SECTION 4 - WATER QUALITY INDICATORS

RIVERINE HABITAT STUDIES

Fisheries Studies

The original fish communities of the Great Lakes region are of recent origin. Melt water from the Wisconsinan glacier created aquatic environments for fish. Original fish gained access through migration from connecting waterways. A description of the fish community in the Flint River Watershed at the time of European settlement (early 1800's) is not available. However anecdotal accounts of the time mention several species. Surveys on the Flint River and several tributaries in 1927 provide a reasonable account for additional indigenous fish species (MDNR, Fishery Division). Seventy-seven species are believed to indigenous to the Flint River Watershed. The Original fish habitat of the Flint River watershed has been greatly altered by human settlement. The 1900's gave rise to the industrial era and the urbanization of the Flint River watershed. City's and towns located near the river became more developed as their population increased. The discharge of human wastes and synthetic pollutants into the river degraded water quality to the extent that only the most tolerant fish species could survive. Dams were built for flood control, flow augmentation, and water supply to municipalities and industry. The biologic communities in the Flint River and its tributaries have improved significantly since the 1970's with water quality improvements. Continued efforts to improve water quality will most probably result in greater biological integrity. Although 77 species of fish remain present, at least 5 fish species that once used the Flint River for spawning (lake sturgeon, muskellunge, lake trout, lake herring, lake whitefish) are believed extirpated from the river. The status of 8 other fish species remains unknown. Present day biological communities must adapt to human alteration of the watershed. The geological and hydrological characteristics of the watershed result in an unstable flow and reduce habitat and only biological communities that can adapt will persist. Management options are available to minimize stream degradation and preserve biological integrity.

Fish communities have been altered through intentional and inadvertent introduction of exotic species. Fish stockings by the MDNR, Fisheries Division has focused on improving recreational fishing opportunities. In the early 1920's, many headwaters tributaries were stocked with brook trout. Although brook trout are indigenous to Michigan, no evidence exists to suggest they were native to the Flint River. No other non-indigenous species introduction has altered or affected the Flint River watershed fish communities like the common carp. This exotic was first introduced into Michigan waters in 1885 and spread rapidly. The most aggressive fish management of the entire river system has occurred in Holloway Reservoir and Mott Lake. In 1971 and 1976, the MDNR performed two fish reclamation projects to remove 420 tons and 18 tons of carp respectively due to the carp levels being at a noxious level. Post reclamation stocking included largemouth bass, bluegill, black crappie, channel catfish, northern pike, walleye, tiger muskellunge, pumkinseed sunfish and fathead minnow. (MDNR, fisheries Div.)

Advisories to limit the consumption of certain fish species and sizes (fish contaminant advisories [FCAs]) have been published by MDEQ and the Michigan Department of Community Health for portions of the Flint River. All inland lakes, reservoirs, and impoundments within the State of Michigan are also under a fish advisory for mercury contamination. The latter is a general advisory applied to all inland lakes in Michigan since not all inland lakes, reservoirs, and impoundments have been tested or monitored. Table 4-1 lists the FCAs published for this watershed.

Table 4-1 Fish Advisory Information

Water Body	Location	Fish Species	Restricted Population	Restriction
Flint River	Holloway Reservoir	Channel Catfish	Women and children	One meal per month
All inland lakes, reservoirs, and impoundments	Entire watershed	Crappie	General population	8-22inches - One meal per week
			Women and children	8-22 inches - One meal per month
All inland lakes, reservoirs, and impoundments	Entire watershed	Largemouth and Smallmouth Bass	General population	14-30+ inches - One meal per week
			Women and children	14-30+ inches - One meal per month
All inland lakes, reservoirs, and impoundments	Entire watershed	Muskellunge	General population	30+ inches - One meal per week
			Women and children	30+ inches - One meal per month
All inland lakes, reservoirs, and impoundments	Entire watershed	Northern Pike	General population	22-30+inches - One meal per month
			Women and children	22-30+ inches - One meal per month
All inland lakes, reservoirs, and impoundments	Entire watershed	Rock Bass	General population	8-18 inches - One meal per week
			Women and children	8-18 inches - One meal per month
All inland lakes, reservoirs, and impoundments	Entire watershed	Walleye	General population	14-30+ inches - One meal per week
			Women and children	14-30+ inches - One meal per month
All inland lakes, reservoirs, and impoundments	Entire watershed	Yellow Perch	General population	8-18 inches - One meal per week
			Women and children	8-18 inches - One meal per month

