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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
MARCH 2013

STAFF REPORT

BIOLOGICAL AND WATER CHEMISTRY SURVEYS OF SELECTED STATIONS IN THE LOOKING GLASS RIVER WATERSHED SHIAWASSEE AND CLINTON COUNTIES, MICHIGAN JULY AND SEPTEMBER 2012

Introduction

Biological and physical habitat conditions of selected water bodies in the Looking Glass River watershed in Clinton and Shiawassee Counties were assessed by staff of the Surface Water Assessment Section in July and September 2012. The primary objectives of the assessments were to:

1. Identify nonpoint sources (NPS) of water quality impairment.
2. Assess the current status and condition of individual water bodies and determine if Michigan Water Quality Standards (WQS) are being met.
3. Satisfy monitoring requests submitted by internal and external customers.
4. Evaluate biological integrity temporal trends.

The macroinvertebrate community and/or physical habitat was qualitatively assessed at each of 10 stations using the Surface Water Assessment Section Procedure 51 (MDEQ, 1990; Creal et al., 1996) for wadeable streams and visual observations were made at 4 additional stations (Table 1; Figure 1). If a station was sampled at a road crossing, it was generally sampled upstream unless otherwise noted. The macroinvertebrate communities were assessed and scored with metrics that rate water bodies from excellent (+5 to +9) to poor (-5 to -9). Scores from +4 to -4 are rated acceptable. Negative scores in the acceptable range are considered tending towards a poor rating, while positive scores in the acceptable range are tending towards an excellent rating. Habitat evaluations are based on 10 metrics, with a maximum total score of 200. A station habitat score of >154 is characterized as having excellent habitat, 105-154 is good, 56-104 is marginal, and <56 is poor. Water samples were also collected and preserved according to Michigan Department of Environmental Quality (MDEQ) protocol (Michigan Department of Natural Resources [MDNR], 1994).

Two site selection methods were used to assess the Looking Glass River watershed in 2012: (1) stratified random; and (2) targeted. Seven sites were randomly selected to support the Section's Status and Trend Program. Five of these sites will be combined with randomly selected sites within the Maple River watershed and will be used to estimate the watershed group (Looking Glass River watershed + Maple River watershed) attainment status for the "other indigenous aquatic life and wildlife" designated use component of R 323.1100(e) of the Michigan WQS. Two of these sites will be used to facilitate a measurement of biointegrity temporal trends. A separate monitoring report will be written for data collected in the Maple River watershed.

Two sites within the Looking Glass River watershed were selected for targeted monitoring to support concerns voiced by stakeholders regarding sedimentation in the Remy-Chandler Drain.

A third site was selected for targeted monitoring on the Looking Glass River at Monroe Road because it is a long-term trend station for the MDNR, Fisheries Division, and long-term macroinvertebrate and habitat data will complement the information they have collected.

Figure 1. 2012 Survey stations; Looking Glass River watershed. (Shiawassee, Clinton, and Ionia Counties, Michigan).

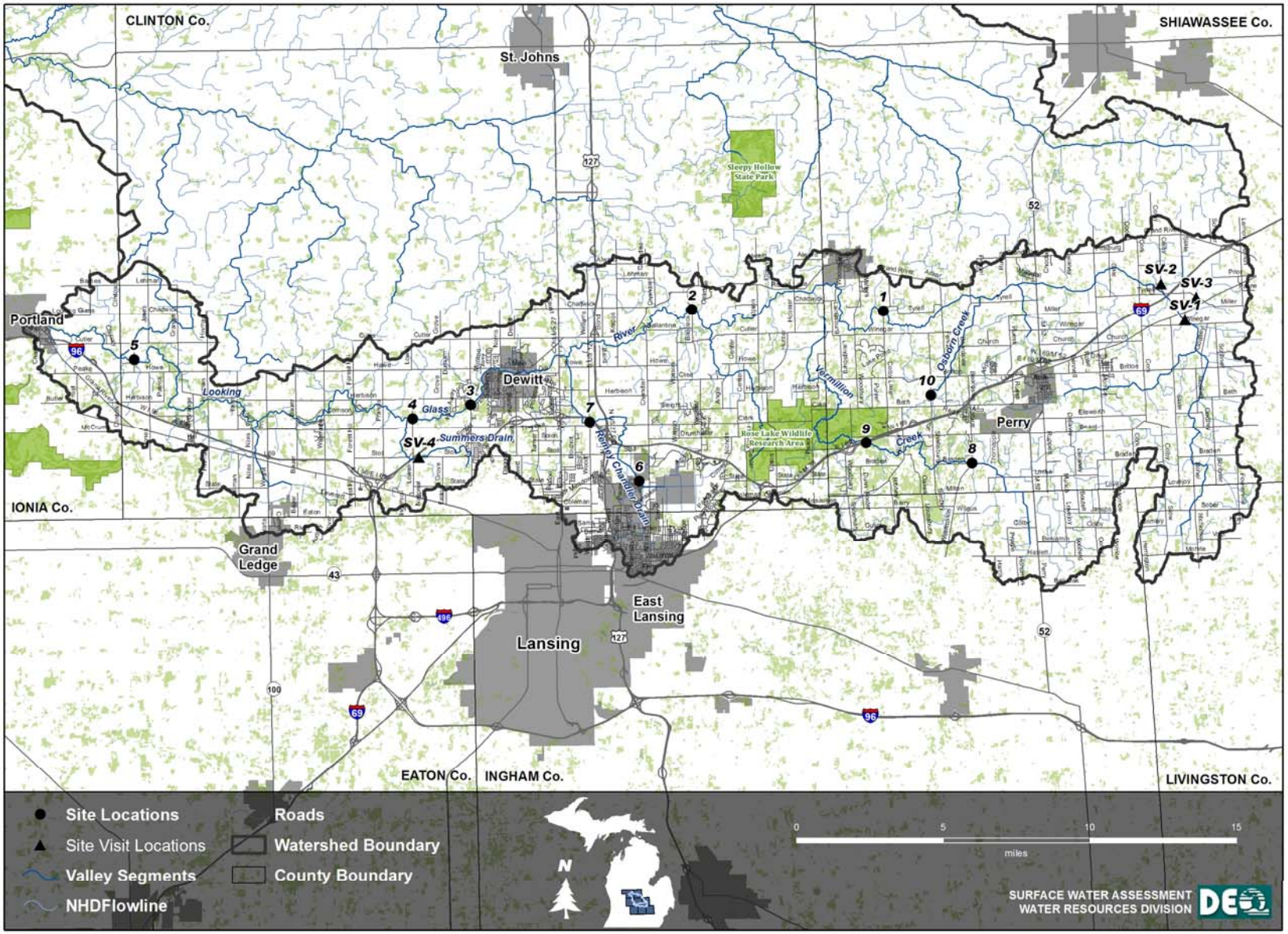

Table 1. Summary of the aquatic habitat and macroinvertebrate community evaluations for selected stations in the Looking Glass River watershed, July and September 2012. S/T/Tr = Status, Targeted, Trend station; SV = site visit only station; -- = not sampled.

