SECTION 3 - CHARACTERISTICS OF THE WATERSHED

SUBWATERSHEDS

Due to the difficulty in working with a watershed as large as 92 acres, the Shiawassee River Watershed was divided into subwatersheds. Ideally each subwatershed has an area from 2mi^2 to 20mi^2. Geographically there are 3 tributaries along the south and west Genesee County line that were divided along this county border. Although these areas are part of larger subwatersheds, the area remaining in Genesee County had areas smaller than 2mi^2. By dividing a watershed this way, it allows specific areas within the Shiawassee River Watershed to be looked at based on their unique conditions. This assisted with Total Maximum Daily Loads (TMDL) and identifying problems that may be specific to that location. All of the Webb and Jones Creeks within Genesee County are county drains and their watersheds were already defined as existing drainage districts. Most of the Shiawassee River is still a natural watercourse. Whenever possible, within the Shiawassee River Watershed, existing drainage districts were used to divide it into subwatersheds. Areas without a drainage district used contours, whenever possible, to divide districts. Otherwise a jurisdictional boundary was used, when necessary. In total, 13 subwatersheds were developed.

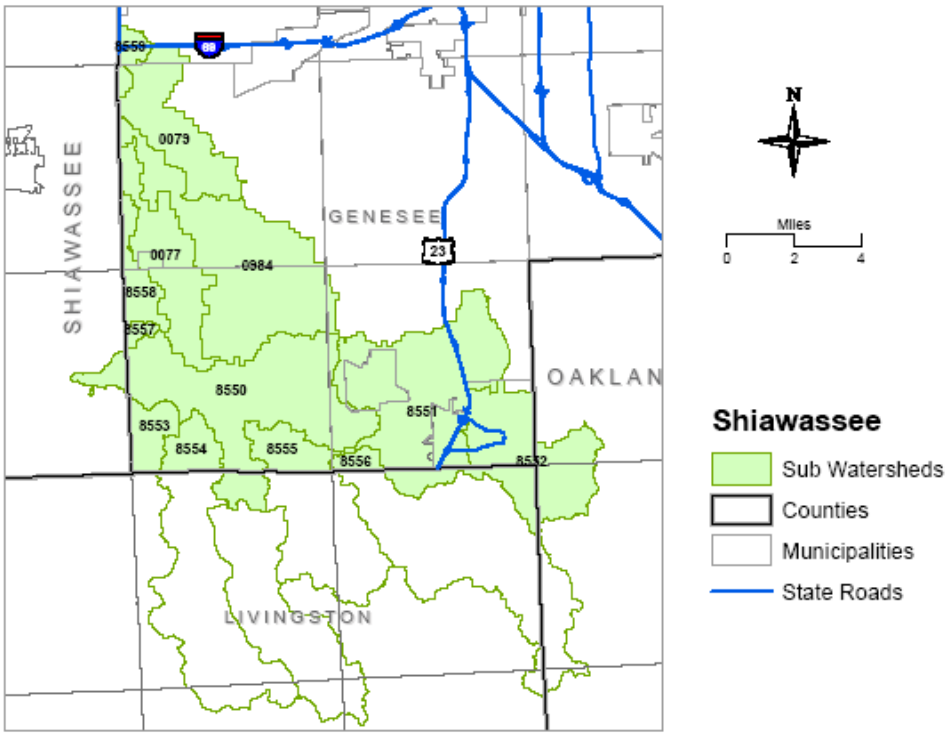


Figure 3-1 Subwatersheds

POLITICAL JURISDICTIONS

Table 3-1 Political Jurisdiction by Subwatershed

		Argentine Twp	Burns Twp	Clayton Twp	Deerfield Twp	City of Fenton	Fenton Twp	Gaines Twp
0984	Jones	8.54					0.42	8.45
0079	Webb			0.58				6.68
8559	Webb outlet 1			0.88				0.35
0077	Corregal Drain	3.54						3.62
	Webb Jones Cr Total	12.08	0.00	1.46	0.00	0.00	0.42	19.10
8550	Shiawassee River 1	14.45	0.72		1.50		2.00	
8551	Shiawassee River 2					2.12	11.97	
8552	Shiawassee River 3					4.50		
8553	Shiawassee South Br	2.43						
8554	Yellow River	2.34						
8555	North Ore Creek	2.72					0.11	
8556	Denton Creek	0.02					0.83	
8557	Shiawassee Outlet 1	0.50						
8558	Shiawassee Outlet 2	1.73						0.82
	Shiawassee Total	24.19	0.72	0.00	1.50	6.62	14.91	0.82
	Shiawassee River Total area in square mile	**36.27**	**0.72**	**1.46**	**1.50**	**6.62**	**15.33**	**19.92**
	% of Watershed	**39.37%**	**0.78%**	**1.58%**	**1.63%**	**7.19%**	**16.64%**	**21.62%**

Shiawassee River Political Jurisdiction by Percentage

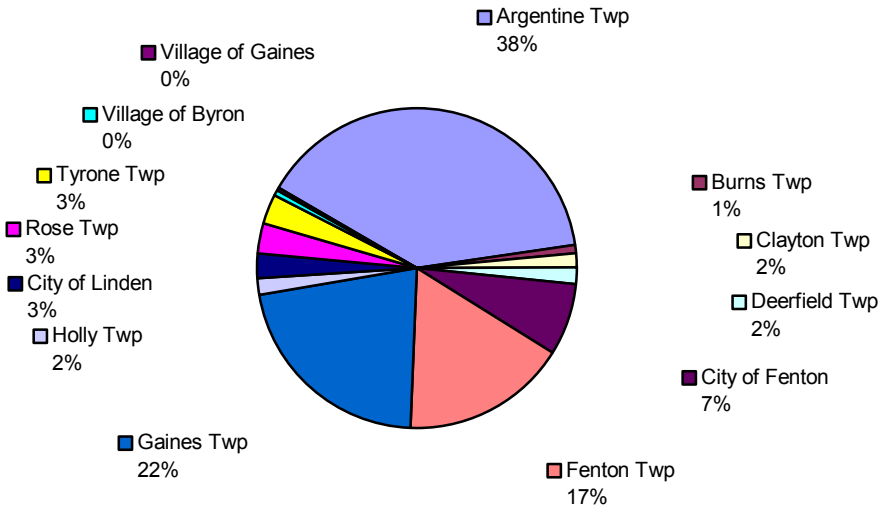


Figure 3-2 Political Jurisdiction by percentage

Holly Twp	City of Linden	Rose Twp	Tyrone Twp	Village of Byron	Village of Gaines	**Total Area in Square miles**	**% of Watershed**
						17.41	**18.90%**
						7.26	**7.88%**
						1.23	**1.34%**
					0.37	**7.53**	**8.17%**
0.00	0.00	0.00	0.00	0.00	0.37	**33.43**	
	0.07			0.27		**19.01**	**20.63%**
	2.35		1.25			**17.69**	**19.20%**
1.54		2.68	1.78			**10.50**	**11.40%**
						2.43	**2.64%**
						2.34	**2.54%**
						2.83	**3.07%**
						0.85	**0.92%**
						0.50	**0.54%**
						2.55	**2.77%**
1.54	2.42	2.68	3.03	0.27	0.00	**58.70**	
1.54	**2.42**	**2.68**	**3.03**	**0.27**	**0.37**	**92.13**	**100.00%**
1.67%	**2.63%**	**2.91%**	**3.29%**	**0.29%**	**0.40%**	**100.00%**	

Political jurisdiction, regarding the Shiawassee River and it's tributaries, are controlled by federal and state laws, county and municipal ordinance, and municipal by-laws. Regulatory and enforcement responsibility for water quantity and quality is multi-layered. Within the Shiawassee River Watershed alone, there are 13 cities, townships, and villages and 4 counties. Of the 13 communities, only 7 are Phase 2 communities.

