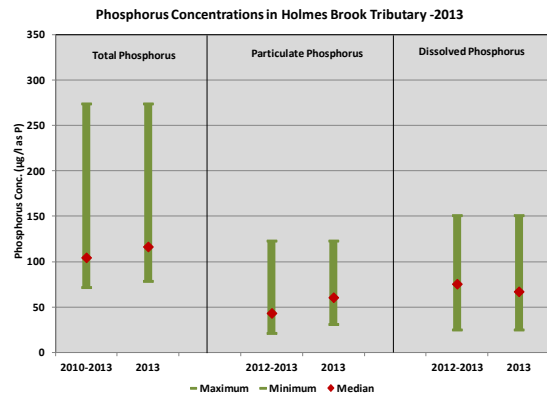
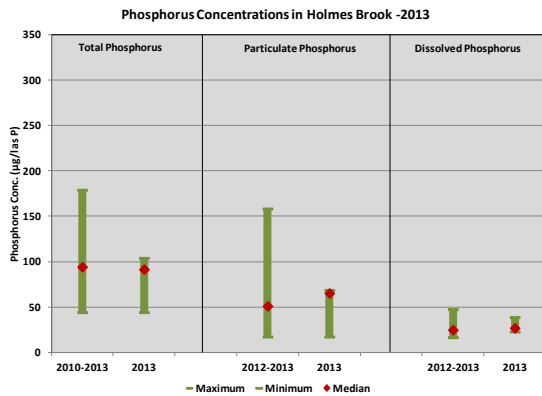
Levels of total phosphorus tended to be slightly higher in Thorp Brook than in Kimball Brook. Concentrations increased somewhat in both streams in 2013, probably in response to

higher rainfall than in earlier years. In Thorp Brook, particulate phosphorus was predominant, probably associated with solids discharged with road runoff.



In contrast, dissolved phosphorus predominated in Kimball Brook. The Kimball Brook watershed upstream from Greenbush Road is forested, and it is likely that the dissolved phosphorus leaches from decaying organic matter entering the stream with runoff.

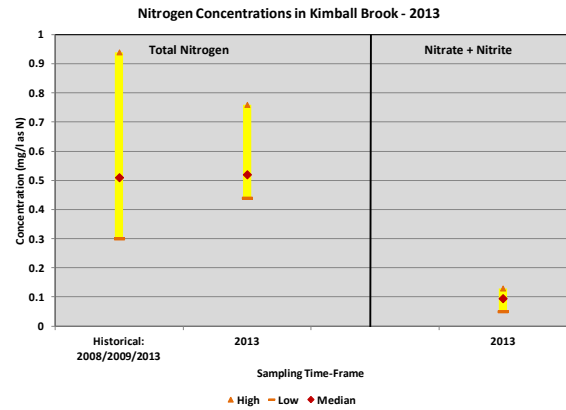
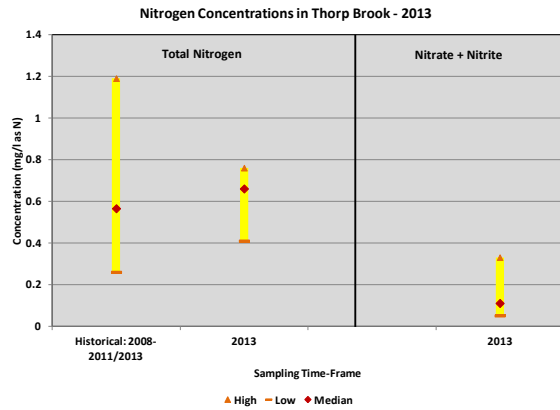
Total phosphorus levels in Holmes Brook and its southern tributary were in general not exceptional and differed little from previous years. In Holmes Brook itself, particulate



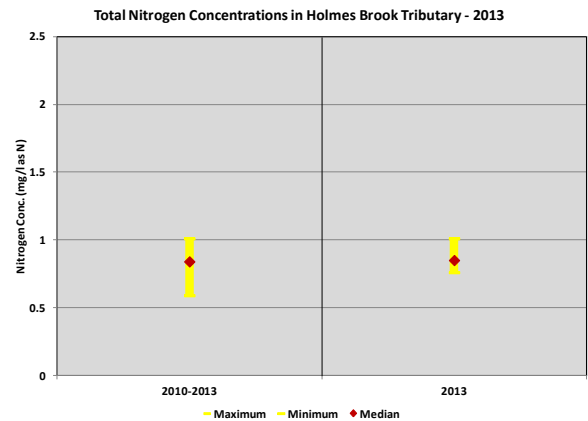
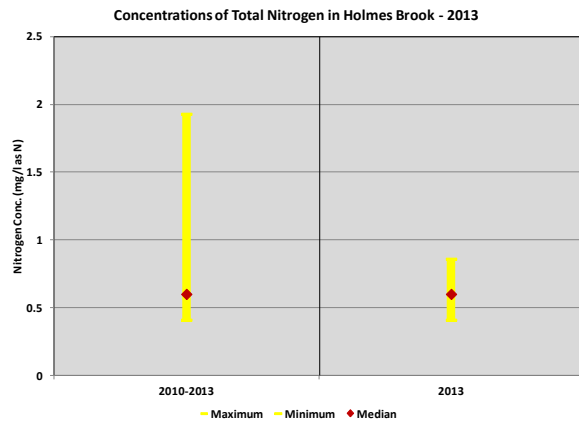
phosphorus predominated. In its southern tributary, levels of dissolved phosphorus were slightly higher than were those of particulate phosphorus, probably reflecting the history of farming in its watershed.

Nitrogen

Nitrogen concentrations in both Thorp and Kimball Brooks in 2013 were low, consistent with, and within, the range observed during previous years, and slightly higher in Thorp than in Kimball Brook.



Similarly, concentrations in Holmes Brook and its southern tributary were low, but slightly higher in the tributary stream, probably reflecting its history of agriculture. Consistent with the generally higher total nitrogen concentrations in the tributary stream were detectable, but low, levels of nitrate plus nitrite with a median value of 0.25 mg/l. This is consistent with the slightly higher phosphorus levels, and in particular, the predominance of dissolved phosphorus, reflecting the agricultural history of its watershed.