Station #	Stream Name	Road Crossing	STORET #	County	TRS	Township	Latitude	Longitude	Habitat Evaluation		Macroinvertebrate Community		S/T/Tr	AUID#
									Rating	Score	Rating	Score		
1	Looking Glass River	Colby Lake Road	780222	Shiawassee	06N01ES34	Sciota	42.866900	-84.324600	Marginal	101	Acceptable	1	Tr	040500040606-02
2	Looking Glass River	Babcock Road	190198	Clinton	06N01WS32	Victor	42.869495	-84.452884	Good	144	Acceptable	-3	S	040500040609-01
3	Looking Glass River	Airport Road	190032	Clinton	05N03WS13	Watertown	42.824450	-84.602780	Good	123	Excellent	5	S	040500040610-01
4	Looking Glass River	Lowell Road	190076	Clinton	05N03WS15	Watertwon	42.818174	-84.641860	Good	138	Excellent	6	S	040500040610-01
5	Looking Glass River	Monroe	190136	Clinton	05N04WS06	Eagle	42.849247	-84.827988	Excellent	161	Excellent	7	T	040500040612-01
6	Remy Chandler Drain	State Road	190154	Clinton	05N02WS25	Dewitt	42.785240	-84.49041	Marginal	63	Poor	-5	T	040500040608-01
7	Remy Chandler Drain	Wood Rd.	190155	Clinton	05N02WS15	Dewitt	42.81500	-84.52300	Marginal	73	Acceptable	-1	T	040500040608-01
8	Vermillion Creek	Beardslee Road	780179	Shiawassee	05N02ES30	Perry	42.790823	-84.267034	Marginal	73	Acceptable	-4	S	040500040604-02
9	Vermillion Creek	Old 78 Road	780226	Shiawassee	05N01ES28	Woodhull	42.801900	-84.337900	Good	114	Acceptable	3	Tr	040500040605-03
10	Osborn Creek	Shaftsburg Road	780253	Shiawassee	05N01ES13	Woodhull	42.825016	-84.293676	Marginal	99	Acceptable	0	S	040500040603-02
SV-1	Looking Glass River	Old State Road	--	Shiawassee	05N03E05	Antrim	42.859210	-84.121960	--	--	--	--	T	040500040602-01
SV-2	Unnamed Tributary to Looking Glass River	Colby Road	--	Shiawassee	06N03E32	Shiawassee	42.877351	-84.137499	--	--	--	--	T	040500040602-01
SV-3	Unnamed Tributary to Looking Glass River	Miller Rd.	--	Shiawassee	06N03E33	Shiawassee	42.870233	-84.114206	--	--	--	--	T	040500040602-01
SV-4	Summers Drain	Stoll Road	190156	Clinton	05N03WS23	Watertown	42.798700	-84.638000	--	--	--	--	T	040500040610-01

Habitat Scoring
Poor < 56 Marginal 56-104 Good 105-154 Excellent >154

Macroinvertebrate Scoring
Poor < -4 Acceptable -4 to +4 Excellent > +4

Watershed Information

The Looking Glass River watershed is approximately 312 square miles with 178 miles of perennial streams (MIRIS, 2007). Most of the watershed is in Shiawassee and Clinton Counties, with small areas in Ingham, Ionia, Livingston, and Eaton Counties. The headwaters begin east and south of the village of Morrice and the city of Perry in Shiawassee County. The river then flows approximately 40 miles to the confluence with the Grand River in the city of Portland (Ionia County). Land use is dominated by agriculture (47%), followed by a mix of grass/pasture area (21%), forest (26%), water (2%), residential (3%), and commercial and industrial (2%) (Purdue, 2012).

The watershed is located in the Ionia Subsection District Ecosystem (Albert, 1995). The Ionia District consists of gently rolling ground moraine, and land use is dominated by agriculture. The watershed lies within the Lansing Sub-subsection, which consists of undulating topography of ground moraine, which forms well- and moderately-drained areas alternating with poorly- to very poorly-drained depressions. Drainage of a large part of the Lansing District was necessary for agricultural use and the number of drainage ditches ranks third across all sub-subsections in the Ionia Subsection. All stations are located in the Southern Michigan/Northern Indiana Drift Plains (SMNIDP) ecoregion (Omernik and Gallant, 2010) (formerly Southern Michigan/Northern Indiana Till Plains (SMNITP); Omernik and Gallant, 1988). The entire Looking Glass River watershed is designated as a warmwater stream.

The most recent surveys of the Looking Glass River watershed were conducted in 2007 (Lipsey, 2008). Aquatic macroinvertebrate community and habitat assessments were conducted at 23 stations. Macroinvertebrate ratings were nearly all acceptable, with one site rating excellent. Habitat ratings ranged from poor to excellent. The fish community was sampled in Clise Drain at Cutler Road and scored poor and was determined to be a maintained drain. It was designated as 4C on the Michigan Section 303(d) list (Goodwin et al., 2012). Water chemistry sample results did not exceed WQS for the parameters analyzed.

Prior to 2007, the most recent survey in the Looking Glass River watershed was conducted in 2002 (Roush, 2003). Aquatic macroinvertebrate community and habitat assessments were conducted at eight stations. Macroinvertebrate ratings ranged from acceptable to excellent. Habitat ratings ranged from poor to excellent. Water and sediment chemistry sample results taken throughout the watershed did not exceed WQS or sediment quality guidelines (MacDonald et al., 2000) for the parameters analyzed with the exception of several Base Neutrals and Acids exceeding the threshold effect sediment concentrations at a station located downstream of the Southern Clinton County Wastewater Treatment Plant.

A nutrient study was conducted in Perry Drain Number 2 in the spring of 2002 (Cooper, 2002). The purpose of the study was to determine if the nutrient load from the Countryside Wastewater Storage Lagoon was being retained within the stream or if it was being transported downstream without impacting water quality. The study indicated that the phosphorus from the effluent is retained within the drain. In 2007, the drain was observed upstream and downstream of the storage lagoon where some filamentous algae were observed, but not nuisance conditions. The stream was also sampled two miles downstream of the lagoon and macroinvertebrates scored acceptable (Lipsey, 2008).

2012 Sampling Results

<u>Looking Glass River</u>

The Looking Glass River was sampled at 5 stations (Stations 1, 2, 3, 4, and 5). Station 1 (the

most upstream station) was sampled at Colby Lake Road. The glide/pool habitat was rated marginal (101; moderately impaired; Table 4a). The Looking Glass has been historically straightened and dredged in this portion of the watershed. The riparian area consisted of a wooded floodplain and one yard that was mowed to the edge of the river. The substrate at this station was very soft and consisted primarily of silt. Sampling began approximately 150 yards upstream due to the depth of the silt closer to the bridge. The silt may be due partially to the wetland nature of the watershed prior to channelization. There was a large amount of woody debris, the surface of which was covered with silt. Firmer sand was available in one of the woody debris jam areas where stream velocity increased. The banks were fairly stable due to the natural riparian area and large trees, but many of the tree roots were exposed due to erosion. The macroinvertebrate community scored acceptable (1; Tables 4b and 4c). This was an improvement from the 2007 score of -3 (low end of acceptable) (Lipsey, 2008). In 2012 oligochaetes were less dominant, there were a higher percentage of mayflies and caddisflies, and one individual stonefly was found.

Station 2 was sampled downstream of Babcock Road (Figure A). The glide/pool habitat at Station 2 was rated as good (144; slightly impaired; Table 4a). This station was sampled downstream of the road crossing due to the river being a large lentic area upstream of the bridge. The surface velocity of the river was roughly estimated to be 0.28 feet per second downstream of the bridge. Large woody debris was present. There was a large amount of floating macrophytes (i.e., duckweed [*Lemna* species and *wolffia* species]) both upstream and downstream of the road crossing, which is typical in an open ponded area. The river is fairly wide at this point in the watershed and despite an extensive riparian area, a lot of the surface water is exposed to sunlight. The epifaunal substrate was limited to woody debris and aquatic vegetation. The substrate consisted primarily of sand covered by silt and fine particulate organic matter. The macroinvertebrate community scored at the low end of acceptable (-3; Tables 4b and 4c). This low score was not surprising given that Procedure 51 is more appropriate for flowing wadeable streams and not lentic areas.

