

Thorp Kimball Holmes Watershed Group

**Water Quality in the
Thorp Brook, Kimball Brook, and Holmes Creek
Watersheds**

2011 Data

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Introduction

2011 was characterized by high flows and flooding and resulting high lake surface levels during the spring followed by low flows during the summer. Then hurricane Irene resulted in the closure of the LaRosa Laboratory facilities in late August. The dry summer and closure of the laboratory impacted the 2011 sampling program in the Thorp-Kimball-Holmes direct-to-lake watersheds by limiting the sampling season to the months of April and May.

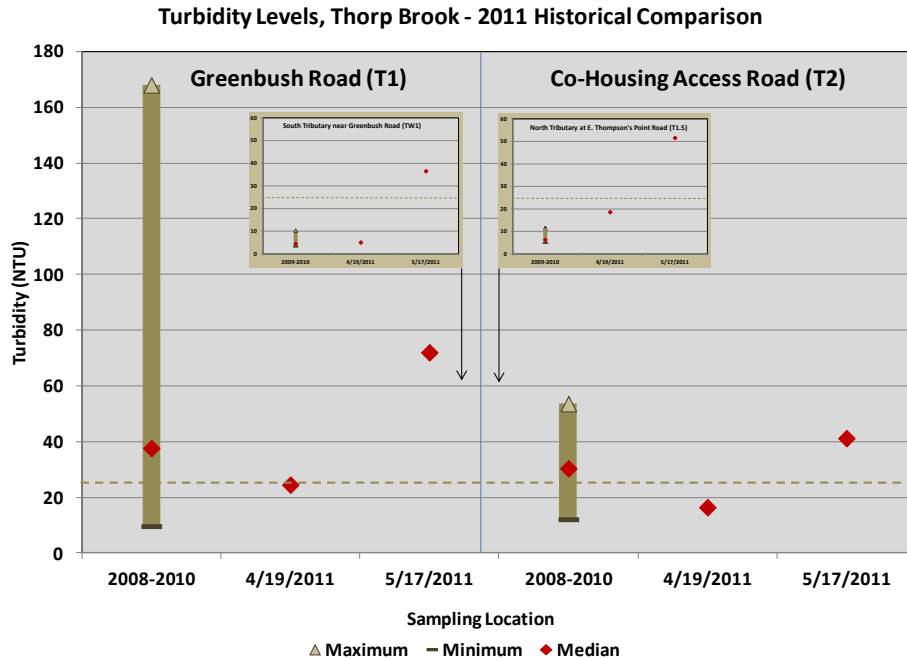
Samples were taken at Thorp and Kimball Brook stations on April 19, 2011 and May 17, 2011, and at Holmes Creek stations on May 17. Flows measured at the USGS gaging stations on Lewis Creek and the LaPlatte River indicate that flows in these much larger and more diverse watersheds were slightly below average on April 19, and relatively high on May 17. Direct comparisons are probably not justified, but the data are suggestive of recent flow histories. Reported readings at staff gages on Thorp and Kimball Brooks are informative. On the May 17 sampling date the water level over-topped the gage on Thorp Brook (station T1), while on 4-18-11 gage readings ranged from 3.8' to 2.4' between 7-10 AM suggesting that the high spring lake level, at 100.78' and 102.58', compared with monthly mean lake levels of 98.63' and 98.40' in April and May, respectively. This would suggest that flow was low, and the water quiescent, when sampled at this location. Gage readings on Kimball Brook (station K2) indicate that the flow was low to moderate on both dates at this location. These flow conditions would be expected to influence water quality, and are discussed below.

Results and Conclusions

Water quality results at all locations sampled during 2011 fell generally within limits observed during previous sampling seasons except for the west tributary to Thorp Brook where turbidity and nutrient levels were lower than in 2010. Exceedences of turbidity and Phosphorus levels continued.