Flow and Nutrient Loading Rates

Measurement of flow in Thorp and Kimball Brooks at Greenbush Road was initiated in 2011. Nutrient and suspended solids loading rates observed in 2013 are provided in the Attachments. Insufficient data are currently available to make reliable comparisons with similar watersheds. But based on the limited Thorp and Kimball Brook phosphorus data available for

2013, loadings calculated based on watershed area suggest that they are lower than in the more intensively agricultural upper McCabe's Brook watershed.

Conclusions

Kimball Brook

- Chlorides were determined only in a spring and a fall sample
- Chloride and solids concentrations were low consistent with immediate upstream forested area
- Total phosphorus concentrations not exceptional for unpolluted area streams
- Predominance of dissolved phosphorus possibly originating from decaying organic matter. Levels were generally low
- Nitrogen concentrations were low. Nitrate plus nitrite concentrations were slightly greater than in Thorp Brook.

Thorp Brook

- Chlorides were determined only in a spring and a fall sample
- Chlorides were higher than normal background levels, suggesting influence of runoff from Greenbush Road
- Solids levels influenced by runoff from Greenbush Road, at times reaching high levels
- Phosphorus levels in general relatively low, dominated by particulate phosphorus associated with sediment carried by runoff from Greenbush Road.
- Nitrogen levels, including nitrate plus nitrite, were low.

Nutrient Loadings

- Continue flow measurement and determination of loading rates

Recommendations

General

- Initiate high flow monitoring

Kimball Brook

- Continue with current sampling plan

Thorp Brook

- Continue with current sampling plan

Holmes Brook

- In view of the frequency of lack of flow, it is recommended that monitoring of water quality be suspended unless i) there is a change to agricultural use of the watershed, and ii) high flows are targeted.

ANNEX I

Sampling Stations

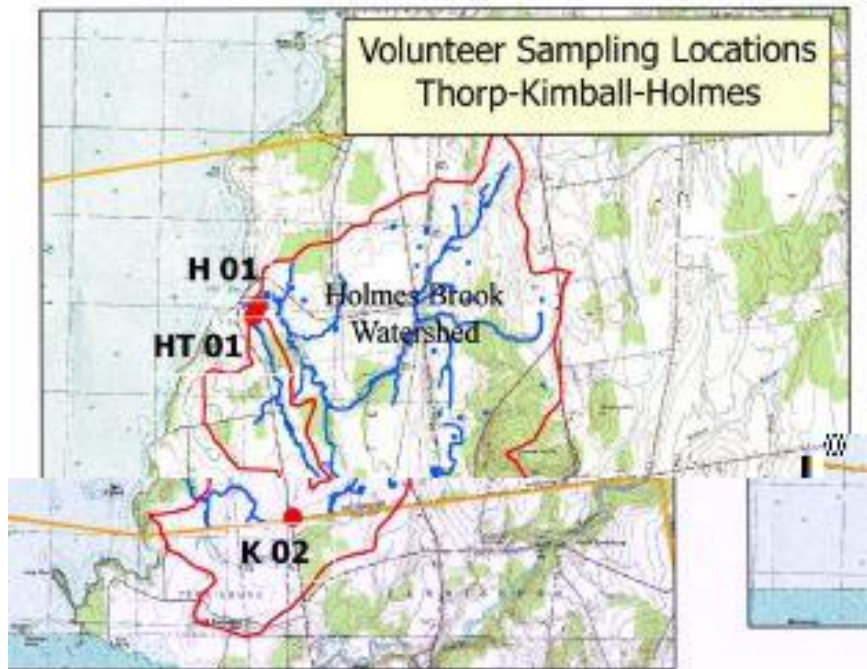
ANNEX IA

Station Descriptions

| Site ID | Site Location | Site Latitude | Site Longitude | Upstream Area (mi2) | Staff Guage |
|---------|---|---------------|----------------|---------------------|-------------|
| T 01 | T 01 - Thorp Brook at Greenbush Road | 44.273073 | -73.256597 | 2.93 | Y |
| K 02 | K 02 - Kimball Brook at Greenbush Road | 44.25836 | -73.249661 | 1.87 | Y |
| H 01 | Behind the tennis court of Charlotte Town Beach, downstream from impoundment pond on the main branch of Holmes Brook. Upstream from HT. | 44.332689 | -73.279539 | 3.84 | N |
| HT 01 | The first tributary feeding into Holmes Brook upstream from the mouth. Downstream from Mouth. | 44.331389 | -73.280556 | 1.71 | N |

ANNEX IB

Map



ANNEX II-A

Raw Data: Final – 2013

Thorp Brook Data
T 01 – Thorp Brook at Greenbush Road

Solids Concentrations in Thorp Brook - 2013

| | 5/27/2013 | 7/9/2013 | 9/3/2013 | 9/13/2013 | 10/8/2013 | Median | Low | High |
|--------------|-----------|----------|----------|-----------|-----------|--------|------|------|
| TSS | 60.2 | 33.3 | 31.4 | 52.8 | 67.5 | 52.8 | 31.4 | 67.5 |
| Turbidity | 66.8 | 33.3 | 29.4 | 55.9 | 110 | 55.9 | 29.4 | 110 |
| Sp Turbidity | 1.11 | 1.00 | 0.94 | 1.06 | 1.63 | 1.06 | 0.94 | 1.63 |

Phosphorus Concentrations in Thorp Brook - 2013

| | 5/27/2013 | 7/9/2013 | 9/3/2013 | 9/13/2013 | 10/8/2013 | Median | Low | High |
|--------|-----------|----------|----------|-----------|-----------|--------|-------|-------|
| TP | 104 | | 81 | 105 | 224 | 104.5 | 81 | 224 |
| PP | 78.6 | | 44.7 | 72.1 | 142.1 | 75.35 | 44.7 | 142.1 |
| DP | 25.4 | 50.3 | 36.3 | 32.9 | 81.9 | 36.3 | 25.4 | 81.9 |
| TSS | 60.2 | 33.3 | 31.4 | 52.8 | 67.5 | 52.8 | 31.4 | 67.5 |
| PP/TSS | 1.31 | | 1.42 | 1.37 | 2.11 | 1.39 | 1.31 | 2.11 |
| %DP | 24.42 | | 44.81 | 31.33 | 36.56 | 33.95 | 24.42 | 44.81 |