* Michigan Department of Community Health, 2001. Michigan 2001 Fish Advisory., Michigan 2001 Flint River Assessment

Macroinvertebrate Studies

In the spring of 1999 the Flint River Watershed Coalition (FRWC) and the Center for Applied Environmental Research (CAER) at UM-Flint established a twice-yearly volunteer monitoring program for the Flint River watershed. The program was funded originally by a grant from MDEQ. Benthic monitoring assesses the quality of the Flint River watershed and educates the public. The volunteer monitoring program uses trained volunteers to gather information about the relative health of the areas stream and rivers. In the past five years over 100 volunteer monitors have participated in the program. The volunteers have helped to build awareness of pollution problems, been trained in pollution prevention, provided valuable data for waters that may otherwise be unassessed, and increased the amount of water quality information available to citizens and decision makers. The data collected thus far has been used to characterize various watersheds, screen for water quality problems, and measure existing conditions and trends.

The major element of the program is the collection and analyzing of benthic macroinvertebrates at 30 locations across the whole **Flint River Watershed**, 3 of those sites are within the Upper Flint River Watershed. Invertebrates are valuable subjects for water quality studies because they stay put. They are not very mobile and unlike fish they cannot move to avoid pollution. Using these creatures to identify water quality conditions is based on the fact that every species has a certain range of physical and chemical conditions in which it can survive. The kinds of benthic invertebrates living in a stream indicate conditions within the stream because they cannot migrate to a different location if conditions are not conducive to survival. Some organisms can survive in a wide range of conditions and are more tolerant of pollution, and so are labeled "**tolerant**". Other species are very sensitive to changes in conditions and are "**intolerant**" of pollution. These are labeled "**sensitive**". The presence of tolerant organisms and few or no sensitive organisms indicates the presence of pollution, because pollution tends to reduce the number of species in a community by eliminating the organisms that are sensitive to changes in water quality.

