MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
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STAFF REPORT

BIOLOGICAL SURVEY OF THE SHIAWASSEE RIVER WATERSHED MIDLAND, GRATIOT, SAGINAW, SHIAWASSEE, GENESEE, AND LIVINGSTON COUNTIES JUNE-SEPTEMBER 2015

INTRODUCTION

Biological and physical habitat surveys of the Shiawassee River watershed (Hydrologic Unit Code 8_04080203) were conducted from June to September 2015 as part of the Surface Water Assessment Section's (SWAS) five-year rotating basin monitoring design. Macroinvertebrate and habitat surveys were completed at 29 probabilistic sites and 10 trend sites following the SWAS Procedure 51 (Michigan Department of Environmental Quality [MDEQ], 1990) for wadeable streams, and at one probabilistic site following the SWAS Procedure 22 (MDEQ, 2013) for nonwadeable streams (Figure 1). Three additional sites within the Shiawassee River watershed were surveyed to address targeted monitoring requests.

Specific monitoring objectives were to:

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

SUMMARY

In 2015, 30 randomly selected sites within the Shiawassee River watershed were sampled to support attainment status calculation. Based on the probabilistic monitoring aspect of this watershed survey, 97% ± 7% of the randomly selected sites supported the Other Indigenous Aquatic Life and Wildlife (OIALW) designated use using biological monitoring procedures (MDEQ, 2015). Of the wadeable sites surveyed in 2015, macroinvertebrates scored Poor at one site, Acceptable at 26 sites, and Excellent at 2 sites. Habitat was characterized as Marginal at 18 of these sites, Good at 10 sites, and Excellent at one site (Table 1). Additionally, macroinvertebrates scored Good at the one nonwadeable site with high functional feeding group diversity and an intact natural floodplain and riparian area.

In 2015, 10 trend sites within the Shiawassee River watershed were sampled to evaluate biological integrity temporal trends. Macroinvertebrates scored Poor at 2 trend sites, Acceptable at 6 sites, and Excellent at 2 sites (Table 1). Both trend sites that scored Poor in 2015 had also scored Poor in 2010 (Cooper, 2011). Habitat was characterized as Marginal at 3 sites, Good at 6 sites, and Excellent at one site (Table 1). All trend sites scored similar or better in 2015 compared to 2010 for both macroinvertebrates and habitat.

In 2015, three targeted sites within the Shiawassee River watershed were sampled to satisfy monitoring requests submitted by a local watershed group, Friends of the Shiawassee River

(FOSR). Targeted sites had Acceptable to Excellent macroinvertebrate communities and Good to Excellent habitat conditions (Table 1).

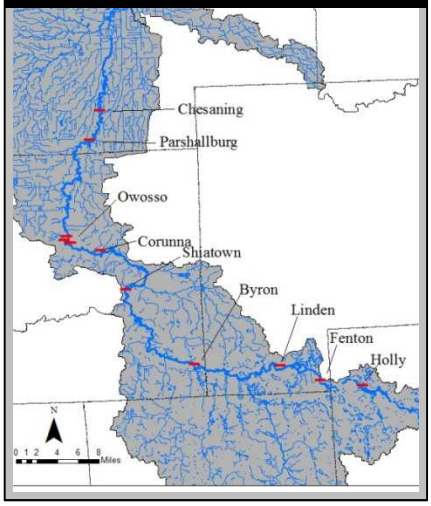
STUDY AREA

The Shiawassee River watershed is located in the eastern-central Lower Peninsula of Michigan. It drains over 809,000 acres and is part of the larger Saginaw Bay watershed (Shiawassee River, Cass River, Flint River, and Tittabawassee River). The Shiawassee River is a large warmwater river that originates from Shiawassee Lake, west of Andersonville, Michigan. It then flows through an agriculturally-dominated landscape, several impoundments, and several cities including Fenton, Linden, Byron, Corunna, Owosso, and Chesaning before joining the Flint River, Cass River, and Tittabawassee River to form the Saginaw River. Along its course, it receives several wastewater treatment plant (WWTP), storm water, sewage lagoon, and small industrial discharges. The upper Shiawassee River watershed (upstream of Owosso) is located in the Southern Michigan/Northern Indiana Drift Plains United States Environmental Protection Agency (USEPA) Level III Ecoregion and is characterized by rolling ground moraines, agricultural land use, and small oak-hickory forests (Omernik and Gallant, 1988). The lower Shiawassee River watershed (downstream of Owosso) is located in the Huron/Erie Lake Plains USEPA Level III Ecoregion and is characterized by flat topography, fertile soils, and heavy agricultural land use (Omernik and Gallant, 1988).

The hydrology of the Shiawassee River is typical of rivers in the Saginaw Bay area that drain large expanses of agricultural land. The river is both a snow-melt and storm-driven system, and is relatively flashy compared to other Michigan rivers (Figure 2; Fongers, 2010). In a hydrologic study of the mid-Shiawassee River watershed, flashiness of the Shiawassee River was in the upper-middle or highest quartile for the state at the United States Geological Survey (USGS) stream gages in Owosso and Fergus. Flashiness was less severe at the gage in Byron and was nonexistent at the Linden gage (Fongers, 2010). This is likely due to differences in land use and geology between the lower and upper watershed. Agricultural land use is more prevalent and tributaries have been altered to a greater degree in the lower part of the watershed. Agricultural practices such as channelization and dredging of drains have disconnected many of the tributaries from their historic floodplains, which in conjunction with tiling of fields, reduces the amount of retention time and increases the speed and intensity of water draining from highly altered basins, which can lead to increased flashiness.

Hydrology can also be altered by channel and flow modifications such as dams. Several dams were built on the mainstem Shiawassee River throughout the mid to late 1800s for mill operation. Dams were found in Chesaning (1863), Parshallburg, Owosso, Corunna (1843), Shiawassee Town (aka Shi-Town, ShiaTown; 1904), Byron (1847), Linden (1967), Fenton (1935), and Holly (1840), as well as a few smaller dams upstream of Holly. Many of these dams have recently been removed or are in the process of being removed due to deterioration, neglect, and safety concerns, as well as to restore natural hydrology and improve fish passage and recreational opportunities along the river (e.g., canoeing and kayaking). Today, only the Corunna Dam, Owosso Dams (3 weirs), and dams upstream of Byron (including Byron) remain intact (most of which, currently serve no purpose or only recreational purposes and do not actively regulate flow).

Shiawassee River Mainstem Dams



The Parshallburg dam (aka Havana; Chesaning Township) was an 8-foot dam built for mill production in the 1850s (Michigan Water Resources Commission, 1963). Remnants in this small barrier are still present where the dam once stood; however, it is navigable in small watercraft and likely does not limit fish passage or recreation to any great extent. More recent dam removals or modifications include the Chesaning Dam and ShiaTown Dam. In 2009, the Chesaning Dam was modified by the addition of an approximately 400-foot long rock ramp opening up approximately 37 miles of river to recreationally important fish species such as walleye (Michigan Department of Natural Resources [MDNR], 2015). Similarly, drawdown and removal of the Shiawassee Town Dam began in 2012. Removal is anticipated to be completed in 2016.

With the removal of these aging dams, the Shiawassee River is currently open to fish passage from the confluence with the Tittabawassee River to Owosso and possibly Corunna. Three weirs in Owosso may make it difficult for some fish species to pass through breaks in the middle of the weirs due to high water velocities, although some species may be able to bypass these dams. The Corunna dam is a major barrier to fish movement and allows little to no fish passage. In 2009, the MDEQ issued a Dam Safety Order to the city of Corunna stating that action must be taken to address the threat of dam failure. The city of Corunna is currently seeking funding to remove this dam. If the dam in Corunna is removed, only the Byron, Linden, and Fenton Dams would remain on the mainstem Shiawassee River opening up approximately 30 additional mainstem river miles (~1/4th of the mainstem), and many tributaries including the south branch of the Shiawassee River to fish passage.

HISTORICAL SAMPLING EFFORTS

Early surveys of the Shiawassee River watershed detail widespread pollution around population centers. In the 1970s, water quality and/or habitat degradation was evident below the Howell WWTP (Johnson, 1979), Genessee County WWTP, Corunna WWTP, and Owosso WWTP (Wuycheck and Jackson, 1979; Freed, 1992). Excessive nutrient loads produced nuisance aquatic plant growth, bacterial slimes, and reductions in the fish and macroinvertebrate communities (Wuycheck and Jackson, 1979). Following the Clean Water Act and subsequent nutrient reductions from WWTPs, there were drastic improvements in the water quality of the Shiawassee River. Even so, areas that were highly polluted by arsenic, manganese, chromium, PCBs, phosphorus, nitrate, and several other pollutants were discovered throughout the 1980s and 1990s and residual contamination remains an issue in some parts of the river today.

Andersonville to Linden

The headwaters of the Shiawassee River from Andersonville to Linden have been sampled for macroinvertebrates and fish relatively few times, but records show that, in general, the biological communities and habitat conditions in these upper reaches are in fairly good condition. Two sites were surveyed near the Holly WWTP in 1990 to assess potential impacts of the WWTP on the biological community, habitat, and water and sediment quality of the Shiawassee River (Scott, 1991). No discernable impacts were observed and macroinvertebrate communities were characterized as Fair, fish communities as Good, and habitat as Good (Scott, 1991). In 1995, fish and macroinvertebrates were sampled at five sites in this segment of the watershed. These sites had Acceptable fish communities and Acceptable to Excellent macroinvertebrate communities with Fair to Excellent habitat conditions (Hanshue, 1998). In 2000, 4 sites were surveyed in this segment and found to have Acceptable macroinvertebrate communities and

Fair to Good habitat conditions (Cooper, 2001). Four additional sites were sampled in 2005 and found to have Acceptable to Excellent macroinvertebrate communities and Good to Excellent habitat conditions (Cooper, 2006). No biological assessments upstream of Linden have been completed since 2005 (Cooper, 2011).

Linden to Byron

The Shiawassee River from Linden to Byron has historically been described as highly degraded (Wuycheck and Jackson, 1979; Roycraft and Buda, 1978). Biological assessments in 1995 found an Acceptable, but "noticeably impaired" fish community in the river downstream of Linden (Hanshue, 1998). Macroinvertebrates were rated as Acceptable at this site; however, habitat was characterized as Fair with low scores for bottom substrate available cover, embeddedness, and bottom deposition suggesting a general lack of good fish habitat, which may have led to the low scores (Hanshue, 1998). An additional upstream site was surveyed in 1995. This site had Acceptable macroinvertebrates and Good habitat conditions (Hanshue, 1998). In 2000, three sites were surveyed between Linden and Byron. All three sites had Acceptable Macroinvertebrate communities. Habitat was characterized as Fair to Good; however, all sites had low scores for bottom deposition, embeddedness, and bottom substrate available cover (Cooper, 2001). In 2005, biosurveys were completed at 4 locations (2 tributaries and 2 sites on the mainstem), and macroinvertebrate communities were characterized as Acceptable, while habitat ranged from Marginal to Good (Cooper, 2006). In 2010, biological assessments were conducted at 4 sites, finding Acceptable to Excellent macroinvertebrate communities and Marginal to Good habitat conditions (Cooper, 2011). Overall, although some habitat metrics have been low historically, macroinvertebrates in this section have never scored lower than acceptable.

South Branch Shiawassee River

High nutrient runoff, nuisance aquatic vegetation (Johnson, 1979), dredging and channelization, PCB and trace metal contamination (Hanshue, 1998), as well as contamination from a number of other pollutants have combined to make the South Branch Shiawassee River one of the most impaired sections of the Shiawassee River watershed. One of the most notable sites on the South Branch Shiawassee River is the Cast Forge Company (now Western Wheel) Superfund Site. From 1971 to 1977, wastewater contaminated with PCBs was directly and indirectly discharged from the facility into the South Branch Shiawassee River (USEPA, 2014). In 1983, the Cast Forge Company facility and approximately 8 miles of river downstream of the site was added to the National Priorities List (USEPA, 2014). Although cleanup efforts were attempted in the 1980s and removed a large amount of the contaminated sediment, subsequent fish contaminant studies have shown that, as of 2011, there are still elevated levels of PCBs at this site (Bohr, 2013).

The South Branch Shiawassee River is characterized by a very uniform channel, degraded in-stream habitat, and large amounts of soft, unstable sediment for much of its course. Biological assessments in the South Branch Shiawassee River have characterized fish as Poor to Acceptable (1995), and macroinvertebrates as Acceptable to Excellent (1995), Acceptable (2000), and Acceptable (2010) with most sites showing slight to moderate impairment. Habitat conditions during these surveys were considered Good to Fair (1995), Poor to Fair (2000), and Marginal to Good (2010), with the majority of sites showing evidence of past dredging.

Tributaries to the South Branch have had a wide range of biological and habitat scores. Marion Genoa Drain is the first major tributary to the South Branch Shiawassee River. Macroinvertebrates in this tributary have scored Poor (2000), and Poor to Acceptable (2005), while habitat has scored Fair (2000), and Marginal to Good (2005). The next tributary, Sprague Creek, has had macroinvertebrate communities characterized as Marginal (2005), and Acceptable to Excellent (2010), and habitat characterized as Marginal (2005, 2010). Downstream of Sprague Creek, Bogue Creek joins the South Branch Shiawassee River. This stream and its tributaries have had Acceptable (1995, 2005), and Acceptable to Excellent (2010) macroinvertebrates, and Fair (1995), Good (2005), and Marginal to Excellent (2010) habitat. The Yellow River is also a tributary to the South Branch Shiawassee River and has had Excellent (1995), or Acceptable (2000) macroinvertebrates, and Fair (1995, 2000) habitat conditions. Cranberry Creek joins the Yellow River just upstream of its confluence with the South Branch Shiawassee River. This stream and an unnamed tributary to Cranberry Creek have had Acceptable macroinvertebrates (1995, 2000, 2005, 2010), and Fair to Good (1995), Fair (2000), Excellent (2005), and Good (2010) habitat.

Byron to Corunna

From Byron, the Shiawassee River flows northwest to Corunna. This stretch of the river has a slightly higher average gradient than upstream portions and is dominated by agricultural land use. Although overall, the mainstem Shiawassee River in this section is in fairly good condition, many of the tributaries in this segment are maintained drains that have been straightened and channelized. Fish in this segment have been characterized as Excellent (1995) on the mainstem, and Poor to Acceptable (1995) in tributaries. Macroinvertebrates in this segment have been characterized as Excellent (1995, 2005, 2010), and Acceptable to Excellent (2000) on the mainstem, and Poor to Acceptable in tributaries (1995, 2000, 2005, 2010). Habitat in this segment has been rated as Excellent (1995), Fair to Excellent (2000), and Good (2005, 2010) on the mainstem, and Poor to Fair (1995), Poor to Good (2000, 2005), and Poor to Marginal (2010) in tributaries.

Corunna to Chesaning

From Owosso, the river runs north through Chesaning receiving mostly small tributaries. As in the segment of the Shiawassee River between Byron and Corunna, many of the tributaries between Corunna and Chesaning have also been modified to facilitate agricultural drainage. Additionally, WWTPs in Corunna and Owosso were historically blamed for downstream impairments (high nutrients, contaminants, etc.), although only the Owosso WWTP was cited as affecting the biological community (1972, 1974, and 1984). A subsequent survey showed some improvement in water quality based on macroinvertebrate and fish surveys (Morse, 1988). Since 1995, this segment of the river has typically been rated as having decent macroinvertebrate communities, with macroinvertebrate communities scoring Excellent (1995), Acceptable to Excellent (2000), and Acceptable to Excellent (2010). Habitat conditions have scored Good to Excellent (1995), Fair to Good (2000), and Marginal to Good (2010).

Chesaning to Mouth

From Chesaning, the Shiawassee River flows north-northeast to its confluence with the Tittabawassee River south of Saginaw. Macroinvertebrates in the mainstem and small, direct tributaries between Chesaning and the mouth have been characterized as Poor to Excellent (1995), Acceptable (2000, 2005), and Poor to Acceptable (2010). Habitat has been characterized as Fair to Good (1995), Fair (2000), Marginal to Good (2005), and Marginal

(2010). Two major tributaries enter the Shiawassee River in this section: the Bad River and Swan Creek (including Marsh Creek).

The Bad River and its tributaries make up the majority of the lower Shiawassee River watershed downstream of Owosso, and approximately 27% of the entire Shiawassee River watershed. Macroinvertebrates in these tributaries were characterized as Acceptable (1995), and Poor to Acceptable (2000, 2005, 2010). Habitat in these tributaries was characterized as Poor (1995), Fair to Good (2000), Marginal to Good (2005), and Poor to Good (2010).

Swan Creek and Marsh Creek are other major tributaries to the lower Shiawassee River and together make up approximately 14% of the entire Shiawassee River watershed. Macroinvertebrates in Swan Creek and Marsh Creek have been characterized as Acceptable (1995), and Poor to Acceptable (2000, 2005, 2010). Habitat has been characterized as Fair (1995), Poor to Fair (2000), Marginal to Good (2005), and Poor to Good (2010).

Historical Watershed-Wide Attainment

Watershed-wide attainment was 77 ± 18% in 2005 (Cooper, 2006) and 88 ± 10% in 2010 (Cooper, 2011). Fifteen sections (i.e., Assessment Unit Identifiers [AUID]) of the Shiawassee River watershed were not supporting the OIALW designated use prior to the 2015 surveys. Five of these AUIDs were not supporting solely due to mercury and/or PCB water column exceedances. Three AUIDs were listed due to mercury and/or PCB water column exceedances in combination with direct habitat alteration and other flow regime alterations (040802030410-05), other anthropogenic substrate alterations and other flow regime alterations (040802030410-02), or an unknown cause (040802030310-01). Four AUIDs were listed as not supporting due to other anthropogenic substrate alterations and other flow regime alterations (040802030203-03, 040802030204-01, 040802030204-02, 040802030408-01), two AUIDs were listed due to direct habitat alterations and other flow regime alterations (040802030307-01, 040802030407-03), and one AUID was listed due to an unknown cause (040802030407-04).

METHODS

Biological surveys were completed at 43 sites in the Shiawassee River watershed from June to September 2015 (Table 1, Figure 1). Thirty sites were randomly selected using a stratified random site-selection method to address statewide and watershed-wide questions (Tables 2 and 3), and 10 sites were chosen to track temporal trends in biological data following the SWAS's Biological Monitoring Status and Trend Procedure (MDEQ, 2015; Tables 4 and 5). Three additional sites within the Shiawassee River watershed were sampled to fulfill targeted monitoring requests (Tables 6 and 7). One site visit was also conducted to address a targeted monitoring request, but biological surveys were not performed. Of the 43 biological surveys, 42 sites were surveyed following the SWAS Procedure 51 and one site was surveyed following the SWAS Procedure 22 for nonwadeable streams and rivers.