Nitrogen Concentrations in Thorp Brook - 2013

| | 5/27/2013 | 7/9/2013 | 9/3/2013 | 9/13/2013 | 10/8/2013 | Median | Low | High |
|-----|-----------|----------|----------|-----------|-----------|--------|------|------|
| TN | 0.69 | 0.66 | 0.41 | 0.51 | 0.76 | 0.66 | 0.41 | 0.76 |
| NOx | 0.33 | 0.21 | 0.05 | 0.07 | 0.11 | 0.11 | 0.05 | 0.33 |

Kimball Brook Data
K 02 – Kimball Brook at Greenbush Road

Solids Concentrations in Kimball Brook - 2013

| | 5/27/2013 | 7/9/2013 | 9/3/2013 | 9/13/2013 | 10/8/2013 | Median | Low | High |
|--------------------|-----------|----------|----------|-----------|-----------|--------|------|------|
| TSS | 36.2 | 5.11 | 22.8 | 42 | 10.2 | 22.8 | 5.11 | 42 |
| Turbidity | 42.5 | | 30.2 | 40.6 | 21.1 | 35.4 | 21.1 | 42.5 |
| Specific Turbidity | 1.17 | | 1.32 | 0.97 | 2.07 | 1.25 | 0.97 | 2.07 |

Phosphorus Concentrations in Kimball Brook - 2013

| | 5/27/2013 | 7/9/2013 | 9/3/2013 | 9/13/2013 | 10/8/2013 | Median | Low | High |
|--------|-----------|----------|----------|-----------|-----------|--------|-------|-------|
| TP | 123 | 70.4 | 96.3 | 153 | 198 | 123 | 70.4 | 198 |
| PP | 74.9 | 10.5 | 46.2 | 75.1 | 56 | 56 | 10.5 | 75.1 |
| DP | 48.1 | 59.9 | 50.1 | 77.9 | 142 | 59.9 | 48.1 | 142 |
| TSS | 36.2 | 5.11 | 22.8 | 42 | 10.2 | 22.8 | 5.11 | 42 |
| PP/TSS | 2.07 | 2.05 | 2.03 | 1.79 | 5.49 | 2.05 | 1.79 | 5.49 |
| %DP | 39.11 | 85.09 | 52.02 | 50.92 | 71.72 | 52.02 | 39.11 | 85.09 |

Nitrogen Concentrations in Kimball Brook - 2013

| | 5/27/2013 | 7/9/2013 | 9/3/2013 | 9/13/2013 | 10/8/2013 | Median | Low | High |
|-----|-----------|----------|----------|-----------|-----------|--------|-------|------|
| TN | 0.44 | 0.46 | 0.52 | 0.76 | 0.74 | 0.52 | 0.44 | 0.76 |
| NOx | 0.13 | <0.05 | 0.06 | <0.05 | <0.05 | 0.095 | <0.05 | 0.13 |

Thorp and Kimball Brooks Nutrient and Solids Loadings

Nutrient and Total Suspended Solids Loadings in Thorp Brook at Greenbush Road based on Drainage Area, 2013

| Date | Flow (cfs) | Flow Per mi ² | Total Phosphorus (kg/day/mi ²) | Particulate Phosphorus (kg/day/mi ²) | Dissolved Phosphorus (kg/day/mi ²) | Total Suspended Solids (kg/day/mi ²) |
|-----------|------------|--------------------------|--|--|--|--|
| 5/27/2013 | 9.30 | 3.17 | 0.81 | 0.61 | 0.20 | 467.41 |
| 7/9/2013 | 5.52 | 1.88 | | | 0.23 | 153.40 |
| 9/13/2013 | 3.62 | 1.24 | 0.32 | 0.22 | 0.10 | 159.74 |
| 10/8/2013 | 1.56 | 0.53 | 0.29 | 0.19 | 0.11 | 88.03 |
| 9/3/2013 | 0.76 | 0.26 | 0.05 | 0.03 | 0.02 | 19.99 |

Nutrient and Total Suspended Solids Loadings in Kimball Brook at Greenbush Road based on Drainage Area, 2013

| Date | Flow (cfs) | Flow Per mi ² | Total Phosphorus (kg/day/mi ²) | Particulate Phosphorus (kg/day/mi ²) | Dissolved Phosphorus (kg/day/mi ²) | Total Suspended Solids (kg/day/mi ²) |
|-----------|------------|--------------------------|--|--|--|--|
| 5/27/2013 | 4.39 | 2.35 | 0.71 | 0.43 | 0.28 | 207.75 |
| 7/9/2013 | 1.11 | 0.60 | 0.10 | 0.02 | 0.09 | 7.44 |
| 9/13/2013 | 0.41 | 0.22 | 0.08 | 0.04 | 0.04 | 22.78 |
| 10/8/2013 | 0.41 | 0.22 | 0.11 | 0.03 | 0.08 | 5.53 |
| 9/3/2013 | 0.10 | 0.05 | 0.01 | 0.01 | 0.01 | 2.98 |

Holmes Creek Watershed Data

Solids Concentrations in the Holmes Creek Watershed - 2013

| | | 5/27/2013 | 7/9/2013 | 9/3/2013 | 9/13/2013 | 10/8/2013 | Median | Minimum | Maximum |
|-------|---------------|-----------|----------|----------|-----------|-----------|--------|---------|---------|
| H 01 | TSS | 8.78 | 35 | No Flow | 37.2 | | 35 | 8.78 | 37.2 |
| | Turbidity | 14.7 | 40.5 | | 38.4 | 38.4 | 14.7 | 40.5 | |
| | Turbidity/TSS | 1.67 | 1.16 | | 1.03 | 1.16 | 1.03 | 1.67 | |
| H 02 | TSS | | | | | 64.3 | | | |
| | Turbidity | | | | | 68 | | | |
| | Turbidity/TSS | | | | | 1.06 | | | |
| HT 01 | TSS | 17.6 | 15.3 | No Flow | 37.2 | 51.5 | 27.4 | 15.3 | 51.5 |
| | Turbidity | 28 | | | 51 | 51 | 28 | 69.2 | |
| | Turbidity/TSS | 1.59 | | | 1.37 | 1.37 | 1.34 | 1.59 | |

