An Assessment of

Stream Water Quality

In

Schoenick Creek and Tributaries to Long Lake

2014, 2015

Shawano County, Wisconsin

Project ID's- NER_01_CMP15
NER_11_CMP14

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Schoenick Creek and Long Lake Tributary Report

Introduction

The Schoenick Creek Watershed covers 13.5 square miles in Shawano County. The headwaters to Schoenick Creek originate in a large wetland complex surrounded by agriculture in the northern part of the watershed. The stream proceeds to flow south where it flows through Long and Schoenick Lakes before its confluence with the Wolf River. There are a few other small tributary streams in the watershed that are generally small cool-warm to warm headwater streams. The landscape in the watershed is covered by forests (28%), agriculture and pastureland (49%), open water and wetlands (22%), and urban (1%).

Water Quality concerns have existed for many years by local residents living on Long Lake. Concerns stem from the premise that degraded water quality conditions in Schoenick Creek are impacting water quality in Long Lake. Long Lake is an 86 acre Deep Lowland Drainage Lake that is on the state's 303(d) list of impaired waterbodies due to excess algal growth. It also likely exceeds the listing threshold for recreational values for Total Phosphorous. (Nordin personal comm.) The lake association approached the Department of Natural Resources (Department) with a proposal to prevent the stream from entering the lake to eliminate external watershed sources from impacting lake water quality. It was determined that not enough information existed on the streams in the watershed to determine their condition and influence on water quality in Long Lake or the benefits that these streams may provide to the lake. The goals of this project were to: 1) Monitor and assess water quality conditions in Schoenick Creek and other tributary streams; 2) Evaluate functions and values that these tributaries may provide to Long Lake; 3) Develop an understanding of how Schoenick Creek and Long Lake interact and 4) Provide recommendations and alternatives for improving water quality conditions in Schoenick Creek and Long Lake.

Methods

Water quality monitoring was conducted at 8 wadeable sites throughout the watershed in the spring, summer, and fall of 2014 and follow-up monitoring was conducted during the summer and fall of 2015. During each field visit, basic water quality parameters including air temperature, water temperature, conductivity, dissolved oxygen, dissolved oxygen percent saturation, pH, flow, and water clarity were collected. Grab water samples including the parameters of Total Phosphorous, Total Suspended Solids, and Total Volatile Suspended Solids were collected once per month throughout the growing season from May-October in 2014 and 2015 at the sites upstream and downstream of the Long Lake confluence and within the deep hole of Long Lake. Robert Holzbach is the citizen lake monitoring volunteer, who provided much assistance with the collection of water samples within the deep hole of Long Lake. In addition, at all other sites a water grab sample was

collected and analyzed for Total Phosphorous during the same 6 month growing season. A continuous temperature HOBO was installed at all sites and collected continuous water temperature readings between May-October.

Site Selection – Sites were selected so data would not be biased toward stream order, location, or natural community. However sites were targeted based on access and the desire to focus a sample site on a particular stream reach. Sample stations were established to limit outside influences and set-up using DNR field procedures manuals of 35 times the mean stream width (Modified from Simonson, et al. 1994). Stations were no less than the minimum of 100 meters and no more than the maximum of 400 meters.

Continuous Water Temperature Monitoring- An Onset Hobo water temperature data logger was placed within the sample station used for fish and habitat survey. Temperature readings were collected every hour from May thru October in 2014. Temperature data will be used to determine relative thermal regimes for the sample station and to ascertain average daily summer time maximum temperatures. The temperature data will not be used to provide verification of natural community classification.

Fish Surveys- Fish surveys were completed through the identified sample station. A direct current electrofishing backpack shocker or tow behind stream shocker was used to collect all fish possible through an upstream pass through the sample station. Typically the back pack units were used on the small streams up to 3 meters wide. On streams larger than 3 meters, a stream shocker was used mounted on a pull behind tow barge with a generator and 2 probes. All fish were collected, identified, and counted. All gamefish were measured. All other WDNR sampling protocols were used to assess the fish community for purposes of calculating an index of biotic integrity. In Wisconsin, the fish based Index of biotic integrity, consists of a series of fish community metrics that reflect basic structural and functional characteristics of the fish community. This index helps assign an overall rating of the quality of the fish community observed relative to its expected natural community fish assemblage.

Habitat Surveys- At the established stations, a quantitative habitat evaluation was completed. A total of 12 transects were located equidistant throughout the station to sample representative available habitat. Quantitative habitat metrics were collected, such as average stream width and depths, depths of fines, substrate, embeddedness of substrate, macrophyte or algal growth, canopy cover, riparian buffers, land use, stream bank erosion, and fish cover. The station length was established at a distance 35 times the mean stream width.

Macroinvertabrate Sampling- Macroinvertebrate samples were obtained by kick sampling a collection using a D-frame net at all sample sites in the fall. These samples were sent to the University of Wisconsin-Stevens

Point for taxonomic classification, analysis, and computation of a Macroinvertabrate Index (M-IBI), Hilsenoff Biotic Index (HBI), and other usable metrics. Macroinvertebrate metrics in the M-IBI includes measures of pollution tolerance, sediment deposition tolerance, taxonomic composition, species richness and functional feeding groups. Each of the individual metrics are weighted and summed to create the M-IBI (Weigel 2003). The M-IBI is applied on wadeable streams across all geographic and physical (flow and temp) conditions (see WDNR 2013) to assign an overall score and rating.

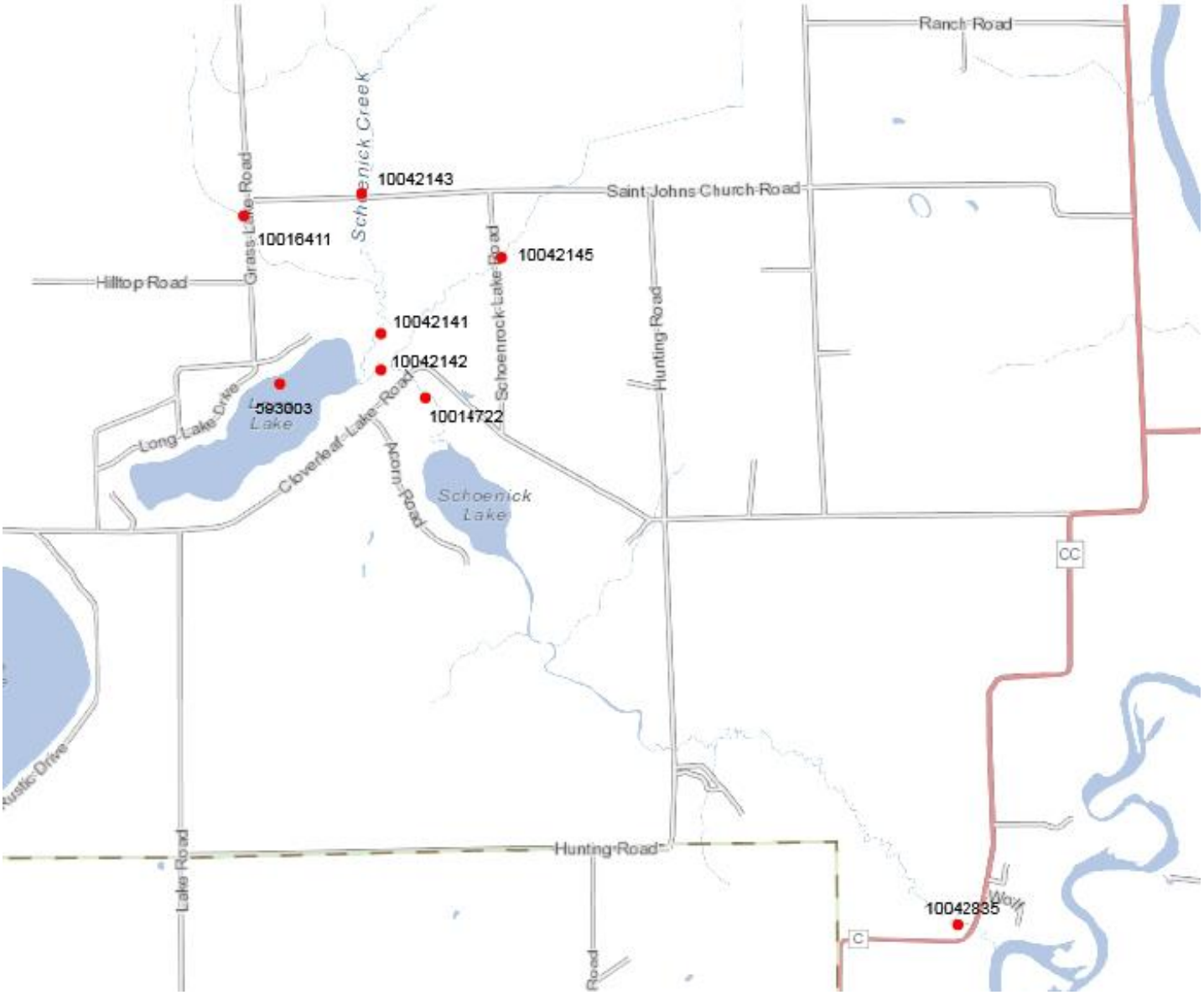
Flyover Air Photos

Aerial flyovers were conducted twice following large summer rainfall events to determine watershed influences on lake and stream interactions at the confluence location. Direct observation was desired to discern if noticeable sedimentation plums enter the lake following large rainfall events and how these plums may spread throughout the lake.

Table 1. Schoenick Creek and Long Lake Tributary Sampling Sites- 2014, 2015.