Thorp Brook

Turbidity levels increased downstream between the co-housing access road (station T2) and Greenbush Road (T1), consistent with past observations, and they fell within previously observed limits or ranges at both locations (although not always at the stations located on the north and south tributaries to this section of the stream (TW1 and T1.5):



- Turbidity levels in Thorp Brook exceeded the State standard of 25 NTU for class B warm water streams on May 17, 2011 although flows were probably high leading up to the sampling date. Similarly, turbidity levels exceeded the standard in both tributaries to this reach (TW1 and T1.5).
- Turbidity levels in the north tributary (TW1) were higher than during previous years, as they were in the south tributary (T1.5) in May.

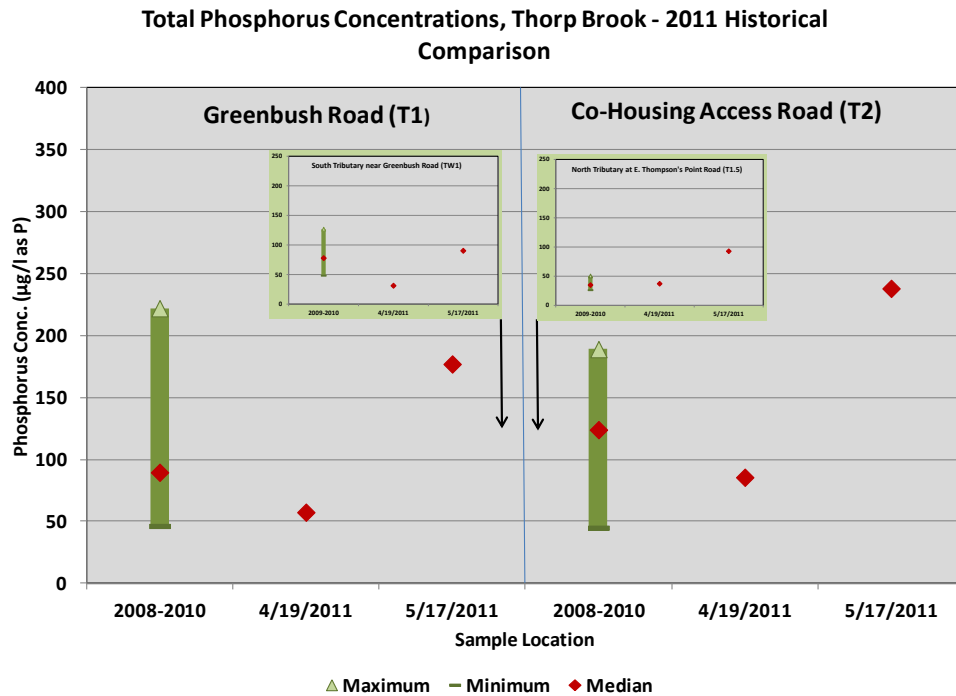
Increases in turbidity values likely originated from field tiles draining into road ditches and road ditch sediment runoff or stream-bank erosion, and at higher flows, mobilization of bottom sediments. Both the TW1 and T1.5 tributaries have greater than 20% channel straightening conditions (Lewis Creek Association 2008, Phase 1 & 2 Geomorphic Assessment Report, Direct Drain to Lake Champlain in Shelburne and Charlotte) which may contribute to the downstream sediment load at high flows, but does not account for the increase.

Total phosphorus concentrations fell downstream between the co-housing access road (T2) and Greenbush Road (T1), consistent with past observations, and except for the value at T2 on May 17, they fell within past ranges:

- High values on May 17 were associated with a probable high runoff and flow history on that date.
- Total phosphorus levels in 2011 and earlier monitoring seasons exceeded the proposed State criterion of 44 $\mu\text{g/l}$ as P for class B warm water medium gradient streams. Whereas this value does not apply directly to the low gradient streams such as Thorp Brook, it

provides a perspective on the total phosphorus levels in the stream as related to stream biology.