Phosphorus Concentrations in the Holmes Creek Watershed - 2013

| | | 5/27/2013 | 7/9/2013 | 9/3/2013 | 9/13/2013 | 10/8/2013 | Median | Minimum | Maximum |
|-------|--------|-----------|----------|----------|-----------|-----------|--------|---------|---------|
| H 01 | TP | 44.2 | 104 | No Flow | 91.5 | | 91.5 | 44.2 | 104 |
| | PP | 17.3 | 65.2 | | 68.7 | 65.2 | 17.3 | 68.7 | |
| | DP | 26.9 | 38.8 | | 22.8 | 26.9 | 22.8 | 38.8 | |
| | TSS | 8.78 | 35 | | 37.2 | 35 | 8.78 | 37.2 | |
| | PP/TSS | 1.97 | 1.86 | | 1.85 | 1.86 | 1.85 | 1.97 | |
| H 02 | TP | | | | | 154 | | | |
| | PP | | | | | 131.2 | | | |
| | DP | | | | | 22.8 | | | |
| | TSS | | | | | 64.3 | | | |
| | PP/TSS | | | | | 2.04 | | | |
| HT 01 | TP | 78.6 | 130 | No Flow | 103 | 274 | 116.5 | 78.6 | 274 |
| | PP | 31.1 | 43.3 | | 77.9 | 60.6 | 31.1 | 123 | |
| | DP | 47.5 | 86.7 | | 25.1 | 67.1 | 25.1 | 151 | |
| | TSS | 17.6 | 15.3 | | 37.2 | 27.4 | 15.3 | 51.5 | |
| | PP/TSS | 1.77 | 2.83 | | 2.09 | 2.24 | 1.77 | 2.83 | |

Nitrogen Concentrations in the Holmes Creek Watershed - 2013

| | Station No. | 5/27/2013 | 7/9/2013 | 9/3/2013 | 9/13/2013 | 10/8/2013 | Median | Minimum | Maximum |
|-----|-------------|-----------|----------|----------|-----------|-----------|--------|---------|---------|
| TN | H 01 | 0.41 | 0.6 | No Flow | 0.86 | | 0.6 | 0.41 | 0.86 |
| | H 02 | | | | | | 0.81 | | |
| | HT 01 | 0.76 | 0.83 | | 0.87 | 1.01 | 0.85 | 0.76 | 1.01 |
| NOx | H 01 | 0.07 | <0.05 | No Flow | <0.05 | | <0.05 | <0.05 | 0.07 |
| | H 02 | | | | | | <0.05 | | |
| | HT 01 | 0.25 | 0.07 | | <0.05 | <0.05 | 0.16 | <0.05 | 0.25 |

ANNEX III-A

Quality Control Analysis - 2013

| Parameter | Station | Date | Results | | (S-D) | Absolute Value (S-D) | (S + D)/2 | RPD |
|-----------|--|-----------|---------|-------|---------|----------------------|-----------|--------|
| | | | Value | Units | | | | |
| Chlorides | MB 05 - McCabes Brook at Lime Kiln Road | 5/27/2013 | 9.25 | mg/L | 0.0200 | 0.0200 | 9.2400 | 0.2165 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 5/27/2013 | 9.23 | mg/L | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 5/27/2013 | 10 | mg/L | 0.0400 | 0.0400 | 9.9800 | 0.4008 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 5/27/2013 | 9.96 | mg/L | | | | |
| | MB05 - McCabes Brook at Lime Kiln Road | 7/9/2013 | 11.4 | mg/L | 0.2000 | 0.2000 | 11.3000 | 1.7699 |
| | MB05 DUP - McCabes Brook at Lime Kiln Road | 7/9/2013 | 11.2 | mg/L | | | | |
| | LP03 - LaPlatte River at Falls Road | 7/9/2013 | 14.2 | mg/L | 0.0000 | 0.0000 | 14.2000 | 0.0000 |
| | LP03 DUP - LaPlatte River at Falls Road | 7/9/2013 | 14.2 | mg/L | | | | |
| | LP05 - LaPlatte River at Carpenter Road | 7/9/2013 | 13.6 | mg/L | -0.1000 | 0.1000 | 13.6500 | 0.7326 |
| | LP05 DUP - LaPlatte River at Carpenter Rd | 7/9/2013 | 13.7 | mg/L | | | | |
| | MB 05 - McCabes Brook at Lime Kiln Road | 9/13/2013 | 14.5 | mg/L | 0.2000 | 0.2000 | 14.4000 | 1.3889 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/13/2013 | 14.3 | mg/L | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 9/13/2013 | 24.5 | mg/L | 0.2000 | 0.2000 | 24.4000 | 0.8197 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 9/13/2013 | 24.3 | mg/L | | | | |
| | H 01 - Holmes Creek behind Tennis Court below pond | 9/13/2013 | 19.7 | mg/L | 0.3000 | 0.3000 | 19.5500 | 1.5345 |
| | H 01 DUP - Holmes Creek behind Tennis Court below | 9/13/2013 | 19.4 | mg/L | | | | |

| | | | | | | | |
|--|-----------|------|------|---------|--------|---------|--------|
| MB 05 - McCabes Brook at Lime Kiln Road | 9/3/2013 | 14.7 | mg/L | -0.3000 | 0.3000 | 14.8500 | 2.0202 |
| MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/3/2013 | 15 | mg/L | | | | |
| LP 05 - LaPlatte River at Carpenter Road | 9/3/2013 | 31.2 | mg/L | -0.4000 | 0.4000 | 31.4000 | 1.2739 |
| LP 05 DUP - LaPlatte River at Carpenter Road | 9/3/2013 | 31.6 | mg/L | | | | |
| MB 04a - McCabes Brook at Teddy Bear Access Road | 10/8/2013 | 25 | mg/L | 0.7000 | 0.7000 | 24.6500 | 2.8398 |
| MB 04a - DUP McCabes Brook at Teddy Bear Access Rd | 10/8/2013 | 24.3 | mg/L | | | | |
| LP 05 - LaPlatte River at Carpenter Road | 10/8/2013 | 30.1 | mg/L | 0.7000 | 0.7000 | 29.7500 | 2.3529 |
| LP 05 DUP - LaPlatte River at Carpenter Road | 10/8/2013 | 29.4 | mg/L | | | | |