Waterbody	WBIC	Location (SWIMS ID)	Order
UNT to Long Lake	321400	Downstream Grass Lake Road (10016411)	1
Schoenick Creek	321000	Upstream St. Johns Church Road (10042143)	3
UNT to Schoenick Creek	321200	Upstream of Schoenrock Lake Road (10042145)	1
Schoenick Creek	321000	Upstream of Long Lake Confluence (10042141)	3
Schoenick Creek	321000	Downstream Long Lake Confluence (10042142)	3
Schoenick Creek	321000	Downstream Cloverleaf Lake Road (10014722)	3
Schoenick Creek	321000	Upstream CTH CCC (10042835)	3
Long Lake	321300	Deep Hole (593003)	NA

Figure 1: Schoenick Creek and Long Lake Tributary Sample Site Locations, 2014, 2015.



SUMMARY RESULTS

Results for the fisheries surveys are provided in Table 2 and 3. The natural communities model (Lyons, 2008) indicates that Schoenick Creek and the tributary streams to Long Lake are classified as cool-warm headwater, warm head headwater, cool-warm mainstem, and warm mainstem streams. Based on the natural community verification draft guidance (Lyons 2014), the streams in the watershed were generally underestimated for flow and/or overestimated the daily maximum water temperatures when reviewing species assemblages for 2 years on the streams in the watershed. Based on the verified natural community, the applicable IBI was applied to achieve a score and rating for each stream reach sampled. Habitat scores within all reaches of streams were evaluated against the small stream criteria with streams of widths <10 m.

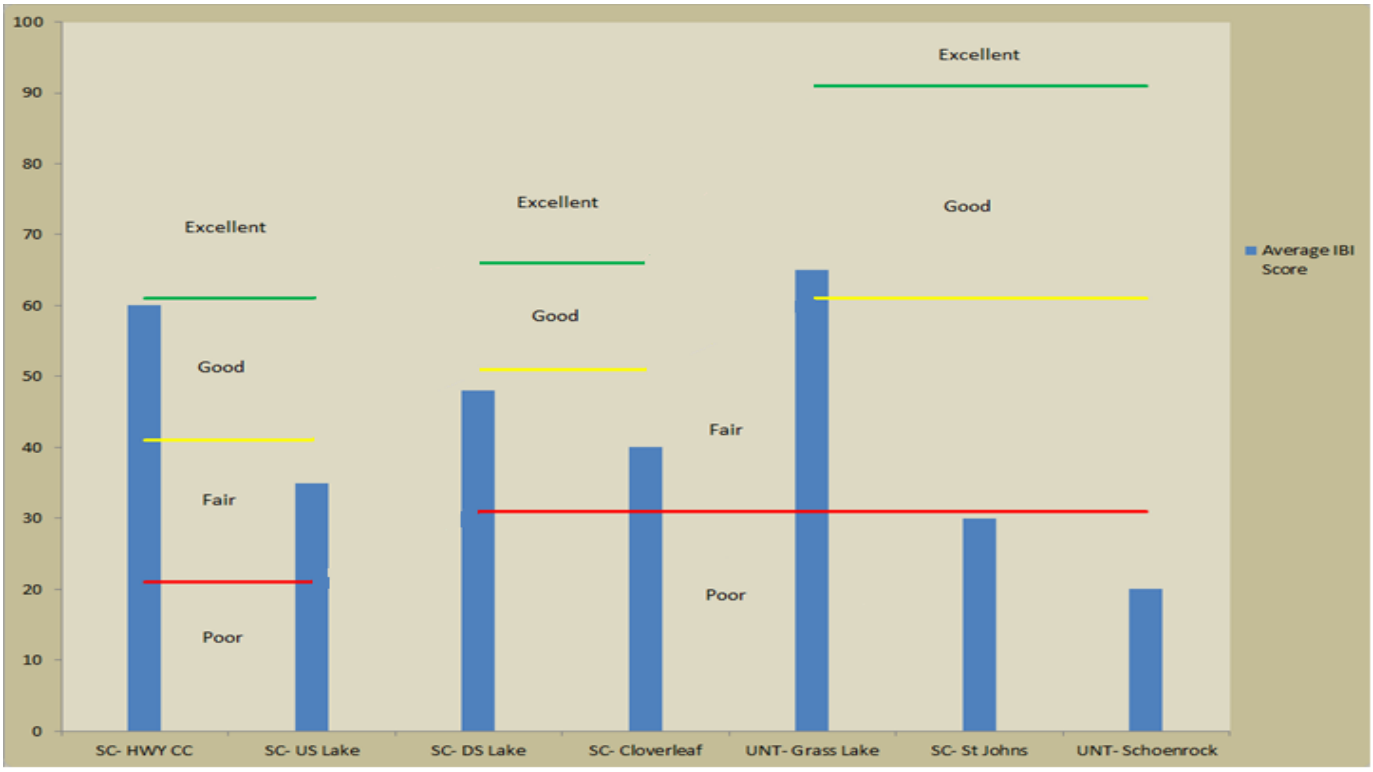


Figure 2- Averaged Fish IBI Scores and Ratings for Schoenick Creek and Tributary Streams to Long Lake- 2014 and 2015.

Figure 3- Habitat Scores and Ratings for Schoenick Creek and Tributary Streams to Long Lake- 2014 and 2015.

Macroinvertabrate samples were collected at all sites in 2014 and selected follow-up sites in 2015 and evaluated with the Hilsenhoff Biotic indices (HBI, Hilsenhoff, 1987) and the Macroinvertebrate index of biotic integrity (MIBI, Weigel, 2003). The Hilsenhoff Biotic Index (HBI) provides a relative measure of organic loading to a stream and as the score increases so does the environmental degradation. The macroinvertebrate IBI (MIBI) was developed for streams within specific eco-regions of Wisconsin and uses metrics related to assemblage composition, structure and function and assesses a wide range of environmental conditions including land use, habitat and water quality (Weigel, 2003). As score decrease, environmental degradation increases and scores below 2.5 are generally considered degraded and impaired. M-IBI results were consistently fair with the exception of Schoenick Creek at Cloverleaf Lake Road achieving a good score and the unnamed tributaries to Schoenick at Grass Lake Road and Schoenrock Lake Road Creek having a poor score. (See Figures 4 and 5 and Tables 4 and 5)

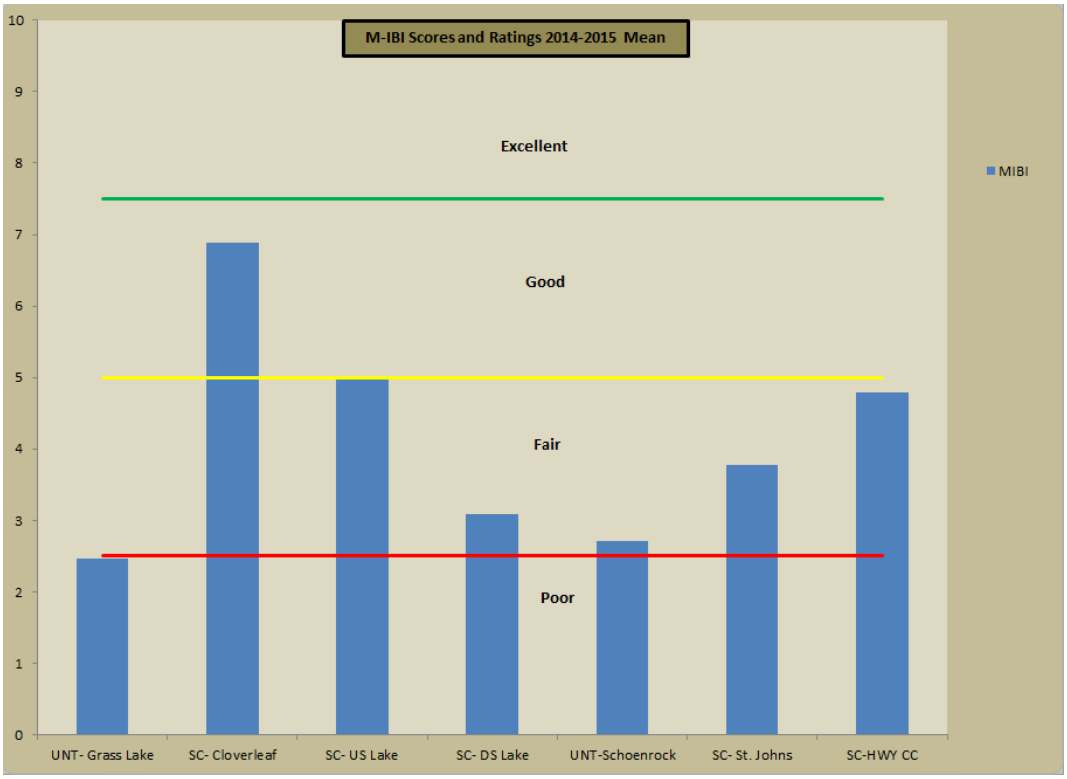


Figure 4- Average M-IBI for Schoenick Creek and Long Lake Tributaries- 2014 and 2015.