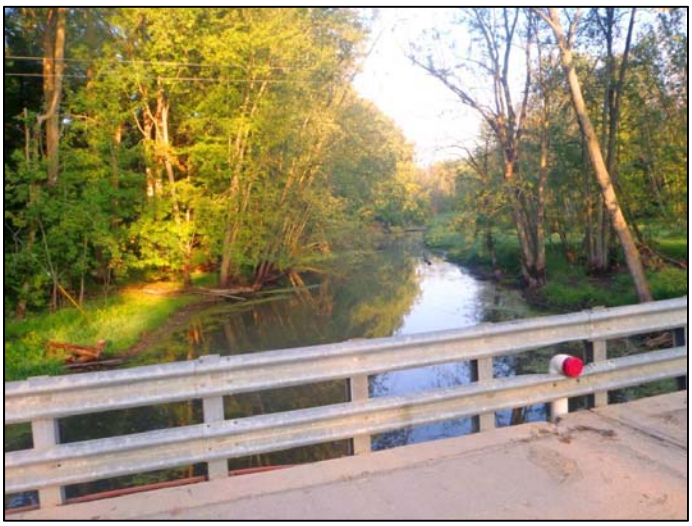

Figure A. Looking Glass River downstream of Babcock Road.

Station 3 was sampled at Airport Road. This station is located less than a mile downstream of the city of Dewitt and the Southern Clinton County Municipal Utilities Authority. There seems to be a change in slope and perhaps soils and geology in this portion of the watershed as there are less wetland areas adjacent to the river. The riffle/run habitat was rated as good (123; slightly impaired; Table 4a). The river flows through residential areas and the riparian area has been altered. The epifaunal substrate was limited to large woody debris and aquatic vegetation. Silt covered a large amount of the woody debris. There was a large amount of silt depositional areas that smelled anaerobic when disturbed. There was approximately 20 inches of raw bank above the surface water of the river, indicating that the river was fairly low. The macroinvertebrate community scored excellent (5; Tables 4b and 4c), which was somewhat surprising given the lack of available substrate.

Station 4, upstream of Lowell Road (Figure B), was located 2.4 stream miles downstream of Station 3. The glide/pool habitat at Station 4 was rated as good (138; slightly impaired; Table 4a). There was an extensive and intact riparian area and floodplain at this station. The canopy was very dense and provided a large amount of shade to the river. Epifaunal substrate included large woody debris, cobble, gravel, and some leaf pack. A fine layer of silt was on a large amount of the substrate. Silt deposits with large amounts of fine particulate organic matter could be found in some areas. There was no aquatic vegetation and the water level looked very low. Many tree roots were exposed along the bank. The macroinvertebrate community scored excellent (6; Tables 4b and 4c).

Figure B. Looking Glass River upstream of Lowell Road.

The most downstream station on the Looking Glass River was sampled at Monroe Road (Station 5) approximately 3 miles east of Portland. The riffle/run habitat was rated as excellent (161; non-impaired; Table 5a), and had the highest habitat score for any station sampled in the watershed in 2012. The habitat scored similarly in 2007. In 2012, the station had a large amount and diversity of epifaunal substrate in the form of riffles made up of cobble and gravel and aquatic vegetation, overhanging vegetation, and large woody debris. The left (south) bank has a large amount of erosion due to a large bluff that has only large trees left as vegetative protection and houses sit at the top of the bluff. The macroinvertebrate community at this station scored excellent (7; Tables 5b and 5c). The macroinvertebrate community composition was very similar to the 2007 community and the score was the same (Lipsey, 2008).

Remy-Chandler Drain

The Remy-Chandler Drain watershed begins in the urban areas of Lansing and East Lansing. The stream channel has historically been altered and it is actively managed as a county drain. The drain was sampled at 2 stations (6 and 7).

Station 6 (Figure C) was sampled at State Road and was the most upstream station in the Remy-Chandler Drain watershed. The glide/pool habitat was rated at the low end of marginal (63; moderately impaired; Table 5a). The station had very steep banks where the channel has been incised more than 30 feet. The riparian area consisted of closely cropped grass and then taller grass along the steep banks. There was a moderate amount of flow in the channel, which

Figure C: Remy-Chandler Drain upstream of State Road.

was significantly different than the flow observed the day before. A large rain event occurred two days prior, and the water was at least nine inches higher and very turbid at 4:00 p.m. one day prior to sampling. The substrate was dominated by sand and silt. Sand deposition was evident in the form of sand bars at the road culvert. Epifaunal substrate was absent except for the large amount of aquatic vegetation. Pools were absent due to the large amount of sedimentation. The macroinvertebrate community scored poor (-5; Tables 5b and 5c). In 2007, the habitat was rated as poor (43; severely impaired) and the macroinvertebrate community scored at the low end of acceptable (-3) (Lipsey, 2008). Only two of the more sensitive Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) (EPT) families were found (compared to three in 2007), and the percent air breathers and dominant taxa both increased from 2007 to 2012 while the percent Ephemeroptera composition decreased. These factors indicate that environmental stress is impacting the macroinvertebrate community. Possible stressors include storm water impacts, sedimentation, and habitat and flow alterations.

Station 7 was sampled at Wood Road. The glide/pool habitat was rated as marginal (73; moderately impaired; Table 5a). This score is similar to the habitat score found in 2007 (65; moderately impaired; Lipsey, 2008). The stream channel is straight at this station and flows through a channel that is incised more than 50 feet. The riparian area consisted of grass and some small shrubs to the top of the steep banks where there are trees on one side of the stream and an agriculture field on the other. The stream flows under I-69 just upstream of this station via 2 culverts, although flow was only coming from a third adjacent culvert. The Wood Road culvert is 20 feet in diameter due to the deep ravine (Figure D). The substrate at Station 7 was dominated by shifting silt and sand that was ankle deep in some places. Epifaunal substrate was absent except for submergent vegetation and some overhanging grass. A few deeply embedded large woody debris pieces and deeply embedded gravel were found. The macroinvertebrate community scored acceptable (-1; Tables 5b and 5c). This score was slightly lower than the score of 0 found in 2007 at this station (Lipsey, 2008). Four families found in 2007 were not found in 2012 decreasing the overall total number of taxa metric score by 1.

Figure D: Remy-Chandler Drain upstream of Wood Road.

Figure E. Vermillion Creek upstream of Beardslee Road.

Vermillion Creek

Vermillion Creek was sampled at two stations. The upstream station (Station 8) was located at Beardslee Road (Figure E) in the upper portion of the Vermillion Creek watershed. The glide/pool habitat was rated at the lower end of marginal (73; moderately impaired; Table 6a). The only epifaunal substrate available for colonization included a small amount of overhanging vegetation. Large woody debris was sparse and was mostly buried. Cladophora and an unknown alga covered the entire bottom of the stream. Some of the Cladophora was at least 10 inches long, although a majority of the algae was shorter. Deposits of fine sediment were as deep as 2 feet. Firmer sand could only be observed along the edges of the stream. The stream had an estimated surface velocity of 0.4 feet per second. The stream channel was very straight, and it was evident that it is a maintained drain, but it had not been recently dredged. There was a very narrow riparian area adjacent to corn fields on both sides of the stream and little canopy available to shade the stream. Two local residents indicated that they had never seen the water level so low in the stream. The macroinvertebrate community scored at the low end of acceptable (-4; Tables 6b and 6c) and was dominated by Oligochaetes (37%). When one taxon dominates a macroinvertebrate community, it is indicative of environmental stress. Visual observations of the landscape upstream of this station indicated that bean and corn row crops dominated the land use. The stream also flows through a golf course approximately two miles upstream of this station. Fertilizers used for the golf course and row crops are both possible sources of nutrients to the stream and could be contributing to the large amount of algae found in the stream.

Station 9 was sampled at Old-78 (Lansing Road). The glide/pool habitat was rated as good (114; slightly impaired; Table 6a). This score was very similar to the 2007 habitat score at this station. In 2012, the station had a large wooded floodplain. Large woody debris was abundant, but was covered with a layer of silt, and was therefore negatively impacting colonization potential. Aquatic vegetation was absent, likely due to the shaded nature of the stream. The stream banks had many areas of erosion and the stream appeared flashy. Large sandbars were present in the stream channel due to sediment deposition. The macroinvertebrate community at Station 9 scored acceptable (3; Tables 6b and 6c), which was improved from the score of 1 in 2007. Two additional mayfly families and one stonefly family was found in 2012 that were not found in 2007. This improvement is not likely the result of habitat since habitat did not appear to improve since 2007. Aerial photos indicate there is an increase in the amount of forested riparian area when compared to the land use upstream of Station 8. This likely results in an increase in the amount of shade and large woody debris available for epifaunal substrate. This may be one factor impacting the improvement of the macroinvertebrate community at Station 9 when compared to the more upstream station (8).