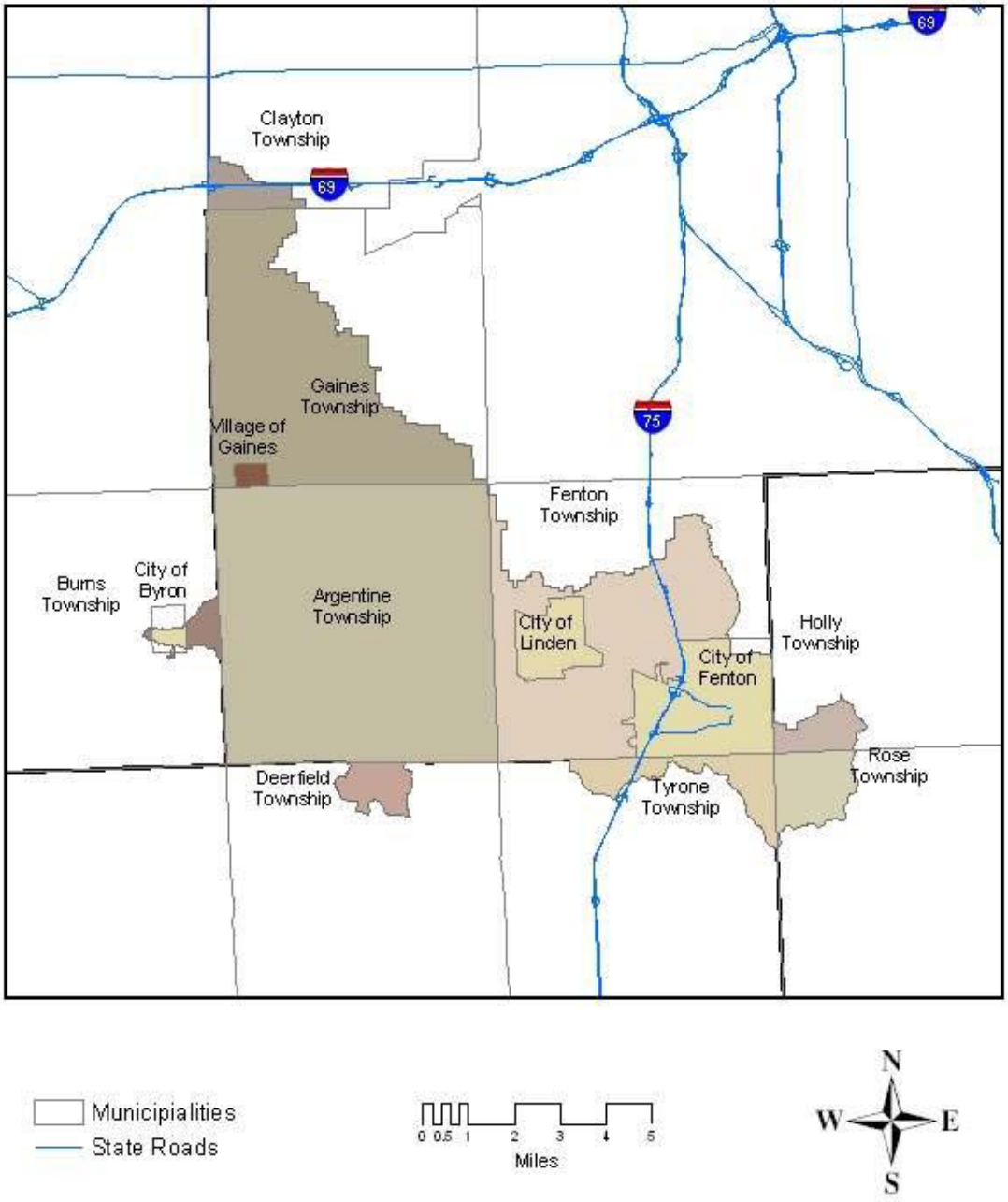


Figure 3-3 Local Units of Government

DEMOGRAPHICS

The Shiawassee River Watershed population has grown in the last 15 years. Although the population has increased in all the municipalities except one, most of that growth has occurred along the major state road corridors. Just within Fenton Township and the City of Fenton borders alone, there has been a population increase of 3858; half of the total population increase. Development has grown along the expressway corridors, outward from the urban areas. Within the last 15 years, the developed area along interstate 23 has been moving south from Flint and north from Ann Arbor within the Shiawassee River Watershed.

Table 3-2 Population Changes

Community	1990 Population within watershed	2000 Population within watershed	% Change from 1990 - 2000	Area within watershed Square Miles
Argentine Township	4,651	6,521	40.2%	36.27
Burns Township	49	58	18.4%	0.72
Clayton Township	356	363	2.0%	1.46
Deerfield Township	120	163	35.8%	1.50
City of Fenton	7,991	10,014	25.3%	6.62
Fenton Township	6,337	8,172	29.0%	15.33
Gaines Township	2,793	3,511	25.7%	19.92
Holly Township	150	306	104.0%	1.54
City of Linden	2,415	2,861	18.5%	2.42
Rose Township	365	460	26.0%	2.68
Tyrone Township	565	697	23.4%	3.03
Village of Byron	205	213	3.9%	0.27
Village of Gaines	427	366	-14.3%	0.37
Total	**26,424**	**33,705**		**92.13**

U.S. Census Bureau Data,

LAND USE AND GROWTH TRENDS

Land Cover – Past, Present and Future

Prior to European settlement of the area, vegetation of the Shiawassee River Watershed consisted of predominantly forested land with Beech-Sugar Forest (sugar maple, basswood, red oak, and white ash) to the north, in Gaines Township, and Oak-Hickory Forest (red oak, white oak, hickory) in the south of Genesee County, Livingston County and Oakland County. Large isolated pockets of Mixed Oak Savannah were present in the southeast quarter of Argentine extending into Fenton Township and along the south City of Fenton and Tyrone Township border. Pockets of forested swamps were scattered throughout Argentine and Fenton Township, although this watershed contains large areas of lakes and wetlands, many of these lakes were either created or enhanced after settlement through the use of lake levels controls.

When the first European explorers entered this area after the war of 1812, they found it populated by Chippewa and Ottawa Indians, with the Chippewas being more numerous (Ellis 1879). However, Chippewa history tells that when they came into the area the Sauks and Onottoways inhabited the valley. Indian villages and encampments developed along the River from Saginaw Bay. So attached were the Indians to this "Land of Lakes" on the Shiawassee that it was their desire to be laid to rest on the border of the lake. Multiple burial grounds were found, the principle one on Mudd Lake.

When Settlers moved into the Shiawassee River watershed, they found a land rich with lakes and plentiful game. Many settlers, mostly from Wayne County, Oakland County and New York State, relocated to the area in the mid 1830's. Fenton was briefly named Dibbleville after it's first settler. Two years later he sold it to William Fenton and Robert LeRoy, and the settlement was known as Fentonville before finally, as we know it today, as the City of Fenton. West of Fenton, Linden was called Warner's Mill until 1840. The Mill still stands and is known as Linden Mill.