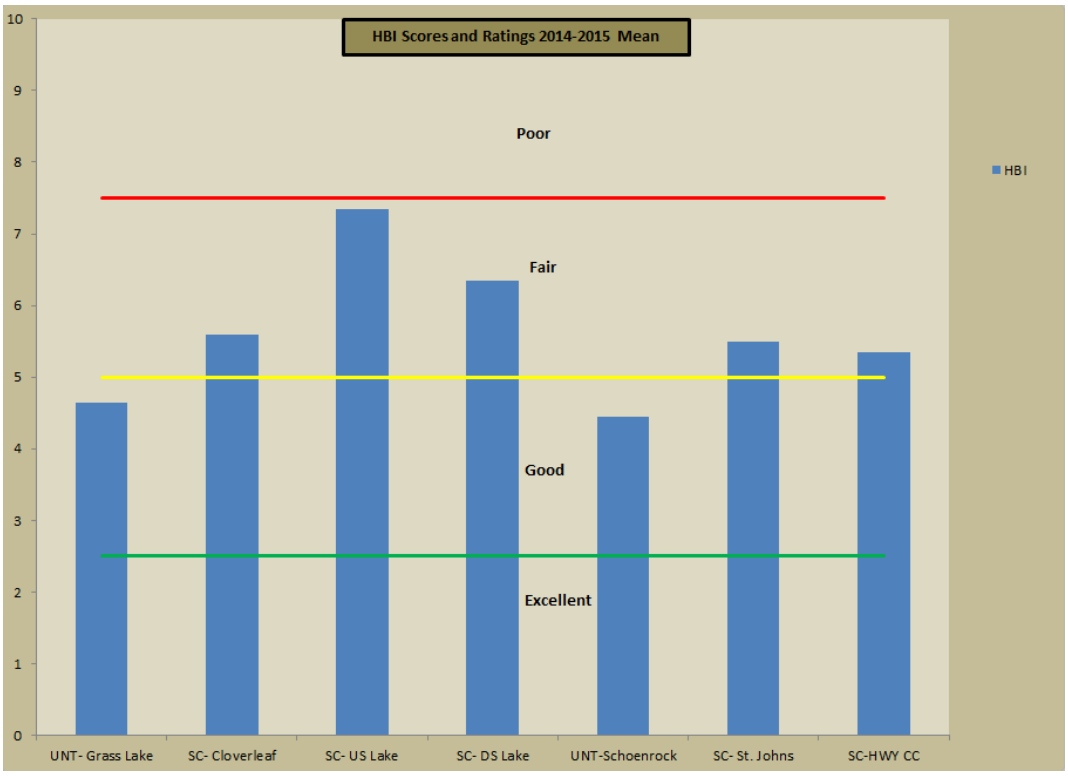


Figure 5- Average HBI Scores for Schoenick Creek and Long Lake Tributaries- 2014 and 2015.

Water quality grab samples for Total Phosphorous were collected once per month at seven sites in 2014 and five sites in 2015 on Schoenick Creek and the Unnamed Tributaries to Long Lake. During the two years that Total Phosphorous samples were collected, all sample sites with the exception of Schoenick Creek at CTH CC consistently exceeded the standards 0.075 mg/l. See figures 7-13. Based upon 2016 WisCalm guidance, the Unnamed Tributaries at Grass Lake Road and Schoenrock Lake Road, and Schoenick Creek from its headwaters to Cloverleaf Lake Road, will be up for consideration for listing as impaired on the State's 303(d) list of impaired waters in 2018. In addition to water quality grab samples for Total Phosphorous, Total Suspended Solids and Volatile Total Suspended Solids were analyzed six times during the growing season for two years at the Upstream and Downstream Schoenick Creek locations and within the Deep Hole at Long Lake. See figure 14-17.

DISCUSSION

Monitoring of Schoenick Creek and the Tributary streams in this project followed guidance in 2016 WisCalm for evaluating streams for impairments. Based on this Guidance, Schoenick Creek from its headwaters downstream to Schoenick Lake and the Unnamed Tributaries at Schoenrock Lake Road and Grass Lake Road may be considered for listing on the state's 303(d) list of impaired waters in 2018. The streams showed either a degraded biological community, exceedances of the Total Phosphorous Criteria or both.

Associated functions and values have been documented between Schoenick Creek and the two Unnamed Tributaries to Long Lake. Schoenick Creek originates within a large wetland complex north of Belle Plain Road. Historic channelization, straightening and ditching of this wetland complex occurred prior to 1938 for cultivation purposes but it appears very little hydrologic alteration attempts have been made since then. A permitted municipal wastewater treatment facility that serves Maple Lane Health Care Facility discharges to this wetland complex upstream of Belle Plain Road. Waste is treated by passive natural processes and held in onsite ponds where discharges occur to the wetland complex usually only over a two week period in the fall. It would appear unlikely that the discharge from this waste facility is causing measurable impacts to Schoenick Creek and Long Lake. There continues to be minimal stream definition upstream and most likely a braided channel carries sheet flow until it converges and passes under Belle Plain road and flows south. The wetland complex contains both woody and open sedge marsh habitat and provides multiple functional values as headwater protection to the stream. Its greatest attribute is likely the high value for fish and wildlife habitat. Although no Northern Pike were observed in the stream surveys above Schoenick Lake, Northern Pike are present in Long Lake and are common in the Wolf River downstream. It would appear this wetland has good potential for northern pike spawning.

As Schoenick Creek flows south, it becomes a meandering stream flowing through a relatively undeveloped corridor with adequate buffers. The general land use surrounding this section is agricultural land prior to entering the large wetland complex along the eastern edge of Long Lake. Both the Unnamed Tributaries converge with Schoenick Creek in this wetland complex but only the western Unnamed Tributary that crosses Grass Lake Road enters upstream of Long Lake. The Unnamed Tributary at Grass Lake Road, along with a few other small unnamed Tributaries have been ditched, straightened and moved along field borders. These streams have little to no buffers and likely are impacted by non-point source issues. The large wetland complex on the eastern edge of Long Lake has additional excellent potential to support northern pike spawning in Schoenick Creek. Located at the confluence of the lake and the eastern unnamed Tributary that crosses Schoenrock Lake Road, a shallow wetland marsh complex provides connectivity of both the inlet and outlet of Schoenick Creek and the unnamed tributary during flood events and wet spring conditions.

Figure 6. Picture looking north from flooded wetland near inlet/outlet of Long Lake.

Temperature data collected during this study indicate that Schoenick Creek upstream of Long Lake is much cooler and likely intercepts ground water throughout the wetland complex. This provides a cool-water source to Long Lake but supports a different species assemblage than Schoenick Creek downstream of Long Lake. Schoenick Creek downstream of the lake is highly influenced by the surface water temperature discharge of Long Lake. Prevailing wind direction and the spatial orientation of the lake in relationship to the inlet and outlet force warm surface water from the lake to the outlet. This warm water segment of Schoenick

Creek downstream of Long Lake provides excellent nursery habitat that helps bolster the largemouth bass and bluegill population within the lake. This was evident by the large number of young of the year largemouth bass and bluegill sampled in both 2014 and 2015. Overall, the Fish index of biotic integrity for both of these sites was rated as fair. Habitat in the downstream segment rated fair and was downgraded by the amount of fines, lack of riffle habitat, poor width to depth ratio, and lack of pools. Conversely, habitat within Schoenick Creek upstream of Long Lake was rated as good but fish scored a lower fair rating on the index of biotic integrity.

Long Lake is oriented in a southwest to northeast direction and Schoenick Creek enters and exits Long Lake at the south-eastern corner in the east end of the lake. Prior to entering the lake, Schoenick Creek flows south meandering along the lake through a large wetland complex. During periods of high water in spring and during larger rainfall events, Schoenick Creek has the ability to overtop its bank, flood the adjacent wetland, and become a larger extension of Long Lake. During periods of low or no flow, water within the stream is contained with the channel, and as it enters the lake, is affected by a number of variables that dictate the extent of mixing and contribution of sediment and nutrient load to the lake. As Schoenick Creek enters long lake, a depositional delta exists, that for the most part is sparsely vegetated with submergent and emergent aquatic plants during the growing season. When looking at the results of the water quality parameters for Total Phosphorous, Total Suspended Solids, and Volatile Total Suspended Solids, a few basic conclusions became evident. Sediment transport into the lake from Schoenick Creek and sediment export out of the lake from Schoenick Creek matched fairly well. This would lead to the conclusion that although Schoenick Creek delivers a sediment load into the lake, the outlet also serves to transport sediment out of the lake. This relationship is strong likely due to the close proximity of the inlet to the outlet, the orientation of the lake and prevailing wind direction. Sediment settles at the delta, is re-suspended by wind and wave action and exits through the outlet. This process is strengthened during the growing season when vegetation limits the extent of transportation of smaller sized suspended particles to areas past the delta. Over the 2-year period where growing season water samples were taken, a strong correlation did not exist that would indicate the lake is acting as a sediment and nutrient sink leading to significant adverse water quality conditions in the lake.

RECCOMENDATIONS

- Propose listing Unnamed Tributaries to Long Lake and Schoenick Creek upstream of Long Lake on the 2018 impaired waters list.
- Support the development of a 9- Key Elements Plan for the Watershed by Shawano County Land Conservation Department
- Develop understanding of agricultural producer operations in the watershed and foster partnerships between Long Lake Association, Shawano County, and Agricultural producers in the watershed.
- Work with the Shawano County Land and Water Conservation Department to utilize all available land modeling tools to identify erosion vulnerability of land within the watershed.
- Work to develop agricultural field tile line maps within the watershed.
- Help promote soil health principles and improve buffer conditions around tributaries and direct drainages to these tributary streams.
- Develop a strategy to support partnerships with producers to achieve contributory reductions in nutrient and sediment loads to Schoenick Creek and Long Lake through land conservation practices.
- Promote Shoreline stabilization projects with the property owners along Long Lake to prevent soil and nutrient loss from the lands adjacent to the lake.
- Promote the re-establishment and enhancement of shoreline emergent vegetation and submergent aquatic plants.
- Develop a delta enhancement project that will provide course woody debris habitat and support dense native emergent and submergent aquatic plant beds. This delta enhancement project will seek to trap incoming sediments near the inlet and prevent suspension out into the lake while allowing native submergent and emergent plants to uptake available nutrients and providing habitat for fish and wildlife.
- Review, identify, and work towards completing unfinished recommendations in the 2004 Final Report of *Water Quality in the Schoenick Creek Watershed and Long and Schoenick Lakes Shawano County, WI.*