Procedure 51 assigns a score to macroinvertebrate communities and habitat conditions using metrics that rate macroinvertebrates as Excellent (> 4), Acceptable (+ 4 to - 4), or Poor (< 4) based on the macroinvertebrate community composition and structure, and habitat as Excellent (> 154), Good (105 to 154), Marginal (56 to 104), or Poor (< 56) based on several parameters that describe in-stream and riparian conditions (Creal et al., 1996).

Procedure 22 assigns a score to macroinvertebrate communities using metrics that rate macroinvertebrates as Excellent (76 to 100), Good (51-75), Marginal (26-50), or Poor (0-25) based on several metrics that describe macroinvertebrate community composition and structure, and abundance and diversity of functional feeding groups (MDEQ, 2013). Procedure 22 also characterizes riparian habitat, in-stream cover, substrate, bank stability, and off-channel habitat.

Shiawassee River (Beach Buggy Lane) 2015

RESULTS

Status Sites

Shiawassee River Headwaters

The Shiawassee River originates from Shiawassee Lake near Andersonville, Michigan. The river then flows north through Davisburg Trout Pond, turns west and winds through several lakes before reaching Holly. Downstream of Holly, the river continues west passing through impoundments in Fenton, Linden, and Byron. One status site on the mainstem Shiawassee River in this section was sampled in 2015. This site was located approximately one mile downstream of the Linden Dam (Beach Buggy Lane). The reach sampled was characterized by sandy substrate with mixed silt at depositional areas and some filamentous algae. Macroinvertebrates at this site were characterized as Acceptable (1), while habitat conditions were considered Good (126). Freshwater mussels were abundant in this reach; however, percent contribution to the macroinvertebrate community was likely underestimated due to inefficiencies of sampling unionids with dip nets.

North Ore Creek (Center Road) 2015

Marion Genoa Drain (Fisk Road) looking upstream 2015 (Reach that was sampled)

North Ore Creek and South Branch Shiawassee River

North Ore Creek and the South Branch Shiawassee River are major tributaries to the upper Shiawassee River. North Ore Creek originates near Hartland, Michigan and flows northwest joining the Shiawassee River west of Linden. One status site was surveyed in this reach in 2015 (Center Road). This site had an Acceptable (2) macroinvertebrate community with 31 taxa present and Good (147) habitat conditions.

Marion Genoa Drain at Fisk Road looking downstream (Not sampled in 2015)

The South Branch Shiawassee River originates from Coon Lake south of Howell, Michigan. It then flows northwest, joining the Shiawassee River in Byron, Michigan. Along its course it receives four main tributaries: Marion and Genoa Drain, Sprague Creek, Bogue Creek, and Yellow River Drain. A site on Marion Genoa Drain was sampled in 2015 and found to have Acceptable (1) macroinvertebrate communities, and Marginal (95) habitat conditions. However, it appears that the reach

Marion Genoa Drain looking at downstream location of pipe

immediately downstream of this crossing, has been modified by removal of riparian vegetation (via mowing and potentially spraying), and addition of riprap along the banks of the drain. A pipe, presumably leading from a treated pond directly to the stream was observed.

Unnamed Tributary to Indian Lake (Faussett Road) 2015

Marion Genoa Drain flows into the South Branch Shiawassee River upstream of Howell. Two status sites on the South Branch Shiawassee River downstream of the Marion Genoa Drain (Chase Lake Road and Lovejoy Road) were surveyed in 2015. The Chase Lake Road site had Acceptable (-1) macroinvertebrate communities and Marginal (81) habitat conditions, and the Lovejoy Road site had Acceptable (2) macroinvertebrate communities and Marginal (93) habitat conditions. The Chase Lake Road site had a fair amount of woody debris but little in-stream vegetation, while the Lovejoy Road site had much more in-stream submerged and floating vegetation along the margins and little large woody debris. However, both sites had substantial in-stream sedimentation that likely reduced the available in-stream habitat for macroinvertebrates.

An unnamed tributary to Indian Lake, southwest of Linden, flows from Faussett Lake to Indian Lake (Yellow River Drain is an outlet of this lake). This tributary was sampled at Faussett Road in 2015 (~0.5 miles downstream of the Faussett Lake impoundment) and found to have Acceptable (-4) macroinvertebrates and Marginal (89) habitat conditions. This site had very poor substrate and in-stream habitat conditions with excessive sedimentation (~2 to 2.5 feet of silt/muck with 1 to 3 inches of clear water on top for most of the reach). Twenty-three taxa were present at this site; however, the poor habitat conditions were reflected in the macroinvertebrate community with amphipods making up 78% of the community, and no Ephemeroptera, Plecoptera, or Tricoptera (EPT) found. Additionally, invasive curly leaf pondweed and Chinese mystery snails were present at this site. This site should be monitored during the next cycle to determine if conditions further degrade.

Shiawassee River

From Byron, the Shiawassee River flows roughly northwest until it reaches the impoundment in Corunna. Sites on 3 tributaries in the reach between Byron and Corunna were sampled in 2015, the first of which was Scribner Creek. Scribner Creek flows into the Shiawassee River between Bancroft and Union Plains. The site sampled in 2015 was downstream of Beard Road. This site had Acceptable (-3) macroinvertebrates and Good (106) habitat conditions. The macroinvertebrate community was dominated by isopods (70%) and contained few ephemeroptera (3%) and tricoptera (7%).

Pratt Drain (Geeck Road) 2015

Pratt Drain (aka Hovey Drain) is a small tributary to Holly Drain, which is a tributary to the Shiawassee River near Vernon, Michigan. Two sites on this drain were surveyed in 2015, one at Geeck Road and one at Garrison Road (~0.3 miles apart). Both sites had Acceptable macroinvertebrate communities (Geeck: -4; Garrison: -3), and Good habitat conditions (Geeck: 127; Garrison: 148). The greatest difference in habitat conditions between the

Pratt Drain (Garrison Road) 2015

two sites was in sediment deposition. The upstream site was dominated by sand substrate resulting in substrate instability and accounting for the lower score for sediment deposition at this site. The upstream site also had sand substrate but contained fair amounts of woody debris, coarse particulate organic matter, gravel, cobble, and other stabilizing characteristics. Amphipods dominated both sites (Geeck: 78%; Garrison: 52%); however, Garrison Road had ~10% greater tricoptera composition, likely due to the increase in available habitat, which led to the slightly higher score at this site. Although both sites are quite impaired biologically, the site at Geeck Road especially, should be monitored during the next cycle to determine if conditions change. This site has clearly been straightened and dredged in the past and may improve with time.

The Shiawassee River downstream of Holly Drain flows northwest to Corunna and Owosso. One site on the mainstem was surveyed in 2015 in Owosso (Gould Street Bridge). This site scored the highest for macroinvertebrate communities of all sites surveyed in 2015 with an Excellent (7) community. Habitat in this reach was characterized as Good (121). Two invasive species were present at this site, Chinese mystery snail and Asian clams.

From Owosso, the Shiawassee River flows north through Chesaning. Two sites were surveyed in this section in 2015. A site on the mainstem Shiawassee River in Chesaning (Showboat Park) had an Excellent (6) macroinvertebrate community and Excellent (157) habitat conditions. Additionally, a small tributary that flows into the Shiawassee River north of Chesaning (Deer Creek) had an Acceptable (-3) macroinvertebrate community and Marginal (93) habitat conditions.

Shiawassee River (Showboat Park, Chesaning) 2015

Bad River

The Bad River originates south of Ithaca, Michigan, and flows east, where it joins the Shiawassee River near St. Charles, Michigan. Twelve sites were sampled in the Bad River watershed in 2015. The only site on the mainstem Bad River was sampled near its origin at Blair Road. The macroinvertebrate community at this site was considered Acceptable (-3) with 24 taxa present, but contained very few EPT taxa, and was dominated by chironomids (48%). This site also had Marginal (84) habitat as expected for an agricultural ditch that has been channelized, straightened, and has little riparian vegetation.

Bad River at (Blair Road) 2015

Shad Creek is a small tributary to the Bad River east of Ithaca. A site off McClelland Road was sampled in 2015. The macroinvertebrate community at this site was Acceptable (-1) with 27 taxa present including one ephemeroptera taxa, and 4 tricoptera taxa. Surface air breathers were prevalent (32%) and chironomids and corixids dominated the community. Habitat at this site was rated as Marginal (101). However, stream habitat was in fairly good condition for an agricultural stream in this area due to slight improvements in riparian vegetation (lots of willows, some medium sized trees) for approximately 300 meters upstream of the road crossing (although still lacking riparian width >10 meters).

Shad Creek (McClelland Road) 2015

Downstream of the road crossing, riparian vegetation has been removed and the stream is a typical agricultural ditch.

The South Fork Bad River originates in southeast Gratiot County and flows northeast joining the Bad River in St. Charles, Michigan. The majority of tributaries in the South Fork Bad River watershed have been highly modified for agricultural drainage. Several of these tributaries were surveyed in 2015.

Limbocker Creek is a tributary to the South Fork Bad River. One site on Limbocker Creek at Harris Road was surveyed in 2015. This site had an Acceptable (3) macroinvertebrate community with 31 taxa present. Habitat in this reach was characterized as Marginal (88). This section of the creek has good riparian habitat and bank structure; however, in-stream habitat was less than desirable with little stable habitat and high sediment deposition.

Lamb Creek is also a tributary to the South Fork Bad River. Two sites were surveyed on this stream in 2015, one at Wickie Road and one at Brady Road (~1 mile apart). Macroinvertebrates scored Acceptable (-2) at the upstream site (Wickie Road), and Acceptable (2) at the downstream site (Brady Road). The downstream site had 5 additional taxa overall, 1 additional ephemeroptera taxa, 3 additional tricoptera taxa, higher % composition of ephemeroptera and tricoptera, and less % dominant taxa than the upstream site. Better macroinvertebrate scores at the downstream site were likely due to better habitat conditions and more available habitat at the downstream site. The upstream site was characterized as a pool/glide stream and was a deeper, slower moving, wider reach with high sedimentation and low channel complexity, while the downstream riffle/run site had lower water levels and contained more complex habitat. Overall, the upstream habitat scored Marginal (88), while the downstream habitat scored Good (127). Both sites are bordered by mixed deciduous forest, with the upstream site having better riparian zone width. Invasive rusty crayfish were found at the upstream site, but were not collected at the downstream site.

Lamb Creek (Brady Road) 2015

Lamb Creek (Wickie Road) 2015

Potato Creek is a small tributary to the South Fork Bad River. Little Potato Creek joins Potato Creek just upstream of its confluence with the South Fork Bad River. One site on Little Potato Creek was surveyed in 2015 at Fowler Road in the Gratiot-Saginaw State Game Area. This small glide/pool stream had an Acceptable (0) macroinvertebrate community and Good (109) habitat conditions. Substrate and in-stream cover were Marginal, and channel morphology was Marginal to Good for all metrics evaluated, while riparian habitat and bank structure were Good for all metrics evaluated.

Little Potato Creek (Fowler Road) 2015

One site on the South Fork Bad River just upstream of its confluence with the Bad River in St. Charles was surveyed in 2015. This site had an Acceptable (-2) macroinvertebrate community and Marginal (103) habitat conditions. This section of the river is slow moving allowing for increased sediment deposition and reduced available habitat. Rip rap and trash

(mixed metal and other hard objects) lined the bottom of the stream in this section. Riparian vegetation consisted of mixed deciduous trees with floodplain habitat present on the left bank. Riparian habitat was minimal on the right bank.

Beaver Creek

Beaver Creek is a major tributary to the Bad River. It originates northeast of Ithaca and flows roughly east where it joins the Bad River just downstream of St. Charles (below the confluence with the South Fork Bad River). Two status sites were surveyed in this tributary in 2015, one near the headwaters at Blair Road and one in the middle section of the creek at Hemlock Road. The upstream site at Blair Road is a small agricultural ditch that has been channelized. This site had an Acceptable (-3) macroinvertebrate community and Marginal (61) habitat conditions. Very few EPT taxa were found and the community was dominated by corixids (41%, surface-air breathers made up 64% of the community). In-stream habitat was poor with sand and silt covering most available habitat and heavy deposits of fine sediment. Additionally, riparian habitat was nearly nonexistent. A small amount of invasive curly leaf pondweed was also found at this site.

Beaver Creek (Blair Road) 2015

The downstream Beaver Creek site at Hemlock Road had much better in-stream and riparian habitat, which likely led to a better macroinvertebrate community. This site had a good variety of in-stream habitat and scored Good (113) overall. Macroinvertebrates scored Acceptable (2) with many more taxa present including 2 additional ephemeroptera taxa, 4 additional tricoptera taxa, and a more even community overall. An extensive amount of invasive rusty crayfish were found at this site.

Beaver Creek (Hemlock Road) 2015

Carson Drain is a tributary to Pickerel Creek, which is a tributary to the Bad River downstream of St. Charles. Carson Drain is a highly altered system and has been straightened over much of its course. One status site was surveyed on Carson Drain in 2015 immediately upstream of its confluence with Pickerel Creek (Ryan Road). This site had an Acceptable (-2) macroinvertebrate community with 23 taxa present, and only about 3% surface air breathers. Habitat was Marginal (78), but in-stream vegetation was abundant likely driving the abundance of Coenagrionidae at this site (~70% of the community). Much of the in-stream vegetation at this site consisted of invasive curly leaf pondweed.

Carson Drain (Ryan Road) 2015

Downstream of the confluence of Carson Drain and Pickerel Creek, Pickerel Creek continues north for approximately 1.5 miles before emptying into the Bad River. One site was surveyed on this tributary in 2015 at Hulien Road. This section of the creek is straightened, channelized, diked, and borders the west side of the Shiawassee State Game Area. This site had an Acceptable (-3) macroinvertebrate community and Marginal (92) habitat conditions. This reach was characterized by moderate sediment deposition, little riparian vegetation, with few mature

Pickerel Creek (Hulien Road) 2015

trees, and a fairly uniform channel. Water level fluctuations appear to be common (likely both controlled via pumps and natural). This site is also an access point to the State Game Area and signs of human traffic were evident. Although aquatic invasive species were not prevalent at the time of this sampling effort (some Eurasian watermilfoil present), this may be a moderate risk aquatic invasive species site.

Swan Creek

Swan Creek originates south of Midland, Michigan, and flows southeast where it joins Marsh Creek for a short distance before entering the Shiawassee River northeast of St. Charles, Michigan. Three tributaries to Swan Creek were surveyed in 2015: Weeks Drain, Handy Creek, and Whitmore Drain.

Weeks Drain is a tributary to Nelson Run, which is a tributary to Swan Creek in northwest Saginaw County. One site near the origin of this stream was surveyed in 2015 at Meridian Road. This site appeared to have been dredged fairly recently with bare banks in some areas but thick herbaceous plants in other areas. Clay substrate and filamentous algae were present throughout most of reach and overall habitat conditions were characterized as Marginal (69). The macroinvertebrate community was considered Acceptable (-3) and consisted of predominately chironomidae (62%).

Weeks Drain (Meridian Road) 2015

Handy Creek is also a small headwater tributary in this basin. A site near its origin was surveyed in 2015 and found to have an Acceptable (-4) macroinvertebrate community and Marginal (75) habitat conditions. This site had slightly better substrate and in-stream cover compared to the Weeks Drain site; however, it still scored marginal for most metrics and had a greater percent isopod, snail, leech (15%), and surface air breathers (12%) leading to the lower macroinvertebrate score.

Handy Creek drains into Whitmore Drain near Hemlock, Michigan. Whitmore Drain then flows northeast to Nelson Run and then Swan Creek. One site on Whitmore Drain near the confluence with Nelson Run was surveyed in 2015 at Tittabawassee Road. This site was a straightened ditch with little riparian habitat. Macroinvertebrates scored Acceptable (-3) with 22 taxa present, low percent surface air breathers and a moderate percentage of isopods, snails, and leeches (13%). However, this site was also dominated by chironomids and had few EPT taxa. Habitat conditions were characterized as Marginal (87). Invasive rusty crayfish were extensive at this site.

Whitmore Drain (Tittabawassee Road) 2015

One status site on Swan Creek was surveyed in 2015 at Gleanor Road. This site had an Acceptable (-1) macroinvertebrate community with 19 taxa present, 20% tricoptera composition, low percent isopod, snail, leech composition (3%), and low percent air breathers (1%). However, this site also had low ephemeroptera composition, and was dominated by chironomids (33%). Rusty crayfish also made up approximately 23% of the community at this site; however,

Swan Creek (Gleanor Road) 2015

abundance was likely underestimated due to the inefficiency of sampling crayfish with dip nets. Visual estimation of rusty crayfish abundance within this 300-foot reach was easily over 100 individuals. Freshwater mussels were also very abundant at this site and made up roughly 9% of the community (may have also been underestimated). Habitat at this site was characterized as Good (106) and contained a good mix of in-stream habitat; however, most of it was unavailable for macroinvertebrate colonization due to siltation.

Birch Run

Birch Run is a tributary to the Shiawassee River that originates southeast of Frankenmuth, Michigan, and flows northwest where it joins the Shiawassee River between the Flint River and Cass River. Two sites on Moon Drain, a tributary to Birch Run, were surveyed on the same day in 2015 at Pagels Road and Dehmel Road (~1.5 miles apart). Both sites had similar habitat conditions and scored Marginal overall (Pagels Road: 98; Dehmel Road: 91); however, macroinvertebrate community condition varied between the 2 sites. The upstream site at Pagels Road had a Poor (-6) macroinvertebrate community, while the downstream site at Dehmel Road had an Acceptable (-2) macroinvertebrate community. The severely impaired upstream site was dominated by chironomidae (49%) and hirudinea (27%). It is unknown why the macroinvertebrate communities at these sites, in such close proximity to each other, differed to the extent that they did.

Below the confluence of the Bad River and Swan Creek, the Shiawassee River channel becomes less defined as it flows through emergent herbaceous wetlands bordered by emergent wooded wetlands until it eventually reaches the Tittabawassee River south of Saginaw, Michigan. One site approximately 1.0 mile upstream of the confluence with the Tittabawassee River was surveyed in 2015 using Procedure 22. This site had a Good macroinvertebrate community with Excellent Functional Feeding Group Diversity (25/25), %Tricoptera (20/25), and percent dominance (5/5), and poor Habitat Stability Functional Feeding Group Surrogate (0/25), EPT Richness (0/8), Diptera Richness (0/5), and Plecoptera Richness (0/5). Riparian habitat and bank stability was excellent throughout most of the reach, due impart to its location within the Shiawassee National Wildlife Refuge. In-stream habitat consisted of some native submergent vegetation, and little large woody debris, with emergent marshland plants along the margins of the river.

Trend Sites

In order to evaluate temporal changes in biological data, 10 trend sites were sampled in the Shiawassee River watershed in 2015. All trend sites sampled in 2015 had been previously sampled at least once in 2010 (Cooper, 2011). Most sites were similar in 2015 when compared to sites in 2010; however, data will not be available to fully evaluate trends until 2020 when 3 visits to each site have been completed.