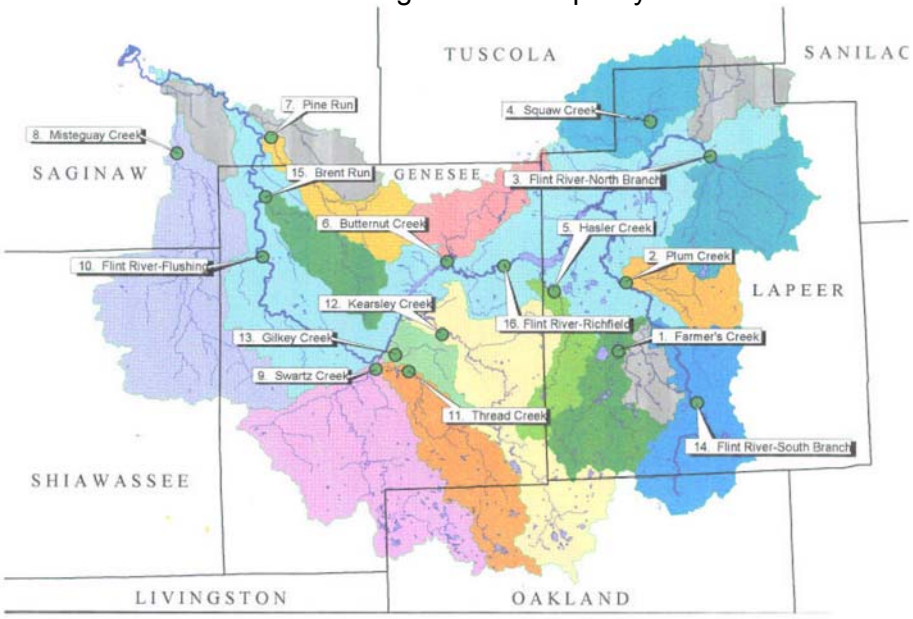

Figure 4-1 Flint River Watershed

Table 4-2 Benthic Monitoring Results

Site/Location	Jun 1999	Sep 1999	May 2000	Oct 2000	Apr 2001	Oct 2001	Apr 2002
Brent Run Montrose Twp	43.3 Good	38.6 Good	31.8 Fair	33.4 Fair	33.6 Fair	38.6 Good	38.1 Good
Brent Run Headwaters Mt. Morris Twp	N/M	20.2 Fair	17.2 Poor	10.2 Poor	N/M	N/M	N/M
Butternut Creek Genesee Twp	31.5 Fair	10.5 Poor	39.4 Good	N/M	39.9 Good	49.4 Excellent	26.6 Fair
Butternut Creek, Headwaters Forest Twp	N/M	N/M	42.8 Good	N/M	47.9 Good	34.7 Good	49.2 Excellent
Flint River, Flushing Twp	N/M	34.8 Good	26.0 Fair	N/M	27.5 Fair	N/M	29.5 Fair
Flint River, Richfield Twp	41.1 Good	41.6 Good	43.0 Good	22.4 Fair	16.5 Poor	29.9 Fair	26.5 Fair
Gilkey Creek City of Flint	29.5 Fair	11.2 Poor	13.3 Poor	18.8 Poor	5.1 Poor	15.3 Poor	9.5 Poor
Gilkey Creek Headwaters Burton Twp	N/M	N/M	N/M	N/M	N/M	N/M	N/M
Kearsley Creek Burton Twp	23.5 Fair	36.5 Good	N/M	N/M	23.2 Fair	N/M	42.0 Good
Kearsley Creek Headwaters Atlas Twp	N/M	21.2 Fair	10.1 Poor	32.6 Fair	40.8 Good	43.5 Good	49.7 Excellent
Misteguay Creek Headwaters Clayton Twp	N/M	32.0 Fair	40.0 Good	N/M	N/M	N/M	N/M
Pine Run Headwaters Vienna Twp	N/M	22.7 Fair	39.5 Good	N/M	N/M	N/M	N/M
Swartz Creek Flint Twp	26.9 Fair	5.1 Poor	11.3 Poor	41.5 Good	15.0 Poor	10.2 Poor	11.2 Poor
Swartz Creek Headwaters Fenton Twp	N/M	30.4 Fair	25.7 Fair	51.0 Excellent	N/M	N/M	N/M
Thread Creek Burton Twp	23.2 Fair	33.4 Fair	11.2 Poor	N/M	24.3 Fair	28.3 Fair	37.5 Good
Thread Creek Headwaters Grand Blanc Twp	N/M	41.7 Good	44.1 Good	46.8 Good	40.8 Good	37.3 Good	48.8 Excellent

Oct 2002	Apr 2003	Oct 2003	Apr 2004	Oct 2004	Apr 2005	Oct 2005	Apr 2006
53.0 Excellent	28.8 Fair	10.1 Poor	N/M	N/M	31.9 Fair	30.3 Fair	35.3 Good
N/M	N/M	N/M	4.3 Poor	N/M	30.1 Fair	N/M	26.7 Fair
45.0 Good	40.5 Good	45.0 Good	33.4 Fair	38.0 Good	40.2 Good	35.5 Good	36.3 Good
24.8 Fair	43.4 Good	31.0 Fair	38.2 Good	46.4 Good	45.5 Good	51.6 Excellent	60.9 Excellent
N/M	40.1 Good	24.5 Fair	26.8 Fair	40.0 Good	34.1 Good	N/M	27.2 Fair
N/M	28.2 Fair	24.7 Fair	26.3 Fair	N/M	23.4 Fair	N/M	N/M
23.8 Fair	11.3 Poor	4.4 Poor	16.4 Poor	N/M	15.6 Poor	17.5 Poor	19.4 Fair
24.5 Fair	N/M	30.9 Fair	N/M	35.8 Good	44.2 Good	N/M	34.8 Good
43.2 Good	54.0 Excellent	N/M	32.1 Fair	N/M	17.2 Poor	N/M	35.2 Good
18.1 Poor	N/M	31.2 Fair	N/M	N/M	26.4 Fair	N/M	N/M
N/M	N/M	N/M	35.5 Good	27.0 Fair	30.1 Fair	N/M	15.4 Poor
N/M	18.1 Poor	N/M	35.7 Good	N/M	19.3 Fair	N/M	25.6 Fair
18.5 Poor	30.8 Fair	N/M	9.4 Poor	N/M	40.6 Good	N/M	31.7 Fair
11.3 Poor	18.4 Poor	N/M	33.6 Fair	N/M	N/M	30.4 Fair	30.4 Fair
33.4 Fair	19.4 Fair	17.2 Poor	23.4 Fair	N/M	19.3 Fair	24.1 Fair	12.2 Poor
N/M	37.8 Good	21.2 Fair	31.5 Fair	N/M	22.2 Fair	N/M	40.0 Good