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STREAM NARRATIVES

Schoenick Creek- Upstream Long Lake

Schoenick Creek downstream of Belle Plain Road downstream to Long Lake is classified as a warm headwater. When the natural community verification was completed, this stream is likely a better resemblance of a cool-warm transitional headwater stream. This segment of stream is well buffered throughout running through a mix of lowland hardwood and alder swamp. The stream meanders through the flood plain and evidence of recent channel shifts and meander cutoff are present. Habitat is limited by lack of pools, riffles and limited bank erosion. Instream habitat in the form of woody debris is present and provides cover for fish. Substrate is dominated by silty sands with limited gravel or cobble present. Direct drainage swales from agricultural lands to this segment of stream are not well buffered and likely improvements could be made to provide additional benefits to water quality. Winter spreading of manure in close proximity to these swales has been observed. As Schoenick Creek approaches the lake and large wetland complex, the water temperatures takes a dynamic drop. The lowest segment of the stream is a deep run with extensive woody debris from old beaver activity. The macroinvertebrate index of biotic integrity was fair and likely depressed from localized non-point source watershed factors and local habitat availability

Schoenick Creek- Downstream of Long Lake and Upstream of Schoenick Lake

As water discharges from Long Lake it reforms Schoenick Creek. Unlike the immediate area upstream of the lake, this downstream segment between Long Lake and Schoenick Lake is dictated by the surface water temperature of Long Lake and is considerably warmer during the summer growing season. This warmer surface water temperature has allowed a Warm headwater fish community to be present. Extensive sand and silt are present in this segment and lack of pools and fish cover limit the habitat scores. The fish community however in this segment is dominated by young of the year bluegill and bass that likely use this segment of the stream as nursery habitat between the two lakes. The stream is well buffered as if flows through lowland alder swamp and northern hardwood forest vegetation types. The macroinvertebrate index of biotic integrity was fair to good and is likely depressed from watershed factors and local habitat availability.

Schoenick Creek- Downstream of Schoenick Lake

Schoenick Creek downstream of Schoenick Lake is well buffered as it meanders through lowland hardwood swamp as it approaches its confluence with the Wolf River. The natural community is modeled as a warm-mainstem stream however the verified natural community is consistent with a cool-warm mainstem stream. The substrate is dominated by sand and bank erosion on outer bends is present. Overall it would appear that habitat scores should be good however the scores are depressed from the percent of fines, moderate bank erosion, and lack of fish cover. This segment of stream appears to provide nursery habitat for burbot as significant numbers of young of the year were present in both survey years. The macroinvertebrate index of biotic integrity was fair to good and is likely depressed from watershed factors and local habitat availability.

UNT to Schoenick Creek- Schoenrock Lake Road

The Unnamed Tributary to Schoenick Creek that drains land to the east of Long Lake is a typical small headwater tributary. The extreme headwaters originate as agricultural ditches with little to no buffer. The stream flows through these ditches, a pasture, lowland hardwood woodlots and reed canary dominated sedge meadows. The fish community is dominated by headwater pioneer species of Brook Stickleback and Central Mudminnow. For its size, the habitat score was good with adequate cover for fish. The fish cover however was monotypic and limited to overhanging vegetation comprised of reed canary grass along the margins. The substrate is dominated by sand and silt; however there are a few locations with gravel and cobble present. The macroinvertebrate index of biotic integrity was fair and likely depressed from the local non-point source watershed factors.

UNT to Schoenick Creek- Grass Lake Road

The Unnamed Tributary to Schoenick Creek that drains land to the west of Long Lake is a typical small headwater tributary. The extreme headwaters originate as agricultural ditches with little to no buffer. The stream flows through these ditches, a pasture, agricultural lands, and northern hardwood forest prior to its confluence with Schoenick Creek upstream of Long Lake. The fish community is dominated by headwater pioneer species of Brook Stickleback, Central Mudminnow, and Northern Red Belly Dace and it verified natural community matched its modeled natural community of a cool-warm headwater. For its size, the habitat score was good but the score was depressed by buffer width, excessive fines and lack of fish cover. The substrate is dominated by sand and silt with only one small area of cobble present. The macroinvertebrate index of biotic integrity was poor and likely depressed from the local non-point source watershed factors and excessive fines.

Appendix of Tables and Figures

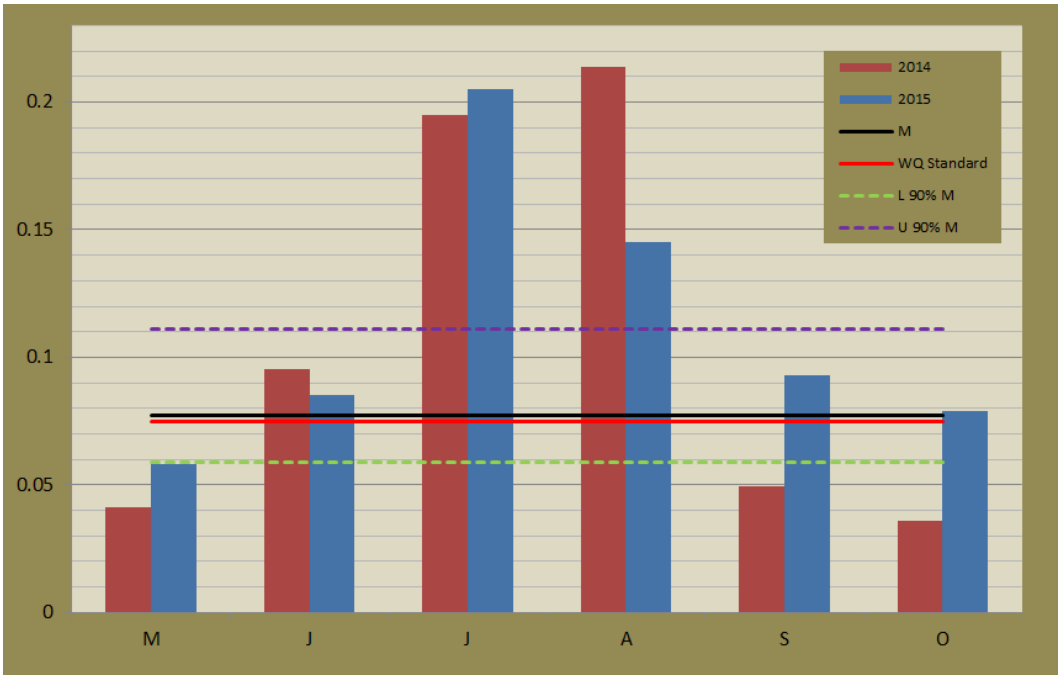


Figure 7. Total Phosphorous results from growing season samples UNT to Schoenick Creek @ Grass Lake Road 2014 and 2015.

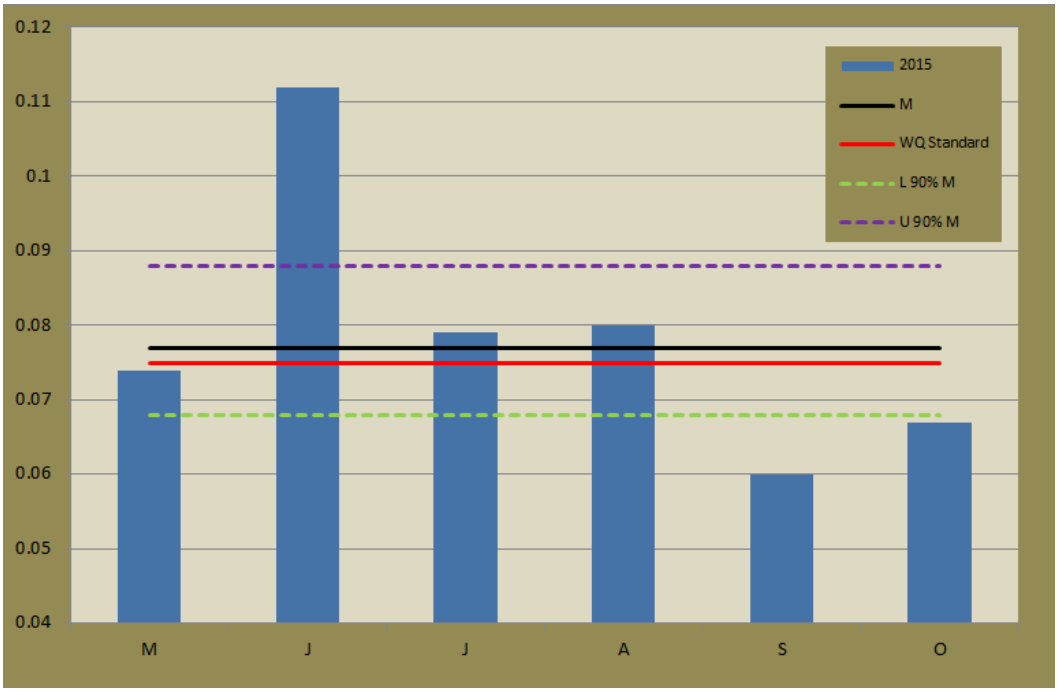


Figure 8. Total Phosphorous results from growing season samples Schoenick Creek @ CTH CC 2015.