It should be noted that 2015 was a fairly wet year with higher than normal water levels on the mainstem in June, July, and August when the majority of sites were sampled. Discharge was greater than the median daily statistic for the last 83 years at the USGS stream gage in Owosso during these months (USGS, 2015), and may have influenced sampling efficiency relative to historical sampling efforts. In contrast, many of the northern tributaries had higher flows in 2010 than 2015 as evidenced by site photos.

Shiawassee River (Hogan Road)

The Shiawassee River at Hogan Road is an approximately 40- to 60-feet wide, sinuous section of river downstream of the Linden Dam. This site had similar habitat and macroinvertebrate scores in 2005, 2010, and 2015 with macroinvertebrate communities scoring Acceptable (2005: 1, 2010: 1, 2015: 3) and habitat conditions scoring Good (2005: 138, 2010: 142, 2015: 137). In 2015, several invasive species including curly leaf pondweed, Asian clams, and zebra mussels were found at this site.

Shiawassee River (Hogan Road) 2010

Shiawassee River (Hogan Road) 2015

North Ore Creek (Crouse Road)

North Ore Creek at Crouse Road is a small stream that flows through lowland/marshland area. Macroinvertebrates at this site scored Acceptable (4) in 2010 and Excellent (6) in 2015. Habitat was characterized as Good (153) in 2010 and Excellent (162) in 2015. Habitat metrics at this site scored Good or Excellent for all metrics in both years; however, several metrics including velocity/depth regime, frequency of riffles, and vegetative protection scored slightly higher in 2015. Overall, this section of stream appears to be in excellent condition.

North Ore Creek (Crouse Road) 2015

Bogue Creek (Allen Road)

Bogue Creek at Allen Road is a slow moving section of river approximately 0.5 miles upstream of an impoundment. This site scored similar in 2010 and 2015 with Acceptable (2010: 0, 2015: -1) macroinvertebrates and Good (2010: 114, 2015: 122) habitat. The macroinvertebrate community in 2010 had a slightly better community due to a greater number of tricoptera taxa, % ephemeroptera composition, and % tricoptera composition. However, there was lower % isopod, snail, leech composition and a single perlodid was found in 2015.

Bogue Creek (Allen Road) 2015

Bogue Creek (Jones Road)

Bogue Creek at Jones Road (approximately 1.5 miles downstream of the impoundment at Oak Grove) is slightly narrower than the upstream Allen Road site, with a better mix of stable habitat and less sediment deposition. This site scored similar in 2010 and 2015 with Acceptable (2010: 4,

Bogue Creek (Jones Road) 2010

Bogue Creek (Jones Road) 2015

2015: 4) macroinvertebrate communities and Good habitat conditions (2010: 127, 2015: 141). In 2015, 1 invasive species, Chinese mystery snail, was found at this site.

Three Mile Creek (Monroe Road)

Three Mile Creek (Monroe Road) 2015

Three Mile Creek at Monroe Road had similar macroinvertebrate communities in 2010 and 2015 with both years scoring Acceptable (2010: 0, 2015: 0). However, habitat conditions scored 39 points higher in 2015 (2010: 89, 2015: 128). In 2010, the site was considered a pool/glide stream, whereas in 2015, the site was considered a riffle/run stream potentially accounting for some of the discrepancies. Water levels may have also played a role in the differences in scores. Water levels were low in 2010 with water filling 25-75% of the channel, whereas in 2015 water reached both banks of the channel. Slower water velocities could have led to increased sedimentation, reduced stream substrate variability, and reduced available habitat at the time of the 2010 survey. In 2015, extensive curly leaf pondweed was noted at this site.

Shiawassee River (Harmon Patride Park (Owosso))

The Shiawassee River at Harmon Patride Park is a large riffle/run river, characterized by a mix of stable in-stream habitat and a variety of velocity/depth regimes. Macroinvertebrates in this reach were Excellent in both 2010 (6) and 2015 (6). Habitat was also similar in both years and scored Good (132) in 2010 and Good (152) in 2015. In 2015, invasive Chinese mystery snails, Asian clams, and rusty crayfish were noted at this site.

Shiawassee River (Harmon Patride Park) 2010

Shiawassee River (Harmon Patride Park) 2015

Beaver Creek (Ransom Road)

Beaver Creek (Ransom Road) 2010

Beaver Creek (Ransom Road) 2015

Beaver Creek at Ransom Road is a straightened, channelized, glide/pool stream in the upper end of the Bad River watershed. This site had Poor macroinvertebrates (-7) in 2010 and Marginal habitat conditions (64). However, in 2015 this site had Acceptable (-1) macroinvertebrates and Marginal habitat conditions (75). Much of the improvement in the macroinvertebrate community was due to a ~22% increase in ephemeroptera, and a ~14% decrease in percent isopod, snail, leech composition, along with the presence of 8 additional taxa in 2015. Surveys were conducted in early June and water temperatures were identical in both years; however, water levels were substantially lower in 2015. There was also much less aquatic vegetation present in the reach in 2015 (50% vs 100% of reach with aquatic vegetation). Both the amount of water and

prevalence of aquatic vegetation may have influenced sampling efficiency in 2010. In 2015, a moderate number of rusty crayfish were also noted at this site.

Carson Drain (Fergus Road)

Carson Drain is a highly modified stream in the Bad River watershed. The site at Fergus Road had Poor macroinvertebrate communities in 2010 (-7) and 2015 (-5) and Marginal habitat in both years (65, 76). The biggest difference in macroinvertebrate communities between years was in % surface air breathers (~29% in 2010 and ~7% in 2015); however, communities varied widely between years. For example, there was a 15% decrease in Amphipods, 29% decrease in Isopods, and an 18% decrease in Corixids from 2010 to 2015. There was also a 30% increase in Chironomids, and 21% increase in Physids. Part of the changes in macroinvertebrate communities may be explained by the higher water levels in 2010. There was almost a two-fold increase in stream width between the years and on average the stream was 0.9 feet deeper in 2010. In addition, in 2015 a moderate number of rusty crayfish were noted at this site.

Unnamed Tributary (Nelson Run; Fehn Road)

Nelson Run is a tributary to Swan Creek in the northern part of the Shiawassee River watershed. The site sampled at Fehn Road was channelized and straightened. Macroinvertebrates scored Acceptable in both 2010 (-3) and 2015 (0) with improvements in number and % of tricoptera taxa. Habitat conditions were Marginal in both years scoring slightly higher in 2015 (93) than in 2010 (65). In 2015, a moderate number of rusty crayfish were noted at this site.

Unnamed Trib to Nelson Run (Fehn Road) 2010

Unnamed Tributary to Nelson Run (Fehn Road) 2015

Swan Creek (Schomaker Road)

Swan Creek is a large, low gradient, depositional, pool/glide system. This reach is listed as impaired due to unknown causes (040802030407-04) and macroinvertebrates scored Poor (-7) in 2010. The river also scored Poor (-5) in 2015 with improvements in percent of surface air breathers and number of ephemeroptera taxa (addition of only 1 family). However, there were also declines in the number of tricoptera taxa present. Habitat scored slightly higher in 2015 and was characterized as Good (117) as opposed to Marginal (100) in 2010. In both years, water levels made it difficult to effectively sample all available habitats and scores may not be indicative of the river as a whole.

Swan Creek (Schomaker Road) 2010

Swan Creek (Schomaker Road) 2015

SHIAWASSEE RIVER WATERSHED TREND SITES 2010 & 2015									
WATERBODY NAME	LOCATION	2010				2015			
		MACROINVERTEBRATES		HABITAT		MACROINVERTEBRATES		HABITAT	
		Score	Category	Score	Category	Score	Category	Score	Category
Shiawassee River	Hogan Road	3	Acceptable	142	Good	3	Acceptable	137	Good
North Ore Creek	Crouse Road	4	Acceptable	153	Good	6	Excellent	162	Excellent
Bogue Creek	Allen Road	0	Acceptable	114	Good	-1	Acceptable	122	Good
Bogue Creek	Jones Road	4	Acceptable	127	Good	4	Acceptable	141	Good
Three Mile Creek	Monroe Road	0	Acceptable	89	Marginal	0	Acceptable	128	Good
Shiawassee River	Harmon Patride Park (Owos	6	Excellent	132	Good	6	Excellent	152	Good
Carson Drain	Fergus Road	-7	Poor	68	Marginal	-5	Poor	76	Marginal
Beaver Creek	Ransom Road	-7	Poor	64	Marginal	-1	Acceptable	75	Marginal
Unnamed Trib (Nelson Rur	Fehn Road	-3	Acceptable	65	Marginal	0	Acceptable	93	Marginal
Swan Creek	Schomaker Road	-7	Poor	100	Marginal	-5	Poor	117	Good

Targeted Monitoring Requests

The SWAS completed 4 targeted monitoring requests within the Shiawassee River watershed in 2015. All 4 requests were submitted by the FOSR, a local watershed group.

Shiawassee River at DeVries Nature Center (2014059)

The FOSR requested that the SWAS sample macroinvertebrates at a site on the Shiawassee River near the DeVries Nature Center in Owosso for comparison of volunteer-collected data to SWAS-collected data. SWAS staff conducted side-by-side surveys with FOSR volunteers (Procedure 51 vs Michigan Clean Water Corps protocol) in August of 2015 to compare results and aid in volunteer identification of taxa, methodology, and general stream sampling practices. Emphasis on equal sampling of all available habitats and identification of taxa were the primary focuses of the survey. Following Procedure 51, the site had an Excellent (6) macroinvertebrate community and Excellent (180) habitat conditions.

Shiawassee River at Holly Drain confluence (Request 2015110)

Shiawassee River downstream of Holly Drain Confluence 2015

Holly Drain is a tributary to the Shiawassee River near Vernon, Michigan. The stream has been listed as not supporting four designated uses: Total Body Contact, Partial Body Contact, OIALW, and Fish Consumption. A Total Maximum Daily Load for *E. coli* has been approved for this drain (Alexander, 2011). The FOSR requested sampling on the Shiawassee River upstream and downstream of the confluence of Holly Drain and the Shiawassee River to assess potential impacts of the drain on the Shiawassee River. The SWAS preformed one Procedure 51 biological survey downstream of the confluence to determine if the site was impaired biologically. Macroinvertebrates were characterized as Acceptable (4), while habitat was considered Good (128). Holly Drain does not appear to be negatively influencing the macroinvertebrate community at this site.

Shiawassee River at Corunna Dam (Request 2015113)

Corunna Dam, September 2015

The Corunna dam is a 6-foot high, deteriorating dam that was built in the 1840s for mill operation. The FOSR are leading the effort to remove the dam. In anticipation of the dam's removal, the FOSR requested that "before" conditions upstream and downstream of the dam be documented to provide baseline data prior to dam removal. The SWAS conducted a Procedure 51 biological survey downstream of the dam, in the area most likely to be adversely affected by removal, in order to establish this baseline. Biological assessments were not completed upstream of the dam due to the impounded nature of the river and the lack of suitability of Procedure 51. The site downstream of the Corunna Dam had an Excellent (5) macroinvertebrate community and was characterized as having Good (132) habitat conditions.

Brick Plant Bridge, August 2015

Shiawassee River at Brick Plant Road (Request 2015114)

In response to a targeted monitoring request from the FOSR to investigate the impacts of an old bridge structure on stream communities, SWAS staff visited a site near the Michigan (Hanson) Brick Plant east of Owosso in August 2015. The bridge was built across the river to connect Hanson Brick Plant property on both sides of the river; however, it is unknown if the bridge is currently used. The bridge is made of many small culverts and spans the entire width of the river. SWAS staff found that the bridge is likely an impediment to both navigation and flow, although navigation appears to be possible during high flows through a side channel. This bridge may also impede fish passage following debris build up. The bridge was reported to the MDEQ, NPS Unit, on August 20, 2015.

NPS CONCERNS

The greatest NPS concerns noted in 2015 were the Corunna dam and the Michigan (Hanson) Brick Plant Bridge. Removal of the Corunna dam would open up approximately 30 additional mainstem river miles and many tributaries between Corunna and Byron to fish passage. Modification or removal of the Michigan Brick Plant Bridge would allow more natural flow, increased fish passage, and improved navigation.

WATERSHED ATTAINMENT

In 2015, 30 randomly selected sites within the Shiawassee River watershed were sampled to support attainment status calculation. Based on the probabilistic monitoring aspect of this watershed survey, 97% ± 7% of the randomly selected sites supported the OIALW designated use using biological monitoring procedures (MDEQ, 2015). Percent attainment was calculated by dividing the number of random sites that meet Water Quality Standards by the total number of random locations ((29/30)100 = 96.7%). This value is coupled with a 95% confidence interval to provide our estimation of certainty (MDEQ, 2015), meaning there is 95% certainty that the true proportion of attainment in the Shiawassee River watershed is between 90% and 100%.

CONCLUSION

Although most sites surveyed in 2015 scored Acceptable or better for macroinvertebrates, many sites were borderline severely impaired with 37% of status sites (11 of 30) scoring -3 or -4, and only 2 sites scoring Excellent. Similarly, there were only 2 sites that did not have either slightly impaired or moderately impaired habitat conditions. Of particular concern are the South Branch Shiawassee River sites and the unnamed tributary to Indian Lake site. These sites had severe sedimentation problems and highly degraded habitat that was not adequately emphasized based on habitat score alone.

Overall, the mainstem Shiawassee River had very good macroinvertebrate scores and habitat conditions, while the majority of tributaries (especially in the lower end of the watershed) were highly altered, channelized, agricultural ditches with Marginal to Acceptable scores.

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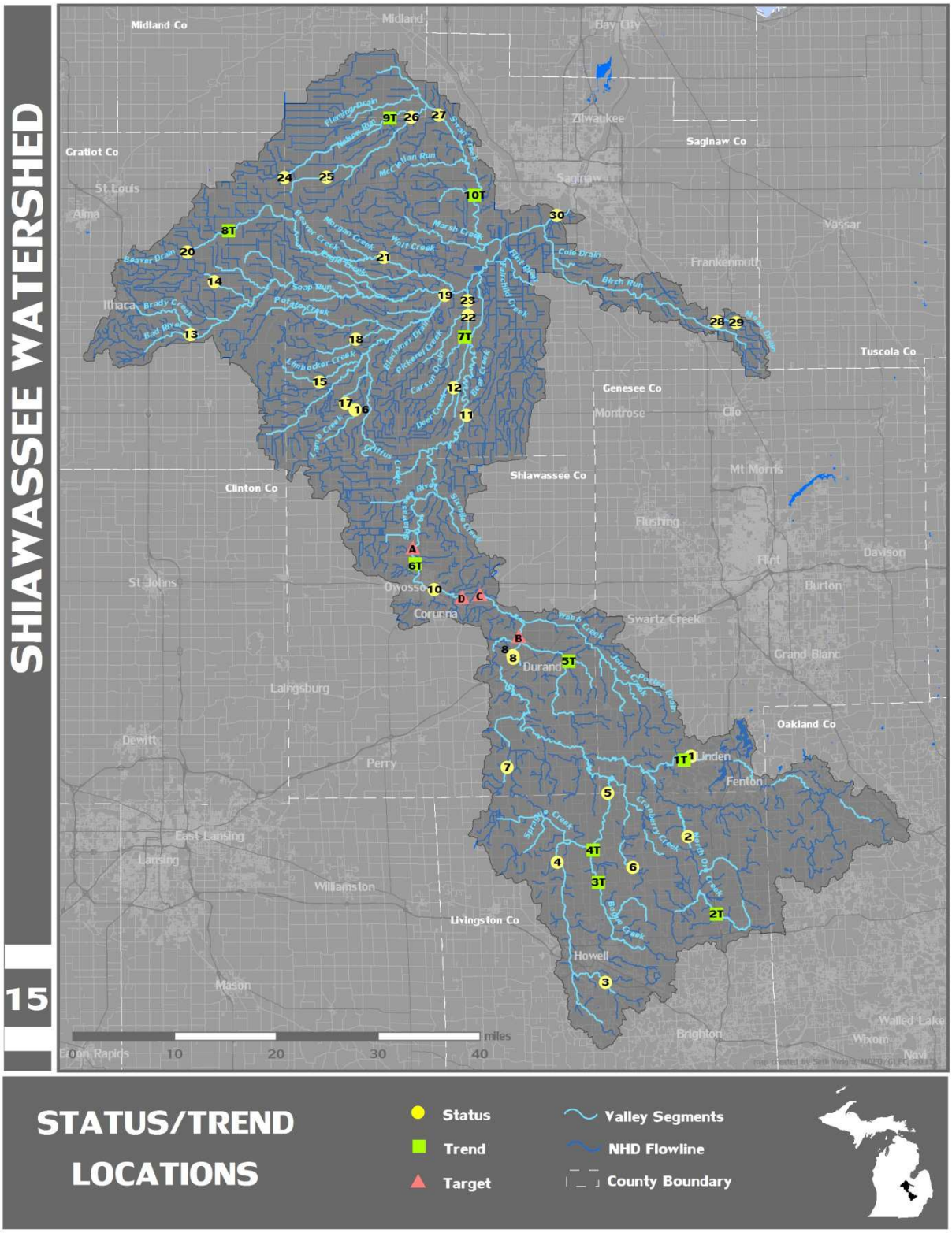

Figure 1. Status, trend, and targeted site locations during the 2015 biological survey of the Shiawassee River watershed.