Source: Flint River Watershed Coalition
N/M: Not Monitored

WATER TESTING WITH PROJECT GREEN

Global Rivers Environmental Education Network (GREEN) is a curriculum based, mentored program designed to propose solutions to local environmental problems using water quality testing. This project has been in existence for fourteen years in Genesee County under the direction of the Genesee County Intermediate School District (GISD). In late 2003 the Flint River Watershed Coalition was approached by Earth Force Green and General Motors to be the coordinator of the GREEN in the Flint River Watershed. FRWC was identified as the primary organization that could help improve program participation and effectiveness because of its focus on water quality monitoring and environmental education. The FRWC Board of Directors has endorsed this vision and has agreed to take full administrative control over the next two years. In 2004 the Genesee County Drain Office on behalf of the Phase II program partnered with the FRWC with funding and mentors. In the spring of 2005 and 2006, Hundereds of students had a combination of class time and field experience on the local rivers. The students learned about water quality and testing procedures and went to various sites on the Flint River and tributaries to take water samples for the following indicators.

- Dissolved Oxygen
- Nitrates
- PH
- Fecal Coliform
- Temperature
- Total Solids
- Turbidity
- Total Phosphorus

By testing for the above indicators the students can compare the results to the "norm" and draw conclusions on the health of the water. Chemical testing is a snapshot of water health, and the results should not be taken alone. By using chemical testing and other water quality indicators such as benthic monitoring or photo/ physical observations, changes to the water can be shown.

Although the data has not compiled at this time within Genesee County there was 16 school (24 teachers) and hundreds of students that had the opportunity to participate.

E. Coli Water Sampling (Health Department or Local Agencies)

The following language from the Michigan Water Quality Standards regulates the allowable limits of *E. coli* bacteria in surface waters of the State:

> "R 323.1062 Microorganisms.
>
> Rule 62. (1) All waters of the state protected for total body contact recreation shall not contain more than 130 Escherichia coli (E. coli) per 100 milliliters, as a 30-day geometric mean. Compliance shall be based on the geometric mean of all individual samples taken during 5 or more sampling events representatively spread over a 30-day period. Each sampling event shall consist of 3 or more samples taken at representative locations within a defined sampling area. At no time shall the waters of the state protected for total body contact recreation contain more than a maximum of 300 E. coli per 100 milliliters. Compliance shall be based on the geometric mean of 3 or more samples taken during the same sampling event at representative locations within a defined sampling area.

(2) All waters of the state protected for partial body contact recreation shall not contain more than a maximum of 1,000 E. coli per 100 milliliters. Compliance shall be based on the geometric mean of 3 or more samples, taken during the same sampling event, at representative locations within a defined sampling area."

The Genesee County Health Department performs Weekly e. coli test from May through September on the following water bodies within the Upper Flint River Watershed:

Covenant Hills	West Sister Lake	Buttercup
Walleye Pike	Lake Linda	Goldenrod
Bluegill	Bluebell	Stepping Stone