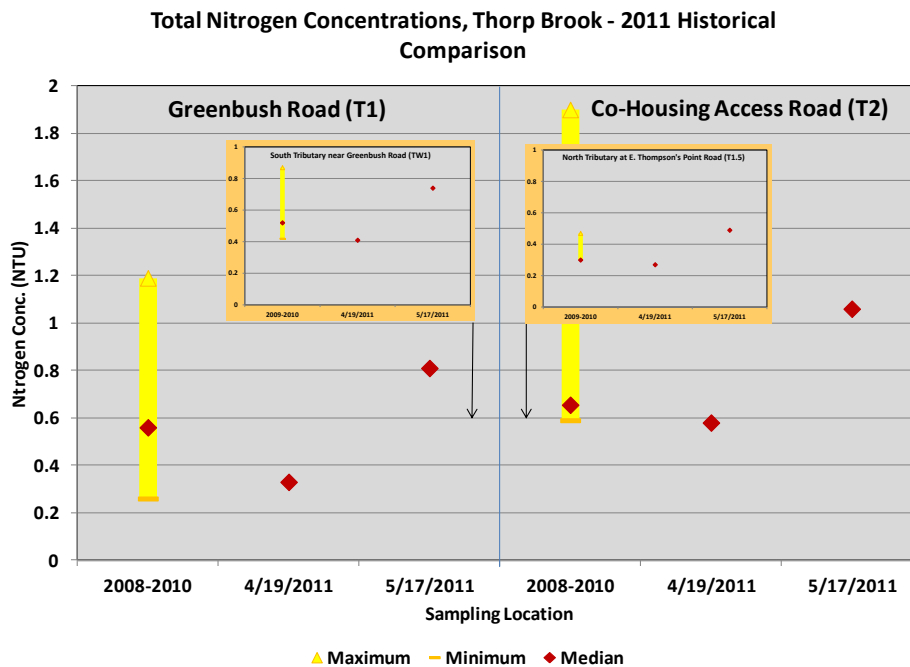
- The consistent decreases in total phosphorus concentrations in Thorp Brook between T2 and T1 may have several explanations:
 - Dilution as a result of inflows from ground water and from the stream's two eastern tributaries (TW1 and T1.5) illustrated in the inserts to the graph of total phosphorus concentrations



- Inconsistent relationships between total phosphorus concentrations and turbidity values, together with decreasing total phosphorus concentrations associated with increasing turbidity levels would suggest that phosphorus occurs predominantly as dissolved phosphorus, at least under flow and runoff conditions sampled. Predominance of dissolved phosphorus has been associated with agricultural land uses in other watersheds in Addison County draining to Lake Champlain.
- Measurement of flow is important to interpretation of water quality results, and essential to assessment of loadings of phosphorus to the lake from small direct-to-lake watersheds.

Total nitrogen concentrations decreased downstream between the co-housing access road (T2) and Greenbush Road (T1) as did total phosphorus concentrations, and in a manner consistent with observations during previous years:

- High values on May 17 were associated with a probable high runoff and flow on that date.