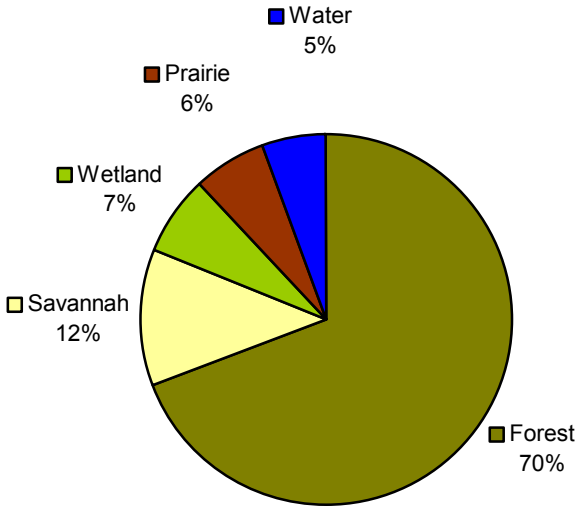


Figure 3-4 Ecosystems, circa 1830s by percentage

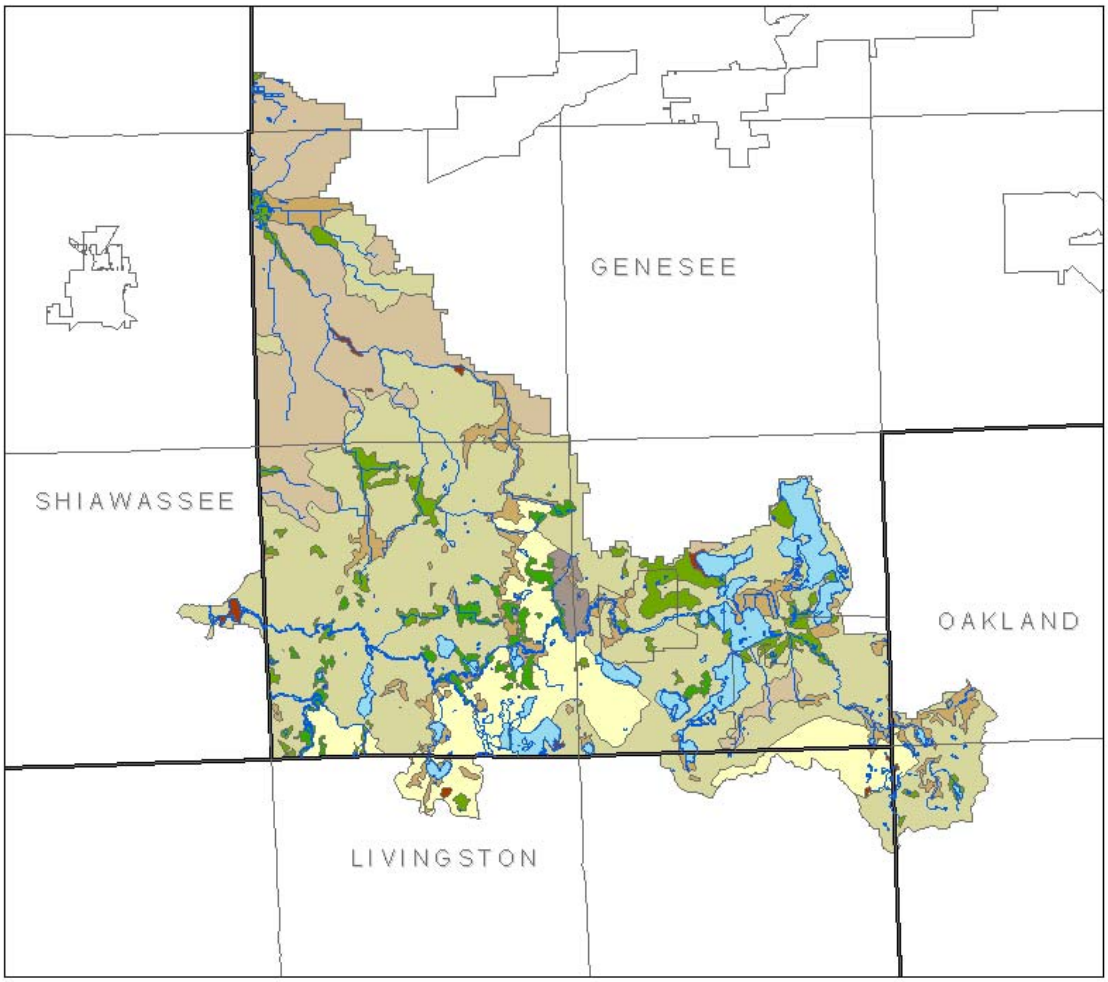


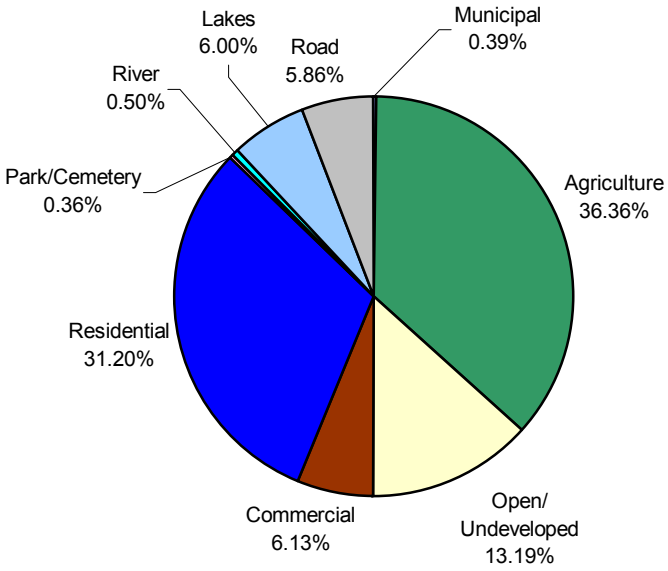
Figure 3-5 Ecosystems, circa 1830s

Settlers' spread out within the area purchasing 40 acre to 240 acre plots for farmland. Several mills were built along the Shiawassee River, performing necessary services such as cutting lumber or grinding grain (grist). Permanent human settlement brought great change to the landscape as the land began to be altered for human benefit. Although Michigan was primarily an agricultural state before the Civil War, lumbering became the principal economic activity in the new state during the second half of the 19th century (Fitting 1975). Other changes included the building of the Detroit and Milwaukee Railroad through Fenton, Linden and the Village of Gaines, this helped establish these as areas of commerce in an agriculturally dominated watershed. Growth was also encouraged nearly 100-years later with the construction of a new highway, US 23, was built to improve the connection between Flint and Ann Arbor.

Localized areas were experiencing growth through residential development concentrated around the lakes. Despite slow but steady growth, half of the watershed remains agricultural or undeveloped.

Figure 3-6 Current Land Cover by percentage

Current land use for Genesee was determined by using the assessment classification for each parcel of land. Open/ Undeveloped areas are undeveloped residential and commercial properties. Parkland was to be considered municipal owned parks. Cemeteries could be public or privately owned. Golf courses are considered developed commercial property. Within Oakland, Livingston and Shiawassee Counties, the land use was determined using the aerial and land cover maps.



There is no consistent source for future land cover within the Shiawassee River Watershed. The Genesee County Land Bank has been compiling a comprehensive inventory of Master Plans and Ordinances for Municipalities within Genesee County. The inventory covers all ordinances, including environmental. This can provide a resource to measure a community's ordinance for effectiveness against what other communities are doing. This inventory will be made available once it is complete.

Each Municipal Master Plan may have a future land use. It may be for ultimate build out or for a defined period of time. Currently there is no standardized method for classifying current or future land use among the municipalities. Following is a list of Community Master Plans with future land use and when they were prepared. Each community has their master plan on file.