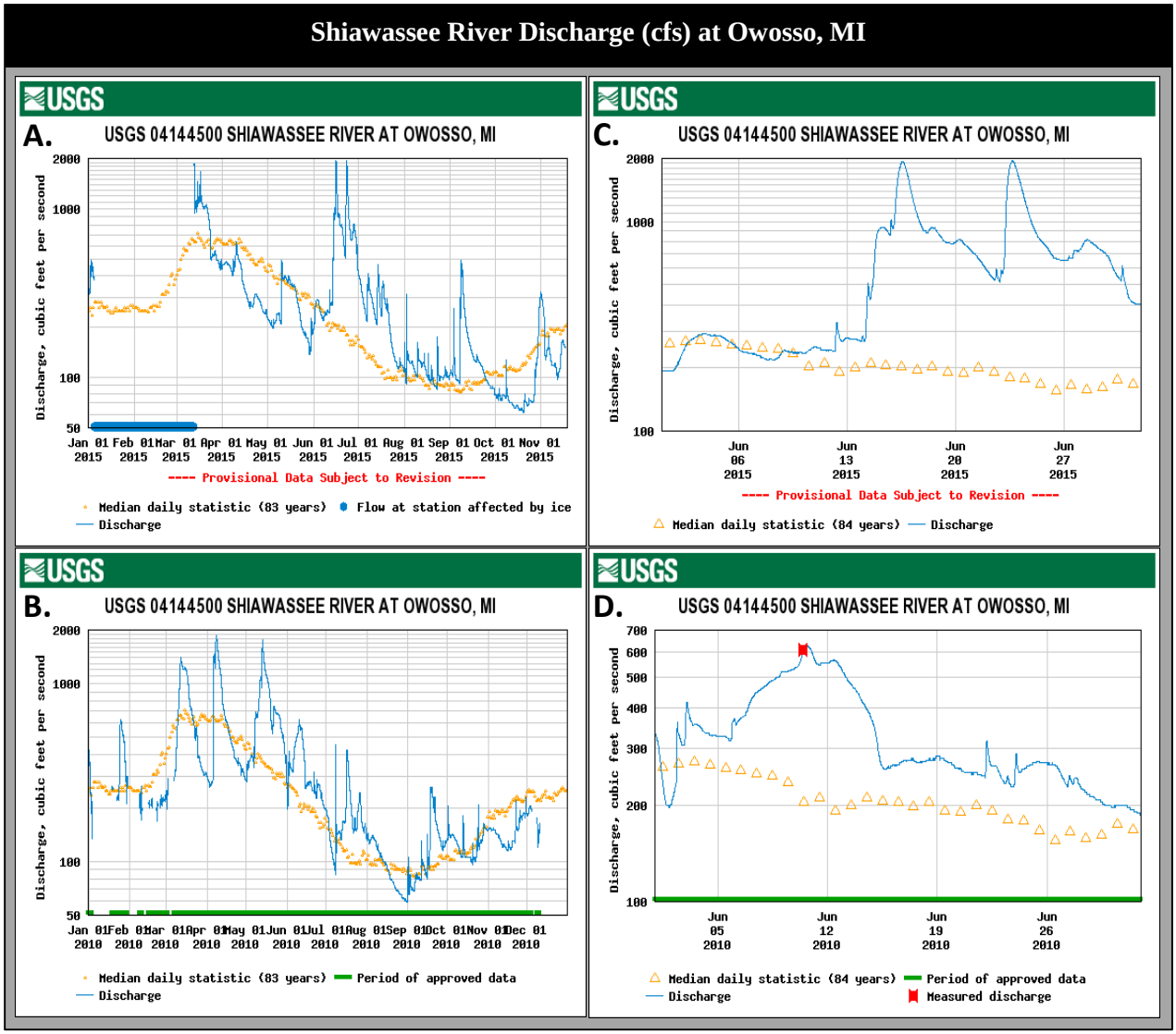

Figure 1. Hydrographs for the Shiawassee River at Owosso in (A) Jan-Dec 2015; (B) Jan-Dec 2010; (C) June 2015; and (D) June 2010 (note change in y-axis scale). Yellow points depict median daily statistic (83 years).

Table 1. Status, trend, and targeted site locations during the 2015 biological survey of the Shiawassee River watershed.

SHIAWASSEE – 2015

Total Stream Length = 581.9 miles

STATUS SITES

SITE ID	WATERBODY NAME	LOCATION	LATITUDE	LONGITUDE	COUNTY	STORET	MACROINVERTEBRATES		HABITAT	
							Score	Category	Score	Category
1	Shiawassee River	Beach Buggy Ln	42.81950	-83.79205	Genesee	250542	1	Acceptable	126	Good
2	North Ore Creek	Center Rd	42.73570	-83.79698	Livingston	470664	2	Acceptable	147	Good
3	Marion Genoa Drain	Fisk Rd	42.58343	-83.91394	Livingston	470186	1	Acceptable	95	Marginal
4	South Branch Shiawassee River	Chase Lake Rd	42.70884	-83.98228	Livingston	470500	-1	Acceptable	81	Marginal
5	South Branch Shiawassee River	Lovejoy Rd	42.78101	-83.91093	Livingston	470663	2	Acceptable	93	Marginal
6	Unnamed Trib to Indian Lake	Faussett	42.70388	-83.87510	Livingston	470662	-4	Acceptable	89	Marginal
7	Scribner Creek	Beard Rd	42.80781	-84.05378	Shiawassee	780182	-3	Acceptable	106	Good
8	Pratt Drain	Geeck Rd	42.92178	-84.04520	Shiawassee	780184	-4	Acceptable	127	Good
9	Pratt Drain	Garrison Rd	42.92447	-84.04551	Shiawassee	780198	-3	Acceptable	148	Good
10	Shiawassee River	Gould St	42.99317	-84.15760	Shiawassee	780147	7	Excellent	121	Good
11	Shiawassee River	Showboat Park	43.17406	-84.11110	Saginaw	730376	6	Excellent	157	Excellent
12	Deer Creek	intersection 4th St and Baldwin Rd	43.20229	-84.12951	Saginaw	730375	-3	Acceptable	93	Marginal
13	Bad River	Blair Rd	43.25742	-84.50388	Gratiot	290204	-3	Acceptable	84	Marginal
14	Shad Creek	McClelland Rd	43.31216	-84.46953	Gratiot	290215	-1	Acceptable	101	Marginal
15	Limbocker Creek	Harris Rd	43.20839	-84.31995	Saginaw	730373	3	Acceptable	88	Marginal
16	Lamb Creek	Wickie Rd	43.17969	-84.26941	Saginaw	730370	-2	Acceptable	88	Marginal
17	Lamb Creek	Brady Rd	43.18641	-84.28312	Saginaw	730377	2	Acceptable	127	Good
18	Little Potato Creek	Fowler Rd	43.25240	-84.26852	Saginaw	730364	0	Acceptable	109	Good
19	South Fork Bad River	Saginaw St	43.29814	-84.14216	Saginaw	730372	-2	Acceptable	103	Marginal
20	Beaver Creek	Blair Rd	43.34278	-84.50821	Gratiot	290216	-3	Acceptable	61	Marginal
21	Beaver Creek	Hemlock Rd	43.33710	-84.22925	Saginaw	730367	2	Acceptable	113	Good
22	Carson Drain	upstream Ryan Rd	43.27726	-84.10936	Saginaw	730365	-2	Acceptable	78	Marginal
23	Pickerel Creek	end of Hulien Rd	43.29249	-84.10990	Saginaw	730368	-3	Acceptable	92	Marginal
24	Weeks Drain	Meridian Rd	43.41941	-84.36999	Gratiot	290214	-3	Acceptable	69	Marginal
25	Handy Creek	Chapin Rd	43.42019	-84.31049	Saginaw	730371	-4	Acceptable	75	Marginal
26	Whitmore Drain	Tittabawassee Rd	43.48184	-84.18968	Saginaw	730366	-3	Acceptable	87	Marginal
27	Swan Creek	Gleaner Rd	43.48422	-84.15085	Saginaw	730369	-1	Acceptable	106	Good
28	Moon Drain	Dehmel Rd	43.27069	-83.75490	Saginaw	730374	-2	Poor	91	Marginal
29	Moon Drain	Pagels Rd	43.26976	-83.72799	Saginaw	730363	-6	Acceptable	98	Marginal
30	Shiawassee River (non-wadeable)	0.7 miles u/s Tittabawassee River confluence	43.38078	-83.98309	Saginaw		52	Good	NA	NA

Table 1 cont. Status, trend, and targeted site locations during the 2015 biological survey of the Shiawassee River watershed.

SHIAWASSEE – 2015

Total Stream Length = 581.9 miles

TREND SITES

SITE ID	WATERBODY NAME	LOCATION	LATITUDE	LONGITUDE	COUNTY	STORET	2015 Results MACROINVERTEBRATES Score	MACROINVERTEBRATES Category	HABITAT Score	HABITAT Category
1T	Shiawassee River	Hogan Road	42.81563	-83.80227	Genesee	250462	3	Acceptable	137	Good
2T	North Ore Creek	Crouse Road	42.65502	-83.75636	Livingston	470507	6	Excellent	162	Excellent
3T	Bogue Creek	Allen Road	42.68788	-83.92372	Livingston	470642	-1	Acceptable	122	Good
4T	Bogue Creek	Jones Road	42.72164	-83.93175	Livingston	470636	4	Acceptable	141	Good
5T	Three Mile Creek	Monroe Road	42.91844	-83.96596	Shiawassee	780241	0	Acceptable	128	Good
6T	Shiawassee River	Harmon Patride Park (Owosso)	43.01974	-84.18417	Shiawassee	780243	6	Excellent	152	Good
7T	Carson Drain	Fergus Road	43.25485	-84.11384	Saginaw	730348	-5	Poor	76	Marginal
8T	Beaver Creek	Ransom Road	43.36480	-84.44924	Gratiot	290202	-1	Acceptable	75	Marginal
9T	Unnamed Trib (Nelson Run)	Fehn Road	43.48090	-84.22039	Saginaw	730349	0	Acceptable	93	Marginal
10T	Swan Creek	Schomaker Road	43.40122	-84.09955	Saginaw	730345	-5	Poor	117	Good

SHIAWASSEE – 2015

Total Stream Length = 581.9 miles

TARGETED SITES

SITE ID	WATERBODY NAME	LOCATION	LATITUDE	LONGITUDE	COUNTY	STORET	MACROINVERTEBRATES Score	MACROINVERTEBRATES Category	HABITAT Score	HABITAT Category
A	Shiawassee River	DeVries Nature Center	43.03654	-84.18784		780257	6	Excellent	180	Excellent
B	Shiawassee River	Parmenter Rd.	42.94448	-84.03734		780258	4	Acceptable	128	Good
C	Shiawassee River	Brick Plant Rd.	42.98834	-84.09259		NA	NA	NA	NA	NA
D	Shiawassee River	Corunna Dam	42.98526	-84.11800		780259	5	Excellent	132	Good

Table 2. Habitat evaluation for the Shiawassee River watershed probabilistic sites, June-September 2015.

	Shiawassee River		North Ore Creek		Marion Genoa Drain		South Branch Shiawassee River	
	Beach Buggy Lane		Center Road		Fisk at Francis		Chase Lake Road	
	GLIDE/POOL		GLIDE/POOL		GLIDE/POOL		GLIDE/POOL	
HABITAT METRIC								
Substrate and Instream Cover								
Epifaunal Substrate/ Avail Cover (20)	8		10		8		5	
Embeddedness (20)*								
Velocity/Depth Regime (20)*								
Pool Substrate Characterization (20)**	13		7		9		6	
Pool Variability (20)**	3		10		3		5	
Channel Morphology								
Sediment Deposition (20)	10		15		2		4	
Flow Status - Maint. Flow Volume (10)	9		9		9		8	
Flow Status - Flashiness (10)	9		5		8		2	
Channel Alteration (20)	19		18		9		8	
Frequency of Riffles/Bends (20)*								
Channel Sinuosity (20)**	18		19		7		15	
Riparian and Bank Structure								
Bank Stability (L) (10)	8		8		7		7	
Bank Stability (R) (10)	7		8		6		7	
Vegetative Protection (L) (10)	8		9		5		4	
Vegetative Protection (R) (10)	5		9		7		4	
Riparian Veg. Zone Width (L) (10)	8		10		8		4	
Riparian Veg. Zone Width (R) (10)	1		10		7		2	
TOTAL SCORE (200):	126		147		95		81	
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)		GOOD (SLIGHTLY IMPAIRED)		MARGINAL (MODERATELY IMPAIRED)		MARGINAL (MODERATELY IMPAIRED)	
	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).							
Date:	9/28/2015		9/28/2015		8/13/2015		9/28/2015	
Weather:	Sunny		Sunny		Sunny		Cloudy	
Air Temperature:	80	Deg. F.	75	Deg. F.		Deg. F.	70	Deg. F.
Water Temperature:	66	Deg. F.	70	Deg. F.	70	Deg. F.	66	Deg. F.
Ave. Stream Width:	16	Feet	29.5	Feet	13.1	Feet	27	Feet
Ave. Stream Depth:	1.3	Feet	1.5	Feet	1.6	Feet	0.9	Feet
Surface Velocity:	0.42	Ft./Sec.	0.5	Ft./Sec.	1.19	Ft./Sec.	0.76	Ft./Sec.
Estimated Flow:	8.736	CFS	22.125	CFS	24.9424	CFS	18.468	CFS
Stream Modifications:	None		None		Dredged		Dredged	
Nuisance Plants (Y/N):	N		N		N		N	
Report Number:								
STORET No.:	250542		470664		470186		470500	
Stream Name:	Shiawassee River		North Ore Creek		Marion Genoa Drain		South Branch Shiawassee River	
Road Crossing/Location:	Beach Buggy Lane		Center Road		Fisk at Francis		Chase Lake Road	
County Code:	25		47		47		47	
TRS:	05N06E19		04N06E19		02N04E07		04N04E28	
Latitude (dd):	42.8195		42.7357		42.58343		42.70885	
Longitude (dd):	-83.79205		-83.79698		-83.91395		-83.98227	
Ecoregion:	SMNITP		SMNITP		SMNITP		SMNITP	
Stream Type:					Warmwater		Warmwater	
USGS Basin Code:	4080203		4080203		4080203		4080203	
* Applies only to Riffle/Run stream Surveys								
** Applies only to Glide/Pool stream Surveys								

Table 2 cont. Habitat evaluation for the Shiawassee River watershed probabilistic sites, June-September 2015.

	South Branch Shiawassee River		Unnamed Tributary to Indian Lake		Scribner Creek		Hovey-Pratt Drain	
	Lovejoy Road		Fausset Road		Beard Road		Geeck Road	
	GLIDE/POOL		GLIDE/POOL		GLIDE/POOL		RIFFLE/RUN	
HABITAT METRIC								
Substrate and Instream Cover								
Epifaunal Substrate/ Avail Cover (20)	5		5		10		8	
Embeddedness (20)*							10	
Velocity/Depth Regime (20)*							11	
Pool Substrate Characterization (20)**	8		10		11			
Pool Variability (20)**	6		8		5			
Channel Morphology								
Sediment Deposition (20)	3		1		13		3	
Flow Status - Maint. Flow Volume (10)	9		8		8		9	
Flow Status - Flashiness (10)	4		6		6		4	
Channel Alteration (20)	11		8		11		15	
Frequency of Riffles/Bends (20)*							15	
Channel Sinuosity (20)**	7		5		9			
Riparian and Bank Structure								
Bank Stability (L) (10)	7		9		8		8	
Bank Stability (R) (10)	6		9		8		8	
Vegetative Protection (L) (10)	7		5		6		9	
Vegetative Protection (R) (10)	5		5		6		9	
Riparian Veg. Zone Width (L) (10)	10		5		2		9	
Riparian Veg. Zone Width (R) (10)	5		5		3		9	
TOTAL SCORE (200):	93		89		106		127	
HABITAT RATING:	MARGINAL (MODERATELY IMPAIRED)		MARGINAL (MODERATELY IMPAIRED)		GOOD (SLIGHTLY IMPAIRED)		GOOD (SLIGHTLY IMPAIRED)	
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).								
Date:	8/13/2015		8/13/2015		8/13/2015		7/23/2015	
Weather:	Sunny		Sunny		Partly Cloudy		Sunny	
Air Temperature:	75	Deg. F.		Deg. F.	64	Deg. F.		Deg. F.
Water Temperature:	67	Deg. F.	74	Deg. F.	69	Deg. F.	69	Deg. F.
Ave. Stream Width:	50	Feet	9	Feet	8.6	Feet	12	Feet
Ave. Stream Depth:	2	Feet	0.3	Feet	0.9	Feet	0.2	Feet
Surface Velocity:	0.67	Ft./Sec.	0.28	Ft./Sec.	0.66	Ft./Sec.	1.1	Ft./Sec.
Estimated Flow:	67	CFS	0.756	CFS	5.1084	CFS	2.64	CFS
Stream Modifications:	Dredged		Dredged		Dredged		Dredged	
Nuisance Plants (Y/N):	N		N		N		N	
Report Number:								
STORET No.:	470663		470662		780182		780184	
Stream Name:	anch Shiawassee River		Unnamed Tributary to Indian Lake		Scribner Creek		Hovey-Pratt Drain	
Road Crossing/Location:	Lovejoy Road		Fausset Road		Beard Road		Geeck Road	
County Code:	47		47		78		78	
TRS:	04N05E06		04N05E33		05N03E24		06N04E18	
Latitude (dd):	42.78101		42.70388		42.80781		42.92178	
Longitude (dd):	-83.91093		-83.8751		-84.05378		-84.0452	
Ecoregion:	SMNITP		SMNITP		SMNITP		SMNITP	
Stream Type:								
USGS Basin Code:	4080203		4080203		4080203		4080203	
* Applies only to Riffle/Run stream Surveys								
** Applies only to Glide/Pool stream Surveys								

Table 2 cont. Habitat evaluation for the Shiawassee River watershed probabilistic sites, June-September 2015.

	Pratt Drain		Shiawassee River	
	Garrison Road		Gould Bridge	
	RIFFLE/RUN		GLIDE/POOL	
HABITAT METRIC				
Substrate and Instream Cover				
Epifaunal Substrate/ Avail Cover (20)	13		8	
Embeddedness (20)*	16			
Velocity/Depth Regime (20)*	14			
Pool Substrate Characterization (20)**			9	
Pool Variability (20)**			10	
Channel Morphology				
Sediment Deposition (20)	15		11	
Flow Status - Maint. Flow Volume (10)	9		9	
Flow Status - Flashiness (10)	5		2	
Channel Alteration (20)	13		16	
Frequency of Riffles/Bends (20)*	18			
Channel Sinuosity (20)**			11	
Riparian and Bank Structure				
Bank Stability (L) (10)	7		8	
Bank Stability (R) (10)	7		8	
Vegetative Protection (L) (10)	9		9	
Vegetative Protection (R) (10)	9		9	
Riparian Veg. Zone Width (L) (10)	4		5	
Riparian Veg. Zone Width (R) (10)	9		6	
TOTAL SCORE (200):	148		121	
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)		GOOD (SLIGHTLY IMPAIRED)	
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).				
Date:	9/28/2015		7/23/2015	
Weather:	Cloudy		Partly Cloudy	
Air Temperature:	70	Deg. F.		Deg. F.
Water Temperature:	60	Deg. F.	72	Deg. F.
Ave. Stream Width:	11.25	Feet	125	Feet
Ave. Stream Depth:	0.9	Feet	1.5	Feet
Surface Velocity:	0.75	Ft./Sec.		Ft./Sec.
Estimated Flow:	7.59375	CFS		CFS
Stream Modifications:	Relocated		None	
Nuisance Plants (Y/N):	N		N	
Report Number:				
STORET No.:	780198		780147	
Stream Name:	Pratt Drain		Shiawassee River	
Road Crossing/Location:	Garrison Road		Gould Bridge	
County Code:	78		78	
TRS:	06N03E18		07N03E19	
Latitude (dd):	42.92447		42.99317	
Longitude (dd):	-84.04551		-84.1576	
Ecoregion:	SMNITP		SMNITP	
Stream Type:				
USGS Basin Code:	4080203		4080203	
* Applies only to Riffle/Run stream Surveys				
** Applies only to Glide/Pool stream Surveys				

Table 2 cont. Habitat evaluation for the Shiawassee River watershed probabilistic sites, June-September 2015.