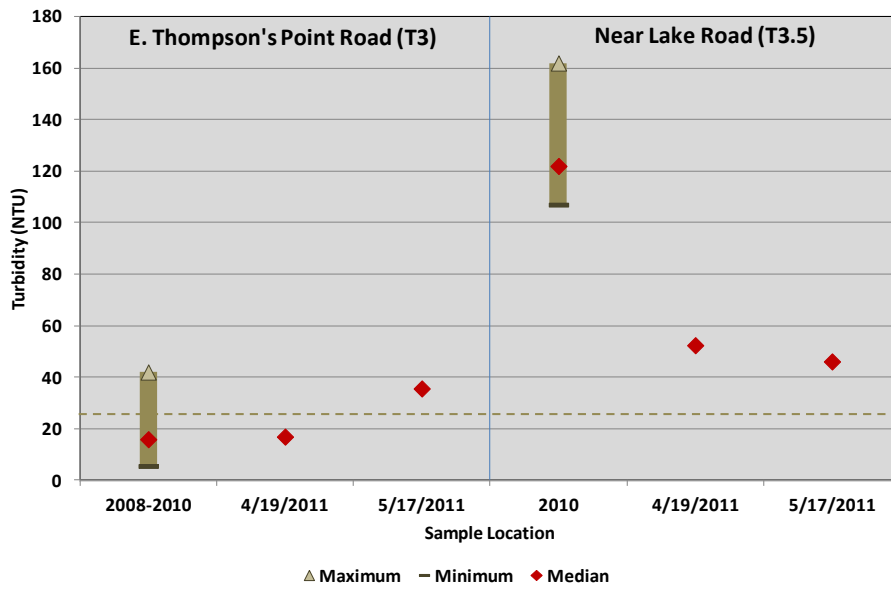


- Total nitrogen levels in 2011 exceeded the proposed State criterion of 0.75 mg/l as N for class B warm water medium gradient streams on May 17 as they had on occasion during past sampling seasons. Whereas this value does not apply directly to the low gradient streams such as Thorp Brook, it provides a perspective on the total nitrogen levels in the stream as related to stream biology as it did total phosphorus levels.
- The consistent decreases in total nitrogen concentrations in Thorp Brook between T2 and T1 resemble those of phosphorus, and most likely are a result of inflows from ground water and from the stream's two eastern tributaries (TW1, T1.5) illustrated in the inserts to the graph of total phosphorus concentrations
- As with phosphorus, measurement of flow is important to interpretation of water quality results, and essential to assessment of loadings of phosphorus to the lake from small direct-to-lake watersheds.

Western Tributary to Thorp Brook

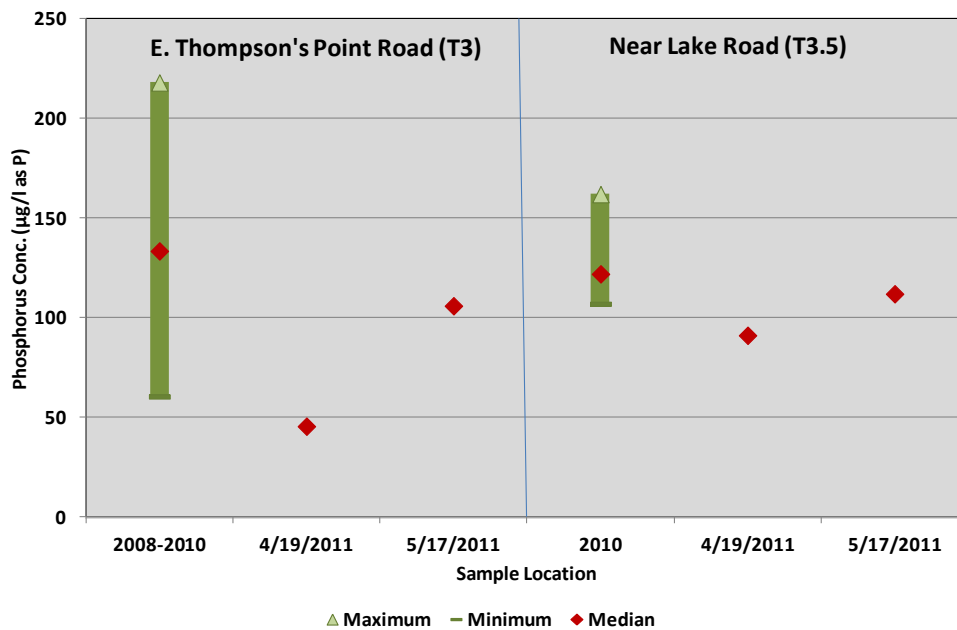
Water quality in the West Branch of Thorp Brook at East Thompson's Point Road fell generally within the range observed during the 2008-2010 sampling seasons, nutrient concentrations falling in the low range. In contrast, downstream from the agricultural fields (T3.5), turbidity values and total nitrogen concentrations fell substantially below minimum values observed in 2010, and while the change in total phosphorus concentrations was less, both values fell below the minimum observed in 2010.