1989
Village of Byron

2000
Burns Township

2001
City of Linden
Clayton Township

2002

Fenton Township
Tyrone Township

2004
Holly Township
City of Fenton

2005
Rose Township

2007
Gaines Township

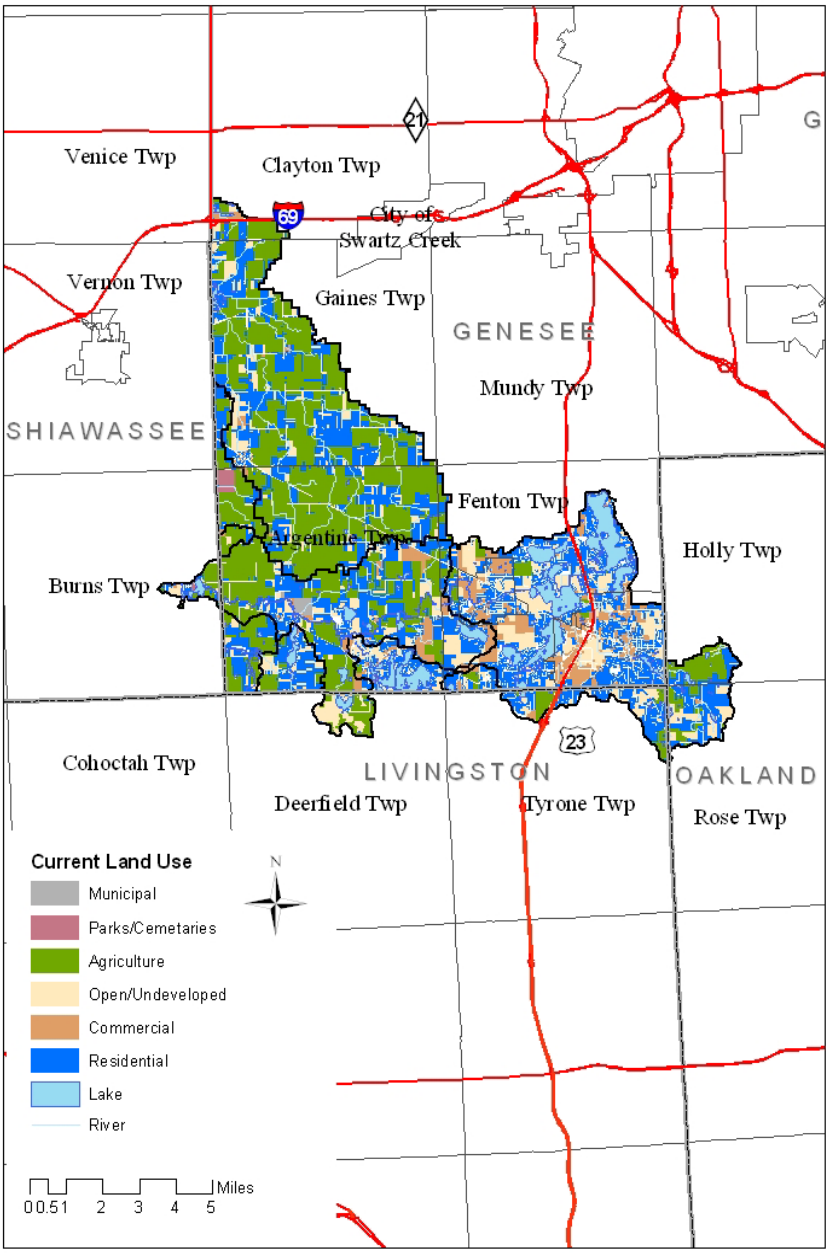


Figure 3-7 Current Land Covers

Urbanized Land Use

Within the Shiawassee River Watershed the largest increases to population within the watershed have been along the state road corridors. When comparing the individual communities current land uses to future land use, many areas that are current open areas or agriculture are classified in the future land use as residential or commercial. Many of the open/undeveloped areas in figure 3-7 are already zoned and assessed as residential or commercial but as of 2003, they have not been developed.

Agricultural Land Use

Around the edges of the Shiawassee River Watershed, the land becomes more agricultural. According to the USDA office the 2 predominant cash crops are corn and soybean. On a much smaller scale other cash crops within the watershed are hay, wheat, and small grains.

Based on conversations with the local USDA office, of the 15 diary operations in Genesee County, approximately 1 of them are within the Shiawassee River. Most of the dairy farms have an average of 50-150 head with the largest operation being 250 head of cattle.

The census of agricultural data for the table below is based on the entire Shiawassee River Watershed.

Within the Shiawassee River Watershed, as we defined here, there are no known Concentrated Animal Feeding Operations (CAFO's). A CAFO is an agricultural business where animals are raised in confined situations and fed an unnatural diet, instead of allowing them to roam and graze.

Table 3-3 Livestock in the Shiawassee River Watershed

Beef Cattle	159
Dairy Cattle	222
Swine	29
Sheep	184
Horse	475
Chicken	871
Turkey	119

USDA Census of Agriculture 2002

Riparian Buffer

Studies of impervious cover impacts to surface waters indicate that one of the key variables influencing watershed response is the presence or absence of an intact (wooded) riparian corridor or buffer. These riparian buffers act as a filter for storm water entering the stream corridor through overland flow. The riparian buffers are able to reduce erosive water velocities; extract sediment, nutrients, and other contaminants; and allow additional storm water to be infiltrated into the soil.

Within the Shiawassee River Watershed, any conservation practices along watercourses or lakes are done voluntarily or through an agriculture stewardship program.

Currently Buffer strips along sensitive areas are recommended as a Best Management Practice (BMP), but there are no current requirements. Within the Action Plan in Chapter 8 there is an action item to draft a buffer strip ordinance.

Wetlands

Wetlands can play critical roles in flood storage, nutrient capture, and water quality protection and, as part of a healthy riparian corridor, may dampen the effects of added impervious cover such as pavement, within the watershed. Important wetland functions and values include:

- Flood prevention and temporary flood storage, allowing the water to be slowly released, evaporated, or percolate into the ground and recharging groundwater.
- Sediment capture and storage.
- Wildlife habitat for a wide diversity of plants, amphibians, reptiles, fish, birds, mammals, and related recreational values.
- Water quality improvement by filtering pollutants out of water.
- The support of approximately 50 percent of Michigan's endangered or threatened species (Cwikiel, 2003).

There are not any local wetland inventories or assessments. The National Wetland Inventory maps are produced by the U.S. Department of Interior, Fish and Wild Life Division. These maps show where wetland's could be. The Michigan Department of Environmental Quality (MDEQ) reviews sites as they are developed to certify or evaluate the presence and limits of a wetland. A wetland is regulated under the MDEQ if it is more than 5 acres or within 500 feet of an inland lake or stream. The Drain Commissioner's Office has on file MDEQ permits and wetland assessments for individual development properties that have been submitted for review. This information has not been compiled.

Another action item that is being proposed is to identify existing floodplains and wetlands that will then be ranked for value. This would allow a mechanism to choose which areas need to be protected first.

As the following map shows, most of the wetlands are concentrated along and around the streams, rivers and lakes. The wetlands on the following map were identified in the Wetland Inventory Map from 1979. By then, much of the land within the watershed had already been altered through agricultural development.