	Shiawassee River		Deer Creek		Bad River		Shad Creek	
	Showboat Park		Twin Brooks Golf Course		Blair Road		McClelland Road	
	GLIDE/POOL		GLIDE/POOL		GLIDE/POOL		RIFFLE/RUN	
HABITAT METRIC								
Substrate and Instream Cover								
Epifaunal Substrate/ Avail Cover (20)	14		11		7		9	
Embeddedness (20)*							12	
Velocity/Depth Regime (20)*							11	
Pool Substrate Characterization (20)**	16		13		12			
Pool Variability (20)**	15		7		6			
Channel Morphology								
Sediment Deposition (20)	16		16		11		10	
Flow Status - Maint. Flow Volume (10)	10		9		9		9	
Flow Status - Flashiness (10)	6		8		8		6	
Channel Alteration (20)	18		6		5		10	
Frequency of Riffles/Bends (20)*							8	
Channel Sinuosity (20)**	19		3		2			
Riparian and Bank Structure								
Bank Stability (L) (10)	9		6		4		6	
Bank Stability (R) (10)	9		6		4		7	
Vegetative Protection (L) (10)	4		4		4		4	
Vegetative Protection (R) (10)	9		4		4		5	
Riparian Veg. Zone Width (L) (10)	3		0		1		2	
Riparian Veg. Zone Width (R) (10)	9		0		7		2	
TOTAL SCORE (200):	157		93		84		101	
HABITAT RATING:	EXCELLENT		MARGINAL		MARGINAL		MARGINAL	
	(NON-		(MODERATELY		(MODERATELY		(MODERATELY	
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)	
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).								
Date:	9/17/2015		9/17/2015		9/15/2015		9/11/2015	
Weather:	Sunny		Sunny		Sunny		Partly Cloudy	
Air Temperature:	75	Deg. F.	60	Deg. F.	60	Deg. F.	70	Deg. F.
Water Temperature:		Deg. F.	60	Deg. F.	66	Deg. F.	68	Deg. F.
Ave. Stream Width:	90	Feet	2	Feet	5	Feet	6	Feet
Ave. Stream Depth:	2.3	Feet	0.7	Feet	0.5	Feet	0.7	Feet
Surface Velocity:	0.97	Ft./Sec.	0.05	Ft./Sec.	0.48	Ft./Sec.	0.35	Ft./Sec.
Estimated Flow:	200.79	CFS	0.07	CFS	1.2	CFS	1.47	CFS
Stream Modifications:	Canopy Removal				Dredged		Dredged	
Nuisance Plants (Y/N):	N		N		N		N	
Report Number:								
STORET No.:	730376		730375		290204		290215	
Stream Name:	Shiawassee River		Deer Creek		Bad River		Shad Creek	
Road Crossing/Location:	Showboat Park		Twin Brooks Golf Course r		Blair Road		McClelland Road	
County Code:	73		73		29		29	
TRS:	09N03E16		09N03E8		10N02W14		11N01W30	
Latitude (dd):	43.1773		43.19884		43.25742		43.31216	
Longitude (dd):	-84.11281		-84.13159		-84.50386		-84.46953	
Ecoregion:	HELP		HELP		HELP		HELP	
Stream Type:					Warmwater			
USGS Basin Code:	4080203		4080203		4080203		4080203	
* Applies only to Riffle/Run stream Surveys								
** Applies only to Glide/Pool stream Surveys								

Table 2 cont. Habitat evaluation for the Shiawassee River watershed probabilistic sites, June-September 2015.

	Limbocker Creek		Lamb Creek		Lamb Creek		Little Potato Creek	
	Harris Road		Wilkie Road		Brady Road		Fowler Road	
	GLIDE/POOL		GLIDE/POOL		RIFFLE/RUN		GLIDE/POOL	
HABITAT METRIC								
Substrate and Instream Cover								
Epifaunal Substrate/ Avail Cover (20)	6		6		12		9	
Embeddedness (20)*					14			
Velocity/Depth Regime (20)*					12			
Pool Substrate Characterization (20)**	6		6				7	
Pool Variability (20)**	5		6				8	
Channel Morphology								
Sediment Deposition (20)	5		6		14		10	
Flow Status - Maint. Flow Volume (10)	3		7		7		7	
Flow Status - Flashiness (10)	3		2		6		5	
Channel Alteration (20)	9		12		11		14	
Frequency of Riffles/Bends (20)*					13			
Channel Sinuosity (20)**	1		1				10	
Riparian and Bank Structure								
Bank Stability (L) (10)	7		5		4		6	
Bank Stability (R) (10)	7		5		5		6	
Vegetative Protection (L) (10)	9		9		9		8	
Vegetative Protection (R) (10)	9		9		9		8	
Riparian Veg. Zone Width (L) (10)	9		7		3		4	
Riparian Veg. Zone Width (R) (10)	9		7		8		7	
TOTAL SCORE (200):	88		88		127		109	
HABITAT RATING:	MARGINAL (MODERATELY IMPAIRED)		MARGINAL (MODERATELY IMPAIRED)		GOOD (SLIGHTLY IMPAIRED)		GOOD (SLIGHTLY IMPAIRED)	
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).								
Date:	9/15/2015		9/16/2015		9/16/2015		9/16/2015	
Weather:	Sunny		Sunny		Sunny		Sunny	
Air Temperature:	80	Deg. F.		Deg. F.	80	Deg. F.	75	Deg. F.
Water Temperature:		Deg. F.	64	Deg. F.		Deg. F.	64	Deg. F.
Ave. Stream Width:	4	Feet	18	Feet	10	Feet	5	Feet
Ave. Stream Depth:	0.3	Feet	1	Feet	0.3	Feet	0.3	Feet
Surface Velocity:	0.12	Ft./Sec.	0.1	Ft./Sec.	0.26	Ft./Sec.	0.54	Ft./Sec.
Estimated Flow:	0.144	CFS	1.8	CFS	0.78	CFS	0.81	CFS
Stream Modifications:	Dredged				Dredged		None	
Nuisance Plants (Y/N):	N		N		N		N	
Report Number:								
STORET No.:	730373		730370		730377		730364	
Stream Name:	Limbocker Creek		Lamb Creek		Lamb Creek		Little Potato Creek	
Road Crossing/Location:	Harris Road		Wilkie Road		Brady Road		Fowler Road	
County Code:	73		73		73		73	
TRS:	09N01E2		09N02E18		09N02E18		10N02E19	
Latitude (dd):	43.20839		43.17969		43.18641		43.2524	
Longitude (dd):	-84.31995		-84.26941		-84.28312		-84.26852	
Ecoregion:	HELP		HELP		HELP		HELP	
Stream Type:								
USGS Basin Code:	4080203		4080203		4080203		4080203	
* Applies only to Riffle/Run stream Surveys								
** Applies only to Glide/Pool stream Surveys								

Table 2 cont. Habitat evaluation for the Shiawassee River watershed probabilistic sites, June-September 2015.

	South Fork Bad River		Beaver Creek		Beaver Creek		Carson Drain	
	Saginaw Street		Blair Road		Hemlock Road		Ryan Road	
	GLIDE/POOL		GLIDE/POOL		GLIDE/POOL		GLIDE/POOL	
HABITAT METRIC								
Substrate and Instream Cover								
Epifaunal Substrate/ Avail Cover (20)	11		2		12		9	
Embeddedness (20)*								
Velocity/Depth Regime (20)*								
Pool Substrate Characterization (20)**	10		6		13		10	
Pool Variability (20)**	11		6		10		3	
Channel Morphology								
Sediment Deposition (20)	7		5		11		10	
Flow Status - Maint. Flow Volume (10)	9		9		8		8	
Flow Status - Flashiness (10)	4		5		3		3	
Channel Alteration (20)	12		6		14		6	
Frequency of Riffles/Bends (20)*								
Channel Sinuosity (20)**	5		2		12		1	
Riparian and Bank Structure								
Bank Stability (L) (10)	5		6		5		7	
Bank Stability (R) (10)	5		6		4		7	
Vegetative Protection (L) (10)	8		4		6		5	
Vegetative Protection (R) (10)	5		4		5		5	
Riparian Veg. Zone Width (L) (10)	9		0		7		2	
Riparian Veg. Zone Width (R) (10)	2		0		3		2	
TOTAL SCORE (200):	103		61		113		78	
HABITAT RATING:	MARGINAL		MARGINAL		GOOD		MARGINAL	
	(MODERATELY		(MODERATELY		(SLIGHTLY		(MODERATELY	
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)	
	Note: Individual metrics may better describe conditions directly affecting the biological community while the H							
	describes the general riverine environment at the site(s).							
Date:	9/14/2015		9/11/2015		9/15/2015		9/14/2015	
Weather:	Sunny		Cloudy		Sunny		Sunny	
Air Temperature:	75	Deg. F.	60	Deg. F.	80	Deg. F.	75	Deg. F.
Water Temperature:	62	Deg. F.	67	Deg. F.	64	Deg. F.	68	Deg. F.
Ave. Stream Width:	30	Feet	7	Feet	18	Feet	18	Feet
Ave. Stream Depth:	2	Feet	1	Feet	1.5	Feet	1.5	Feet
Surface Velocity:	0.29	Ft./Sec.	0.38	Ft./Sec.	0.21	Ft./Sec.	0.17	Ft./Sec.
Estimated Flow:	17.4	CFS	2.66	CFS	5.67	CFS	4.59	CFS
Stream Modifications:			Dredged		Dredged		Dredged	
Nuisance Plants (Y/N):	N		Y		N		N	
Report Number:								
STORET No.:	730372		290216		730367		730365	
Stream Name:	h Fork Bad River		Beaver Creek		Beaver Creek		Carson Drain	
Road Crossing/Location:	Saginaw Street		Blair Road		Hemlock Road		Ryan Road	
County Code:	73		29		73		73	
TRS:	10N03E5		11N02W13		11N02E22		10N03E16	
Latitude (dd):	43.29814		43.34278		43.3371		43.27726	
Longitude (dd):	-84.14216		-84.50821		-84.22925		-84.10936	
Ecoregion:	HELP		HELP		HELP		HELP	
Stream Type:								
USGS Basin Code:	4080203		4080203		4080203		4080203	
* Applies only to Riffle/Run stream Surveys								
** Applies only to Glide/Pool stream Surveys								

Table 2 cont. Habitat evaluation for the Shiawassee River watershed probabilistic sites, June-September 2015.

	Pickerel Creek		Weeks Drain		Handy Creek		Whitmore Drain	
	Hulien Road		Meridian Road		Chapin Road		Tittabawassee Road	
	GLIDE/POOL		GLIDE/POOL		GLIDE/POOL		GLIDE/POOL	
HABITAT METRIC								
Substrate and Instream Cover								
Epifaunal Substrate/ Avail Cover (20)	8		5		9		11	
Embeddedness (20)*								
Velocity/Depth Regime (20)*								
Pool Substrate Characterization (20)**	12		8		7		11	
Pool Variability (20)**	11		0		6		8	
Channel Morphology								
Sediment Deposition (20)	10		13		7		9	
Flow Status - Maint. Flow Volume (10)	9		9		9		9	
Flow Status - Flashiness (10)	4		4		4		4	
Channel Alteration (20)	8		6		8		6	
Frequency of Riffles/Bends (20)*								
Channel Sinuosity (20)**	1		1		1		1	
Riparian and Bank Structure								
Bank Stability (L) (10)	7		6		6		6	
Bank Stability (R) (10)	7		5		6		6	
Vegetative Protection (L) (10)	4		4		5		5	
Vegetative Protection (R) (10)	5		4		5		5	
Riparian Veg. Zone Width (L) (10)	3		2		1		3	
Riparian Veg. Zone Width (R) (10)	3		2		1		3	
TOTAL SCORE (200):	92		69		75		87	
HABITAT RATING:	MARGINAL		MARGINAL		MARGINAL		MARGINAL	
	(MODERATELY		(MODERATELY		(MODERATELY		(MODERATELY	
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)	
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).								
Date:	9/14/2015		9/11/2015		9/11/2015		7/27/2015	
Weather:	Sunny		Cloudy		Cloudy		Sunny	
Air Temperature:		Deg. F.	55	Deg. F.	55	Deg. F.		Deg. F.
Water Temperature:	70	Deg. F.	60	Deg. F.		Deg. F.		Deg. F.
Ave. Stream Width:	45	Feet	10	Feet	3	Feet	19.5	Feet
Ave. Stream Depth:	2.5	Feet	0.5	Feet	0.4	Feet	0.9	Feet
Surface Velocity:	0.35	Ft./Sec.	0.3	Ft./Sec.	0.52	Ft./Sec.	0.146	Ft./Sec.
Estimated Flow:	39.375	CFS	1.5	CFS	0.624	CFS	2.5623	CFS
Stream Modifications:	Dredged		Dredged		Dredged		Canopy Removal	
Nuisance Plants (Y/N):	N		N		N		N	
Report Number:								
STORET No.:	730368		290214		730371		730366	
Stream Name:	Pickerel Creek		Weeks Drain		Handy Creek		Whitmore Drain	
Road Crossing/Location:	Hulien Road		Meridian Road		Chapin Road		Tittabawassee Road	
County Code:	73		29		73		73	
TRS:	10N03E09		12N01E21		12N01E24		12N02E1	
Latitude (dd):	43.29249		43.41941		43.42019		43.48184	
Longitude (dd):	-84.1099		-84.36999		-84.31049		-84.18968	
Ecoregion:	HELP		HELP		HELP		HELP	
Stream Type:								
USGS Basin Code:	4080203		4080203		4080203		4080203	
* Applies only to Riffle/Run stream Surveys								
** Applies only to Glide/Pool stream Surveys								

Table 2 cont. Habitat evaluation for the Shiawassee River watershed probabilistic sites, June-September 2015.

	Swan Creek		Moon Drain					
	Gleaner Road		Dehmel Road					
	GLIDE/POOL		GLIDE/POOL					
HABITAT METRIC								
Substrate and Instream Cover								
Epifaunal Substrate/ Avail Cover (20)	10		7					
Embeddedness (20)*								
Velocity/Depth Regime (20)*								
Pool Substrate Characterization (20)**	11		8					
Pool Variability (20)**	10		10					
Channel Morphology								
Sediment Deposition (20)	8		7					
Flow Status - Maint. Flow Volume (10)	7		5					
Flow Status - Flashiness (10)	2		6					
Channel Alteration (20)	12		11					
Frequency of Riffles/Bends (20)*								
Channel Sinuosity (20)**	10		3					
Riparian and Bank Structure								
Bank Stability (L) (10)	5		7					
Bank Stability (R) (10)	5		7					
Vegetative Protection (L) (10)	9		7					
Vegetative Protection (R) (10)	9		7					
Riparian Veg. Zone Width (L) (10)	4		3					
Riparian Veg. Zone Width (R) (10)	4		3					
TOTAL SCORE (200):	106		91					
HABITAT RATING:	GOOD		MARGINAL					
	(SLIGHTLY		(MODERATELY					
	IMPAIRED)		IMPAIRED)					
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).								
Date:	7/27/2015		9/14/2015					
Weather:	Sunny		Partly Cloudy					
Air Temperature:	80	Deg. F.	55	Deg. F.				
Water Temperature:	75	Deg. F.	52	Deg. F.				
Ave. Stream Width:	22	Feet	6	Feet				
Ave. Stream Depth:	0.9	Feet	0.25	Feet				
Surface Velocity:	0.29	Ft./Sec.	0.41	Ft./Sec.				
Estimated Flow:	5.742	CFS	0.615	CFS				
Stream Modifications:	Relocated		Dredged					
Nuisance Plants (Y/N):	N		N					
Report Number:								
STORET No.:	730369		730374					
Stream Name:	Swan Creek		Moon Drain					
Road Crossing/Location:	Gleaner Road		Dehmel Road					
County Code:	73		73					
TRS:	13N03E31		10N06E15					
Latitude (dd):	43.48422		43.27069					
Longitude (dd):	-84.15085		-83.7549					
Ecoregion:	HELP		HELP					
Stream Type:								
USGS Basin Code:	4080203		4080203					
* Applies only to Riffle/Run stream Surveys								
** Applies only to Glide/Pool stream Surveys								

Table 2 cont. Habitat evaluation for the Shiawassee River watershed probabilistic sites, June-September 2015.

	Moon Drain								
	Pagels Road								
	GLIDE/POOL								
HABITAT METRIC									
Substrate and Instream Cover									
Epifaunal Substrate/ Avail Cover (20)	9								
Embeddedness (20)*									
Velocity/Depth Regime (20)*									
Pool Substrate Characterization (20)**	7								
Pool Variability (20)**	10								
Channel Morphology									
Sediment Deposition (20)	8								
Flow Status - Maint. Flow Volume (10)	6								
Flow Status - Flashiness (10)	6								
Channel Alteration (20)	12								
Frequency of Riffles/Bends (20)*									
Channel Sinuosity (20)**	1								
Riparian and Bank Structure									
Bank Stability (L) (10)	7								
Bank Stability (R) (10)	7								
Vegetative Protection (L) (10)	8								
Vegetative Protection (R) (10)	8								
Riparian Veg. Zone Width (L) (10)	4								
Riparian Veg. Zone Width (R) (10)	5								
TOTAL SCORE (200):	98								
HABITAT RATING:	MARGINAL								
	(MODERATELY								
	IMPAIRED)								
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).									
Date:	9/14/2015								
Weather:	Sunny								
Air Temperature:	60	Deg. F.							
Water Temperature:	54	Deg. F.							
Ave. Stream Width:	8	Feet							
Ave. Stream Depth:	0.4	Feet							
Surface Velocity:	0.1	Ft./Sec.							
Estimated Flow:	0.32	CFS							
Stream Modifications:	Dredged								
Nuisance Plants (Y/N):	N								
Report Number:									
STORET No.:	730363								
Stream Name:	Moon Drain								
Road Crossing/Location:	Pagels Road								
County Code:	73								
TRS:	10N06E14								
Latitude (dd):	43.26976								
Longitude (dd):	-83.72799								
Ecoregion:	SMNITP								
Stream Type:									
USGS Basin Code:	4080203								
* Applies only to Riffle/Run stream Surveys									
** Applies only to Glide/Pool stream Surveys									

Table 3. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed probabilistic sites June-September 2015.