Mean 1.28

Target 10%

| Parameter | Station | Date | Results | | (S-D) | Absolute Value (S-D) | (S + D)/2 | RPD |
|-----------|--|-----------|---------|-------|---------|----------------------|-----------|---------|
| | | | Value | Units | | | | |
| Turbidity | MB 05 - McCabes Brook at Lime Kiln Road | 5/27/2013 | 9.25 | NTU | -1.3500 | 1.3500 | 9.9250 | 13.6020 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 5/27/2013 | 10.6 | NTU | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 5/27/2013 | 12.5 | NTU | -1.1000 | 1.1000 | 13.0500 | 8.4291 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 5/27/2013 | 13.6 | NTU | | | | |
| | H 01 - Holmes Creek Behind Tennis Court Below Pond | 5/27/2013 | 14.7 | NTU | -0.9000 | 0.9000 | 15.1500 | 5.9406 |
| | H 01 DUP - Holmes Crk bnd Tennis Crt Blw Pond | 5/27/2013 | 15.6 | NTU | | | | |
| | MB05 - McCabes Brook at Lime Kiln Road | 7/9/2013 | 7.99 | NTU | 0.5200 | 0.5200 | 7.7300 | 6.7270 |
| | MB05 DUP - McCabes Brook at Lime Kiln Road | 7/9/2013 | 7.47 | NTU | | | | |
| | LP03 - LaPlatte River at Falls Road | 7/9/2013 | 13.4 | NTU | -2.0000 | 2.0000 | 14.4000 | 13.8889 |
| | LP03 DUP - LaPlatte River at Falls Road | 7/9/2013 | 15.4 | NTU | | | | |
| | MB 05 - McCabes Brook at Lime Kiln Road | 9/3/2013 | 41.8 | NTU | 3.4000 | 3.4000 | 40.1000 | 8.4788 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/3/2013 | 38.4 | NTU | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 9/3/2013 | 12.7 | NTU | 0.7000 | 0.7000 | 12.3500 | 5.6680 |

| | | | | | | | |
|--|-----------|------|-----|---------|--------|---------|---------|
| LP 05 DUP - LaPlatte River at Carpenter Road | 9/3/2013 | 12 | NTU | | | | |
| MB 05 - McCabes Brook at Lime Kiln Road | 9/13/2013 | 28.2 | NTU | -0.3000 | 0.3000 | 28.3500 | 1.0582 |
| MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/13/2013 | 28.5 | NTU | | | | |
| LP 05 - LaPlatte River at Carpenter Road | 9/13/2013 | 66.8 | NTU | -8.5000 | 8.5000 | 71.0500 | 11.9634 |
| LP 05 DUP - LaPlatte River at Carpenter Road | 9/13/2013 | 75.3 | NTU | | | | |
| H 01 - Holmes Creek behind Tennis Court below pond | 9/13/2013 | 38.4 | NTU | 2.4000 | 2.4000 | 37.2000 | 6.4516 |
| H 01 DUP - Holmes Creek behind Tennis Court below | 9/13/2013 | 36 | NTU | | | | |
| MB 04a - McCabes Brook at Teddy Bear Access Road | 10/8/2013 | 24.5 | NTU | -1.4000 | 1.4000 | 25.2000 | 5.5556 |
| MB 04a - DUP McCabes Brook at Teddy Bear Access Rd | 10/8/2013 | 25.9 | NTU | | | | |
| LP 05 - LaPlatte River at Carpenter Road | 10/8/2013 | 39.1 | NTU | -0.2000 | 0.2000 | 39.2000 | 0.5102 |
| LP 05 DUP - LaPlatte River at Carpenter Road | 10/8/2013 | 39.3 | NTU | | | | |
| H 02 - Holmes Creek behind Tennis Court below pond | 10/8/2013 | 68 | NTU | -1.5000 | 1.5000 | 68.7500 | 2.1818 |
| H 02 DUP - Holmes Creek behind Tennis Court below | 10/8/2013 | 69.5 | NTU | | | | |

Mean 10.20
Target 15%

| Parameter | Station | Date | Results | | (S-D) | Absolute Value (S-D) | (S + D)/2 | RPD |
|-----------|--|-----------|---------|-------|---------|----------------------|-----------|---------|
| | | | Value | Units | | | | |
| TSS | MB 05 - McCabes Brook at Lime Kiln Road | 5/27/2013 | 10.7 | mg/l | -0.1000 | 0.1000 | 10.7500 | 0.9302 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 5/27/2013 | 10.8 | mg/l | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 5/27/2013 | 12.3 | mg/l | -2.9000 | 2.9000 | 13.7500 | 21.0909 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 5/27/2013 | 15.2 | mg/l | | | | |
| | H 01 - Holmes Creek Behind Tennis Court Below Pond | 5/27/2013 | 8.78 | mg/L | -0.4400 | 0.4400 | 9.0000 | 4.8889 |
| | H 01 DUP - Holmes Crk bnd Tennis Crt Blw Pond | 5/27/2013 | 9.22 | mg/L | | | | |
| | MB05 - McCabes Brook at Lime Kiln Road | 7/9/2013 | 5.57 | mg/L | -0.9000 | 0.9000 | 6.0200 | 14.9502 |
| | MB05 DUP - McCabes Brook at Lime Kiln Road | 7/9/2013 | 6.47 | mg/L | | | | |