Turbidity Levels, West Tributary Thorp Brook - 2011 Historical Comparison

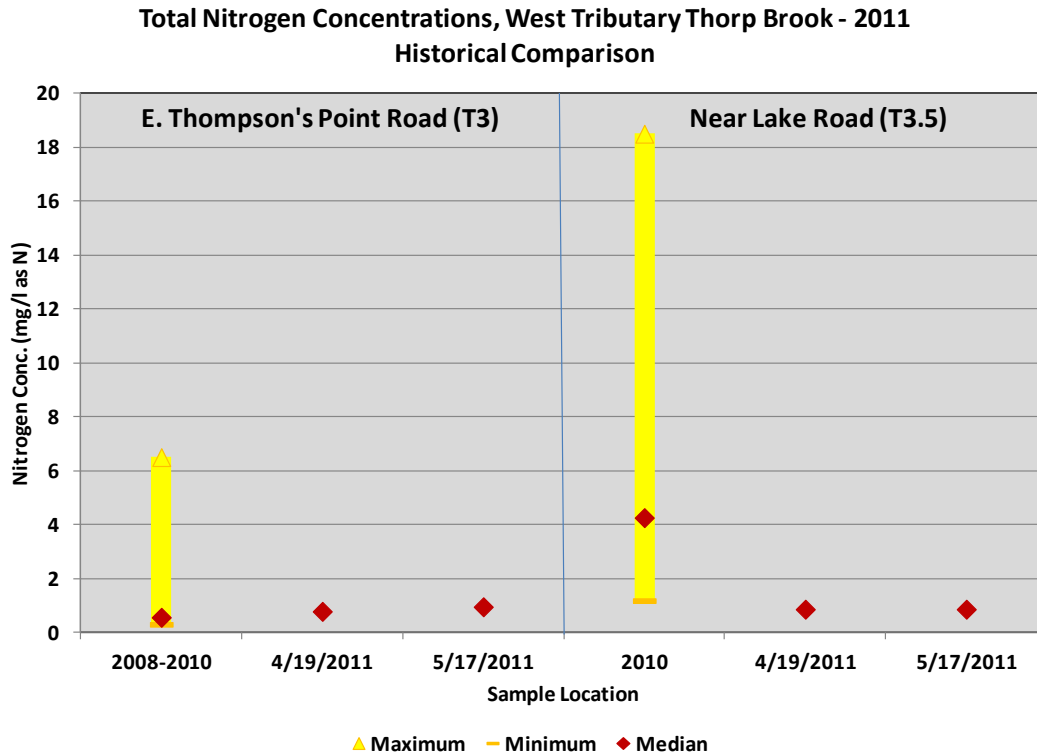


Whereas turbidity levels at East Thompson’s Point Road (T3) fell within the range observed from 2008 through 2010, levels observed at the upstream sampling location (T3.5) fell well below the range of values observed in 2010, although they still were greater than those observed at the downstream location and exceeded the State standard.

Total Phosphorus Concentrations, West Tributary Thorp Brook - 2011 Historical Comparison

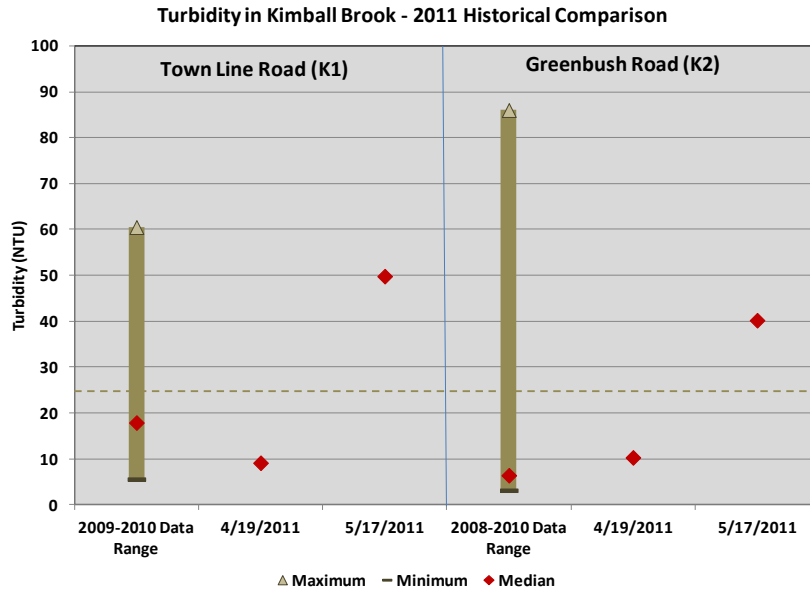


Total phosphorus concentrations at East Thompson’s Point Road (T3) were lower than observed during 2008-2010 when flow was low in April, but higher and within the range of earlier results at moderate to high flows in May. Concentrations at the upstream location (T3.5) were likewise lower than observed in 2010 in April, but at the low end of the range and at about the same level as at T3 in May.