Figure F. Osborn Creek downstream of Shaftsburg Road.

Osborn Creek

Station 10 was sampled on Osborn Creek downstream of Shaftsburg Road (Figure F). It is a small tributary to the Looking Glass River. Its confluence is upstream of the city of Laingsburg. Station 10 was sampled downstream of the road because the stream was not

accessible for any discernible reach upstream of the road due to overhanging alders and shifting fine sediment that made wading nearly impossible. A small pond is located less than 0.7 miles upstream of the road crossing and influences this reach of stream. The glide/pool habitat at Station 10 was rated as marginal (99; moderately impaired; Table 6a). Aquatic vegetation was the primary epifaunal substrate present for colonization. No cobble and very little gravel or other firm substrate were available. Clay and some marl substrate were also present. The riparian area was intact on the left bank but on the right side the riparian area was mowed to the edge and an herbicide appeared to have been used. The macroinvertebrate community scored acceptable (0; Tables 6b and 6c). There were only three EPT taxa found.

Summary of Results of Monitoring Objectives

1. Identify NPS of Water Quality Impairment.

The following NPS issues were observed or investigated in the 2012 sampling season. Locations are noted in Figure 1 and Table 1.

Looking Glass River at Old State Road (SV-1)

In 2007, unrestricted livestock were found in the Looking Glass River upstream of Old State Road at County Road 665. In 2012, no livestock were found in the stream and the adjacent riparian area appears to no longer be used for grazing.

Unnamed Tributaries to the Looking Glass River at Colby Road (SV-2) and Miller Road (SV-3)

Targeted reconnaissance regarding observations of nutrient issues in the upper portions of the watershed were conducted (SV-2 and SV-3; Figure 1). In previous years, staff of the MDEQ, NPS Section, pointed out nutrient concerns in an Unnamed Tributary to the Looking Glass River at Colby Road and Miller Road northeast of the Village of Morrice. We conducted some observations of several sites in the upper portions of the watershed in mid-July to determine if further water chemistry monitoring is warranted. Water levels were extremely low and most sites had channels with no water present. Nutrient concerns could not be observed due to a lack of water.

Remy-Chandler Drain at State Road (Station 6) and Wood Road (Station 7)

Members of the Friends of the Looking Glass River watershed group pointed out Remy-Chandler Drain as an area they have concerns about regarding sedimentation issues that may be the result of a large increase in development and construction in this watershed. They indicated that a sand bar/delta is forming where the Remy-Chandler Drain joins the Looking Glass River, due to the amount of sedimentation being discharged from the drain. The habitat and macroinvertebrate community were surveyed in the Remy-Chandler Drain watershed at two stations (Stations 6 and 7; see above for detailed results).

In 2012, the glide/pool habitat at Station 6 was rated at the low end of marginal (63; moderately impaired; Table 5a) and the macroinvertebrate community scored poor (-5; Tables 5b and 5c). In 2007, the habitat was rated as poor (43; severely impaired) and the macroinvertebrate community scored at the low end of acceptable (-3; Lipsey, 2008). Only two of the more sensitive EPT taxa were found in 2012 (compared to three in 2007), and the percent air breathers and dominant taxa both increased while the percent mayfly composition decreased. Both of these metrics may indicate that environmental stressors (such as storm water impacts, sedimentation, and habitat alterations) have either increased or are having chronic effects on

the macroinvertebrate community. The Remy-Chandler Drain watershed received a large amount of rain 2 days prior to the sampling of this stream. The stream was observed approximately 8 hours prior to this survey and at that time it was found to still be very turbid and at least 9 inches higher than when it was sampled. The flashy flows and turbidity after a rain event combined with the poor macroinvertebrate community score suggest that storm water flow and associated stressors of this maintained drain may be impacting the macroinvertebrate community and causing nonattainment of the other indigenous aquatic life and wildlife designated use.

In 2012, the glide/pool habitat at Station 7 (Wood Road) was rated as marginal (73; moderately impaired; Table 5a) and the macroinvertebrate community scored acceptable (-1; Tables 5b and 5c). In 2007, the habitat was rated as marginal (65; moderately impaired) and the macroinvertebrate community scored acceptable (0, Lipsey, 2008). Four families found in 2007 were not found in 2012, decreasing the overall total number of taxa metric score by 1. The number and % of EPT taxa increased slightly in 2012 when compared to 2007, but did not change the metric score.

Summers Drain at Stoll Road (SV-4)

In 2007, a large amount of housing development construction was occurring along Stoll Road west of the Airport Road intersection and Stoll Road was being widened and paved. A significant amount of sedimentation due to the construction was occurring in Summers Drain at the east crossing of Stoll Road. Best management practices had been set up, but were not being maintained and were not effective in preventing sediment from entering the stream channel. In 2007, the macroinvertebrate community scored a -3 in Summers Drain at the west crossing of Stoll Road. In 2012, this same station was observed to have very little flow. Water was flowing at the station, but was likely the result of the recent rains that occurred in the area. Iron bacteria slimes were abundant, most likely due to groundwater seeps and relatively stagnant water. The site was not appropriate for Procedure 51 biological surveys. The more eastern crossing of Stoll Road was also visited and no recent sedimentation issues were noted. The stream channel was extremely dry (no flow) and most likely only receives flow during the highest storm events.

Grub Creek at State Road (Observation)

An observation was made that a residence at 10742 State Road, Antrim Township (Latitude 42.835761; Longitude -84.13076) has a fenced horse pasture that slopes toward Grub Drain, which could be a potential source of nutrients and pathogens to the stream during rain events.

2. <u>Assess the current status and condition of individual waters of the state and determine whether Michigan WQS are being met</u>.

In 2012, five randomly selected sites within the Looking Glass River watershed, and an additional ten sites within the Maple River watershed, were assigned to support attainment status calculation. These sites were used to estimate the attainment status in the Maple River and Looking Glass River watersheds group for the “other indigenous aquatic life and wildlife” designated use. Based on the probabilistic monitoring aspect of this watershed survey, 100% +/- 18% of the randomly selected sites supported the other indigenous aquatic life and wildlife designated use using Procedure 51. Percent attainment was calculated by dividing the number of random sites that met WQS by the total number of random locations (15 / 15 = 1.0). This value is coupled with a 95% confidence interval to provide our estimation of certainty, meaning

there is 95% certainty that the true proportion of attainment in the Looking Glass and Maple River watersheds is between 82% and 100%.

In 2012, aquatic macroinvertebrate community and habitat assessments were conducted at a total of 10 stations in the Looking Glass River watershed (Table 1; Figure 1). The "other indigenous aquatic life and wildlife" designated use was being met at all but one station. The macroinvertebrate community scored poor in the Remy-Chandler Drain at State Road (-5; Tables 5b and 5c) and the habitat was rated at the low end of marginal (63; moderately impaired; Table 5a). It is a maintained storm drain at this point in the watershed. The drain has not been recently dredged, but causes of the low score could include anthropogenic flow regime and substrate alterations due to historic drain maintenance activities and storm water impacts. It should be noted that the -5 macroinvertebrate score found in 2012 is slightly lower than the -3 score found in 2007 (Lipsey, 2008). Remy-Chandler Drain is also listed as having insufficient information regarding the partial and total body contact recreation designated uses. Four samples were collected in 2009 and were below the *E. coli* WQS; however, this is not sufficient to make a formal determination of WQS attainment according to our listing methodology (Goodwin et al., 2012). No additional samples were taken in 2012 to assess this designated use.