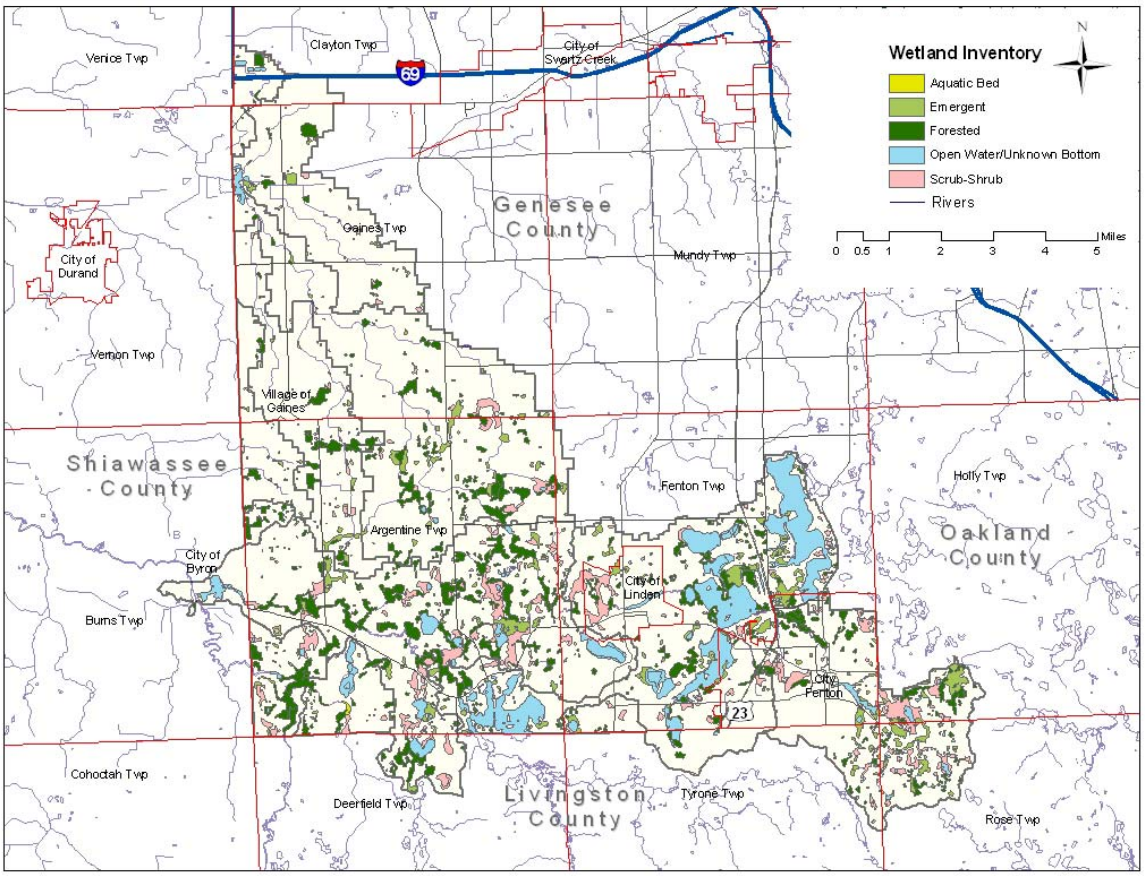


Figure 3-8 Wetlands
Source: National Wetland Inventory

CLIMATE AND TOPOGRAPHY

Table 3-4 Temperature & Precipitation

	Average High	Average Low	Average Precipitation	Record High	Record Low
January	29°F	13°F	1.57 in	65°F (1950)	-25°F (1976)
February	32°F	15°F	1.35 in	63°F (1984)	-22°F (1967)
March	43°F	24°F	2.22 in	78°F (1990)	-12°F (1978)
April	56°F	34°F	3.13 in	87°F (1990)	6°F (1982)
May	69°F	45°F	2.74 in	93°F (1988)	22°F (1966)
June	78°F	55°F	3.07 in	101°F (1988)	33°F (1998)
July	82°F	59°F	3.17 in	101°F (1995)	40°F (1965)
August	80°F	58°F	3.43 in	98°F (1988)	37°F (1982)
September	72°F	50°F	3.76 in	97°F (1953)	26°F (1991)
October	60°F	39°F	2.34 in	89°F (1963)	19°F (1974)
November	47°F	30°F	2.65 in	79°F (1950)	-7°F (1949)
December	34°F	19°F	2.18 in	67°F (1982)	-12°F (1989)

The Shiawassee River Watershed is predominantly made up of gently rolling hills with large relatively flat areas. The highest elevation is in Holly Township at 1150 feet above sea level, per the USGS 5' contour map. The Shiawassee River travels westerly through Genesee County and into Shiawassee County. The Shiawassee River converges with the south branch outlet in Burns Township where the lowest elevation is 760 feet.

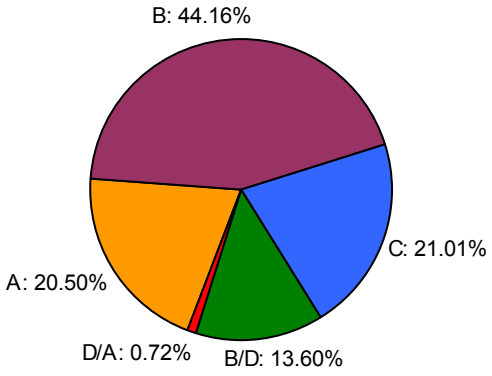
GEOLOGY AND SOILS

Several ice sheets advanced over Mid Michigan and retreated during the glacial period. The most recent ice sheet or glacier was during the late Wisconsin glacial period, some 9,000 or more years ago. Soon after, the Shiawassee River Watershed emerged from the retreating Saginaw ice lobe. The lobe halted and built the Fowler Moraine. This moraine starts in Lapeer County, continues southwesterly across Genesee County until it reaches the western part of Grand Blanc Township, and then turns west. Melt waters from the ice lobe were dammed up by the Portland Moraine, and following the path of least resistance, they flowed westward to form the Shiawassee River. This would be the northeast border of the Shiawassee River Watershed. The lakes of this region were also formed from melt water.

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geological forces. The characteristics of a soil are determined by 1) the physical and mineral composition of the parent material; 2) the climate under which the soil material has accumulated and existed since accumulation; 3) the plant and animal life on and in the soil; 4) the relief or lay of the land; 5) the length of time the forces of soil development have acted on the soil material.

The Shiawassee River Watershed is made up of the following soils.

Figure 3-9 Hydrologic Soil Groups by percentage



SPINKS-HOUGHTON-BOYER (MI014)	3.87%
BOYER-OAKVILLE-COHOCTAH (MI024)	16.63%
MIAMI-SPINKS-OAKVILLE (MI015)	16.91%
MIAMI-CONOVER-BROOKSTON (MI017)	1.07%
MIAMI-HILLSDALE-EDWARDS (MI023)	21.55%
MARLETTE-CAPAC-PARKHILL (MI035)	0.86%
MARLETTE-CAPAC-SPINKS (MI036)	3.77%
CONOVER-BROOKSTON-PARKHILL (MI025)	13.60%
LENAWEE-DEL REY-KIBBIE (MI009)	21.01%
HOUGHTON-CARLISLE-ADRIAN (MI022)	0.72%

The USDA Natural Resources Conservation Service (Formerly the Soil Conservation Service) produced a soil survey for each county. The survey has classified and named the soils. Adjacent soils have been grouped into soil associations based on their landscape that has a distinctive proportional pattern of soils. These soil associations are useful for a general idea of what kinds of soils are present over a large area. Each soil has a corresponding hydraulic classification ranging from A-D and is referred to as hydraulic soil groups. The hydraulic soil groups are defined as:

A: (low runoff potential). Soils having high infiltration rate even when thoroughly wetted and consisting chiefly of deep, well to excessively drained soils with moderately fine to moderately coarse texture.

B: Soils having a moderate infiltration rate when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse texture.

C: Soils having a slow infiltration rate when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water or soils with moderately fine to fine textures.

D: (High Runoff potential). Soils having a very slow infiltration rate when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material.

HYDROLOGY

The Shiawassee River Watershed contains 91 lakes, (1 acre or larger) covering approximately 3509 acres. The largest of these lakes are Fenton Lake, Lobdell Lake, Silver Lake, and Lake Ponemah. Also the Shiawassee River Watershed has more than 234 miles of rivers, creeks and drains. Of the larger watercourses that have base flow all year long there is the Main Shiawassee, the Jones Creek and Webb Creek. Each of these watercourses is fed through a series of swales, road ditches, county drains, and underground pipes. Many of the smaller drains and watercourses have intermittent flow and are dry most of the time. Many of the watercourses have been dedicated as county drains over the years and have had maintenance done on them. As areas are developed, it is common for enclosures to be placed to cross the drain watercourse or sometimes relocations are made. Some of the drains that have been petitioned for are entirely man made, meaning a ditch may be constructed where one did not exist before or a new storm system is placed in pipes. Historically, since large areas of the Shiawassee River Watershed were agricultural, there are many unmapped private farm tiles that drain low areas within the watershed.

There are four characteristics to hydrology, which become important for a watershed plan: **volume, peak flow, time to peak** (flashiness), and **frequency of flows** (particularly bankfull conditions). Development typically increases the volume, the peak, and the frequency and decreases the time to peak.

The USGS has no stream gauges within this watershed. The closest stream gauge is located in Owasso on the main channel of the Shiawassee. Although we are unable to measure the flow in the river, several observations can be made. Within this watershed there are over 5 Mi^2 of lakes and almost as many wetlands. Most of the large lakes have a dam or impoundments that control the water level. The lakes and wetlands, making up a large percentage of this watershed, help to provide: Storage for rain events and since the water is being released over a longer period of time, a stable base flow for habitat.

Development in a watershed changes the hydraulic characteristics. Urbanization tends to fill in low areas, that previously provided storage and pave over pervious areas, that had provided infiltration into the soil. Less flow is available to recharge ground water. Storm sewer pipe systems along with curb and gutter speed up how fast the water is concentrated and transported to the outlet. These activities change the four characteristics to hydrology. **Volume** and the **peak flow** are increased. **The time to peak** occurs quicker, and smaller rain events produce a larger frequency of flows. In addition, channels experience more bankfull flood events each year and are exposed to critical erosive velocities for longer intervals. This is a problem because stream flow is linked to and regulates ecological integrity. Changes in stream flows and flow regimes limit and sometimes eliminate many aquatic species within a stream system. Flow stability is critical to support balanced diverse fish communities and is an important component of habitat suitability.

The physical, chemical, and biological integrity of a given stream system has been shown to be strongly correlated to the amount of impervious cover (the area covered by rooftops, streets, parking facilities, and other hard surfaces) in the subbasin or watershed (Schueler, 1994). Imperviousness appears to be one of the principal indicators of watershed “health,” and analysis of stream systems across the country seems to indicate that there are thresholds at which watershed imperviousness results in degradation of water quality and physical stream processes.

The conversion of natural landscapes (i.e. farmland, forests, and wetlands) into urban landscapes creates a layer of impervious surface. Urbanization has a significant impact on hydrology, morphology, water quality and ecology of surface waters. The amount of impervious cover in a watershed can be used as an indicator to predict how severe differences are in character of urban watersheds and natural watersheds.