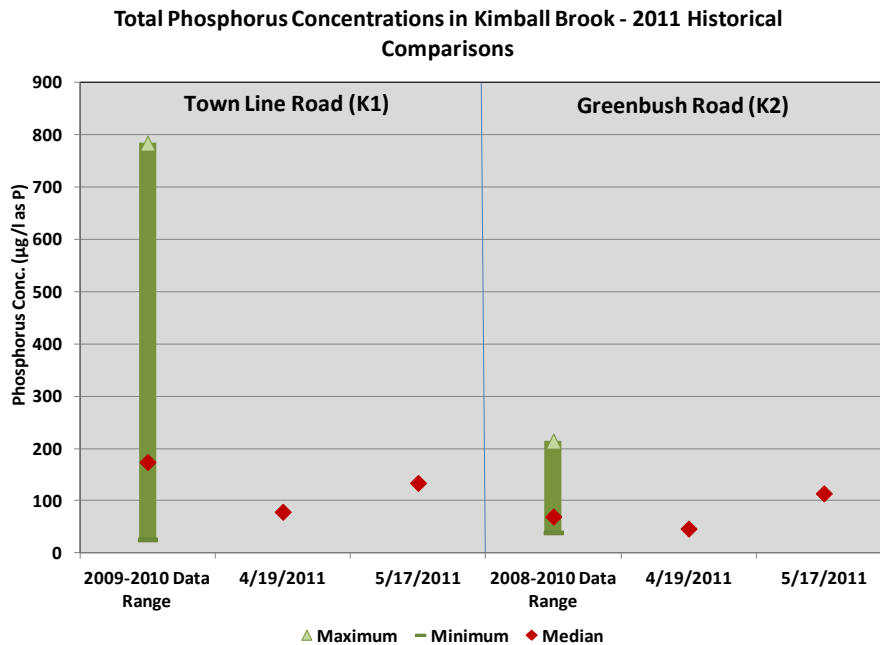


Kimball Brook

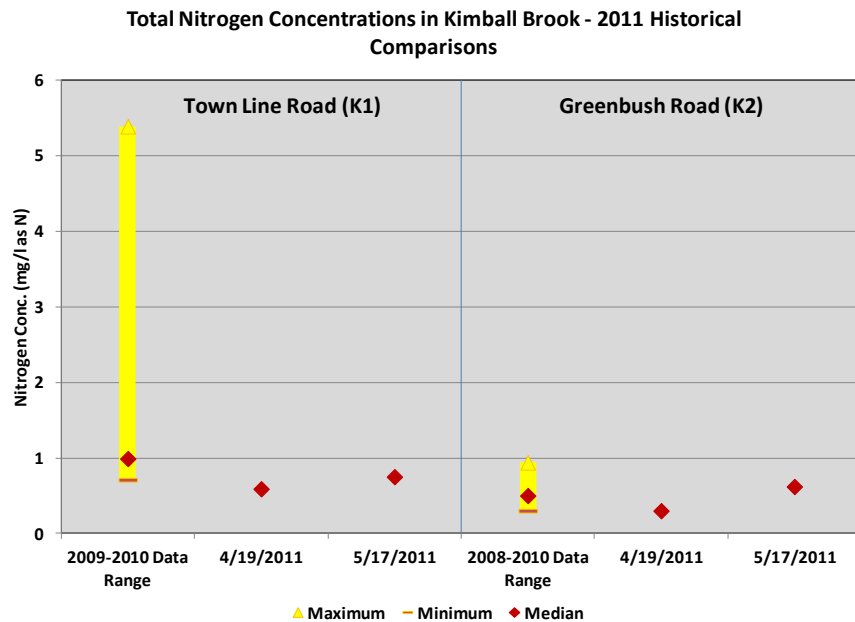
Turbidity values and total phosphorus concentrations in Kimball Brook generally fell within the range observed during previous years, while exceeding the State standard for turbidity of 25 NTU for class B warm water streams. Concentrations of total nitrogen were often lower than previously observed and did not exceed the proposed State criterion of 0.75 mg/l as N for class B warm water medium gradient streams. Although turbidity values reached moderate levels, total phosphorus and total nitrogen concentrations detected during 2011 were at the low end of the range previously observed.