Although the macroinvertebrate community in Vermillion Creek at Beardslee Road was meeting the "other indigenous aquatic life and wildlife" designated use, it was only one point away from a poor score and had nuisance vegetation conditions. Therefore, it should be further monitored before determining if WQS are being met. This particular year had extremely low water levels, and increased algae and macrophyte densities would be expected with lower flows. The creek is a maintained drain at this point in the watershed and although it has not been recently dredged, causes of the low score could include anthropogenic flow regime and substrate alterations due to historic drain maintenance activities.

The entire Looking Glass River watershed is listed on the 2012 Section 303(d) nonattainment list (Goodwin et al., 2012) due to exceedances of the PCB WQS and PCB in fish tissue leading to the fish consumption designated use not being met. A statewide PCB Total Maximum Daily Load (TMDL) is being written to address this nonattainment issue.

Due to poor fish communities found in 2007, Clise Drain is listed as a 4c on the 2012 Section 303(d) list because it was not attaining the warmwater fishery designated use. The low diversity and numbers of fish was attributed to the lack of habitat in the stream due to drain maintenance activities (Lipsey, 2008). Clise Drain was not sampled in 2012, but it can be assumed that conditions have not changed due to the extensive maintenance activity observed at that time.

Perry Drain No. 2 and Austin (Kellogg) Drain are listed as having insufficient information regarding the warmwater fisheries designated use. Limited measurements in the past indicated low dissolved oxygen, although we lacked a sufficient number of measurements to make a formal attainment decision. Due to the number of dissolved oxygen studies needed for TMDL development in the 2012 field season in other water bodies, we did not pursue a dissolved oxygen study for either drain in 2012.

3. Satisfy Monitoring Requests Submitted by Internal and External Customers.

Members of Friends of the Looking Glass River watershed group have concerns regarding sedimentation from the Remy-Chandler Drain to the Looking Glass River. To respond to this

concern we added two targeted surveys in the Remy-Chandler Drain (Stations 6 and 7); see above for details.

Members of the Friends of the Looking Glass River also had concerns about the amount of duckweed that can be found in the Looking Glass River downstream of Babcock Landing. In 2012, MDEQ staff targeted several stations upstream of Babcock Landing and collected water samples for analysis of nutrients (Table 2 and Figure 2). Total Phosphorus results ranged from 0.040 to 0.0484 milligrams per liter (mg/L) and were compared with statewide samples collected from 2005 to 2009 (Roush, 2013). Statewide stations were selected using a probabilistic sampling design to be used to establish a water chemistry statewide status and trends program. Results indicate median statewide total phosphorus concentrations were 0.0315 mg/L. Median total phosphorus concentrations within the SMNIDP ecoregion were 0.0455 mg/ L and were 0.0484 mg/L within the Grand River watershed. The Looking Glass River is a tributary to the Grand River and both are within the SMNIDP ecoregion. Therefore, it appears that total phosphorus conditions are within the range that would be expected in this region of the state.

Figure 2. Water sampling stations in the Looking Glass River, September 26, 2012, Clinton County, Michigan.

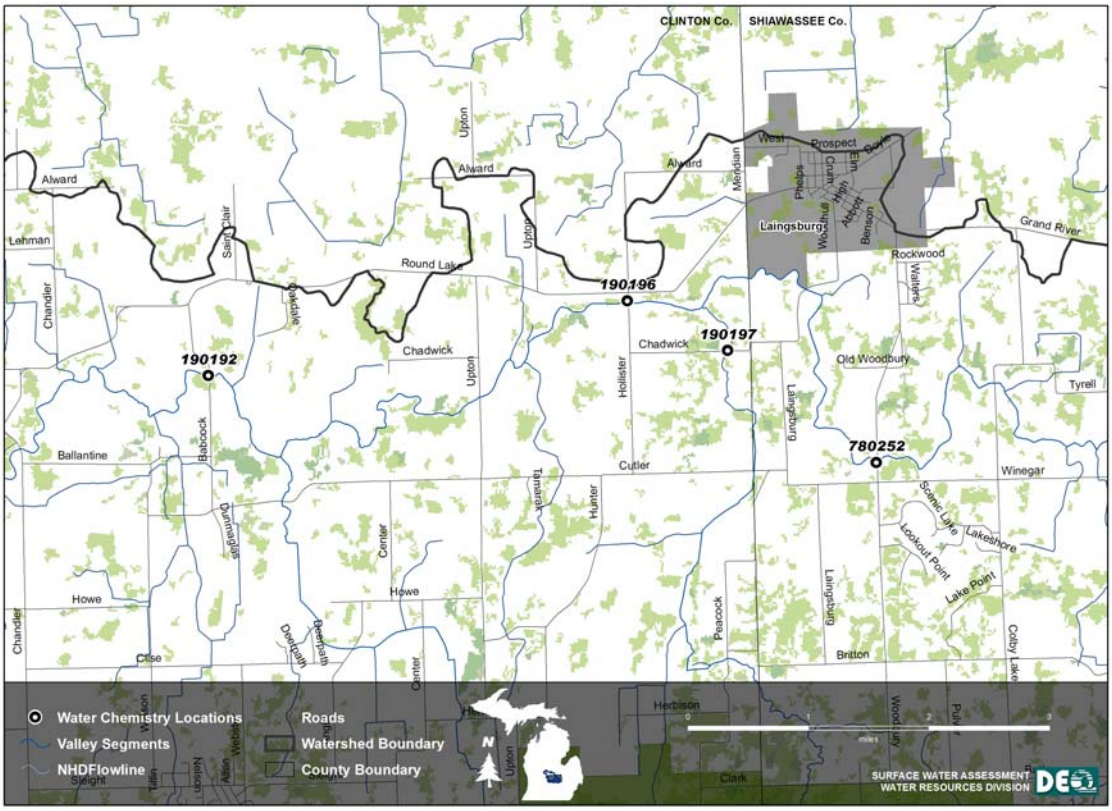

Table 2. Sampling and analysis results for nutrient parameters collected from selected stations in the Looking Glass River watershed and comparison with statewide, ecoregion, and Grand River watershed probabilistic sampling results.

	Looking Glass downstream of Babcock Landing	Looking Glass @ Hollister Road	Looking Glass @ Woodbury Road	Vermillion Creek @ Chadwick	Median Statewide	Median in SMNIDP Ecoregion	Median in Grand River Watershed
STORET Station #	190192	190196	780252	190197	--	--	--
Nitrate + Nitrite	0.014	.0.039	0.086	0.028	--	--	--
Nitrite	0.007	0.002	0.001	0.001	--	--	--
Ortho-phosphate	0.018	0.022	0.024	0.028	--	--	--
Solids-Suspended	7	5	6	6	--	--	--
Total Kjeldahl Nitrogen	0.61	0.42	0.40	0.58	--	--	--
Total Phosphorus	0.044	.042	0.040	0.046	0.0315	0.0455	0.0484

Units = mg/L.
Median values are calculated from median data collected from 2005-2009 probabilistic monitoring sites.
Samples collected September 26, 2012.

In 2012, MDEQ staff sampled the Looking Glass River at Monroe Road because it is a Status and Trends station (one that is surveyed on a three-year on, three-year off rotation) for the MDNR, Fisheries Division. The Monroe station was sampled by the Fisheries Division from 2008 to 2010. In 2009, all species were collected for the first 500 feet of the sampling reach and smallmouth bass were collected for all 1,000 feet of the reach. Table 3 indicates the number and species collected for the entire reach (Scott Hanshue, personal communication, MDNR). Procedure 51 fish metrics were not used to score the fisheries data due to the differences in sampling methods used and the applicability of the metrics. In 2012, Monroe Road (Station 5) was the most downstream station sampled on the Looking Glass River; approximately 3 miles east of the city of Portland. The riffle/run habitat was rated as excellent (161; non-impaired; Table 5a), and had the highest habitat score for any station sampled in the watershed in 2012. The macroinvertebrate community at this station scored excellent (7; Tables 5b and 5c). The macroinvertebrate community composition and habitat was very similar in 2007 (Lipsey, 2008).