In natural settings, there is very little runoff, with most of the rainfall being filtered by the soils, and supplying deep-water aquifers. In urbanized areas, however, less and less rainfall is infiltrated, and as a result, less water is available to streams. Additional changes in urban streams, due to increased impervious cover, includes enlarged

channels, upstream channel erosion contributing greater sediment load to the stream, in stream habitat structure degrades and declining water quality.

“Even small increases in impervious, change stream morphology and degradation of aquatic habitat. The relationship between impervious cover and subwatershed quality can be predicted by a simple model, projecting current and future quality of streams and other water resources.” (CWP)

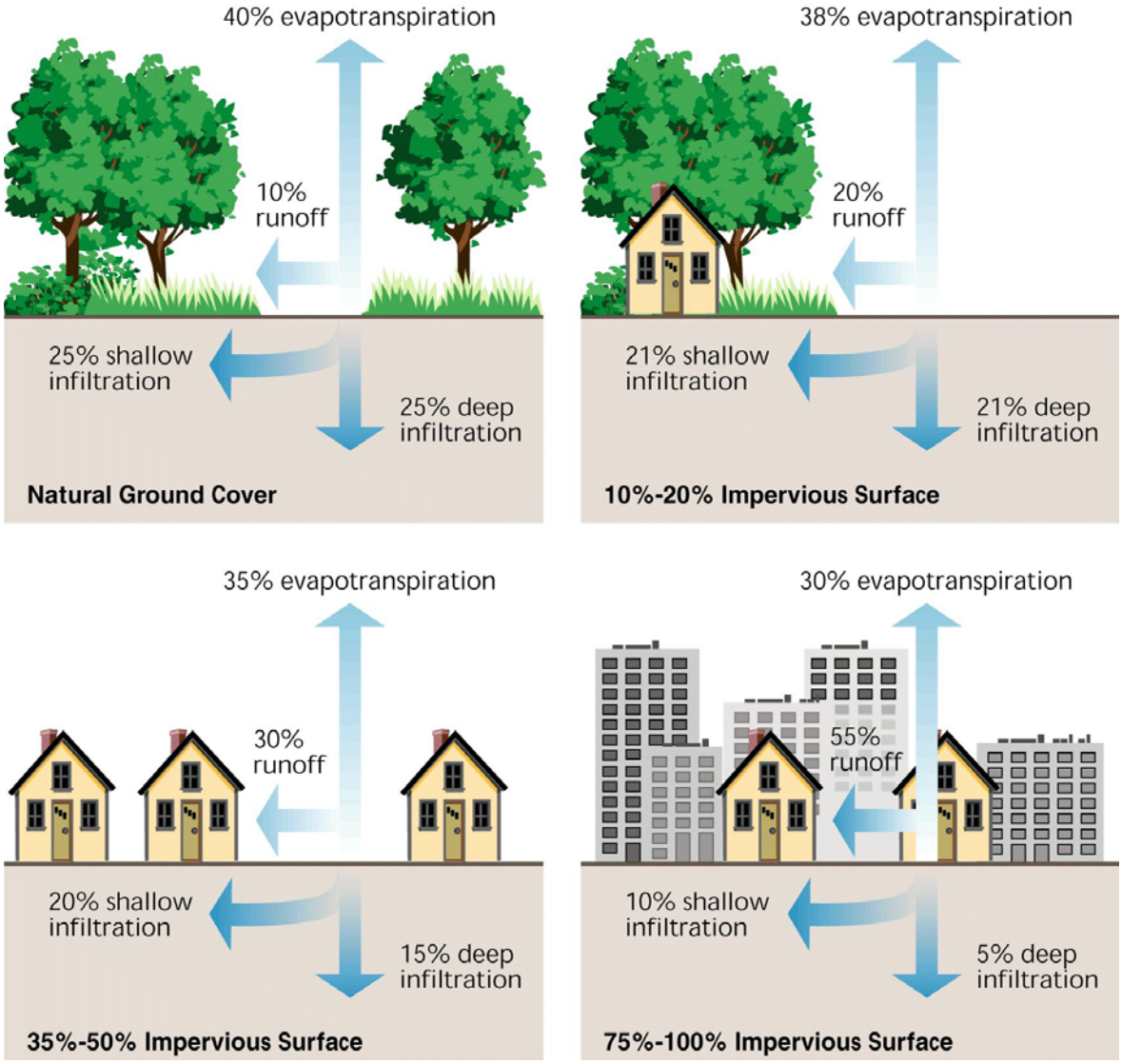


Figure 3-10 Effect of urbanization on runoff
Source: FISRWG, 1998

Research indicates that zones of stream quality exist, most noticeably beginning around 10% impervious cover, with a second threshold appearing at around 25-30% impervious cover. These thresholds are powerfully modeled in the Impervious Cover Model, classifying streams into three categories, sensitive, impacted, and non-supporting. Watersheds with less than 10 percent imperviousness appear to exhibit natural chemical, physical, and biological quality. Between 10 and 25 percent imperviousness river systems show signs of degradation. Beyond 25 percent imperviousness, the damage to physical, chemical, and biological integrity may be irreversible. It is important to understand the Impervious Cover Model, a powerful model predicting quality of streams based on impervious cover change, is not without its limitations. (Schueler, 1994).