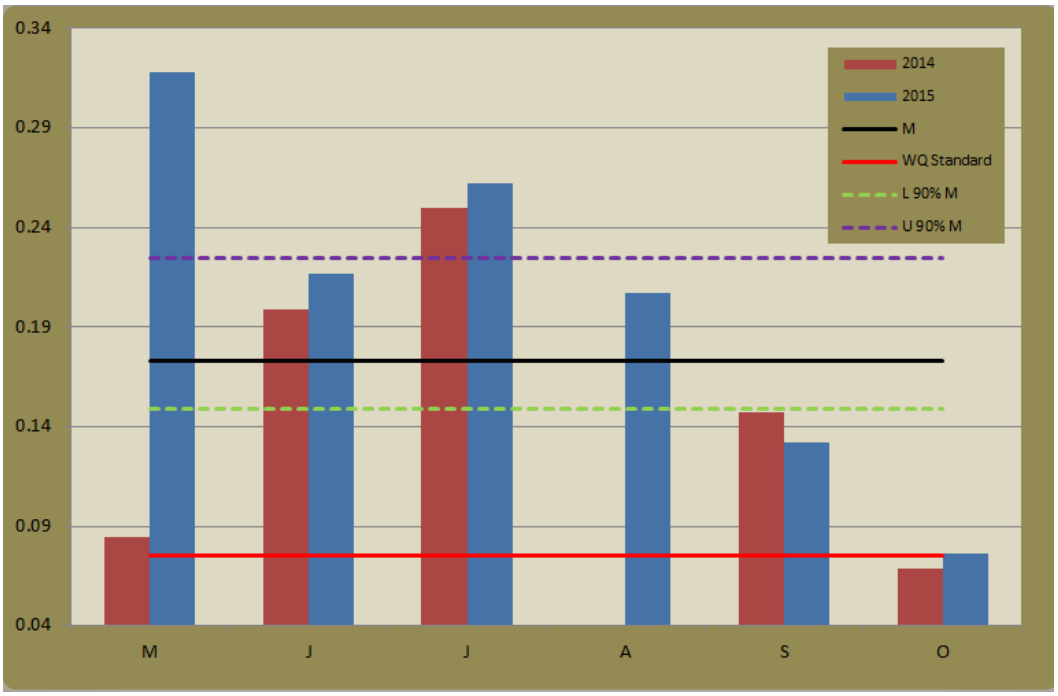


Figure 9. Total Phosphorous results from growing season samples Schoenick Creek upstream of Long Lake Confluence 2014 and 2015.

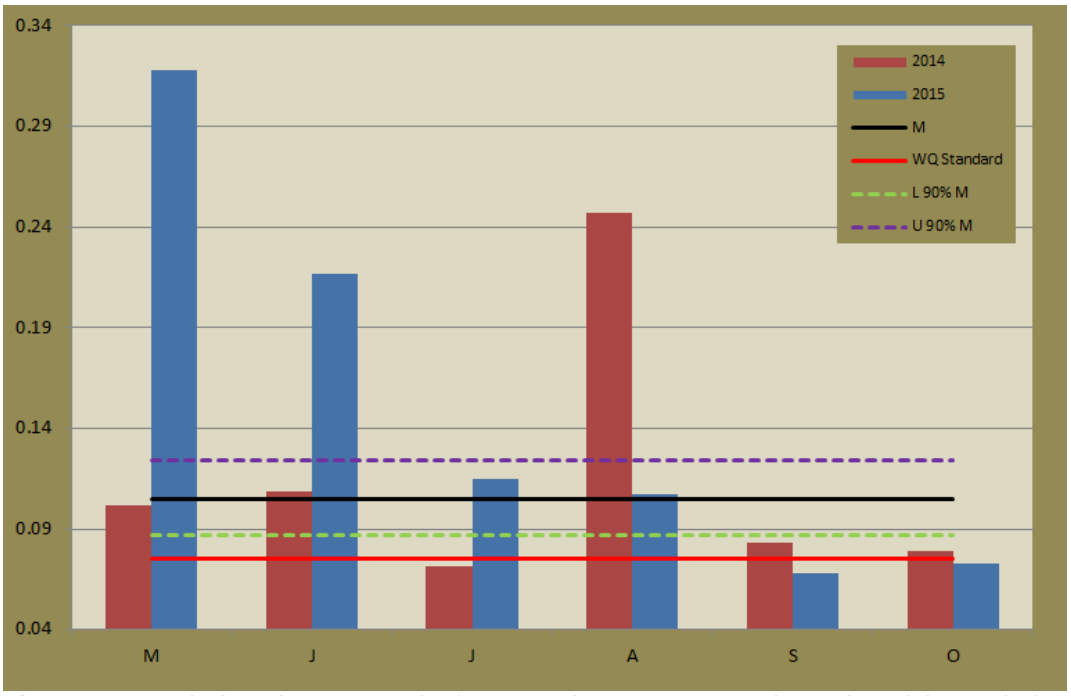


Figure 10. Total Phosphorous results from growing season samples Schoenick Creek downstream of Long Lake Confluence 2014 and 2015.

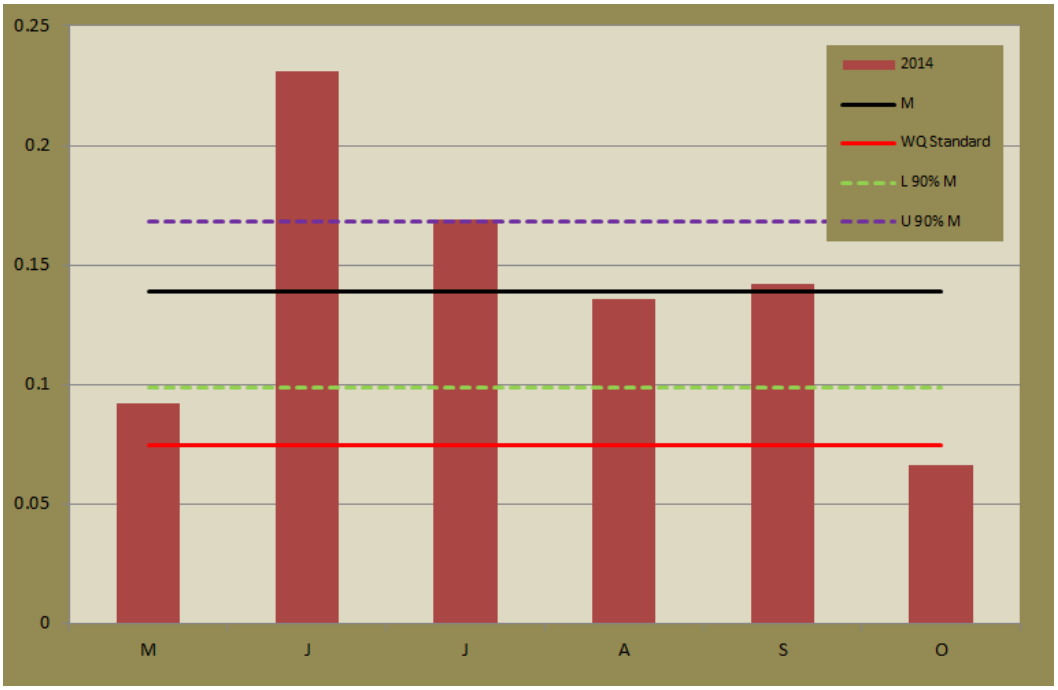


Figure 11. Total Phosphorous results from growing season samples Schoenick Creek @ St. John's Church Road 2014.

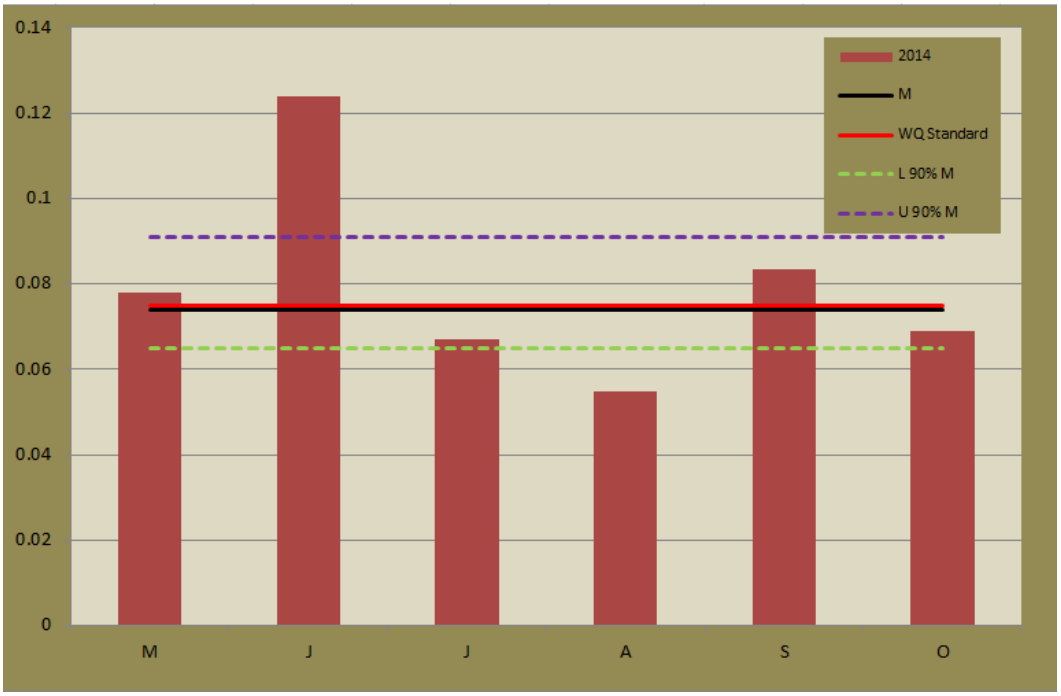


Figure 12. Total Phosphorous results from growing season samples Schoenick Creek @ Cloverleaf Lake Road 2014.