4. Evaluate Biological Integrity Temporal Trends.

Two stations (Stations 1 and 9; Table 1 and Figure 1) within the Looking Glass River were randomly selected as trend stations and will be sampled every five years. When sufficient data have been collected, trend information will be presented in a separate report.

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Table 3. Fish species collected from the Looking Glass River at Monroe Road by the MDNR, Fisheries Division, 2009.

Species (common name)	Number	Average length (inches)
Bluegill	3	3.8
Bluntnose minnow	17	2.6
Bowfin	2	15
Blackside darter	8	3.1
Common carp	2	20.5
Common shiner	3	4.5
White sucker	4	7.0
Golden redhorse	1	4.5
Green sunfish	7	2.9
Horneyhead chub	16	4.6
Johnny darter	6	2.4
Central mudminnow	1	3.5
Northern hog sucker	2	9.0
Northern pike	3	12.2
Pumpkinseed	2	5.5
Rainbow darter	5	2.2
River chub	14	6.5
Rock bass	157	4.5
Rosyface shiner	5	2.5
Spotfin shiner	1	3.5
Smallmouth bass	7	13.2
Stonecat	3	8.3
Yellow bullhead	8	6.2

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Table 4a. Habitat evaluation for selected stations in the Looking Glass River watershed, Clinton and Shiawassee Counties, July and September 2012.

	Looking Glass River Colby Lake Road GLIDE/POOL	Looking Glass River Babcock Road GLIDE/POOL	Looking Glass River Airport Road RIFFLE/RUN	Looking Glass River Lowell Road GLIDE/POOL
	Station 1	**Station 2**	**Station 3**	**Station 4**
HABITAT METRIC				
Substrate and Instream Cover				
Epifaunal Substrate/ Available Cover (20)	9	8	7	13
Embeddedness (20)*			15	
Velocity/Depth Regime (20)*			10	
Pool Substrate Characterization (20)**	6	11		15
Pool Variability (20)**	6	13		8
Channel Morphology				
Sediment Deposition (20)	6	11	8	10
Flow Status - Maintenance Flow Volume (10)	8	8	7	7
Flow Status - Flashiness (10)	6	8	4	9
Channel Alteration (20)	11	18	16	16
Frequency of Riffles/Bends (20)*			13	
Channel Sinuosity (20)**	6	14		13
Riparian and Bank Structure				
Bank Stability (L) (10)	6	9	8	8
Bank Stability (R) (10)	6	9	8	6
Vegetative Protection (L) (10)	8	9	8	8
Vegetative Protection (R) (10)	8	8	6	8
Riparian Vegetative Zone Width (L) (10)	8	9	8	9
Riparian Vegetative Zone Width (R) (10)	7	9	5	8
TOTAL SCORE (200):	**101**	**144**	**123**	**138**
HABITAT RATING:	**MARGINAL (MODERATELY IMPAIRED)**	**GOOD (SLIGHTLY IMPAIRED)**	**GOOD (SLIGHTLY IMPAIRED)**	**GOOD (SLIGHTLY IMPAIRED)**
Date:	7/31/2012	9/6/2012	9/7/2012	9/7/2012
Weather:	Partly Cloudy	Partly Cloudy	Cloudy	Partly Cloudy
Air Temperature:	80ºF	70 ºF	70 ºF	75 ºF
Water Temperature:	76 ºF	70 ºF	70 ºF	68 ºF
Average Stream Width:	20 Feet	48 Feet	75 Feet	65 Feet
Average Stream Depth:	2 Feet	3 Feet	2 Feet	1.5 Feet
Surface Velocity:	0.2 Ft./Sec.	0.28 Ft./Sec.	1 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	8 CFS	40.32 CFS	150 CFS	97.5 CFS
Stream Modifications:	Dredged	None	None	None
Nuisance Plants (Y/N):	N	N	N	N
STORET No.:	780222	190198	190032	190076
Stream Name:	Looking Glass River	Looking Glass River	Looking Glass River	Looking Glass River
Road Crossing/Location:	Colby Lake Road	Babcock Road	Airport Road	Lowell Road
County Code:	78	19	19	19
TRS:	06N01E34	06N01W32	05N03W13	05N03W15
Latitude (dd):	42.8669	42.869719	42.824449	42.818611
Longitude (dd):	-84.3246	-84.453322	-84.602782	-84.642222
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4050004	4050004	4050004	4050004

*Applies only to Riffle/Run stream Surveys **Applies only to Glide/Pool stream Surveys
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).

Table 4b. Qualitative macroinvertebrate community sampling results at selected stations in the Looking Glass River watershed, Clinton and Shiawassee Counties, July and September 2012.

TAXA	Looking Glass River Colby Lake Road 7/31/12 STATION 1	Looking Glass River Babcock Road 9/6/12 STATION 2	Looking Glass River Airport Road 9/7/12 STATION 3	Looking Glass River Lowell Road 9/7/12 STATION 4
PORIFERA (sponges)		1		
PLATYHELMINTHES (flatworms)				
Turbellaria		2	38	1
ANNELIDA (segmented worms)				
Hirudinea (leeches)	4	2	2	1
Oligochaeta (worms)	4	11	3	48
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	32	50	9	11
Decapoda (crayfish)	5		1	1
Arachnoidea				
Hydracarina		13	1	
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae			7	10
Baetidae		9	9	8
Caenidae	2	11		5
Ephemerellidae			2	7
Heptageniidae	39		7	13
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1		1	1
Gomphidae				1
Libellulidae	1	2		
Zygoptera (damselflies)				
Calopterygidae	27		33	17
Coenagrionidae	4	72	34	22
Plecoptera (stoneflies)				
Perlidae	1		1	6
Hemiptera (true bugs)				
Belostomatidae	1		1	2
Corixidae	90	9		2
Gerridae			7	1
Mesoveliidae		2		
Naucoridae		5		
Nepidae			1	1
Notonectidae		2		
Pleidae		13		
Veliidae			1	
Megaloptera				
Sialidae (alder flies)	2			
Trichoptera (caddisflies)				
Brachycentridae			2	
Hydropsychidae	8		7	14
Leptoceridae			4	1
Limnephilidae	4			
Philopotamidae			1	
Polycentropodidae	1			
Uenoidae				1
Lepidoptera (moths)				
Pyralidae			1	
Coleoptera (beetles)				

Table 4b. Qualitative macroinvertebrate community sampling results at selected stations in the Looking Glass River watershed, Clinton and Shiawassee Counties, July and September 2012.

TAXA	Looking Glass River Colby Lake Road 7/31/12 STATION 1	Looking Glass River Babcock Road 9/6/12 STATION 2	Looking Glass River Airport Road 9/7/12 STATION 3	Looking Glass River Lowell Road 9/7/12 STATION 4
Haliplidae (adults)	1	1		
Hydrophilidae (total)	17	1		
Elmidae	3		18	45
Haliplidae (larvae)		1		
Psephenidae (larvae)			5	24
Scirtidae (larvae)			1	
Diptera (flies)				
Ceratopogonidae		4		
Chironomidae	12	43	43	24
Culicidae		1		
Dixidae		2		
Simuliidae			26	6
Tabanidae		1	1	9
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1	1	3	1
Lymnaeidae		12		
Physidae	1		4	
Planorbidae			3	1
Pomatiopsidae			1	4
Pelecypoda (bivalves)				
Sphaeriidae (clams)	3		7	23
TOTAL INDIVIDUALS	264	271	285	311

Table 4c. Macroinvertebrate metric evaluation of selected stations in the Looking Glass River watershed, Clinton and Shiawassee Counties, July and September 2012.