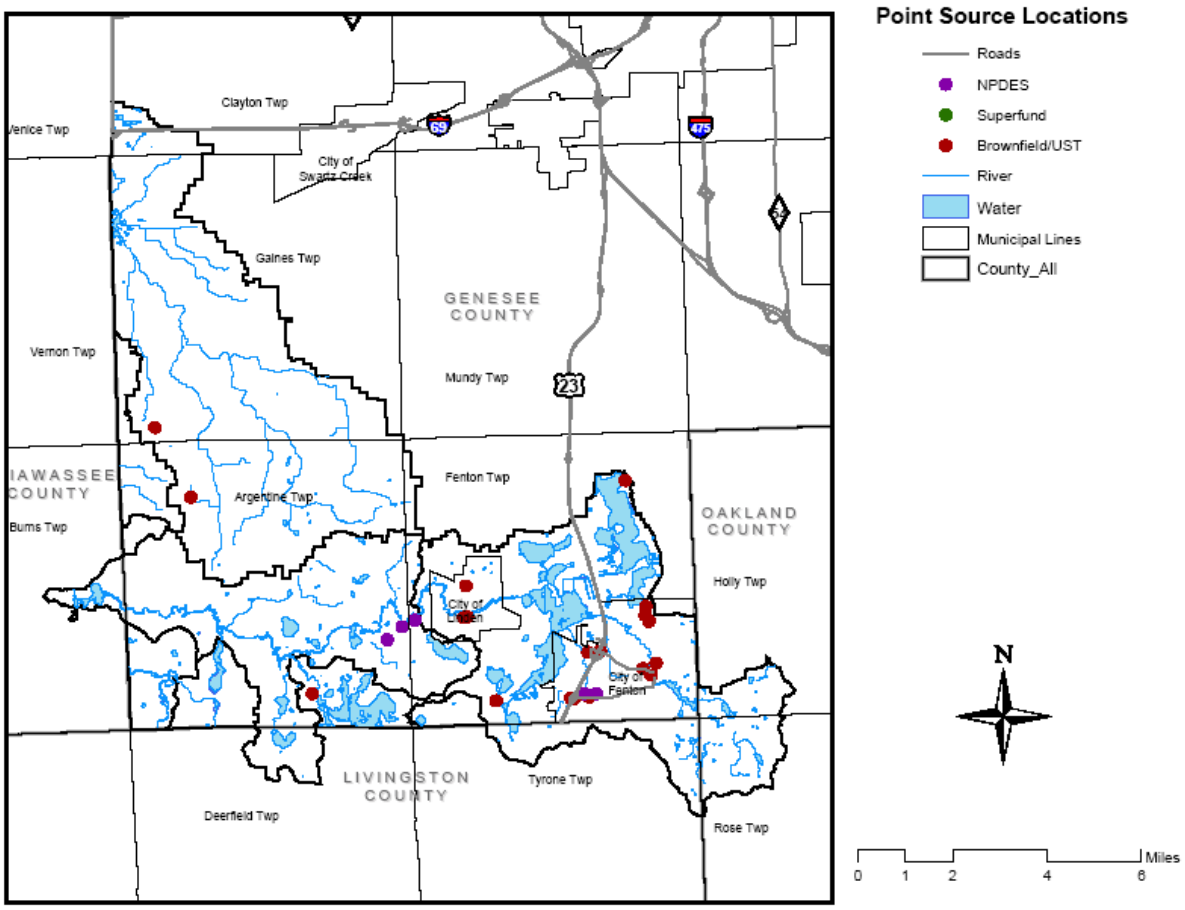


Figure 3-11 Point Sources

POINT SOURCES OF POTENTIAL POLLUTANTS

Table 3-5 Point Sources

Description	Permit #	Owneship	Status	Sub-Watershed	Municipality	Receiving Waters
Active Superfund Sites						
Active Brownfield LUST UST						
Newcor, Inc.	25000342	Private	Inactive	8552	Fenton	Shiawassee River
Kovacs, Emil	1474	Private	Open	8555	Linden	North Ore
Vek's Auto Service	3770	Private	Open	8552	Fenton	Shiawassee River
1st United Methodist Church	41787	Private	Open	8552	Fenton	Shiawassee River
Proposed Fenton Fire Station	41082	Private	Open	8552	Fenton	Shiawassee River
Action Auto #7	12970	Private	Open	8552	FENTON	Shiawassee River
Clark Service Station #824	12190	Private	Open	8552	West Bloomfiel	Shiawassee River
Total Station #2023	16380	Private	Open	8552	San Antonio	Shiawassee River
Genesee County Linden Park	14946	Public	Open	8550	Flint	Shiawassee River
Exit 80, Inc.	7061	Private	Open	8552	Fenton	Shiawassee River
Nagy Excavating Inc.	9805	Private	Open	8551	Fenton	Shiawassee River
Best Self Storage	50001646	Private	Open	8552	Unknown	Shiawassee River
Waldon. Melvin	50001222	Private	Open	8552	Unknown	Shiawassee River
Cms Fenton Bulk Plant	13384	Private	Open	8552	Lapeer	Shiawassee River
Fisherman's Landing	50001992	Private	Open	8551	East Lansing	Shiawassee River

Lake Side Party Store	18485	Private	Open	8551	Fenton	Shiawassee River
Quick Sav Foods Stores #30	10887	Private	Open	8551	Flushing	Shiawassee River
Langs Marine	5159	Private	Open	8551	Fenton	Shiawassee River
Fenton Township Fire Department	14953	Public	Open	8551	Fenton	Shiawassee River
Montrose Express	00014012	Private		8551	Montrose	Shiawassee River
Knight Enterprises K-78	00004159	Private		8551	Fenton	Shiawassee River
Speedway #8405	00008917	Private		8551	Fenton	Shiawassee River
Speedway #5509	00016617	Private		8551	Fenton	Shiawassee River
Owen Rd BP	00005664	Private		8551	Fenton	Shiawassee River
Fenton Area Public Schools	00040760	Public		8551	Fenton	Shiawassee River
Nasser Inc	00033413	Private		8555	Linden	North Ore
Fenton Co (M22215)	00041467	Private		8552	Fenton	Shiawassee River
Revana Gaz Station	00008551	Private		8552	Fenton	Shiawassee River
Mr J's Petroleum Inc	00012190	Private		8552	Fenton	Shiawassee River
Auto City Service	00040524	Private		8551	FENTON	Shiawassee River
Exit 80 Inc	00007061	Private		8552	FENTON	Shiawassee River
#39 North Fenton Mgmt	00019465	Private		8552	Fenton	Shiawassee River
Fairbanks Marathon Station	00003005	Private		8551	Linden	Shiawassee River
Quick-sav #8	00002778	Private		8551	LINDEN	Shiawassee River
Leroy Investment LLC	00034344	Private		8552	Fenton	Shiawassee River
Mobil 1-Stop Food Store	00000505	Private		8552	Fenton	Shiawassee River
Fire Station #2	00036539	Public		8551	Flint	Shiawassee River
Sill Farms	00002732	Private		0077	Gaines	Webb- Jones
Charter Twp Of Fenton	00014953	Private		8551	Fenton	Shiawassee River
Village Of Gaines Fire Dept	00008642	Private		0077	GAINES	Webb- Jones
Active NPDES						
Atlas Tech-Copper Ave-Fenton	MIS210773	Private		8551	Fenton	Shiawassee River
Ring Screw LLC-Fenton Oper	MIS210250	Private		8551	Fenton	Shiawassee River
Laidlaw Transit-Linden	MIS210160	Private		8550	Linden	Shiawassee River
GCRC-Linden Maint Garage	MIS210001	Public		8550	Linden	Shiawassee River
Genesee Co #3 WWTP	MIS710019	Public		8550	Linden	Shiawassee River

Data from USEPA National Priorities list; MDEQ Brownfields- USTfields Database; MDEQ Active NPDES permits list.

Note: Although there are no Superfund sites within this Watershed boundary, there is a Superfund site upstream in the South Branch of the Shiawassee that affects the water quality of the stream. Table 4-1 has the fish advisories on the South Branch of the Shiawassee River and the Main Shiawassee River, due to the presence of *PCB's*.

SEWER AND SEPTIC SYSTEM SERVICE AREAS

Wastewater is dealt with by either a system of sanitary sewers leading to a wastewater treatment plant or by on-site sewage disposal systems (OSDS). On-site sewage disposal systems typically include a septic tank and an absorption field. OSDS typically serve single-family residences in less urbanized settings, although community septic systems are becoming more common in newer developments. The Sewer Service Areas Map Figure 3-11 depicts the areas within the watershed that currently have access to sanitary sewers in 2006.

Within Genesee County the sanitary sewer systems had been predominantly constructed since 1960's. This system has been extended into Oakland County & Livingston County to serve isolated developments.

If properly designed, constructed and maintained, both OSDS and sanitary sewers can provide for disposal of sewage in a safe and environmentally responsible manner. If either type of system fails, inadequately treated sewage can be a threat to aquatic ecosystems and human health due to harmful bacteria and excess nutrients. Along with regulation, education is often considered central to addressing potential issues with OSDS. Owners, particularly those moving from areas with sanitary sewers to those with

OSDS, often have limited understanding of the functioning and maintenance of OSDS. This lack of knowledge can lead to poor function and premature failure, leading to contamination of the ground and surface waters. Several action items in chapter 8 have been proposed to address both municipal sanitary and OSDS.

The installation and maintenance of septic systems within the watershed are regulated by the Health Departments of each County; however in Genesee County there is no system currently in place to monitor the functioning and maintenance of these systems following installation.