Turbidity values were high on May 17, increasing downstream from Greenbush Road (K2) to Town Line Road (K1) as they tended to do during earlier years. The high levels and increase were likely associated with high flows prior to the May sampling date. Low turbidity values occurred on April 19 when flows were low to moderate. Turbidities on the May sampling date exceeded the State standard for turbidity in class B warm water streams. All Kimball Brook watershed tributaries have greater than 20% channel straightening. As a result conditions favor erosion. (Lewis Creek Association 2008, Phase 1 & 2 Geomorphic Assessment Report, Direct Drain to Lake Champlain in Shelburne and Charlotte.)



Concentrations of total phosphorus observed in the 2011 samples fell within the range of values observed during previous years, but at the bottom of the range. Still, they increased slightly downstream from Greenbush Road (K2) to Town Line Road (K1) as they had during previous years. They did not exhibit large increases as had been observed during previous years. Concentrations observed in all samples from both K1 and K2 exceeded the proposed criterion for class B warm water medium gradient streams.

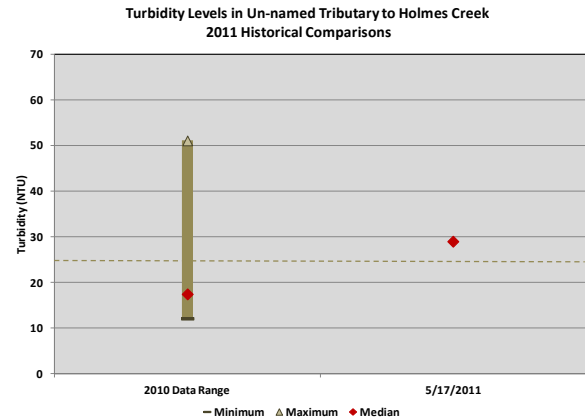
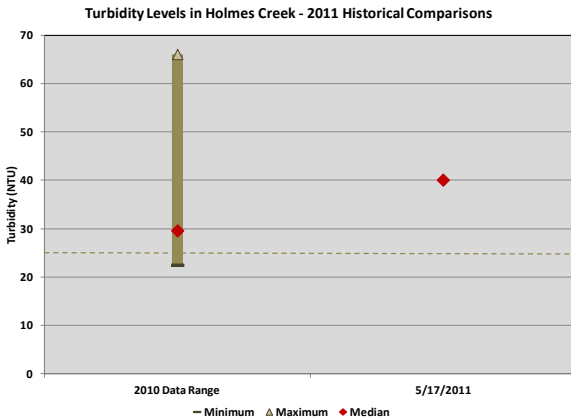


Concentrations of total nitrogen, like those of total phosphorus were comparatively low at both Greenbush Road (K2) and Town Line Road (K1), and while increasing downstream between the stations, the increases were slight. Total nitrogen levels in 2011 did not exceed the proposed State criterion of 0.75 mg/l as N for class B warm water medium gradient streams as they had during past sampling seasons. Whereas this value does not apply directly to the low gradient Kimball Brook stream type, it provides a perspective on the total nitrogen levels in the stream as related to stream biology. Increases also did not exceed the State standard for nitrate reached in earlier years at K1.