	Looking Glass River Colby Lake Road 7/31/12 STATION 1		Looking Glass River Babcock Road 9/6/12 STATION 2		Looking Glass River Airport Road 9/7/12 STATION 3		Looking Glass River Lowell Road 9/7/12 STATION 4	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	24	0	24	0	34	1	31	1
NUMBER OF MAYFLY TAXA	2	0	2	0	4	1	5	1
NUMBER OF CADDISFLY TAXA	3	0	0	-1	4	0	3	0
NUMBER OF STONEFLY TAXA	1	1	0	-1	1	1	1	1
PERCENT MAYFLY COMPOSITION	15.53	0	7.38	0	8.77	0	13.83	0
PERCENT CADDISFLY COMPOSTITION	4.92	0	0.00	-1	4.91	0	5.14	0
PERCENT DOMINANT TAXON	34.09	0	26.57	0	15.09	1	15.43	1
PERCENT ISOPOD, SNAIL, LEECH	2.27	1	5.54	0	4.56	0	2.25	1
PERCENT SURFACE AIR BREATHERS	41.29	-1	12.55	0	3.51	1	1.93	1
TOTAL SCORE		1		-3		5		6
MACROINVERTEBRATE COMMUNITY RATING	ACCEPTABLE		ACCEPTABLE		EXCELLENT		EXCELLENT	

Table 5a. Habitat evaluation for selected stations in the Looking Glass River watershed, Clinton County, September 2012.

	Looking Glass River Monroe Road RIFFLE/RUN	Remy-Chandler Drain State Road GLIDE/POOL	Remy-Chandler Drain Wood Road GLIDE/POOL
	Station 5	**Station 6**	**Station 7**
HABITAT METRIC			
Substrate and Instream Cover			
Epifaunal Substrate/ Available Cover (20)	18	6	7
Embeddedness (20)*	16		
Velocity/Depth Regime (20)*	18		
Pool Substrate Characterization (20)**		8	10
Pool Variability (20)**		0	2
Channel Morphology			
Sediment Deposition (20)	13	6	3
Flow Status - Maintenance Flow Volume (10)	9	9	9
Flow Status - Flashiness (10)	9	2	2
Channel Alteration (20)	17	6	6
Frequency of Riffles/Bends (20)*	18		
Channel Sinuosity (20)**		0	0
Riparian and Bank Structure			
Bank Stability (L) (10)	4	5	7
Bank Stability (R) (10)	9	5	7
Vegetative Protection (L) (10)	6	5	6
Vegetative Protection (R) (10)	9	5	6
Riparian Vegetative Zone Width (L) (10)	6	3	4
Riparian Vegetative Zone Width (R) (10)	9	3	4
TOTAL SCORE (200):	**161**	**63**	**73**
HABITAT RATING:	**EXCELLENT (NON-IMPAIRED)**	**MARGINAL (MODERATELY IMPAIRED)**	**MARGINAL (MODERATELY IMPAIRED)**
Date:	9/7/2012	9/6/2012	9/6/2012
Weather:	Cloudy	Sunny	Sunny
Air Temperature:	63 ºF	75 ºF	80 ºF
Water Temperature:	67 ºF	76 ºF	76 ºF
Ave. Stream Width:	65 Feet	13.5 Feet	15 Feet
Ave. Stream Depth:	2 Feet	0.5 Feet	2 Feet
Surface Velocity:	1 Ft./Sec.	0.56 Ft./Sec.	0.63 Ft./Sec.
Estimated Flow:	130 CFS	3.78 CFS	18.9 CFS
Stream Modifications:	None	Dredged	Dredged
Nuisance Plants (Y/N):	N	N	N
STORET No.:	190136	190154	190155
Stream Name:	Looking Glass River	Remy-Chandler Drain	Remy-Chandler Drain
Road Crossing/Location:	Monroe Road	State Road	Wood Road
County Code:	19	19	19
TRS:	05N04W06	05N02W25	05N02W15
Latitude (dd):	42.8487	42.78524	42.815
Longitude (dd):	-84.8275	-84.49041	-84.523
Ecoregion:	SMNITP	SMNITP	SMNITP
Stream Type:	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4050004	4050004	4050004

*Applies only to Riffle/Run stream Surveys **Applies only to Glide/Pool stream Surveys

Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).

Table 5b. Qualitative macroinvertebrate community sampling results at selected stations in the Looking Glass River watershed, Clinton County, September 2012.

TAXA	Looking Glass River Monroe Road 9/7/2012 STATION 5	Remy-Chandler Drain State Road 9/6/2012 STATION 6	Remy-Chandler Drain Wood Road 9/6/2012 STATION 7
PLATYHELMINTHES (flatworms)			
Turbellaria	1	2	4
ANNELIDA (segmented worms)			
Hirudinea (leeches)	1	2	
Oligochaeta (worms)	7	28	12
ARTHROPODA			
Crustacea			
Amphipoda (scuds)	6	2	21
Decapoda (crayfish)	1	1	1
Isopoda (sowbugs)	2		
Arachnoidea			
Hydracarina	1	1	
Insecta			
Ephemeroptera (mayflies)			
Baetiscidae	1		
Baetidae	30	15	19
Caenidae	8	1	4
Ephemerellidae	14		
Heptageniidae	27		
Isonychiidae	18		
Tricorythidae	2		
Odonata			
Anisoptera (dragonflies)			
Aeshnidae			1
Gomphidae	5		
Libellulidae		1	
Zygoptera (damselflies)			
Calopterygidae	18		2
Coenagrionidae	15	35	95
Plecoptera (stoneflies)			
Perlidae	3		
Pteronarcyidae	1		
Hemiptera (true bugs)			
Belostomatidae	1	1	1
Corixidae		163	4
Gerridae	4		
Mesoveliidae	1		
Nepidae			1
Pleidae			1
Saldidae	3		
Megaloptera			
Corydalidae (dobson flies)	1		
Trichoptera (caddisflies)			
Hydropsychidae	30		4
Hydroptilidae			3
Leptoceridae	3		3
Limnephilidae	1		
Uenoidae	1		

Table 5b. Qualitative macroinvertebrate community sampling results at selected stations in the Looking Glass River watershed, Clinton County, September 2012.

TAXA	Looking Glass River Monroe Road 9/7/2012 STATION 5	Remy-Chandler Drain State Road 9/6/2012 STATION 6	Remy-Chandler Drain Wood Road 9/6/2012 STATION 7
Coleoptera (beetles)			
Dytiscidae (total)		1	1
Gyrinidae (adults)		24	
Haliplidae (adults)			2
Hydrophilidae (total)	1		
Elmidae	27	1	73
Gyrinidae (larvae)		12	
Haliplidae (larvae)			4
Psephenidae (larvae)	11		
Diptera (flies)			
Athericidae	3		
Ceratopogonidae		1	
Chironomidae	36	7	93
Culicidae		1	
Simuliidae	15	1	4
Tabanidae	1		
Tipulidae	6		
MOLLUSCA			
Gastropoda (snails)			
Hydrobiidae		1	
Physidae	1	13	20
Planorbidae		1	1
Pleuroceridae	1		
Pelecypoda (bivalves)			
Sphaeriidae (clams)	1	1	4
Unionidae (mussels)	1		
TOTAL INDIVIDUALS	**310**	**316**	**378**

Table 5c. Macroinvertebrate metric evaluation of selected stations in the Looking Glass River watershed, Clinton County, September 2012.