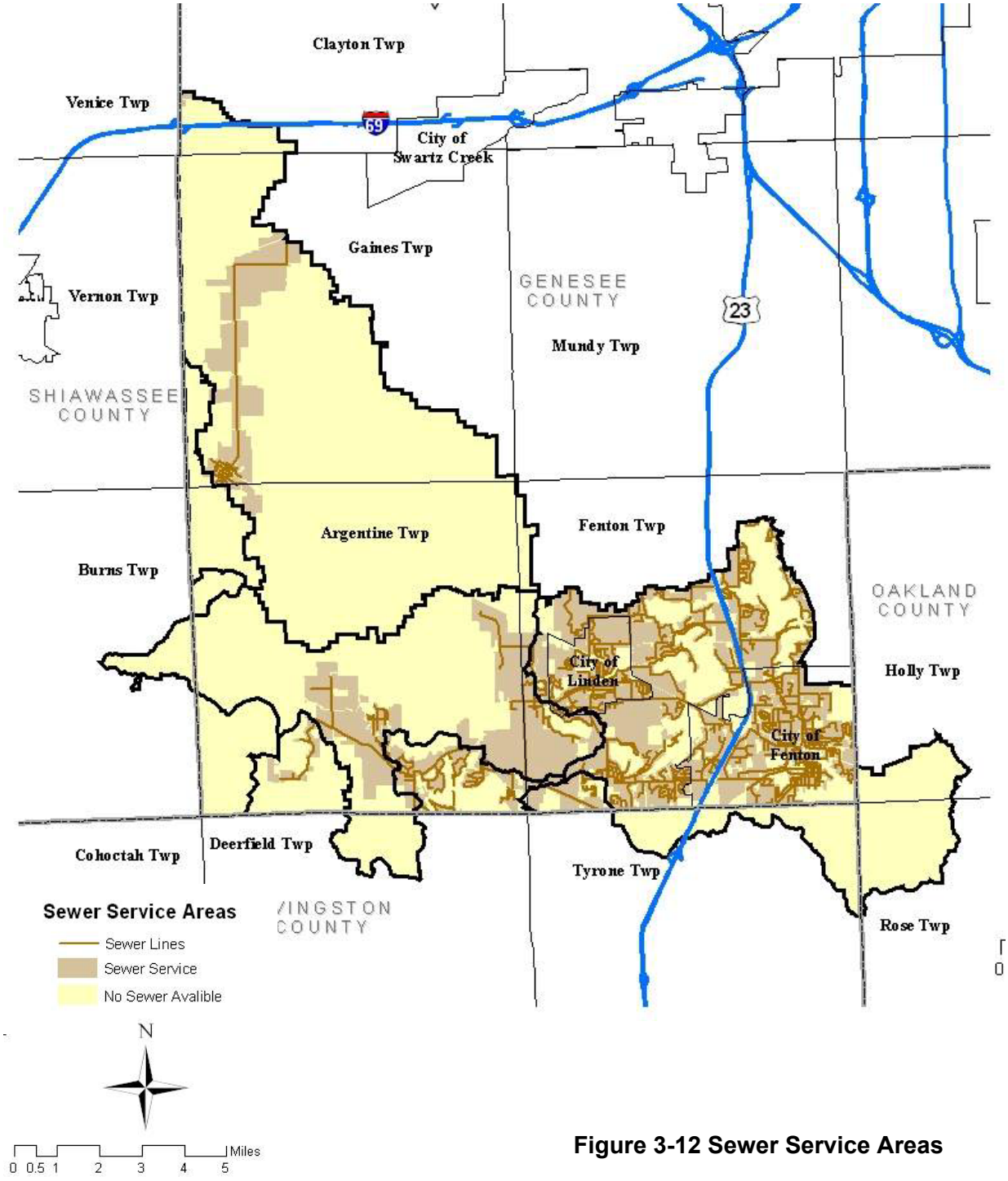


Figure 3-12 Sewer Service Areas

SIGNIFICANT NATURAL FEATURES TO BE PROTECTED

Michigan has a number of significant natural features located across the State. These natural features can provide a number of public benefits, which may include recreation, bird watching, hunting, fishing, camping, hiking, off-roading, and water sports. These areas also include critical habitat for different species of plants, mammals, amphibians, reptiles, birds, fish, and macroinvertebrates.

The Michigan Department of Natural Resources provides information on threatened and endangered species in Michigan by watershed. This work is coordinated by the Michigan Natural Features Inventory.

A species is classified as **endangered** if it is near extinction throughout all or a significant portion of its range in Michigan.

A species is **threatened** if it is likely to become classified as endangered within the foreseeable future, throughout all or a significant portion of its range in Michigan.

A species is of **special concern** if it is extremely uncommon in Michigan or if it has a unique or highly specific habitat requirement and deserves careful monitoring of its status. A species on the edge or periphery of its range that is not listed as threatened may be included in this category along with any species that was once threatened or endangered but now has an increasing or protected, stable population.

A species is **extinct** if it can no longer be found anywhere in the world. An **extirpated** species is one, which doesn't exist in Michigan, but can be found elsewhere in the world.

A species is **stable** if it is not included in the above categories and the population is not declining drastically. A stable species is breeding and reproducing well enough to maintain current population in a given area.

Table 3-6 shows the species of plants and animals, which are listed as threatened, endangered, or of special concern. Since the watershed has experienced urbanization and population growth, certain types of land are less common than in the past. In order to protect these areas and species, sensitive areas in the watershed have been identified.

This list is based on known and verified sightings of threatened, endangered, and special concern species and represents the most complete data set available. It should not be considered a comprehensive listing of every potential species found within a watershed. Because of the inherent difficulties in surveying for threatened, endangered, and special concern species and inconsistent of inventory effort across the State species may be present in a watershed and not appear on this list.

Table 3-6 Threatened and Endangered Species

Scientific Name	Common Name	Federal Status	State Status
Angelica venenosa	Hairy Angelica		SC
Clemmys guttata	Spotted Turtle		T
Cypripedium candidum	White Lady-slipper		T
Emys blandingii	Blanding's Turtle		SC
Great Blue Heron Rookery	Great Blue Heron Rookery		
Intermittent wetland	Infertile Pond/marsh, Great Lakes Type		
Microtus pinetorum	Woodland Vole		SC
Morus rubra	Red Mulberry		T
Myotis sodalis	Indiana Bat or Indiana Myotis	LE	E
Oarisma poweshiek	Poweshiek Skipperling		T
Prairie fen	Alkaline Shrub/herb Fen, Midwest Type		
Sistrurus catenatus catenatus	Eastern Massasauga	C	SC

(Source: Michigan Natural Features Inventory)

Key: SC = Special Concern E = Endangered T = Threatened
PE = Proposed Endangered C2/C3 = Candidate

Threatened and endangered species information was taken from the Michigan Natural Features Inventory. Those animals/plants listed above are within the Shiawassee River Watershed. As shown in Figure 3-13 the areas where these plants and animals are found are along the south and west watershed lines.

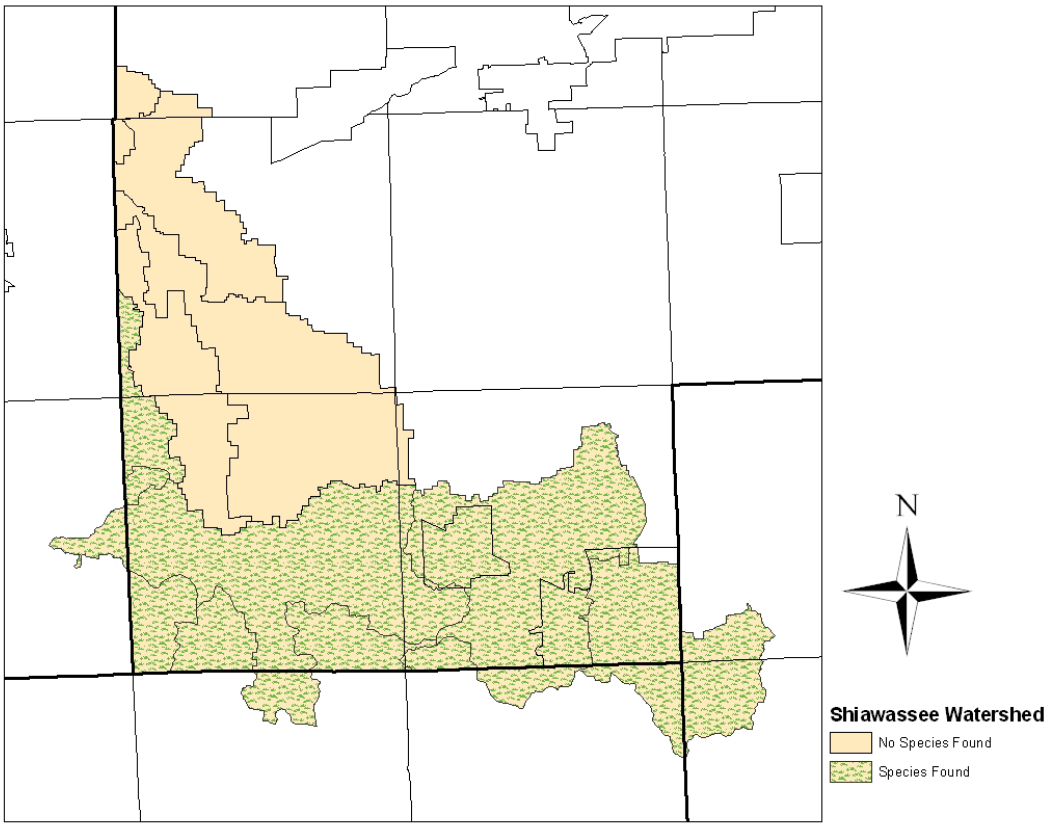


Figure 3-13 Natural Features Area(s)