| | | | | | | | |
|---|-----------|------|------|---------|--------|---------------|---------|
| LP05 - LaPlatte River at Carpenter Road | 7/9/2013 | 18.8 | mg/L | 0.8000 | 0.8000 | 18.4000 | 4.3478 |
| LP05 DUP - LaPlatte River at Carpenter Rd | 7/9/2013 | 18 | mg/L | | | | |
| H01-Holmes Creek | 7/9/2013 | 35 | mg/L | 4.2000 | 4.2000 | 32.9000 | 12.7660 |
| H01 DUP - Holmes Crk behind Tennis Court below Pond | 7/9/2013 | 30.8 | mg/L | | | | |
| MB 05 - McCabes Brook at Lime Kiln Road | 9/3/2013 | 32.2 | mg/L | 0.0000 | 0.0000 | 32.2000 | 0.0000 |
| MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/3/2013 | 32.2 | mg/L | | | | |
| LP 05 - LaPlatte River at Carpenter Road | 9/3/2013 | 15.2 | mg/l | 0.6000 | 0.6000 | 14.9000 | 4.0268 |
| LP 05 DUP - LaPlatte River at Carpenter Road | 9/3/2013 | 14.6 | mg/l | | | | |
| MB 05 - McCabes Brook at Lime Kiln Road | 9/13/2013 | 18.2 | mg/L | -1.2000 | 1.2000 | 18.8000 | 6.3830 |
| MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/13/2013 | 19.4 | mg/L | | | | |
| LP 05 - LaPlatte River at Carpenter Road | 9/13/2013 | 79.2 | mg/L | 7.6000 | 7.6000 | 75.4000 | 10.0796 |
| LP 05 DUP - LaPlatte River at Carpenter Road | 9/13/2013 | 71.6 | mg/L | | | | |
| H 01 - Holmes Creek behind Tennis Court below pond | 9/13/2013 | 37.2 | mg/L | 1.6000 | 1.6000 | 36.4000 | 4.3956 |
| H 01 DUP - Holmes Creek behind Tennis Court below | 9/13/2013 | 35.6 | mg/L | | | | |
| MB 04a - McCabes Brook at Teddy Bear Access Road | 10/8/2013 | 22.6 | mg/L | 0.6000 | 0.6000 | 22.3000 | 2.6906 |
| MB 04a - DUP McCabes Brook at Teddy Bear Access Rd | 10/8/2013 | 22 | mg/L | | | | |
| LP 05 - LaPlatte River at Carpenter Road | 10/8/2013 | 27.8 | mg/L | -2.2000 | 2.2000 | 28.9000 | 7.6125 |
| LP 05 DUP - LaPlatte River at Carpenter Road | 10/8/2013 | 30 | mg/L | | | | |
| H 02 - Holmes Creek behind Tennis Court below pond | 10/8/2013 | 64.3 | mg/L | 3.3000 | 3.3000 | 62.6500 | 5.2674 |
| H 02 DUP - Holmes Creek behind Tennis Court below | 10/8/2013 | 61 | mg/L | | | | |
| | | | | | | Mean | 9.95 |
| | | | | | | Target | 15% |

| Parameter | Station | Date | Results | | (S-D) | Absolute Value (S-D) | (S + D)/2 | RPD |
|-----------|--|-----------|---------|--------|---------|----------------------|-----------|--------|
| | | | Value | Units | | | | |
| Total P | LP 05 - LaPlatte River at Carpenter Road | 5/27/2013 | 49.9 | µg P/L | -0.9000 | 0.9000 | 50.3500 | 1.7875 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 5/27/2013 | 50.8 | µg P/L | | | | |

| | | | | | | | |
|---|-----------|------|--------|---------|--------|----------|--------|
| H 01 - Holmes Creek Behind Tennis Court Below Pond | 5/27/2013 | 44.2 | µg P/L | -2.8000 | 2.8000 | 45.6000 | 6.1404 |
| H 01 DUP - Holmes Crk bnd Tennis Crt Blw Pond | 5/27/2013 | 47 | µg P/L | | | | |
| MB05 - McCabes Brook at Lime Kiln Road | 7/9/2013 | 66.8 | µg P/L | -0.7000 | 0.7000 | 67.1500 | 1.0424 |
| MB05 DUP - McCabes Brook at Lime Kiln Road | 7/9/2013 | 67.5 | µg P/L | | | | |
| LP03 - LaPlatte River at Falls Road | 7/9/2013 | 66.7 | µg P/L | -0.2000 | 0.2000 | 66.8000 | 0.2994 |
| LP03 DUP - LaPlatte River at Falls Road | 7/9/2013 | 66.9 | µg P/L | | | | |
| LP05 - LaPlatte River at Carpenter Road | 7/9/2013 | 65.9 | µg P/L | -3.9000 | 3.9000 | 67.8500 | 5.7480 |
| LP05 DUP - LaPlatte River at Carpenter Rd | 7/9/2013 | 69.8 | µg P/L | | | | |
| H01-Holmes Creek | 7/9/2013 | 104 | µg P/L | 2.0000 | 2.0000 | 103.0000 | 1.9417 |
| H01 DUP - Holmes Crk behind Tennis Court below Pond | 7/9/2013 | 102 | µg P/L | | | | |
| MB 05 - McCabes Brook at Lime Kiln Road | 9/3/2013 | 108 | µg P/L | 4.0000 | 4.0000 | 106.0000 | 3.7736 |
| MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/3/2013 | 104 | µg P/L | | | | |
| LP 05 - LaPlatte River at Carpenter Road | 9/3/2013 | 57.7 | µg P/L | -0.4000 | 0.4000 | 57.9000 | 0.6908 |
| LP 05 DUP - LaPlatte River at Carpenter Road | 9/3/2013 | 58.1 | µg P/L | | | | |
| MB 05 - McCabes Brook at Lime Kiln Road | 9/13/2013 | 135 | µg P/L | -2.0000 | 2.0000 | 136.0000 | 1.4706 |
| MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/13/2013 | 137 | µg P/L | | | | |
| LP 05 - LaPlatte River at Carpenter Road | 9/13/2013 | 184 | µg P/L | 2.0000 | 2.0000 | 183.0000 | 1.0929 |
| LP 05 DUP - LaPlatte River at Carpenter Road | 9/13/2013 | 182 | µg P/L | | | | |
| H 01 - Holmes Creek behind Tennis Court below pond | 9/13/2013 | 91.5 | µg P/L | -2.6000 | 2.6000 | 92.8000 | 2.8017 |
| H 01 DUP - Holmes Creek behind Tennis Court below | 9/13/2013 | 94.1 | µg P/L | | | | |
| MB 04a - McCabes Brook at Teddy Bear Access Road | 10/8/2013 | 158 | µg P/L | 1.0000 | 1.0000 | 157.5000 | 0.6349 |
| MB 04a - DUP McCabes Brook at Teddy Bear Access Rd | 10/8/2013 | 157 | µg P/L | | | | |
| LP 05 - LaPlatte River at Carpenter Road | 10/8/2013 | 148 | µg P/L | 4.0000 | 4.0000 | 146.0000 | 2.7397 |
| LP 05 DUP - LaPlatte River at Carpenter Road | 10/8/2013 | 144 | µg P/L | | | | |
| H 02 - Holmes Creek behind Tennis Court below pond | 10/8/2013 | 154 | µg P/L | -2.0000 | 2.0000 | 155.0000 | 1.2903 |
| H 02 DUP - Holmes Creek behind Tennis Court below | 10/8/2013 | 156 | µg P/L | | | | |