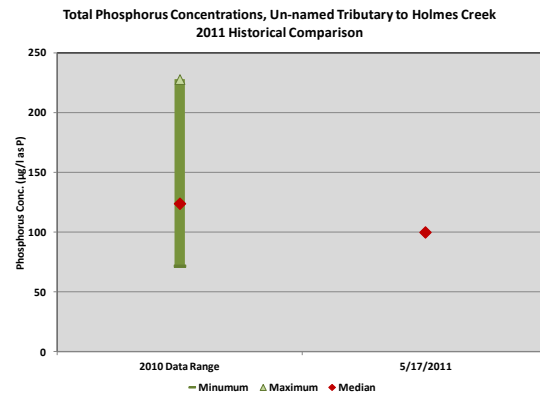
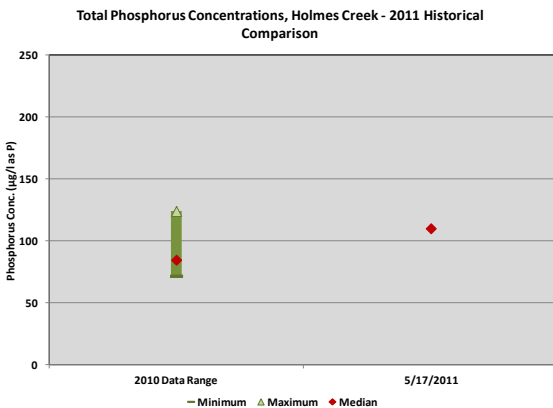
It should be stressed that, as in Thorp Brook, the interpretation of results would be enhanced by the inclusion of flow data: it is essential to assessment of loadings of phosphorus to the lake from small direct-to-lake watersheds.

Holmes Creek

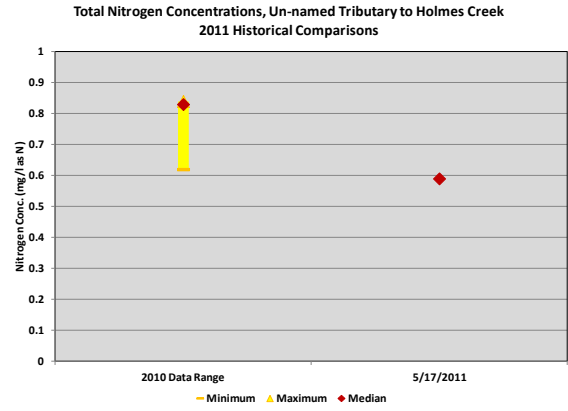
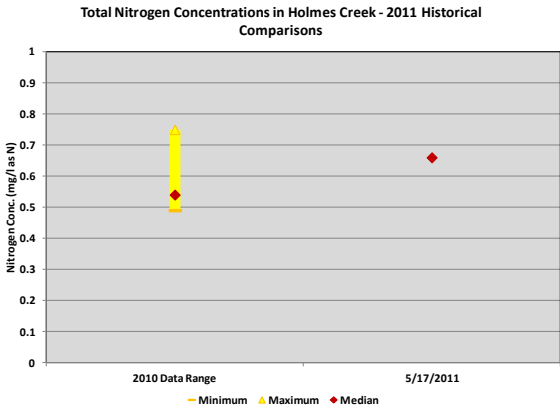
Holmes Creek and its western tributary from the south were sampled only on May 17, 2011. Water quality in the two streams appear similar based on the limited results available. Results from the 2011 samples fall generally within the range observed in 2010.



Turbidity levels in both Holmes Creek and its tributary were within the range of values observed in 2010, but above the median and greater than the State standard of 25 NTU for class B warm water streams.



Total phosphorus concentrations were about 100 µg/l as P in the samples from both Holmes Creek and the tributary from the south. Both concentrations fell within the range of concentrations observed in 2010, being higher than the median in Holmes Creek, and lower in the tributary. The range of values was small in Holmes Creek in 2010, and the maximum concentration was less than 130 µg/l. The range of concentrations observed in the tributary was greater in 2010, and its maximum value was close to 230 µg/l. All Holmes Creek concentrations exceeded the proposed state criterion for class B warm water medium gradient streams.



Total nitrogen concentrations in Holmes Creek and its tributary, like phosphorus concentrations, were lower in Holmes Creek during 2010 than they were in its tributary. In the 2011 samples, concentrations were similar but slightly higher in Holmes Creek. No samples from Holmes Creek have exceeded the proposed State nitrogen criterion for class B warm water medium gradient streams. Although most samples from the tributary stream exceeded the proposed criterion, those from 2011 did not.