TAXA	Shiawassee River Beach Buggy Lane 9/28/2015 STATION 1	North Ore Creek Center Road 9/28/2015 STATION 2	Marion Genoa Drain Fisk at Francis 8/13/2015 STATION 3	South Branch Shiawassee River Chase Lake Road 9/28/2015 STATION 4
PLATYHELMINTHES (flatworms)				
Turbellaria				2
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1		1	1
Oligochaeta (worms)	2	14	4	19
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	50	82	113	115
Decapoda (crayfish)	1	1	6	1
Isopoda (sowbugs)				2
Arachnoidea				
Hydracarina	30			3
Insecta				
Ephemeroptera (mayflies)				
Baetidae	35	19	24	9
Caenidae	95			
Heptageniidae		3	17	
Tricorythidae	6			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	2	
Gomphidae			1	
Zygoptera (damselflies)				
Calopterygidae	1	6	4	6
Coenagrionidae	24	8		21
Hemiptera (true bugs)				
Belostomatidae	1	1		3
Corixidae	5	1		5
Gerridae		1	1	
Mesoveliidae	1			2
Nepidae	1	2		
Notonectidae	1	1		
Pleidae		7	1	
Veliidae				4
Trichoptera (caddisflies)				
Hydropsychidae		34	31	69
Hydroptilidae	2			
Leptoceridae	7	6		1
Limnephilidae			1	
Philopotamidae		6		
Phryganeidae			1	
Polycentropodidae		5		
Lepidoptera (moths)				
Pyralidae				1
Coleoptera (beetles)				
Dytiscidae (total)		2	1	7
Gyrinidae (adults)		1	1	
Haliplidae (adults)		1		
Hydrophilidae (total)			3	
Dryopidae				1
Elmidae	3	26	12	2
Diptera (flies)				
Ceratopogonidae	3		2	3
Chironomidae	43	24	28	29
Culicidae		2	2	
Ptychopteridae			1	
Simuliidae		82	9	2
Stratiomyidae		1	1	2
Tabanidae		1		

MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		2	3	1
Physidae	2	4		1
Planorbidae		1		1
Viviparidae			1	
Pelecypoda (bivalves)				
Sphaeriidae (clams)		4	2	2
Unionidae (mussels)	1			
TOTAL INDIVIDUALS	315	349	273	315

	Shiawassee River Beach Buggy Lane 9/28/2015 STATION 1		North Ore Creek Center Road 9/28/2015 STATION 2		Marion Genoa Drain Fisk at Francis 8/13/2015 STATION 3		South Branch Shiawassee River Chase Lake Road 9/28/2015 STATION 4	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	22	0	31	1	27	1	28	1
NUMBER OF MAYFLY TAXA	3	0	2	0	2	0	1	-1
NUMBER OF CADDISFLY TAXA	2	0	4	0	3	0	2	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	43.17	1	6.30	0	15.02	0	2.86	-1
PERCENT CADDISFLY COMP.	2.86	-1	14.61	0	12.09	0	22.22	0
PERCENT DOMINANT TAXON	30.16	0	23.50	0	41.39	-1	36.51	0
PERCENT ISOPOD, SNAIL, LEECH	0.95	1	2.01	1	1.83	1	1.90	1
PERCENT SURF. AIR BREATHERS	2.86	1	5.73	1	4.03	1	7.30	0
TOTAL SCORE		1		2		1		-1
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 3 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed probabilistic sites June-September 2015.

TAXA	South Branch Shiawassee River Lovejoy Road 8/13/2015 STATION 5	Unnamed Tributary to Indian Lake Fausset Road 8/13/2015 STATION 6	Scribner Creek Beard Road 8/13/2015 STATION 7	Hovey-Pratt Drain Geeck Road 7/23/2015 STATION 8
PORIFERA (sponges)			1	
PLATYHELMINTHES (flatworms)				
Turbellaria	3		14	
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1	3	5	
Oligochaeta (worms)	9		5	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	71	260	28	218
Decapoda (crayfish)	1	1	1	9
Isopoda (sowbugs)	1		341	5
Arachnoidea				
Hydracarina	4	2		
Insecta				
Ephemeroptera (mayflies)				
Baetidae	14			5
Caenidae	10		12	
Heptageniidae	3		1	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	1	1
Gomphidae	1			
Libellulidae		6		
Zygoptera (damselflies)				
Calopterygidae	8	8	12	4
Coenagrionidae	17	5		1
Hemiptera (true bugs)				
Belostomatidae	1	1	1	
Corixidae	27	11		
Gerridae	2		1	1
Nepidae	1	1		
Notonectidae	1	1	1	
Pleidae	9	1	1	
Megaloptera				
Corydalidae (dobson flies)		1		
Sialidae (alder flies)	1	10	1	
Trichoptera (caddisflies)				
Brachycentridae	6			
Hydropsychidae	3		30	10
Leptoceridae	2			
Limnephilidae	2		3	
Philopotamidae	1			
Polycentropodidae	26			
Rhyacophilidae				1
Coleoptera (beetles)				
Dytiscidae (total)	1	1		
Gyrinidae (adults)	2			
Haliplidae (adults)	3	1		
Dryopidae	6			3
Elmidae	8		9	2
Diptera (flies)				
Ceratopogonidae			1	
Chironomidae	29	12	8	4
Dixidae		1		

Tabanidae	1			
Tipulidae		1		
MOLLUSCA				
Gastropoda (snails)				
Physidae	1	3		13
Planorbidae				1
Viviparidae		1	1	
Pelecypoda (bivalves)				
Sphaeriidae (clams)		1	7	1
Unionidae (mussels)			1	
TOTAL INDIVIDUALS	276	333	486	280

	South Branch Shiawassee Lovejoy Road 8/13/2015 STATION 5		Unnamed Tributary to Indian Fausset Road 8/13/2015 STATION 6		Scribner Creek Beard Road 8/13/2015 STATION 7		Hovey-Pratt Drain Geeck Road 7/23/2015 STATION 8	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	34	1	23	0	24	0	17	0
NUMBER OF MAYFLY TAXA	3	0	0	-1	2	0	1	-1
NUMBER OF CADDISFLY TAXA	6	1	0	-1	2	0	2	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	9.78	0	0.00	-1	2.67	-1	1.79	-1
PERCENT CADDISFLY COMP.	14.49	0	0.00	-1	6.79	0	3.93	-1
PERCENT DOMINANT TAXON	25.72	0	78.08	-1	70.16	-1	77.86	-1
PERCENT ISOPOD, SNAIL, LEECH	1.09	1	2.10	1	71.40	-1	6.79	0
PERCENT SURF. AIR BREATHERS	17.03	0	5.11	1	0.82	1	0.36	1
TOTAL SCORE		2		-4		-3		-4
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 3 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed probabilistic sites June-September 2015.

TAXA	Pratt Drain Garrison Road 9/28/2015 STATION 9	Shiawassee River Gould Bridge 7/23/2015 STATION 10
PLATYHELMINTHES (flatworms)		
Turbellaria	1	
ANNELIDA (segmented worms)		
Oligochaeta (worms)	26	3
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	190	7
Decapoda (crayfish)	3	2
Isopoda (sowbugs)	16	1
Insecta		
Ephemeroptera (mayflies)		
Baetidae	5	29
Heptageniidae		25
Polymitarcyidae		1
Tricorythidae		7
Odonata		
Anisoptera (dragonflies)		
Gomphidae		1
Zygoptera (damselflies)		
Calopterygidae	1	1
Plecoptera (stoneflies)		
Perlidae		3
Hemiptera (true bugs)		
Gerridae	1	2
Mesoveliidae		1
Notonectidae	1	
Pleidae	1	
Veliidae	8	
Trichoptera (caddisflies)		
Brachycentridae		4
Glossosomatidae		10
Hydropsychidae	45	61
Lepidostomatidae		2
Leptoceridae		5
Phryganeidae	1	
Polycentropodidae		5
Uenoidae	5	
Coleoptera (beetles)		
Scirtidae (adults)		1
Dryopidae	3	
Elmidae	24	11
Diptera (flies)		
Chironomidae	26	43
Culicidae	1	
Simuliidae		5
Stratiomyidae		1
Tabanidae	3	
Tipulidae	5	
MOLLUSCA		
Gastropoda (snails)		
Ancylidae (limpets)	1	
Bithyniidae		10
Physidae	1	3
TOTAL INDIVIDUALS	368	244

METRIC	Pratt Drain Garrison Road 9/28/2015 STATION 9 Value	Score	Shiawassee River Gould Bridge 7/23/2015 STATION 10 Value	Score
TOTAL NUMBER OF TAXA	22	0	26	1
NUMBER OF MAYFLY TAXA	1	-1	4	1
NUMBER OF CADDISFLY TAXA	3	0	6	1
NUMBER OF STONEFLY TAXA	0	-1	1	1
PERCENT MAYFLY COMP.	1.36	-1	25.41	1
PERCENT CADDISFLY COMP.	13.86	0	35.66	1
PERCENT DOMINANT TAXON	51.63	-1	25.00	0
PERCENT ISOPOD, SNAIL, LEECH	4.89	0	5.74	0
PERCENT SURF. AIR BREATHERS	3.26	1	2.05	1
TOTAL SCORE		-3		7
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT

Table 3 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed probabilistic sites June-September 2015.

TAXA	Shiawassee River Showboat Park 9/17/2015 STATION 11	Deer Creek Twin Brooks Golf Course 9/17/2015 STATION 12	Bad River Blair Road 9/15/2015 STATION 13	Shad Creek McClelland Road 9/11/2015 STATION 14
PLATYHELMINTHES (flatworms)				
Turbellaria	1	139	2	
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1		5	3
Oligochaeta (worms)	5		41	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	24	9		27
Decapoda (crayfish)	1	1		1
Isopoda (sowbugs)	1	77	1	1
Arachnoidea				
Hydracarina	2	2	48	3
Insecta				
Ephemeroptera (mayflies)				
Baetidae	9	1		9
Caenidae	2			
Ephemeridae	1			
Heptageniidae	5			
Potamanthidae	26			
Tricorythidae	60			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		7	4	4
Gomphidae	3			
Libellulidae		3		
Macromiidae	1			
Zygoptera (damselflies)				
Calopterygidae	1	1	1	
Coenagrionidae	7	23	6	3
Lestidae	1			
Plecoptera (stoneflies)				
Perlidae	2			
Hemiptera (true bugs)				
Belostomatidae		1	2	
Corixidae	8	2	10	65
Gerridae	1	1		1
Mesoveliidae	1			
Nepidae			2	
Notonectidae		1		1
Trichoptera (caddisflies)				
Brachycentridae	1			
Hydropsychidae	3		3	7
Hydroptilidae				1
Leptoceridae	9			1
Molannidae	1			
Phryganeidae				1
Lepidoptera (moths)				
Pyralidae			1	
Coleoptera (beetles)				
Dytiscidae (total)		1	2	
Haliplidae (adults)	1	1	6	6
Hydrophilidae (total)			2	
Dryopidae			1	
Elmidae	3	1	3	27

Diptera (flies)				
Ceratopogonidae		1		
Chironomidae	74	9	159	66
Culicidae		1		13
Dixidae				4
Simuliidae				1
Tabanidae				1
Tipulidae		2	1	4
MOLLUSCA				
Gastropoda (snails)				
Hydrobiidae			1	
Physidae	8	2	28	15
Planorbidae			1	1
Pleuroceridae		1		
Pelecypoda (bivalves)				
Sphaeriidae (clams)	1	1	1	1
Unionidae (mussels)	1			
TOTAL INDIVIDUALS	265	288	331	268

	Shiawassee River Showboat Park 9/17/2015 STATION 11		Deer Creek Twin Brooks Golf Course 9/17/2015 STATION 12		Bad River Blair Road 9/15/2015 STATION 13		Shad Creek McClelland Road 9/11/2015 STATION 14	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	32	1	24	1	24	1	27	1
NUMBER OF MAYFLY TAXA	6	1	1	1	0	-1	1	1
NUMBER OF CADDISFLY TAXA	4	1	0	-1	1	0	4	1
NUMBER OF STONEFLY TAXA	1	1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	38.87	1	0.35	-1	0.00	-1	3.36	-1
PERCENT CADDISFLY COMP.	5.28	0	0.00	-1	0.91	-1	3.73	0
PERCENT DOMINANT TAXON	27.92	-1	48.26	-1	48.04	-1	24.63	-1
PERCENT ISOPOD, SNAIL, LEECH	3.77	1	27.78	-1	10.88	0	7.46	0
PERCENT SURF. AIR BREATHERS	4.15	1	2.78	1	7.25	1	32.09	-1
TOTAL SCORE		6		-3		-3		-1
MACROINV. COMMUNITY RATING		EXCELLENT		ACCEPT.		ACCEPT.		ACCEPT.

Table 3 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed probabilistic sites June-September 2015.

TAXA	Limbocker Creek Harris Road 9/15/2015 STATION 15	Lamb Creek Wilkie Road 9/16/2015 STATION 16	Lamb Creek Brady Road 9/16/2015 STATION 17	Little Potato Creek Fowler Road 9/16/2015 STATION 18
ANNELIDA (segmented worms)				
Hirudinea (leeches)	2	1	1	
Oligochaeta (worms)	1	28		3
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	14	1	16	10
Decapoda (crayfish)	1	2	2	
Arachnoidea				
Hydracarina	3	7	15	
Insecta				
Ephemeroptera (mayflies)				
Baetidae			1	12
Caenidae	2	2		1
Heptageniidae	70	19	21	4
Leptophlebiidae			19	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1	5	5
Cordulegastridae				1
Gomphidae				2
Libellulidae	1			
Macromiidae				1
Zygoptera (damselflies)				
Calopterygidae	4	1	10	8
Lestidae	1	6	2	
Hemiptera (true bugs)				
Belostomatidae	1			
Corixidae	4		2	26
Gerridae	1		1	
Mesoveliidae	2		1	1
Notonectidae	1			
Pleidae	1			
Megaloptera				
Sialidae (alder flies)	1			2
Trichoptera (caddisflies)				
Helicopsychidae			4	
Hydropsychidae			59	1
Leptoceridae		6	4	6
Limnephilidae			1	
Molannidae	3			4
Phryganeidae	2	1	2	
Coleoptera (beetles)				
Dytiscidae (total)	7			
Gyrinidae (adults)	5			
Dryopidae		1		6
Elmidae	36	156	21	85
Scirtidae (larvae)	1			
Diptera (flies)				
Ceratopogonidae		1		
Chironomidae	104	37	73	59
Culicidae		1		5
Dixidae	5	6	10	1
Tabanidae	3		3	7
Tipulidae	2	1	2	1

MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		1		9
Hydrobiidae	1		3	9
Physidae	8	3	16	1
Pelecypoda (bivalves)				
Corbiculidae				2
Sphaeriidae (clams)	4		10	8
TOTAL INDIVIDUALS	292	282	304	280

	Limbocker Creek Harris Road 9/15/2015 STATION 15		Lamb Creek Wilkie Road 9/16/2015 STATION 16		Lamb Creek Brady Road 9/16/2015 STATION 17		Little Potato Creek Fowler Road 9/16/2015 STATION 18	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	31	1	21	0	26	1	28	1
NUMBER OF MAYFLY TAXA	2	1	2	0	3	1	3	1
NUMBER OF CADDISFLY TAXA	2	1	2	0	5	1	3	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	24.66	1	7.45	-1	13.49	-1	6.07	-1
PERCENT CADDISFLY COMP.	1.71	-1	2.48	-1	23.03	1	3.93	0
PERCENT DOMINANT TAXON	35.62	-1	55.32	-1	24.01	-1	30.36	-1
PERCENT ISOPOD, SNAIL, LEECH	3.77	1	1.77	1	6.58	0	6.79	0
PERCENT SURF. AIR BREATHERS	7.53	1	0.35	1	1.32	1	11.43	0
TOTAL SCORE		3		-2		2		0
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 3 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed probabilistic sites June-September 2015.

TAXA	South Fork Bad River Saginaw Street 9/14/2015 STATION 19	Beaver Creek Blair Road 9/11/2015 STATION 20	Beaver Creek Hemlock Road 9/15/2015 STATION 21	Carson Drain Ryan Road 9/14/2015 STATION 22
PORIFERA (sponges)	1			
PLATYHELMINTHES (flatworms)				
Turbellaria	1			
ANNELIDA (segmented worms)				
Hirudinea (leeches)		7	2	1
Oligochaeta (worms)	3	21	14	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	25	21	1	29
Decapoda (crayfish)	1		10	
Isopoda (sowbugs)	4	1		8
Arachnoidea				
Hydracarina	16	12		1
Insecta				
Ephemeroptera (mayflies)				
Baetidae	1	2	2	2
Caenidae	26	13	15	14
Heptageniidae	4		28	
Leptophlebiidae			18	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	13	1	1	
Libellulidae		1		3
Zygoptera (damselflies)				
Calopterygidae	1		4	
Coenagrionidae	79	2	7	244
Hemiptera (true bugs)				
Belostomatidae		1	4	1
Corixidae	3	114	8	2
Gerridae		1		1
Mesoveliidae			1	
Nepidae	1	1		1
Notonectidae	7	1	1	
Pleidae	6	2		3
Veliidae				2
Trichoptera (caddisflies)				
Glossosomatidae			1	
Hydropsychidae			3	
Leptoceridae	11		1	6
Phryganeidae			3	1
Coleoptera (beetles)				
Dytiscidae (total)		1	1	
Haliplidae (adults)	5	54	10	1
Hydrophilidae (total)		1	3	1
Elmidae	11		29	15
Haliplidae (larvae)				3
Diptera (flies)				
Ceratopogonidae	3			1
Chironomidae	52	16	74	4
Culicidae			11	
Dixidae			1	
Tabanidae	1			
Tipulidae			3	

MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1			
Physidae		2	5	2
Planorbidae	4			
Pleuroceridae			1	
Pelecypoda (bivalves)				
Sphaeriidae (clams)			1	
TOTAL INDIVIDUALS	280	275	263	347

	South Fork Bad River Saginaw Street 9/14/2015 STATION 19		Beaver Creek Blair Road 9/11/2015 STATION 20		Beaver Creek Hemlock Road 9/15/2015 STATION 21		Carson Drain Ryan Road 9/14/2015 STATION 22	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	25	0	21	1	30	0	23	0
NUMBER OF MAYFLY TAXA	3	0	2	1	4	1	2	0
NUMBER OF CADDISFLY TAXA	1	-1	0	-1	4	1	2	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	11.07	-1	5.45	-1	23.95	1	4.61	-1
PERCENT CADDISFLY COMP.	3.93	0	0.00	-1	3.04	0	2.02	-1
PERCENT DOMINANT TAXON	28.21	-1	41.45	-1	28.14	-1	70.32	-1
PERCENT ISOPOD, SNAIL, LEECH	3.21	1	3.64	1	3.04	1	3.17	1
PERCENT SURF. AIR BREATHERS	7.86	1	64.00	-1	14.83	0	3.46	1
TOTAL SCORE		-2		-3		2		-2
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 3 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed probabilistic sites June-September 2015.