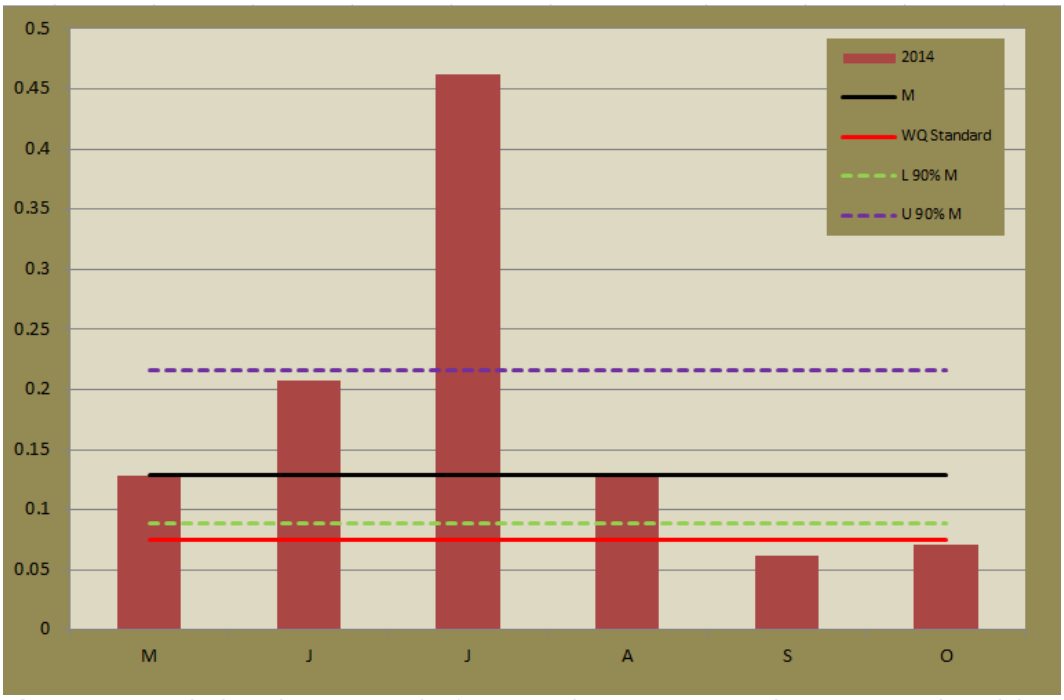


Figure 13. Total Phosphorous results from growing season samples UNT to Schoenick Creek @ Schoenrock Lake Road 2014.

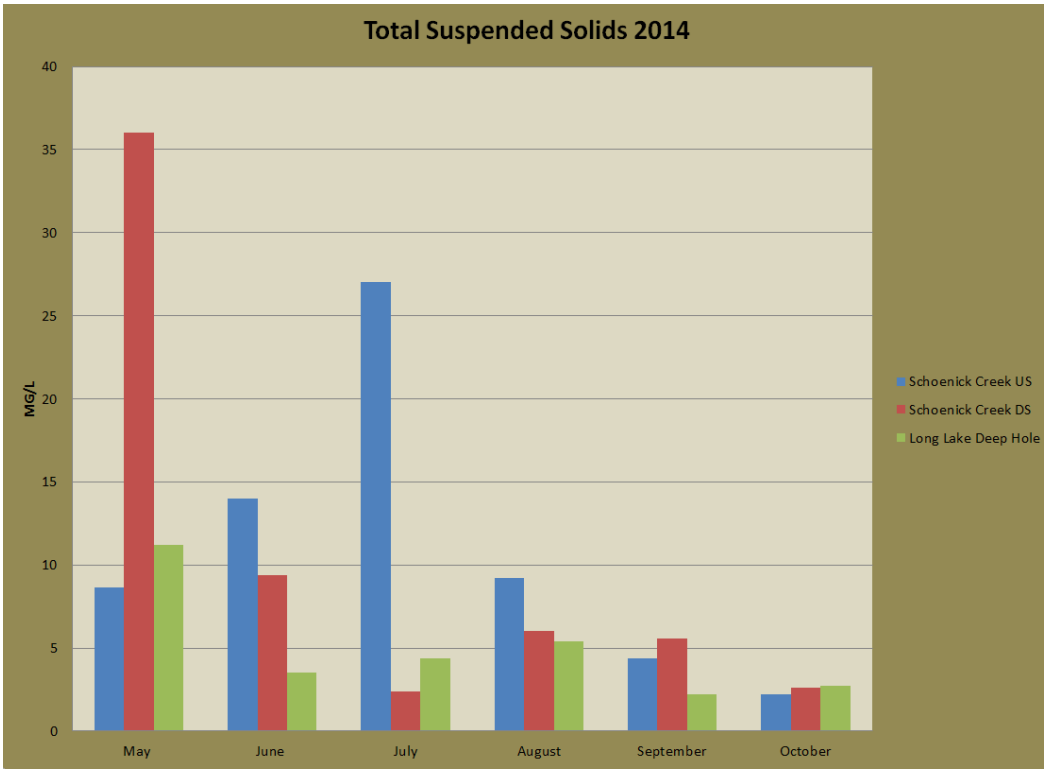


Figure 14. Total Suspended Solids results from growing season samples 2014.

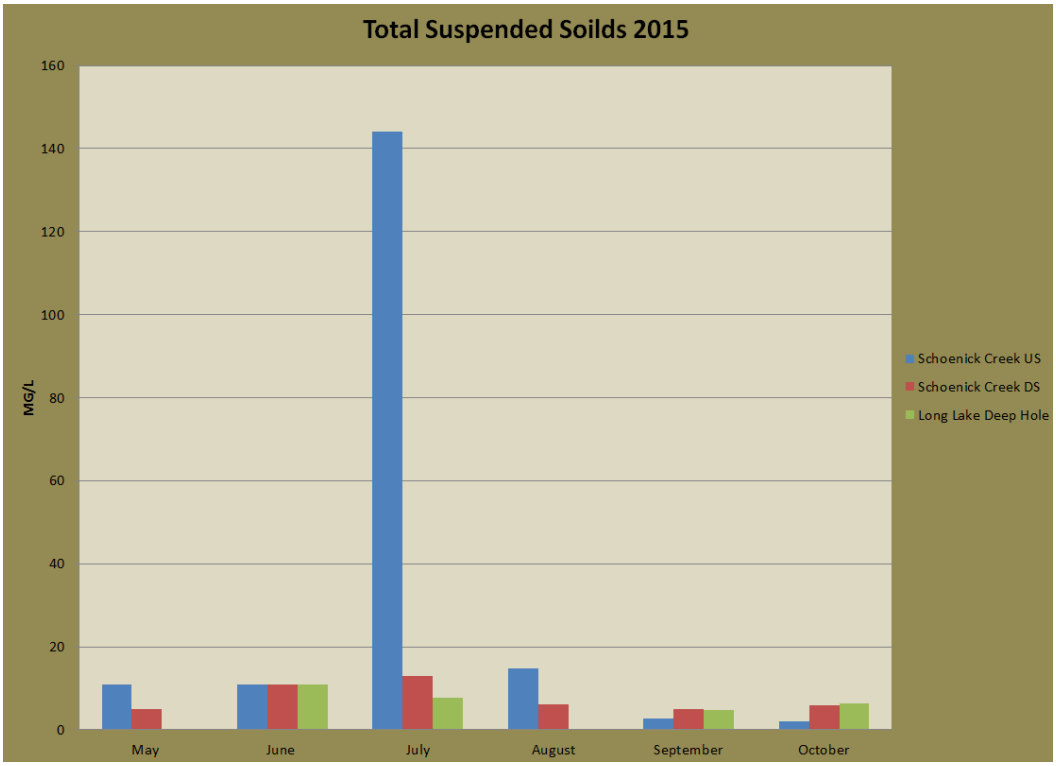


Figure 15. Total Suspended Solids results from growing season samples 2015.

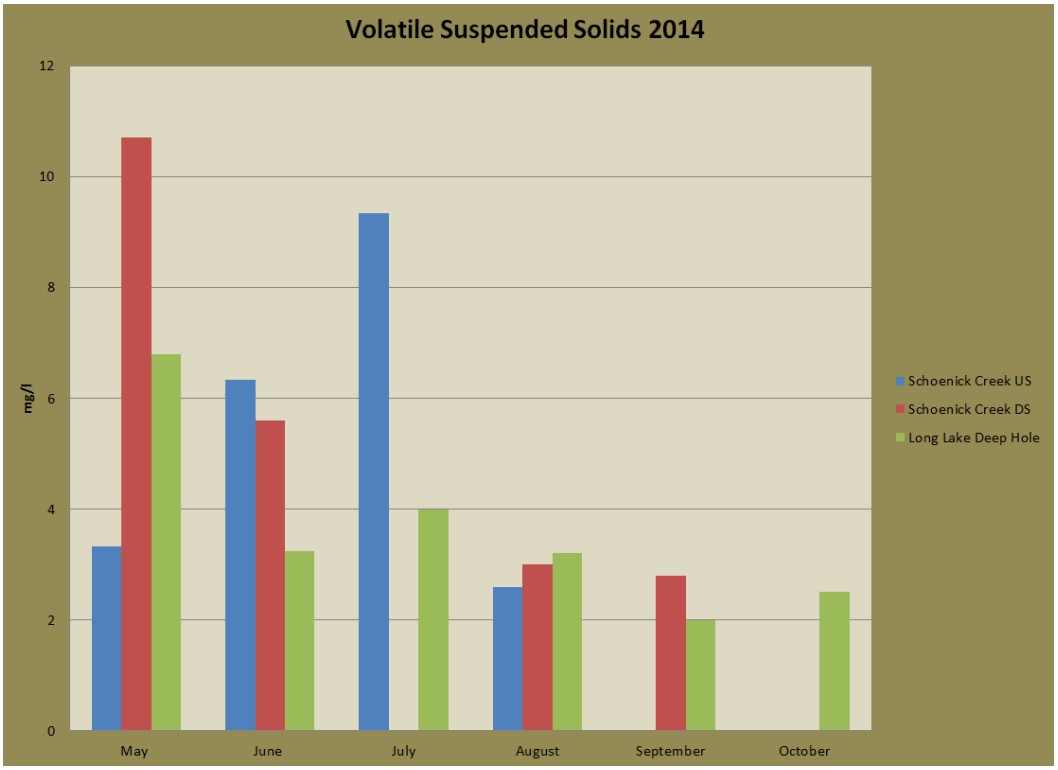


Figure 16. Volatile Suspended Solids results from growing season samples 2014.