	Looking Glass River Monroe Road 9/7/2012 STATION 5		Remy-Chandler Drain State Road 9/6/2012 STATION 6		Remy-Chandler Drain Wood Road 9/6/2012 STATION 7	
METRIC	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	40	1	23	0	24	0
NUMBER OF MAYFLY TAXA	7	1	2	0	2	0
NUMBER OF CADDISFLY TAXA	4	0	0	-1	3	0
NUMBER OF STONEFLY TAXA	2	1	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	32.26	1	5.06	0	6.08	0
PERCENT CADDISFLY COMPOSTITION	11.29	0	0.00	-1	2.65	-1
PERCENT DOMINANT TAXON	11.61	1	51.58	-1	25.13	0
PERCENT ISOPOD, SNAIL, LEECH	1.61	1	5.38	0	5.56	0
PERCENT SURFACE AIR BREATHERS	3.23	1	60.13	-1	2.65	1
TOTAL SCORE		**7**		**-5**		**-1**
MACROINVERTEBRATE COMMUNITY RATING	**EXCELLENT**		**POOR**		**ACCEPTABLE**	

Table 6a. Habitat evaluation for selected stations in the Looking Glass River watershed, Shiawassee County, July and September 2012.

	Vermillion Creek Beardslee Road GLIDE/POOL	Vermillion Creek Lansing Road (Old 78) GLIDE/POOL	Osborn Creek Shaftsburg Road GLIDE/POOL
	Station 8	**Station 9**	**Station 10**
HABITAT METRIC			
Substrate and Instream Cover			
Epifaunal Substrate/ Available Cover (20)	1	10	6
Embeddedness (20)*			
Velocity/Depth Regime (20)*			
Pool Substrate Characterization (20)**	7	9	8
Pool Variability (20)**	1	9	2
Channel Morphology			
Sediment Deposition (20)	2	4	6
Flow Status - Maintenance Flow Volume (10)	9	7	10
Flow Status - Flashiness (10)	9	5	9
Channel Alteration (20)	6	17	16
Frequency of Riffles/Bends (20)*			
Channel Sinuosity (20)**	1	18	7
Riparian and Bank Structure			
Bank Stability (L) (10)	7	2	8
Bank Stability (R) (10)	8	2	6
Vegetative Protection (L) (10)	6	8	8
Vegetative Protection (R) (10)	7	8	3
Riparian Vegetative Zone Width (L) (10)	4	9	9
Riparian Vegetative Zone Width (R) (10)	5	6	1
TOTAL SCORE (200):	**73**	**114**	**99**
HABITAT RATING:	**MARGINAL (MODERATELY IMPAIRED)**	**GOOD (SLIGHTLY IMPAIRED)**	**MARGINAL (MODERATELY IMPAIRED)**
Date:	9/5/2012	7/31/2012	9/5/2012
Weather:	Cloudy	Partly Cloudy	Cloudy
Air Temperature:	75 ºF	80 ºF	83 ºF
Water Temperature:	68 ºF	75 ºF	79 ºF
Ave. Stream Width:	20 Feet	15 Feet	7.5 Feet
Ave. Stream Depth:	1.5 Feet	2 Feet	1 Feet
Surface Velocity:	0.42 Ft./Sec.	0.1 Ft./Sec.	0.42 Ft./Sec.
Estimated Flow:	12.6 CFS	3 CFS	3.15 CFS
Stream Modifications:	Dredged	None	Canopy Removal
Nuisance Plants (Y/N):	N	N	N
STORET No.:	780179	780226	780253
Stream Name:	Vermillion Creek	Vermillion Creek	Osborn Creek
Road Crossing/Location:	Beardslee Road	Lansing Road (Old 78)	Shaftsburg Road
County Code:	78	78	78
TRS:	05N01E30	05N01E28	05N01E14
Latitude (dd):	42.86775	42.80146	42.825163
Longitude (dd):	-84.2855	-84.33945	-84.293933
Ecoregion:	SMNITP	SMNITP	SMNITP
Stream Type:	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4050004	4050004	4050004

*Applies only to Riffle/Run stream Surveys **Applies only to Glide/Pool stream Surveys

Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).

Table 6b. Qualitative macroinvertebrate community sampling results at selected stations in the Looking Glass River watershed, Shiawassee County, July and September 2012.

	Vermillion Creek	Vermillion Creek	Osborn Creek
	Beardslee Road	Lansing Road (Old 78)	Shaftsburg Road
	9/5/2012	7/31/2012	9/5/2012
TAXA	STATION 8	STATION 9	STATION 10
ANNELIDA (segmented worms)			
Hirudinea (leeches)	2		1
Oligochaeta (worms)	102	4	1
ARTHROPODA			
Crustacea			
Amphipoda (scuds)		71	31
Decapoda (crayfish)		1	
Arachnoidea			
Hydracarina	6	1	1
Insecta			
Ephemeroptera (mayflies)			
Baetidae	3	2	1
Caenidae	10	1	63
Ephemeridae		1	
Heptageniidae		4	
Odonata			
Anisoptera (dragonflies)			
Aeshnidae		3	1
Gomphidae		1	1
Libellulidae	24		5
Zygoptera (damselflies)			
Calopterygidae		4	
Coenagrionidae	38	11	51
Plecoptera (stoneflies)			
Perlidae		1	
Hemiptera (true bugs)			
Belostomatidae	1		
Corixidae	1	16	
Gerridae		2	1
Mesoveliidae	2		1
Nepidae	1		
Notonectidae		1	
Pleidae	11	1	2
Saldidae	1		
Veliidae			1
Megaloptera			
Corydalidae (dobson flies)		2	
Sialidae (alder flies)		1	4
Trichoptera (caddisflies)			
Hydropsychidae		12	
Leptoceridae	1	8	1
Limnephilidae		1	
Polycentropodidae		6	
Coleoptera (beetles)			
Dytiscidae (total)	1		
Haliplidae (adults)	5		1
Hydrophilidae (total)	4		
Scirtidae (adults)			1
Elmidae	8	19	10
Gyrinidae (larvae)		1	

Table 6b. Qualitative macroinvertebrate community sampling results at selected stations in the Looking Glass River watershed, Shiawassee County, July and September 2012.

	Vermillion Creek	**Vermillion Creek**	**Osborn Creek**
	Beardslee Road	**Lansing Road (Old 78)**	**Shaftsburg Road**
	9/5/2012	**7/31/2012**	**9/5/2012**
TAXA	**STATION 8**	**STATION 9**	**STATION 10**
Haliplidae (larvae)			1
Scirtidae (larvae)			1
Diptera (flies)			
Ceratopogonidae	3		1
Chironomidae	12	96	81
Culicidae	4		
Dixidae	1		
Tabanidae		5	2
Tipulidae		1	
MOLLUSCA			
Gastropoda (snails)			
Hydrobiidae	24		
Physidae	2		3
Planorbidae	3		8
Viviparidae	1		1
Pelecypoda (bivalves)			
Sphaeriidae (clams)	1	3	2
TOTAL INDIVIDUALS	**272**	**280**	**278**

Table 6c. Macroinvertebrate metric evaluation of selected stations in the Looking Glass River watershed, Shiawassee County, July and September 2012.

	Vermillion Creek Beardslee Road 9/5/2012 STATION 8		**Vermillion Creek Lansing Road (Old 78) 7/31/2012 STATION 9**		**Osborn Creek Shaftsburg Road 9/5/2012 STATION 10**	
METRIC	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	27	1	29	1	26	1
NUMBER OF MAYFLY TAXA	2	0	4	1	2	0
NUMBER OF CADDISFLY TAXA	1	-1	4	0	1	-1
NUMBER OF STONEFLY TAXA	0	-1	1	1	0	-1
PERCENT MAYFLY COMPOSITION	4.78	0	2.86	-1	23.02	1
PERCENT CADDISFLY COMPOSTITION	0.37	-1	9.64	0	0.36	-1
PERCENT DOMINANT TAXON	37.50	-1	34.29	0	29.14	0
PERCENT ISOPOD, SNAIL, LEECH	11.76	-1	0.00	1	4.68	0
PERCENT SURFACE AIR BREATHERS	11.40	0	7.14	0	2.52	1
TOTAL SCORE		**-4**		**3**		**0**
MACROINVERTEBRATE COMMUNITY RATING	**ACCEPTABLE**		**ACCEPTABLE**		**ACCEPTABLE**	