TAXA	Pickerel Creek Hulien Road 9/14/2015 STATION 23	Weeks Drain Meridian Road 9/11/2015 STATION 24	Handy Creek Chapin Road 9/11/2015 STATION 25	Whitmore Drain Tittabawassee Road 7/27/2015 STATION 26
PLATYHELMINTHES (flatworms)				
Turbellaria	2	9		1
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1	6	37	
Oligochaeta (worms)	2	13	113	7
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	110	9	32	7
Isopoda (sowbugs)	14	1	1	1
Arachnoidea				
Hydracarina	8	29	13	8
Insecta				
Ephemeroptera (mayflies)				
Baetidae	1	1		1
Caenidae	15			40
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1		1	2
Libellulidae		1	2	
Zygoptera (damselflies)				
Coenagrionidae	61	3	1	58
Hemiptera (true bugs)				
Belostomatidae				5
Corixidae	5	7	20	1
Gerridae			1	
Notonectidae			1	
Trichoptera (caddisflies)				
Hydropsychidae			1	
Leptoceridae	15			3
Phryganeidae		1	1	1
Coleoptera (beetles)				
Dytiscidae (total)	2			
Haliplidae (adults)	1	1	6	1
Hydrophilidae (total)			1	
Elmidae	3	3	3	6
Haliplidae (larvae)	2			1
Diptera (flies)				
Ceratopogonidae				4
Chironomidae	11	183	26	90
Culicidae		3	1	
Dixidae		2		2
Simuliidae		4		
Stratiomyidae			2	
Tabanidae			1	
MOLLUSCA				
Gastropoda (snails)				
Lymnaeidae				1
Physidae	2	1	4	29
Planorbidae	2			6
Pelecypoda (bivalves)				
Sphaeriidae (clams)	1	16	4	1
TOTAL INDIVIDUALS	259	293	272	276

	Pickerel Creek Hulien Road 9/14/2015 STATION 23		Weeks Drain Meridian Road 9/11/2015 STATION 24		Handy Creek Chapin Road 9/11/2015 STATION 25		Whitmore Drain Tittabawassee Road 7/27/2015 STATION 26	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	19	0	19	0	22	1	22	0
NUMBER OF MAYFLY TAXA	2	0	1	0	0	-1	2	0
NUMBER OF CADDISFLY TAXA	1	-1	1	-1	2	1	2	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	6.18	-1	0.34	-1	0.00	-1	14.86	-1
PERCENT CADDISFLY COMP.	5.79	0	0.34	-1	0.74	-1	1.45	-1
PERCENT DOMINANT TAXON	42.47	-1	62.46	-1	41.54	-1	32.61	-1
PERCENT ISOPOD, SNAIL, LEECH	7.34	0	2.73	1	15.44	-1	13.41	0
PERCENT SURF. AIR BREATHERS	3.09	1	3.75	1	11.76	0	2.54	1
TOTAL SCORE		-3		-3		-4		-3
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 3 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed probabilistic sites June-September 2015.

TAXA	Swan Creek Gleaner Road 7/27/2015 STATION 27	Moon Drain Dehmel Road 9/14/2015 STATION 28
ANNELIDA (segmented worms)		
Hirudinea (leeches)	1	1
Oligochaeta (worms)	2	46
ARTHROPODA		
Crustacea		
Amphipoda (scuds)		9
Decapoda (crayfish)	54	
Isopoda (sowbugs)	1	6
Arachnoidea		
Hydracarina		6
Insecta		
Ephemeroptera (mayflies)		
Baetidae	1	
Heptageniidae	9	
Tricorythidae	1	
Odonata		
Anisoptera (dragonflies)		
Aeshnidae		7
Gomphidae		1
Zygoptera (damselflies)		
Calopterygidae	3	
Coenagrionidae	1	1
Hemiptera (true bugs)		
Corixidae	1	
Gerridae	1	
Mesoveliidae		6
Nepidae		1
Trichoptera (caddisflies)		
Hydropsychidae	41	
Limnephilidae	5	
Phryganeidae		13
Coleoptera (beetles)		
Dytiscidae (total)		5
Scirtidae (adults)	1	
Elmidae	9	
Diptera (flies)		
Ceratopogonidae		5
Chironomidae	76	35
Tabanidae		2
MOLLUSCA		
Gastropoda (snails)		
Lymnaeidae		4
Physidae	5	8
Planorbidae		8
Pelecypoda (bivalves)		
Sphaeriidae (clams)	1	61
Unionidae (mussels)	20	
TOTAL INDIVIDUALS	233	225

	Swan Creek Gleaner Road 7/27/2015 STATION 27		Moon Drain Dehmel Road 9/14/2015 STATION 28	
METRIC	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	19	0	19	1
NUMBER OF MAYFLY TAXA	3	0	0	-1
NUMBER OF CADDISFLY TAXA	2	0	1	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1
PERCENT MAYFLY COMP.	4.72	-1	0.00	-1
PERCENT CADDISFLY COMP.	19.74	0	5.78	0
PERCENT DOMINANT TAXON	32.62	-1	27.11	-1
PERCENT ISOPOD, SNAIL, LEECH	3.00	1	12.00	0
PERCENT SURF. AIR BREATHERS	1.29	1	5.33	1
TOTAL SCORE		-1		-2
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.

Table 3 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed probabilistic sites June-September 2015.

TAXA	Moon Drain Pagels Road 9/14/2015 STATION 29
ANNELIDA (segmented worms)	
Hirudinea (leeches)	65
Oligochaeta (worms)	9
ARTHROPODA	
Crustacea	
Isopoda (sowbugs)	21
Arachnoidea	
Hydracarina	2
Insecta	
Odonata	
Anisoptera (dragonflies)	
Aeshnidae	1
Hemiptera (true bugs)	
Belostomatidae	1
Trichoptera (caddisflies)	
Phryganeidae	1
Coleoptera (beetles)	
Dytiscidae (total)	1
Diptera (flies)	
Ceratopogonidae	3
Chironomidae	115
Culicidae	1
Tabanidae	3
MOLLUSCA	
Gastropoda (snails)	
Physidae	6
Pelecypoda (bivalves)	
Sphaeriidae (clams)	8
TOTAL INDIVIDUALS	237

METRIC	Moon Drain Pagels Road 9/14/2015 STATION 29 Value	Score
TOTAL NUMBER OF TAXA	14	0
NUMBER OF MAYFLY TAXA	0	-1
NUMBER OF CADDISFLY TAXA	1	-1
NUMBER OF STONEFLY TAXA	0	-1
PERCENT MAYFLY COMP.	0.00	-1
PERCENT CADDISFLY COMP.	0.42	-1
PERCENT DOMINANT TAXON	48.52	-1
PERCENT ISOPOD, SNAIL, LEECH	38.82	-1
PERCENT SURF. AIR BREATHERS	1.27	1
TOTAL SCORE		-6
MACROINV. COMMUNITY RATING		POOR

Table 4. Habitat evaluation for the Shiawassee River watershed trend sites, June-September 2015.

	Shiawassee River		North Ore Creek		Bogue Creek		Bogue Creek	
	Hogan Rd		Crouse Road		Allen Road		Jones Road	
	RIFFLE/RUN		RIFFLE/RUN		GLIDE/POOL		GLIDE/POOL	
HABITAT METRIC								
Substrate and Instream Cover								
Epifaunal Substrate/ Avail Cover (20)	14		14		8		13	
Embeddedness (20)*	13		14					
Velocity/Depth Regime (20)*	16		18					
Pool Substrate Characterization (20)**					11		14	
Pool Variability (20)**					11		11	
Channel Morphology								
Sediment Deposition (20)	9		14		6		12	
Flow Status - Maint. Flow Volume (10)	9		9		9		9	
Flow Status - Flashiness (10)	7		8		8		8	
Channel Alteration (20)	18		19		13		15	
Frequency of Riffles/Bends (20)*	10		18					
Channel Sinuosity (20)**					5		7	
Riparian and Bank Structure								
Bank Stability (L) (10)	4		9		8		9	
Bank Stability (R) (10)	8		9		7		9	
Vegetative Protection (L) (10)	8		7		9		8	
Vegetative Protection (R) (10)	9		7		9		8	
Riparian Veg. Zone Width (L) (10)	6		8		9		9	
Riparian Veg. Zone Width (R) (10)	6		8		9		9	
TOTAL SCORE (200):	137		162		122		141	
HABITAT RATING:	GOOD		EXCELLENT		GOOD		GOOD	
	(SLIGHTLY		(NON-		(SLIGHTLY		(SLIGHTLY	
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)	
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).								
Date:	6/10/2015		6/10/2015		6/10/2015		6/10/2015	
Weather:	Partly Cloudy		Partly Cloudy		Partly Cloudy		Partly Cloudy	
Air Temperature:	80	Deg. F.	80	Deg. F.	80	Deg. F.		Deg. F.
Water Temperature:	82	Deg. F.	79	Deg. F.	68	Deg. F.	70	Deg. F.
Ave. Stream Width:	40	Feet	3.7	Feet	34	Feet	27	Feet
Ave. Stream Depth:	1.9	Feet	0.6	Feet	22	Feet	2	Feet
Surface Velocity:	1.13	Ft./Sec.	1	Ft./Sec.	0.92	Ft./Sec.	1.33	Ft./Sec.
Estimated Flow:	85.88	CFS	2.22	CFS	688.16	CFS	71.82	CFS
Stream Modifications:	None		None		Relocated			
Nuisance Plants (Y/N):	Y		N		N		N	
Report Number:								
STORET No.:	250462		470507		470642		470636	
Stream Name:	Shiawassee River		North Ore Creek		Bogue Creek		Bogue Creek	
Road Crossing/Location:	Hogan Rd		Crouse Road		Allen Road		Jones Road	
County Code:	25		47		47		47	
TRS:	05N06E19		03N06E16		03N04E01		04N04E24	
Latitude (dd):	42.81572		42.65502		42.68788		42.72164	
Longitude (dd):	-83.8021		-83.75636		-83.92372		-83.93175	
Ecoregion:	SMNITP		SMNITP		SMNITP		SMNITP	
Stream Type:	Warmwater		Warmwater		Warmwater		Warmwater	
USGS Basin Code:	4080203		4080203		4080203		4080203	
* Applies only to Riffle/Run stream Surveys								
** Applies only to Glide/Pool stream Surveys								

Table 4 cont. Habitat evaluation for the Shiawassee River watershed trend sites, June-September 2015.

	Three Mile Creek						
	Monroe Road						
	RIFFLE/RUN						
HABITAT METRIC							
Substrate and Instream Cover							
Epifaunal Substrate/ Avail Cover (20)	11						
Embeddedness (20)*	11						
Velocity/Depth Regime (20)*	9						
Pool Substrate Characterization (20)**							
Pool Variability (20)**							
Channel Morphology							
Sediment Deposition (20)	11						
Flow Status - Maint. Flow Volume (10)	9						
Flow Status - Flashiness (10)	4						
Channel Alteration (20)	15						
Frequency of Riffles/Bends (20)*	9						
Channel Sinuosity (20)**							
Riparian and Bank Structure							
Bank Stability (L) (10)	6						
Bank Stability (R) (10)	7						
Vegetative Protection (L) (10)	9						
Vegetative Protection (R) (10)	9						
Riparian Veg. Zone Width (L) (10)	9						
Riparian Veg. Zone Width (R) (10)	9						
TOTAL SCORE (200):	128						
HABITAT RATING:	GOOD						
	(SLIGHTLY						
	IMPAIRED)						
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).							
Date:	7/23/2015						
Weather:	Sunny						
Air Temperature:	80	Deg. F.					
Water Temperature:	66	Deg. F.					
Ave. Stream Width:	19	Feet					
Ave. Stream Depth:	0.7	Feet					
Surface Velocity:	0.94	Ft./Sec.					
Estimated Flow:	12.502	CFS					
Stream Modifications:	Relocated						
Nuisance Plants (Y/N):	N						
Report Number:							
STORET No.:	780241						
Stream Name:	Three Mile Creek						
Road Crossing/Location:	Monroe Road						
County Code:	78						
TRS:	06N04E18						
Latitude (dd):	42.91856						
Longitude (dd):	-83.96615						
Ecoregion:	SMNITP						
Stream Type:	Warmwater						
USGS Basin Code:	4080203						
* Applies only to Riffle/Run stream Surveys							
** Applies only to Glide/Pool stream Surveys							

Table 4 cont. Habitat evaluation for the Shiawassee River watershed trend sites, June-September 2015.

	Shiawassee River		Carson Drain		Beaver Creek		Nelson Run	
	Harmon Partridge Park		Fergus Road		Ransom Road		Fehn Road	
	RIFFLE/RUN		GLIDE/POOL		GLIDE/POOL		GLIDE/POOL	
HABITAT METRIC								
Substrate and Instream Cover								
Epifaunal Substrate/ Avail Cover (20)	16		8		8		11	
Embeddedness (20)*	18							
Velocity/Depth Regime (20)*	17							
Pool Substrate Characterization (20)**			10		11		11	
Pool Variability (20)**			3		1		5	
Channel Morphology								
Sediment Deposition (20)	16		12		9		11	
Flow Status - Maint. Flow Volume (10)	9		8		9		9	
Flow Status - Flashiness (10)	4		3		4		1	
Channel Alteration (20)	18		6		7		6	
Frequency of Riffles/Bends (20)*	15							
Channel Sinuosity (20)**			2		1		5	
Riparian and Bank Structure								
Bank Stability (L) (10)	8		6		5		8	
Bank Stability (R) (10)	8		6		4		8	
Vegetative Protection (L) (10)	9		4		5		5	
Vegetative Protection (R) (10)	4		4		5		5	
Riparian Veg. Zone Width (L) (10)	9		2		3		4	
Riparian Veg. Zone Width (R) (10)	1		2		3		4	
TOTAL SCORE (200):	152		76		75		93	
HABITAT RATING:	GOOD		MARGINAL		MARGINAL		MARGINAL	
	(SLIGHTLY		(MODERATELY		(MODERATELY		(MODERATELY	
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)	
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).								
Date:	9/23/2015		6/11/2015		6/11/2015		6/11/2015	
Weather:	Sunny		Partly Cloudy		Partly Cloudy		Partly Cloudy	
Air Temperature:		Deg. F.	78	Deg. F.		Deg. F.	75	Deg. F.
Water Temperature:	72	Deg. F.		Deg. F.	66	Deg. F.	68	Deg. F.
Ave. Stream Width:	115	Feet	16	Feet	16	Feet	12	Feet
Ave. Stream Depth:	1.5	Feet	0.7	Feet	1.3	Feet	1.1	Feet
Surface Velocity:		Ft./Sec.	0.57	Ft./Sec.	0.74	Ft./Sec.	1.67	Ft./Sec.
Estimated Flow:		CFS	6.384	CFS	15.392	CFS	22.044	CFS
Stream Modifications:	None		Canopy Removal		Relocated		Canopy Removal	
Nuisance Plants (Y/N):	N		Y		N		N	
Report Number:								
STORET No.:	780243		730348		290202		730349	
Stream Name:	Shiawassee River		Carson Drain		Beaver Creek		Nelson Run	
Road Crossing/Location:	Harmon Partridge Park		Fergus Road		Ransom Road		Fehn Road	
County Code:	78		73		29		73	
TRS:	07N02E12		10N03E21		11N01W08		10N03E21	
Latitude (dd):	43.02061		43.25485		43.3648		43.4809	
Longitude (dd):	-84.1832		-84.11384		-84.44924		-84.22039	
Ecoregion:	HELP		HELP		HELP		HELP	
Stream Type:	Warmwater		Warmwater		Warmwater		Warmwater	
USGS Basin Code:	4080203		4080203		4080203		4080203	
* Applies only to Riffle/Run stream Surveys								
** Applies only to Glide/Pool stream Surveys								

Table 4 cont. Habitat evaluation for the Shiawassee River watershed trend sites, June-September 2015.

	Swan Creek							
	Schomaker Road							
	GLIDE/POOL							
HABITAT METRIC								
Substrate and Instream Cover								
Epifaunal Substrate/ Avail Cover (20)	7							
Embeddedness (20)*								
Velocity/Depth Regime (20)*								
Pool Substrate Characterization (20)**	10							
Pool Variability (20)**	8							
Channel Morphology								
Sediment Deposition (20)	6							
Flow Status - Maint. Flow Volume (10)	3							
Flow Status - Flashiness (10)	3							
Channel Alteration (20)	13							
Frequency of Riffles/Bends (20)*								
Channel Sinuosity (20)**	15							
Riparian and Bank Structure								
Bank Stability (L) (10)	8							
Bank Stability (R) (10)	8							
Vegetative Protection (L) (10)	9							
Vegetative Protection (R) (10)	9							
Riparian Veg. Zone Width (L) (10)	9							
Riparian Veg. Zone Width (R) (10)	9							
TOTAL SCORE (200):	117							
HABITAT RATING:	GOOD							
	(SLIGHTLY							
	IMPAIRED)							
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).								
Date:	6/11/2015							
Weather:	Partly Cloudy							
Air Temperature:	75	Deg. F.						
Water Temperature:	70	Deg. F.						
Ave. Stream Width:	100	Feet						
Ave. Stream Depth:		Feet						
Surface Velocity:		Ft./Sec.						
Estimated Flow:		CFS						
Stream Modifications:	None							
Nuisance Plants (Y/N):	N							
Report Number:								
STORET No.:	730345							
Stream Name:	Swan Creek							
Road Crossing/Location:	Schomaker Road							
County Code:	73							
TRS:	12N03E34							
Latitude (dd):	43.40122							
Longitude (dd):	-84.09955							
Ecoregion:	HELP							
Stream Type:	Warmwater							
USGS Basin Code:	4080203							
* Applies only to Riffle/Run stream Surveys								
** Applies only to Glide/Pool stream Surveys								

Table 5. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed trend sites June-September 2015.

TAXA	Shiawassee River Hogan Rd 6/10/2015 STATION 1T	North Ore Creek Crouse Road 6/10/2015 STATION 2T	Bogue Creek Allen Road 6/10/2015 STATION 3T	Bogue Creek Jones Road 6/10/2015 STATION 4T
ANNELIDA (segmented worms)				
Hirudinea (leeches)	18	2		
Oligochaeta (worms)	1	9	35	50
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	7	85	14	119
Decapoda (crayfish)	1	1	1	5
Arachnoidea				
Hydracarina		1	5	
Insecta				
Ephemeroptera (mayflies)				
Baetidae	12	22	5	15
Caenidae	5		1	1
Ephemeridae			2	
Heptageniidae	3			7
Leptophlebiidae		2		
Tricorythidae	7			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	1	1
Gomphidae			1	2
Zygoptera (damselflies)				
Calopterygidae		1	1	2
Coenagrionidae	3			
Plecoptera (stoneflies)				
Perlidae		3		
Perlodidae			1	1
Hemiptera (true bugs)				
Corixidae			128	
Gerridae			1	
Trichoptera (caddisflies)				
Brachycentridae	4			1
Glossosomatidae	1			
Hydropsychidae	71	34	1	32
Lepidostomatidae				1
Leptoceridae	3	4	3	
Limnephilidae			3	1
Molannidae		1		
Philopotamidae		2		
Polycentropodidae	3		1	
Coleoptera (beetles)				
Gyrinidae (adults)			5	1
Hydrophilidae (total)	1		1	
Elmidae	12	1	42	15
Gyrinidae (larvae)				2
Scirtidae (larvae)		1	2	
Diptera (flies)				
Ceratopogonidae	1	3	1	5
Chaoboridae			1	
Chironomidae	98	34	35	27
Culicidae		1		
Simuliidae	19	116	2	19
Tabanidae			1	
Tipulidae	1	2	1	1

MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)				3
Lymnaeidae		1	1	1
Physidae			3	1
Planorbidae	1			
Viviparidae		1		2
Pelecypoda (bivalves)				
Dreissenidae	1			
Sphaeriidae (clams)		3		5
Unionidae (mussels)	1			
TOTAL INDIVIDUALS	274	331	299	320

	Shiawassee River Hogan Rd 6/10/2015 STATION 1T		North Ore Creek Crouse Road 6/10/2015 STATION 2T		Bogue Creek Allen Road 6/10/2015 STATION 3T		Bogue Creek Jones Road 6/10/2015 STATION 4T	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	23	0	24	1	29	1	25	1
NUMBER OF MAYFLY TAXA	4	1	2	1	3	0	3	0
NUMBER OF CADDISFLY TAXA	5	1	4	1	4	0	4	0
NUMBER OF STONEFLY TAXA	0	-1	1	1	1	1	1	1
PERCENT MAYFLY COMP.	9.85	0	7.25	0	2.68	-1	7.19	0
PERCENT CADDISFLY COMP.	29.93	1	12.39	0	2.68	-1	10.94	0
PERCENT DOMINANT TAXON	35.77	0	35.05	0	42.81	-1	37.19	0
PERCENT ISOPOD, SNAIL, LEECH	6.93	0	1.21	1	1.34	1	2.19	1
PERCENT SURF. AIR BREATHERS	0.36	1	0.30	1	45.48	-1	0.31	1
TOTAL SCORE		3		6		-1		4
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT		ACCEPT.		ACCEPT.