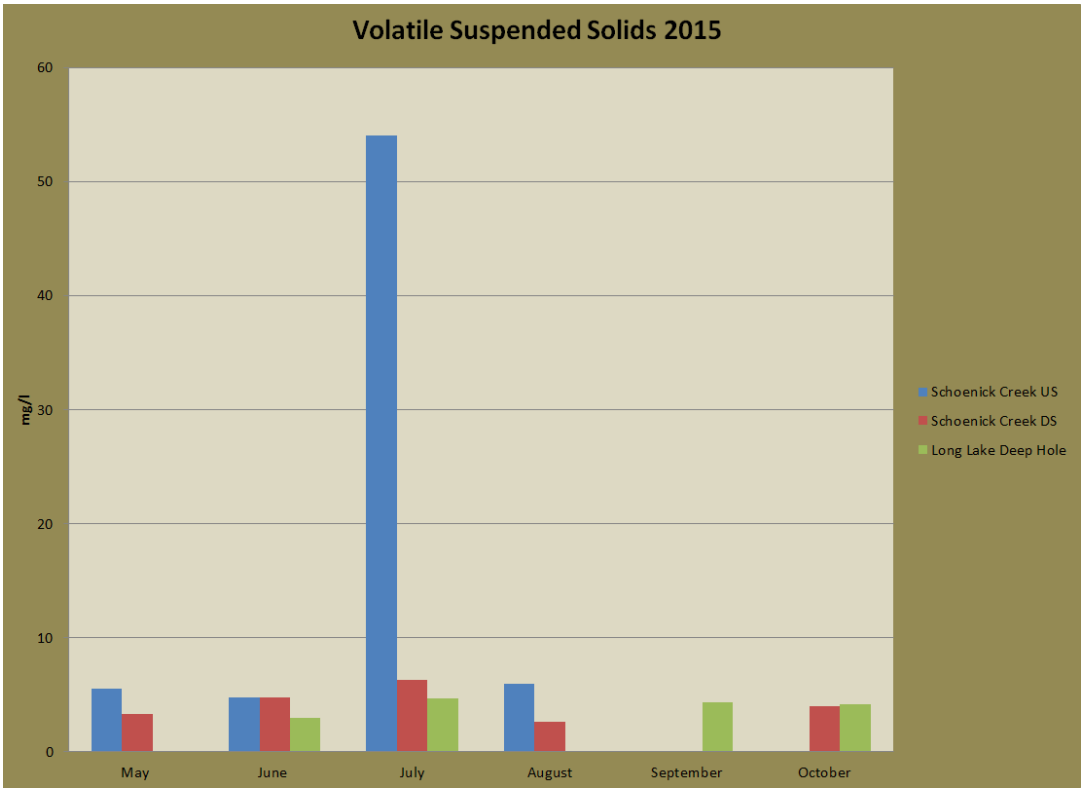


Figure 17. Volatile Suspended Solids results from growing season samples 2015

Table 2. Fish IBI for the Schoenick Creek and Long Lake Tributaries, 2014

2014 Stream - Site	UNT to Long Lake DS Grass Lake Rd	Schoenick Creek US St. John's Church Rd	UNT to Schoenick Creek US Schoenrock Lake Rd	Schoenick Creek US Lake Confluence	Schoenick Creek DS Lake Confluence	Schoenick Creek DS Cloverleaf Lake Rd	Schoenick Creek US CTH CCC
Stream Order	1	3	1	3	3	3	3
Mean Stream Width	3	3	1.5	5	6	6	5
Station Length	105	105	105	175	210	210	175
Modeled Natural Community	CWHW	CWHW	CCHW	WHW	WHW	WHW	WMS
Verified Natural Community	**CWHW**	**CWHW**	**CWHW**	**CWHW**	**WMS**	**WMS**	**CWMS**
Fish Species							
Black Bullhead					2		
Central Mudminnow	9	66	13	54	20	4	
Bluegill				1	113	73	4
Yellow Perch				4			
Blackside Darter							2
Tadpole Madtom					4		
Brook Stickleback	11	3	44	1			
Johnny Darter		3			5	1	35
Yellow Bullhead					1	1	
Rock Bass							1
Pumpkinseed					17	22	
Creek Chub					1		
Spotfin Shiner					2		16
Bluegill x Pumpkinseed					8		
Largemouth Bass				1	88	15	1
Northern Pike							2
Burbot					1		121
Northern Redbelly Dace	22						
White Sucker				2	1		2
Total # Fish Sampled	42	72	57	63	263	116	184
Total # Species	3	3	2	6	13	6	9
IBI Score							
Coldwater	-	-	-	-	-	-	-
Coolwater (CC)	-	-	-	-	-	-	-
Coolwater (CW)	-	-	-	-	-	-	60 (G)
Warmwater	-	-	-	-	50 (G)	40 (F)	-
Small Stream	50 (F)	20 (P)	20 (P)	20 (P)	-	-	-

CWMS= Cool-Warm Mainstem
CWHW= Cool-Warm Headwater
CCMS= Cool-Cold Mainstem
CCHW= Cool-Cold Headwater
WMS- Warm Mainstem
WHW- Warm Headwater
CW= Coldwater

E= Excellent
G= Good
F= Fair
P= Poor

Green value represents verified natural community score other with applicable IBI

Table 3. Fish IBI for the Schoenick Creek and Long Lake Tributaries, 2015

2015 Stream - Site	UNT to Long Lake DS Grass Lake Rd	Schoenick Creek US St. John's Church Rd	Schoenick Creek US Lake Confluence	Schoenick Creek DS Lake Confluence	Schoenick Creek US CTH CCC
Stream Order	1	3	3	3	3
Mean Stream Width	3	3	5	6	5
Station Length	105	105	175	210	175
Modeled Natural Community	CWHW	CWHW	WHW	WHW	WMS
Verified Natural Community	**CWHW**	**CWHW**	**CWHW**	**WMS**	**CWMS**
Fish Species					
Central Mudminnow	5	13	60	47	
Bluegill				117	4
Yellow Perch			11	2	
Johnny Darter		4		5	14
Brook Stickleback	9	2			
Black Crappie			10	5	
Weed Shiner			1		
Bluntnose Minnow					2
Yellow Bullhead				1	
Iowa Darter				3	
Blackside Darter					2
Golden Shiner			4	2	1
Spotfin Shiner					5
Mimic Shiner					2
Emerald Shiner					11
Largemouth Bass			7	52	23
Common Carp				2	11
Bowfin					1
Brassy Minnow	12				
Fathead Minnow	1		1		
Green Sunfish		2		8	21
Northern Redbelly Dace	126	1			2
White Sucker		3	12	8	15
Burbot				6	10
Total # Fish Sampled	153	25	106	258	124
Total # Species	5	6	8	13	15
IBI Score					
Coldwater	-	-	-	-	-
Coolwater (CC)	-	-	-	-	-
Coolwater (CW)	-	-	-	-	60 (G)
Warmwater	-	-	-	47 (F)	-
Small Stream	80 (G)	40 (F)	70 (G)	-	-

CWMS= Cool-Warm Mainstem
CWHW= Cool-Warm Headwater
CCMS= Cool-Cold Mainstem
CCHW= Cool-Cold Headwater
WMS- Warm Mainstem
WHW- Warm Headwater
CW= Coldwater

E= Excellent
G= Good
F= Fair
P= Poor

Green value represents verified natural community score other with applicable IBI

Table 4. Macroinvertabrate Ratings of Streams in the Schoenick Creek Watershed 2014.

2014							
Stream - Site	UNT to Long Lake DS Grass Lake Rd	Schoenick Creek US St. John's Church Rd	UNT to Schoenick Creek US Schoenrock Lake Rd	Schoenick Creek US Lake Confluence	Schoenick Creek DS Lake Confluence	Schoenick Creek DS Cloverleaf Lake Rd	Schoenick Creek US CTH CCC
Stream Order	1	3	1	3	3	3	3
Mean Stream Width	3	3	1.5	5	6	6	5
Station Length	105	105	105	175	210	210	175
Modeled Natural Community	CWHW	CWHW	CCHW	WHW	WHW	WHW	WMS
Verified Natural Community	**CWHW**	**CWHW**	**CWHW**	**CWHW**	**WMS**	**WMS**	**CWMS**
HBI Rating [1]	G	G	VG	FP	F	F	F
HBI Score [1]	5.11	5.24	4.45	7.31	5.76	5.59	5.57
MIBI Rating [2]	F	F	F	F	P	G	F
MIBI Score [2]	3.05	3.49	2.71	4.97	2.44	6.88	4.69

1) E= Excellent (0-3.5)
VG= Very Good (3.51-4.50)
G= Good (4.51-5.50)
F= Fair (5.51-6.50)
F= Fairly Poor (6.51-7.50)
P= Poor (7.51-8.50)
VP= Very Poor (8.51-10)

2) E= Excellent (7.5-10)
G= Good (5.0- 7.49)
F= Fair (2.51- 4.99)
P= Poor (0- 2.5)

Table 5. Macroinvertabrate Ratings of Streams in the Schoenick Creek Watershed 2015.