Mean 2.25
Target 15%

| Parameter | Station | Date | Results | | (S-D) | Absolute Value (S-D) | (S + D)/2 | RPD |
|---|---|-----------|---------|--------|---------|----------------------|-----------|--------|
| | | | Value | Units | | | | |
| Dissolved P | LP 05 - LaPlatte River at Carpenter Road | 5/27/2013 | 25.8 | µg P/L | 0.8000 | 0.8000 | 25.4000 | 3.1496 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 5/27/2013 | 25 | µg P/L | | | | |
| | MB 05 - McCabes Brook at Lime Kiln Road | 5/27/2013 | 23.9 | µg P/L | -0.2000 | 0.2000 | 24.0000 | 0.8333 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 5/27/2013 | 24.1 | µg P/L | | | | |
| | H 01 - Holmes Creek Behind Tennis Court Below Pond | 5/27/2013 | 26.9 | µg P/L | 0.4000 | 0.4000 | 26.7000 | 1.4981 |
| | H 01 DUP - Holmes Crk bnd Tennis Crk Blw Pond | 5/27/2013 | 26.5 | µg P/L | | | | |
| | MB05 - McCabes Brook at Lime Kiln Road | 7/9/2013 | 48.9 | µg P/L | 0.1000 | 0.1000 | 48.8500 | 0.2047 |
| | MB05 DUP - McCabes Brook at Lime Kiln Road | 7/9/2013 | 48.8 | µg P/L | | | | |
| | LP03 - LaPlatte River at Falls Road | 7/9/2013 | 35.8 | µg P/L | 0.3000 | 0.3000 | 35.6500 | 0.8415 |
| | LP03 DUP - LaPlatte River at Falls Road | 7/9/2013 | 35.5 | µg P/L | | | | |
| | LP05 - LaPlatte River at Carpenter Road | 7/9/2013 | 34 | µg P/L | 0.7000 | 0.7000 | 33.6500 | 2.0802 |
| | LP05 DUP - LaPlatte River at Carpenter Rd | 7/9/2013 | 33.3 | µg P/L | | | | |
| | H01-Holmes Creek | 7/9/2013 | 38.8 | µg P/L | 1.0000 | 1.0000 | 38.3000 | 2.6110 |
| | H01 DUP - Holmes Crk behind Tennis Court below Pond | 7/9/2013 | 37.8 | µg P/L | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 9/3/2013 | 31.9 | µg P/L | -1.4000 | 1.4000 | 32.6000 | 4.2945 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 9/3/2013 | 33.3 | µg P/L | | | | |
| | MB 05 - McCabes Brook at Lime Kiln Road | 9/13/2013 | 82.9 | µg P/L | 0.4000 | 0.4000 | 82.7000 | 0.4837 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/13/2013 | 82.5 | µg P/L | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 9/13/2013 | 72.1 | µg P/L | -0.6000 | 0.6000 | 72.4000 | 0.8287 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 9/13/2013 | 72.7 | µg P/L | | | | |
| | H 01 - Holmes Creek behind Tennis Court below pond | 9/13/2013 | 22.8 | µg P/L | 0.3000 | 0.3000 | 22.6500 | 1.3245 |
| | H 01 DUP - Holmes Creek behind Tennis Court below | 9/13/2013 | 22.5 | µg P/L | | | | |
| | MB 04a - McCabes Brook at Teddy Bear Access Road | 10/8/2013 | 64.5 | µg P/L | -0.4000 | 0.4000 | 64.7000 | 0.6182 |
| | MB 04a - DUP McCabes Brook at Teddy Bear Access Rd | 10/8/2013 | 64.9 | µg P/L | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 10/8/2013 | 67.5 | µg P/L | -1.5000 | 1.5000 | 68.2500 | 2.1978 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 10/8/2013 | 69 | µg P/L | | | | |
| | H 02 - Holmes Creek behind Tennis Court below pond | 10/8/2013 | 22.8 | µg P/L | -1.4000 | 1.4000 | 23.5000 | 5.9574 |
| H 02 DUP - Holmes Creek behind Tennis Court below | 10/8/2013 | 24.2 | µg P/L | | | | | |

Mean 1.92
Target 15%

| Parameter | Station | Date | Results | | (S-D) | Absolute Value (S-D) | (S + D)/2 | RPD |
|--|--|-----------|---------|--------|---------|----------------------|-----------|---------|
| | | | Value | Units | | | | |
| Total N | MB 05 - McCabes Brook at Lime Kiln Road | 5/27/2013 | 0.36 | mg/L | -0.0100 | 0.0100 | 0.3650 | 2.7397 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 5/27/2013 | 0.37 | mg/L | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 5/27/2013 | 0.41 | mg/L | 0.0400 | 0.0400 | 0.3900 | 10.2564 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 5/27/2013 | 0.37 | mg/L | | | | |
| | H 01 - Holmes Creek Behind Tennis Court Below Pond | 5/27/2013 | 0.41 | mg/L | 0.0000 | 0.0000 | 0.4100 | 0.0000 |
| | H 01 DUP - Holmes Crk bnd Tennis Crt Blw Pond | 5/27/2013 | 0.41 | mg/L | | | | |
| | MB05 - McCabes Brook at Lime Kiln Road | 7/9/2013 | 0.57 | mg/L | 0.0100 | 0.0100 | 0.5650 | 1.7699 |
| | MB05 DUP - McCabes Brook at Lime Kiln Road | 7/9/2013 | 0.56 | mg/L | | | | |
| | LP03 - LaPlatte River at Falls Road | 7/9/2013 | 0.5 | mg/L | 0.0100 | 0.0100 | 0.4950 | 2.0202 |
| | LP03 DUP - LaPlatte River at Falls Road | 7/9/2013 | 0.49 | mg/L | | | | |
| | MB 05 - McCabes Brook at Lime Kiln Road | 9/3/2013 | 0.65 | mg/L | 0.0100 | 0.0100 | 0.6450 | 1.5504 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/3/2013 | 0.64 | mg/L | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 9/3/2013 | 0.56 | mg/L | 0.0000 | 0.0000 | 0.5600 | 0.0000 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 9/3/2013 | 0.56 | mg/L | | | | |
| | MB 05 - McCabes Brook at Lime Kiln Road | 9/13/2013 | 1.03 | mg/L | 0.0000 | 0.0000 | 1.0300 | 0.0000 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/13/2013 | 1.03 | mg/L | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 9/13/2013 | 1.03 | mg/L | -0.0500 | 0.0500 | 1.0550 | 4.7393 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 9/13/2013 | 1.08 | mg/L | | | | |
| | H 01 - Holmes Creek behind Tennis Court below pond | 9/13/2013 | 0.86 | mg/L | -0.2700 | 0.2700 | 0.9950 | 27.1357 |
| | H 01 DUP - Holmes Creek behind Tennis Court below | 9/13/2013 | 1.13 | mg/L | | | | |
| MB 04a - McCabes Brook at Teddy Bear Access Road | 10/8/2013 | 0.85 | mg/L | 0.0100 | 0.0100 | 0.8450 | 1.1834 | |
| MB 04a - DUP McCabes Brook at Teddy Bear Access Rd | 10/8/2013 | 0.84 | mg/L | | | | | |