Table 5 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed trend sites June-September 2015.

TAXA	Three Mile Creek Monroe Road 7/23/2015 STATION 5T
PLATYHELMINTHES (flatworms)	
Turbellaria	10
ANNELIDA (segmented worms)	
Hirudinea (leeches)	4
Oligochaeta (worms)	10
ARTHROPODA	
Crustacea	
Amphipoda (scuds)	1
Decapoda (crayfish)	11
Arachnoidea	
Hydracarina	1
Insecta	
Ephemeroptera (mayflies)	
Baetidae	18
Odonata	
Anisoptera (dragonflies)	
Aeshnidae	2
Hemiptera (true bugs)	
Corixidae	2
Gerridae	1
Mesoveliidae	1
Pleidae	1
Trichoptera (caddisflies)	
Hydropsychidae	82
Hydroptilidae	2
Molannidae	1
Coleoptera (beetles)	
Haliplidae (adults)	1
Hydrophilidae (total)	1
Elmidae	7
Diptera (flies)	
Ceratopogonidae	2
Chironomidae	94
Simuliidae	25
Tipulidae	1
MOLLUSCA	
Gastropoda (snails)	
Physidae	13
Planorbidae	2
Pelecypoda (bivalves)	
Sphaeriidae (clams)	12
TOTAL INDIVIDUALS	305

Three Mile Creek
Monroe Road
7/23/2015
STATION 5T

METRIC	Value	Score
TOTAL NUMBER OF TAXA	25	1
NUMBER OF MAYFLY TAXA	1	-1
NUMBER OF CADDISFLY TAXA	3	0
NUMBER OF STONEFLY TAXA	0	-1
PERCENT MAYFLY COMP.	5.90	0
PERCENT CADDISFLY COMP.	27.87	0
PERCENT DOMINANT TAXON	30.82	0
PERCENT ISOPOD, SNAIL, LEECH	6.23	0
PERCENT SURF. AIR BREATHERS	2.30	1
TOTAL SCORE		0
MACROINV. COMMUNITY RATING		ACCEPT.

Table 5 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed trend sites June-September 2015.

TAXA	Shiawassee River Harmon Partridge Park 9/23/2015 STATION 6T	Carson Drain Fergus Road 6/11/2015 STATION 7T	Beaver Creek Ransom Road 6/11/2015 STATION 8T	Nelson Run Fehn Road 6/11/2015 STATION 9T
PLATYHELMINTHES (flatworms)				
Turbellaria		1		1
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1		1	6
Oligochaeta (worms)	35	26	1	8
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	19	1	22	31
Decapoda (crayfish)	1	1	1	1
Isopoda (sowbugs)	7	29	20	4
Arachnoidea				
Hydracarina		1	4	5
Insecta				
Ephemeroptera (mayflies)				
Baetidae	16	17	91	1
Caenidae		1	2	5
Heptageniidae	9		1	1
Isonychiidae	1			
Polymitarcyidae	1			
Tricorythidae	50			1
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	1	1
Zygoptera (damselflies)				
Calopterygidae	1			1
Coenagrionidae	1	11	9	4
Lestidae				2
Plecoptera (stoneflies)				
Perlidae	2			
Hemiptera (true bugs)				
Corixidae		17	1	1
Gerridae	2	1		
Mesoveliidae	2		1	
Notonectidae		1		
Pleidae			2	
Veliidae	2			
Megaloptera				
Sialidae (alder flies)	1			
Trichoptera (caddisflies)				
Brachycentridae	2			
Glossosomatidae	4			
Helicopsychidae				47
Hydropsychidae	35			2
Lepidostomatidae	2			
Leptoceridae	6	1		
Limnephilidae				1
Philopotamidae				1
Phryganeidae	1		1	1
Polycentropodidae	6			
Lepidoptera (moths)				
Pyralidae	2			
Coleoptera (beetles)				
Dytiscidae (total)		1		1
Haliplidae (adults)	1	2	1	1

Hydrophilidae (total)	1	1	1	1
Elmidae	3	2	60	42
Haliplidae (larvae)			2	
Psephenidae (larvae)	1			
Scirtidae (larvae)	1			
Diptera (flies)				
Ceratopogonidae	2	1	1	2
Chaoboridae				1
Chironomidae	35	117	143	114
Simuliidae		4		1
Tabanidae	1			
Tipulidae	1			
MOLLUSCA				
Gastropoda (snails)				
Bithyniidae	8			
Physidae	1	64	23	28
Planorbidae		8	1	1
Viviparidae	1		1	27
Pelecypoda (bivalves)				
Sphaeriidae (clams)	1	2	1	2
Unionidae (mussels)	1		1	1
TOTAL INDIVIDUALS	267	311	393	347

	Shiawassee River Harmon Partridge Park 9/23/2015 STATION 6T		Carson Drain Fergus Road 6/11/2015 STATION 7T		Beaver Creek Ransom Road 6/11/2015 STATION 8T		Nelson Run Fehn Road 6/11/2015 STATION 9T	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	39	1	24	0	25	0	34	1
NUMBER OF MAYFLY TAXA	5	1	2	0	3	1	4	1
NUMBER OF CADDISFLY TAXA	7	1	1	-1	1	-1	5	1
NUMBER OF STONEFLY TAXA	1	1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	28.84	1	5.79	-1	23.92	1	2.31	-1
PERCENT CADDISFLY COMP.	20.97	0	0.32	-1	0.25	-1	14.99	0
PERCENT DOMINANT TAXON	18.73	0	37.62	-1	36.39	-1	32.85	-1
PERCENT ISOPOD, SNAIL, LEECH	6.74	0	32.48	-1	11.70	0	19.02	-1
PERCENT SURF. AIR BREATHERS	3.00	1	7.40	1	1.53	1	1.44	1
TOTAL SCORE		6		-5		-1		0
MACROINV. COMMUNITY RATING		EXCELLENT		POOR		ACCEPT.		ACCEPT.

Table 5 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed trend sites June-September 2015.

TAXA	Swan Creek Schomaker Road 6/11/2015 STATION 10T
ANNELIDA (segmented worms)	
Hirudinea (leeches)	2
Oligochaeta (worms)	25
ARTHROPODA	
Crustacea	
Amphipoda (scuds)	59
Isopoda (sowbugs)	43
Arachnoidea	
Hydracarina	6
Insecta	
Ephemeroptera (mayflies)	
Baetidae	3
Caenidae	32
Odonata	
Zygoptera (damselflies)	
Coenagrionidae	2
Hemiptera (true bugs)	
Corixidae	24
Gerridae	1
Mesoveliidae	1
Coleoptera (beetles)	
Gyrinidae (adults)	1
Haliplidae (adults)	1
Elmidae	2
Haliplidae (larvae)	1
Diptera (flies)	
Ceratopogonidae	1
Chironomidae	91
Culicidae	1
Tabanidae	1
MOLLUSCA	
Gastropoda (snails)	
Ancylidae (limpets)	1
Physidae	19
Planorbidae	11
TOTAL INDIVIDUALS	328

METRIC	Swan Creek Schomaker Road 6/11/2015 STATION 10T Value	Score
TOTAL NUMBER OF TAXA	21	0
NUMBER OF MAYFLY TAXA	2	0
NUMBER OF CADDISFLY TAXA	0	-1
NUMBER OF STONEFLY TAXA	0	-1
PERCENT MAYFLY COMP.	10.67	-1
PERCENT CADDISFLY COMP.	0.00	-1
PERCENT DOMINANT TAXON	27.74	-1
PERCENT ISOPOD, SNAIL, LEECH	23.17	-1
PERCENT SURF. AIR BREATHERS	8.84	1
TOTAL SCORE		-5
MACROINV. COMMUNITY RATING	POOR	

Table 6. Habitat evaluation for the Shiawassee River watershed targeted sites, June-September 2015.

	Shiawassee River		Shiawassee River						
	Parmenter Road		downstream Corunna Dam						
	RIFFLE/RUN		RIFFLE/RUN						
HABITAT METRIC									
Substrate and Instream Cover									
Epifaunal Substrate/ Avail Cover (20)	10		15						
Embeddedness (20)*	13		16						
Velocity/Depth Regime (20)*	10		12						
Pool Substrate Characterization (20)**									
Pool Variability (20)**									
Channel Morphology									
Sediment Deposition (20)	8		17						
Flow Status - Maint. Flow Volume (10)	10		9						
Flow Status - Flashiness (10)	4		7						
Channel Alteration (20)	15		19						
Frequency of Riffles/Bends (20)*	10		16						
Channel Sinuosity (20)**									
Riparian and Bank Structure									
Bank Stability (L) (10)	8		8						
Bank Stability (R) (10)	8		8						
Vegetative Protection (L) (10)	9		2						
Vegetative Protection (R) (10)	9		2						
Riparian Veg. Zone Width (L) (10)	9		1						
Riparian Veg. Zone Width (R) (10)	5		0						
TOTAL SCORE (200):	128		132						
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)		GOOD (SLIGHTLY IMPAIRED)						
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).									
Date:	8/18/2015		9/17/2015						
Weather:	Cloudy		Sunny						
Air Temperature:	80	Deg. F.		Deg. F.					
Water Temperature:	81	Deg. F.	65	Deg. F.					
Ave. Stream Width:	80	Feet	105	Feet					
Ave. Stream Depth:	1.1	Feet	1	Feet					
Surface Velocity:	2.1	Ft./Sec.	1.8	Ft./Sec.					
Estimated Flow:	184.8	CFS	189	CFS					
Stream Modifications:	None		None						
Nuisance Plants (Y/N):	N		N						
Report Number:									
STORET No.:	780258		780259						
Stream Name:	Shiawassee River		Shiawassee River						
Road Crossing/Location:	Parmenter Road		downstream Corunna Dam						
County Code:	78		78						
TRS:	06N04E6		07N03E21						
Latitude (dd):	42.94448		42.98526						
Longitude (dd):	-84.03734		-84.118						
Ecoregion:	SMNITP		SMNITP						
Stream Type:									
USGS Basin Code:	4080203		4080203						
* Applies only to Riffle/Run stream Surveys									
** Applies only to Glide/Pool stream Surveys									

Table 6 cont. Habitat evaluation for the Shiawassee River watershed targeted sites, June-September 2015.

	Shiawassee River	
	DeVries Nature Center	
	RIFFLE/RUN	
HABITAT METRIC		
Substrate and Instream Cover		
Epifaunal Substrate/ Avail Cover (20)	19	
Embeddedness (20)*	18	
Velocity/Depth Regime (20)*	15	
Pool Substrate Characterization (20)**		
Pool Variability (20)**		
Channel Morphology		
Sediment Deposition (20)	18	
Flow Status - Maint. Flow Volume (10)	9	
Flow Status - Flashiness (10)	5	
Channel Alteration (20)	20	
Frequency of Riffles/Bends (20)*	19	
Channel Sinuosity (20)**		
Riparian and Bank Structure		
Bank Stability (L) (10)	10	
Bank Stability (R) (10)	9	
Vegetative Protection (L) (10)	9	
Vegetative Protection (R) (10)	9	
Riparian Veg. Zone Width (L) (10)	10	
Riparian Veg. Zone Width (R) (10)	10	
TOTAL SCORE (200):	180	
HABITAT RATING:	EXCELLENT (NON-IMPAIRED)	
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).		
Date:	8/18/2015	
Weather:	Cloudy	
Air Temperature:	70	Deg. F.
Water Temperature:	74	Deg. F.
Ave. Stream Width:	34	Feet
Ave. Stream Depth:	1.18	Feet
Surface Velocity:	1.5	Ft./Sec.
Estimated Flow:	60.18	CFS
Stream Modifications:	None	
Nuisance Plants (Y/N):	N	
Report Number:		
STORET No.:	780257	
Stream Name:	Shiawassee River	
Road Crossing/Location:	DeVries Nature Center	
County Code:	78	
TRS:	07N02E2	
Latitude (dd):	43.03654	
Longitude (dd):	-84.18784	
Ecoregion:	HELP	
Stream Type:		
USGS Basin Code:	4080203	
* Applies only to Riffle/Run stream Surveys		
** Applies only to Glide/Pool stream Surveys		

Table 7. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed targeted sites June-September 2015.

TAXA	Shiawassee River Parmenter Road 8/18/2015 STATION A	Shiawassee River downstream Corunna Dam 9/17/2015 STATION B
ANNELIDA (segmented worms)		
Oligochaeta (worms)	6	4
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	14	3
Decapoda (crayfish)	1	1
Isopoda (sowbugs)	11	1
Arachnoidea		
Hydracarina		6
Insecta		
Ephemeroptera (mayflies)		
Baetidae	38	36
Caenidae	1	1
Heptageniidae	7	24
Isonychiidae	1	18
Potamanthidae		2
Tricorythidae	8	5
Odonata		
Anisoptera (dragonflies)		
Aeshnidae		1
Gomphidae	1	1
Zygoptera (damselflies)		
Calopterygidae	1	
Coenagrionidae	21	3
Hemiptera (true bugs)		
Corixidae	2	1
Gerridae	3	3
Mesoveliidae	17	
Veliidae		1
Megaloptera		
Corydalidae (dobson flies)	1	
Sialidae (alder flies)		4
Trichoptera (caddisflies)		
Brachycentridae	42	2
Glossosomatidae	1	
Helicopsychidae		1
Hydropsychidae	14	67
Hydroptilidae	1	1
Leptoceridae	1	1
Limnephilidae	1	1
Molannidae	1	
Philopotamidae		38
Polycentropodidae	2	
Uenoidae		1
Coleoptera (beetles)		
Gyrinidae (adults)	1	
Haliplidae (adults)	1	
Elmidae	7	17
Psephenidae (larvae)	1	1
Diptera (flies)		
Ceratopogonidae	1	
Chironomidae	53	42
Culicidae	2	
Simuliidae	15	3

Tipulidae	1	
MOLLUSCA		
Gastropoda (snails)		
Ancylidae (limpets)		1
Lymnaeidae		1
Physidae	3	1
Planorbidae		2
Pleuroceridae		8
Viviparidae	1	
Pelecypoda (bivalves)		
Sphaeriidae (clams)		3
Unionidae (mussels)		1
TOTAL INDIVIDUALS	282	307

	Shiawassee River Parmenter Road 8/18/2015 STATION A		Shiawassee River downstream Corunna Dam 9/17/2015 STATION B	
METRIC	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	35	1	37	1
NUMBER OF MAYFLY TAXA	5	1	6	1
NUMBER OF CADDISFLY TAXA	8	1	8	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1
PERCENT MAYFLY COMP.	19.50	1	28.01	1
PERCENT CADDISFLY COMP.	22.34	0	36.48	1
PERCENT DOMINANT TAXON	18.79	1	21.82	0
PERCENT ISOPOD, SNAIL, LEECH	5.32	0	4.56	0
PERCENT SURF. AIR BREATHERS	9.22	0	1.63	1
TOTAL SCORE		4		5
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT

Table 7 cont. Qualitative macroinvertebrate sampling results for the Shiawassee River watershed targeted sites June-September 2015.

TAXA	Shiawassee River DeVries Nature Center 8/18/2015 STATION C
ANNELIDA (segmented worms)	
Hirudinea (leeches)	1
Oligochaeta (worms)	11
ARTHROPODA	
Crustacea	
Amphipoda (scuds)	24
Decapoda (crayfish)	1
Isopoda (sowbugs)	29
Arachnoidea	
Hydracarina	3
Insecta	
Ephemeroptera (mayflies)	
Baetidae	37
Caenidae	1
Ephemerellidae	1
Ephemeridae	1
Heptageniidae	7
Siphlonuridae	2
Tricorythidae	17
Odonata	
Anisoptera (dragonflies)	
Aeshnidae	1
Gomphidae	1
Zygoptera (damselflies)	
Calopterygidae	1
Coenagrionidae	3
Plecoptera (stoneflies)	
Perlidae	1
Hemiptera (true bugs)	
Corixidae	10
Gerridae	4
Mesoveliidae	5
Trichoptera (caddisflies)	
Brachycentridae	2
Helicopsychidae	1
Hydropsychidae	20
Hydroptilidae	1
Leptoceridae	18
Limnephilidae	6
Philopotamidae	1
Polycentropodidae	1
Lepidoptera (moths)	
Pyralidae	4
Coleoptera (beetles)	
Haliplidae (adults)	1
Elmidae	14
Psephenidae (larvae)	2
Diptera (flies)	
Chironomidae	17
Culicidae	1
Simuliidae	32
Tabanidae	2

MOLLUSCA	
Gastropoda (snails)	
Ancylidae (limpets)	1
Bithyniidae	1
Lymnaeidae	2
Physidae	5
Pelecypoda (bivalves)	
Corbiculidae	1
Pisidiidae	6
Unionidae (mussels)	1
TOTAL INDIVIDUALS	301

Shiawassee River
DeVries Nature Center
8/18/2015
STATION C

METRIC	Value	Score
TOTAL NUMBER OF TAXA	44	1
NUMBER OF MAYFLY TAXA	7	1
NUMBER OF CADDISFLY TAXA	8	1
NUMBER OF STONEFLY TAXA	1	1
PERCENT MAYFLY COMP.	21.93	0
PERCENT CADDISFLY COMP.	16.61	0
PERCENT DOMINANT TAXON	12.29	1
PERCENT ISOPOD, SNAIL, LEECH	12.96	0
PERCENT SURF. AIR BREATHERS	6.98	1
TOTAL SCORE		6
MACROINV. COMMUNITY RATING		EXCELLENT