2015					
Stream - Site	UNT to Long Lake DS Grass Lake Rd	Schoenick Creek US St. John's Church Rd	Schoenick Creek US Lake Confluence	Schoenick Creek DS Lake Confluence	Schoenick Creek US CTH CCC
Stream Order	1	3	3	3	3
Mean Stream Width	3	3	5	6	5
Station Length	105	105	175	210	175
Modeled Natural Community	CWHW	CWHW	WHW	WHW	WMS
Verified Natural Community	**CWHW**	**CWHW**	**CWHW**	**WMS**	**CWMS**
HBI Rating [1]	VG	G	FP	FP	G
HBI Score [1]	4.19	5.47	7.4	6.94	5.13
MIBI Rating [2]	P	F	FP	FP	F
MIBI Score [2]	1.89	4.05	4.99	3.75	4.9

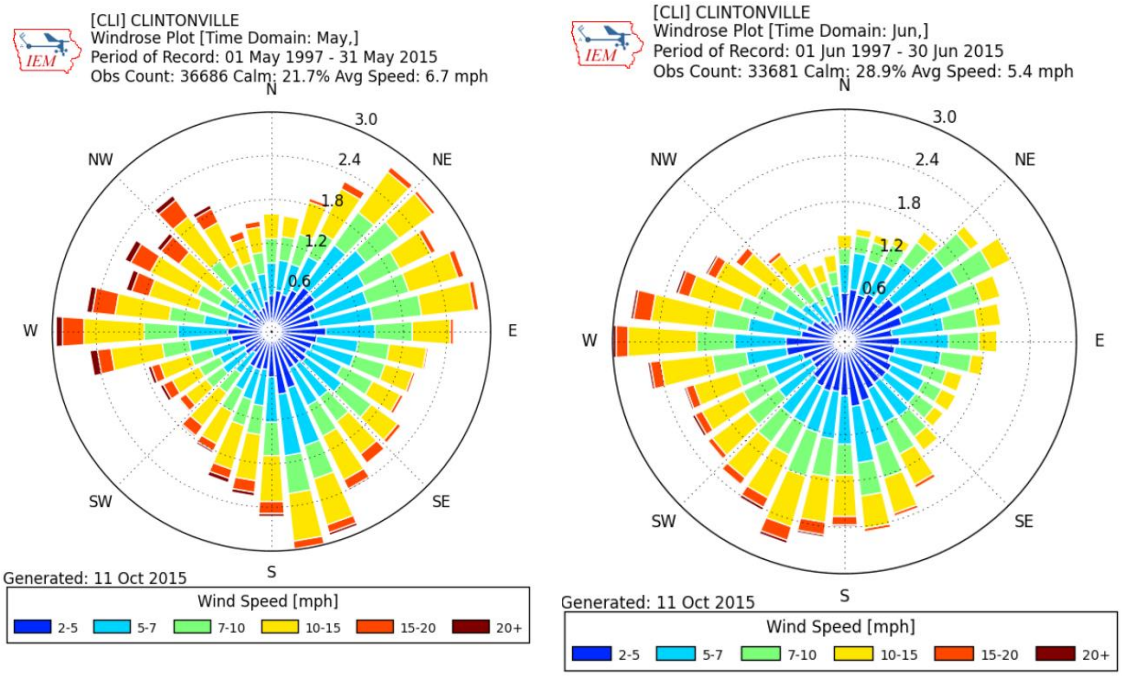
1) E= Excellent (0-3.5)
VG= Very Good (3.51-4.50)
G= Good (4.51-5.50)
F= Fair (5.51-6.50)
F= Fairly Poor (6.51-7.50)
P= Poor (7.51-8.50)
VP= Very Poor (8.51-10)

2) E= Excellent (7.5-10)
G= Good (5.0- 7.49)
F= Fair (2.51- 4.99)
P= Poor (0- 2.5)

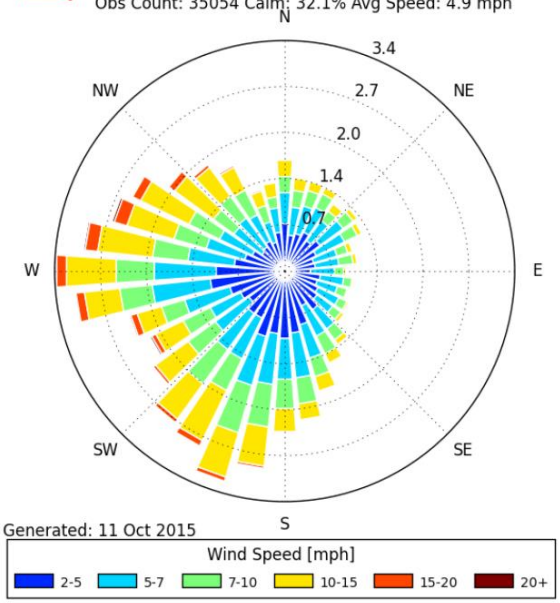
Table 6. Weather patterns leading up to sample dates 2014 and 2015.

Sample Date	Precipitation 7 days leading up to sample day (in)	Wind Speed (mph)	Direction	Max (mph)
05/13/2014	1.14	8	W	18
06/23/2014	1.89	2	SSE	12
07/23/2014	0.012	5	NNE	13
08/14/2014	0.49	2	NW	10
09/23/2014	0.44	2	SW	9
10/21/2014	1.61	5	NNE	13
05/20/2015	0.15	3	W	13
06/24/2015	0.92	4	SW	10
07/23/2015	0.83	3	WSW	9
08/19/2015	0.6	9	SSW	23
09/23/2015	0.69	4	ENE	9
10/21/2015	0.012	6	W	22

Figure18. Wind rose charts near Long Lake May-October 2015.

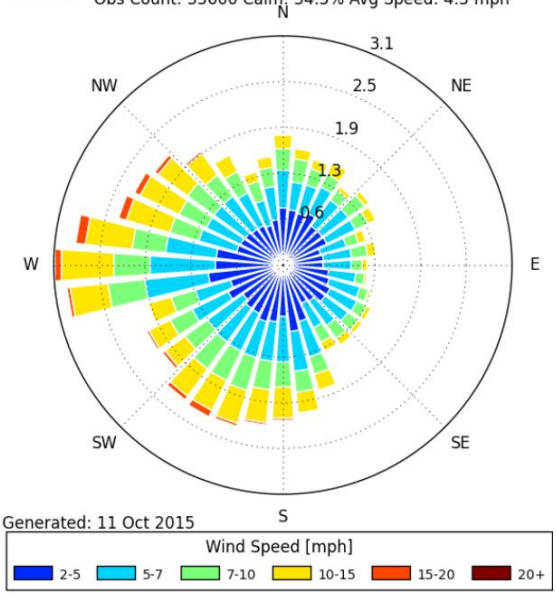


[CLI] CLINTONVILLE
Windrose Plot [Time Domain: Jul,]
Period of Record: 01 Jul 1997 - 31 Jul 2015
Obs Count: 35054 Calm: 32.1% Avg Speed: 4.9 mph



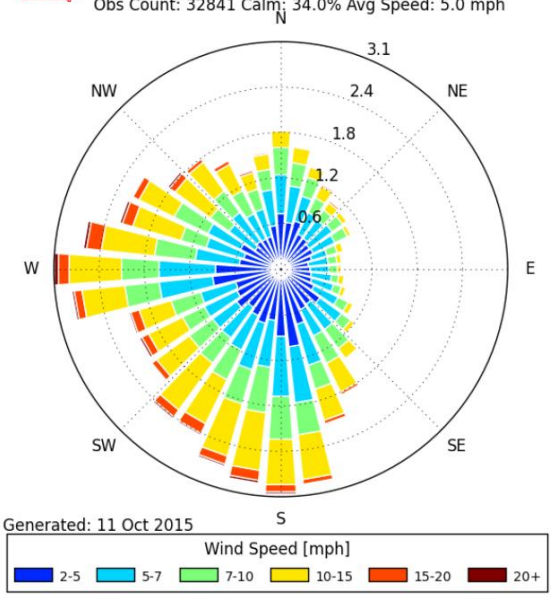
Generated: 11 Oct 2015

[CLI] CLINTONVILLE
Windrose Plot [Time Domain: Aug,]
Period of Record: 01 Aug 1997 - 31 Aug 2015
Obs Count: 35600 Calm: 34.5% Avg Speed: 4.5 mph



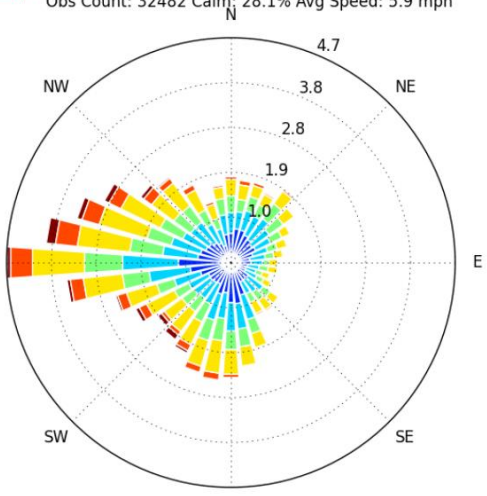
Generated: 11 Oct 2015

[CLI] CLINTONVILLE
Windrose Plot [Time Domain: Sep,]
Period of Record: 01 Sep 1996 - 30 Sep 2015
Obs Count: 32841 Calm: 34.0% Avg Speed: 5.0 mph



Generated: 11 Oct 2015

[CLI] CLINTONVILLE
Windrose Plot [Time Domain: Oct,]
Period of Record: 01 Oct 1997 - 10 Oct 2015
Obs Count: 32482 Calm: 28.1% Avg Speed: 5.9 mph



Generated: 11 Oct 2015

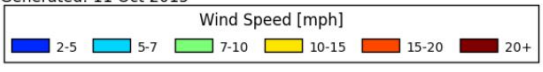


Figure 19. Leaf off Air Photo of Schoenick Creek inlet and outlet of Long Lake and wetland complex.

Figure 20. Flyover storm event photo(s) 9/5/2014