| | | | | | | | |
|--|-----------|------|------|--------|--------|--------|--------|
| LP 05 - LaPlatte River at Carpenter Road | 10/8/2013 | 0.69 | mg/L | 0.0100 | 0.0100 | 0.6850 | 1.4599 |
| LP 05 DUP - LaPlatte River at Carpenter Road | 10/8/2013 | 0.68 | mg/L | | | | |
| H 02 - Holmes Creek behind Tennis Court below pond | 10/8/2013 | 0.81 | mg/L | 0.0100 | 0.0100 | 0.8050 | 1.2422 |
| H 02 DUP - Holmes Creek behind Tennis Court below | 10/8/2013 | 0.8 | mg/L | | | | |

Mean 4.16
Target 15%

| Parameter | Station | Date | Results | | (S-D) | Absolute Value (S-D) | (S + D)/2 | RPD |
|--|--|-----------|---------|--------|---------|----------------------|-----------|---------|
| | | | Value | Units | | | | |
| NOx | MB 05 - McCabes Brook at Lime Kiln Road | 5/27/2013 | 0.05 | mg/L | 0.0000 | 0.0000 | 0.0500 | 0.0000 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 5/27/2013 | 0.05 | mg/L | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 5/27/2013 | 0.06 | mg/L | 0.0000 | 0.0000 | 0.0600 | 0.0000 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 5/27/2013 | 0.06 | mg/L | | | | |
| | H 01 - Holmes Creek Behind Tennis Court Below Pond | 5/27/2013 | 0.07 | mg/L | 0.0000 | 0.0000 | 0.0700 | 0.0000 |
| | H 01 DUP - Holmes Crk bnd Tennis Crk Blw Pond | 5/27/2013 | 0.07 | mg/L | | | | |
| | MB05 - McCabes Brook at Lime Kiln Road | 7/9/2013 | 0.05 | mg/L | 0.0000 | 0.0000 | 0.0500 | 0.0000 |
| | MB05 DUP - McCabes Brook at Lime Kiln Road | 7/9/2013 | 0.05 | mg/L | | | | |
| | LP03 - LaPlatte River at Falls Road | 7/9/2013 | 0.12 | mg/L | 0.0000 | 0.0000 | 0.1200 | 0.0000 |
| | LP03 DUP - LaPlatte River at Falls Road | 7/9/2013 | 0.12 | mg/L | | | | |
| | MB 05 - McCabes Brook at Lime Kiln Road | 9/3/2013 | 0.06 | mg/L | 0.0000 | 0.0000 | 0.0600 | 0.0000 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/3/2013 | 0.06 | mg/L | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 9/3/2013 | 0.2 | mg/L | -0.0100 | 0.0100 | 0.2050 | 4.8780 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 9/3/2013 | 0.21 | mg/L | | | | |
| | MB 05 - McCabes Brook at Lime Kiln Road | 9/13/2013 | 0.21 | mg/L | 0.0200 | 0.0200 | 0.2000 | 10.0000 |
| | MB 05 DUP - McCabes Brook at Lime Kiln Road | 9/13/2013 | 0.19 | mg/L | | | | |
| | LP 05 - LaPlatte River at Carpenter Road | 9/13/2013 | 0.13 | mg/L | 0.0100 | 0.0100 | 0.1250 | 8.0000 |
| | LP 05 DUP - LaPlatte River at Carpenter Road | 9/13/2013 | 0.12 | mg/L | | | | |
| | H 01 - Holmes Creek behind Tennis Court below pond | 9/13/2013 | 0.05 | mg/L | 0.0000 | 0.0000 | 0.0500 | 0.0000 |
| | H 01 DUP - Holmes Creek behind Tennis Court below | 9/13/2013 | 0.05 | mg/L | | | | |
| MB 04a - McCabes Brook at Teddy Bear Access Road | 10/8/2013 | 0.06 | mg/L | 0.0000 | 0.0000 | 0.0600 | 0.0000 | |
| MB 04a - DUP McCabes Brook at Teddy Bear Access Rd | 10/8/2013 | 0.06 | mg/L | | | | | |

Blanks

| | Chloride | TSS | Turbidity | TP | DP | TN | NOx |
|-----------|----------|-----|-----------|----|----|------|-------|
| 5/27/2013 | <2 | <1 | 0.13 | <5 | <5 | <0.1 | <0.05 |
| 7/9/2013 | <2 | <1 | <0.2 | <5 | <5 | <0.1 | <0.05 |
| 9/3/2013 | - | - | - | - | - | - | - |
| 9/13/2013 | - | - | - | - | - | - | - |
| 10/8/2013 | <2 | <1 | <0.2 | <5 | <5 | <0.1 | <0.05 |

Summary of Percent Differences

| Parameter | Target Precision | Mean RPD |
|------------------|------------------|----------|
| Chloride | 10% | 1.28 |
| Turbidity | 15% | 10.20 |
| TSS | 15% | 9.95 |
| Total P | 15% | 2.25 |
| Diss. P | 15% | 1.92 |
| Total N | 15% | 4.07 |
| NOx | 10% | 1.76 |