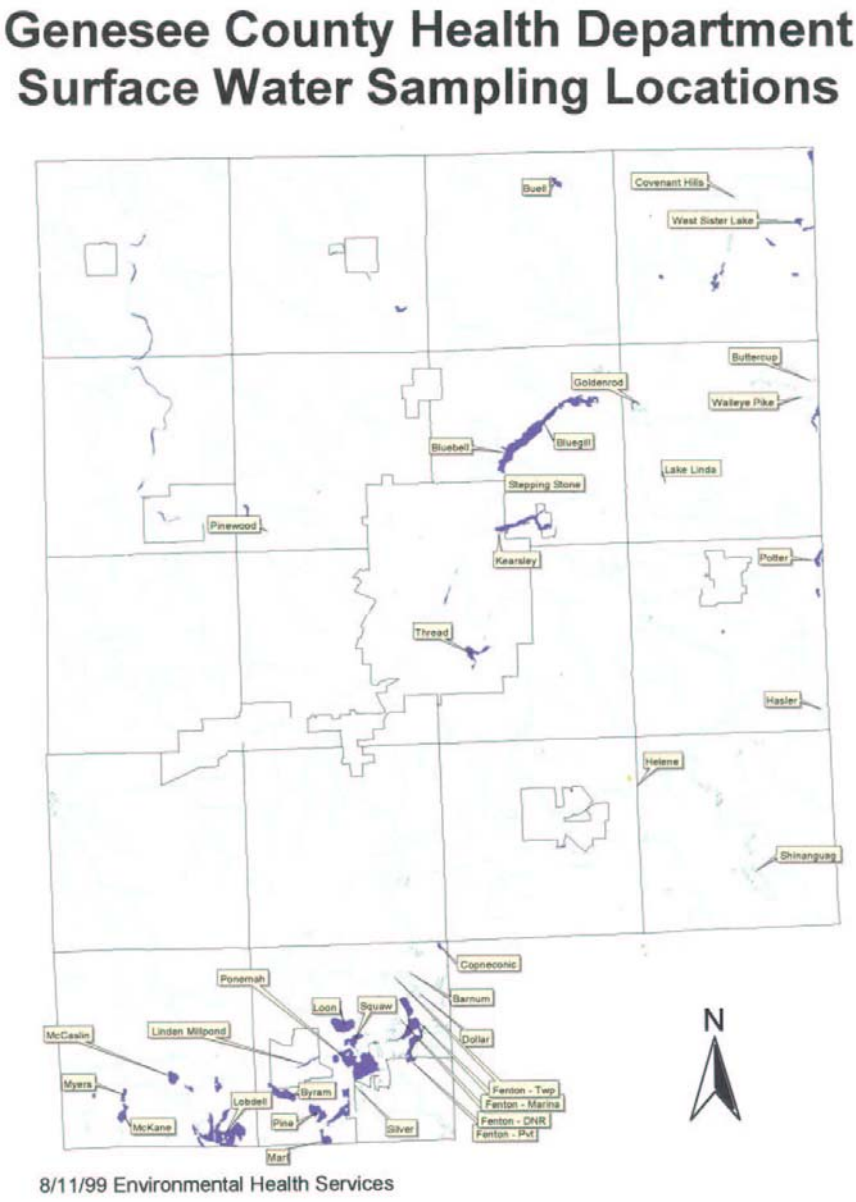

Figure 4-2 E. Coli Test Sites Within Genesee County

WATER CHEMISTRY AND HYDROLOGY STUDIES

Table 4-3 Michigan Section 303d TMDL Water Bodies

Water Body	Waterbody Decription	Pollutants	Expected TMDL Date
C.S. MOTT LAKE BLUEBELL BEACH	Impoundment of the Flint River u/s of Flint.	Pathogens (Rule 100).	2011
FLINT RIVER WATERSHED	Shiawassee River confluence upstream to include all tributaries	WQS exceedances for PCBs	2010
BUTTERNUT CREEK	Mott Reservoir u/s to Otter Lake	Habitat modification-channelization	
POWERS-CULLEN DRAIN	Flint River confluence u/s; Vicinity of Russelville	Habitat modification-channelization	

USGS Monitoring

There is only 1 USGS stream gage within the Upper Flint River Watershed.

04147500 Flint River near Otisville	Southeast ¼ of section 9, Richfield Twp	October 1052 to September 1989, October 1990 to Current year (Water stage recorder.

POLLUTANT LOAD ANALYSIS

The pollutant load analysis was conducted utilizing the Environmental Protection Agency's Spreadsheet Tool for Estimating Pollutant Loads (STEPL). Phosphorus, 5-day Biological Oxygen Demand (BOD), and sediment loadings were all calculated on a subwatershed basis, using this program. The methods used to calculate urban loadings of phosphorus, sediment, and BOD primarily utilized the runoff volume and land use specific pollutant concentrations for each Subwatershed to provide an average annual loading. Agricultural sediment calculations utilized the universal soil loss equation (USLE), widely used to calculate average annual soil losses from sheet and rill erosion (EPA, 2004). Phosphorus and BOD were calculated for agricultural areas by multiplying the soil load by a pollutant concentration for nutrients in the sediment. Graphical results of these calculations are presented in Figure 4-3 through Figure 4-5 and numerically in Table 4-4.

Table 4-4 Unit Area Storm Water Loading Data

Watershed	No.	N Load lb/ac/yr	P Load lb/ac/yr	BOD Load lb/ac/yr	Sediment Load lb/ac/yr
Butternut 1	8540	2.7	0.5	6.7	234
Butternut 2	8541	1.9	0.3	5.7	120
Cullen and Powers	0014	3.0	0.5	7.9	267
Flint River Upper 1	8535	3.0	0.4	9.6	170
Flint River Upper 2	8536	2.5	0.4	7.0	186
Flint River Upper 3	8537	2.1	0.3	6.4	121

Source: Tetra Tech

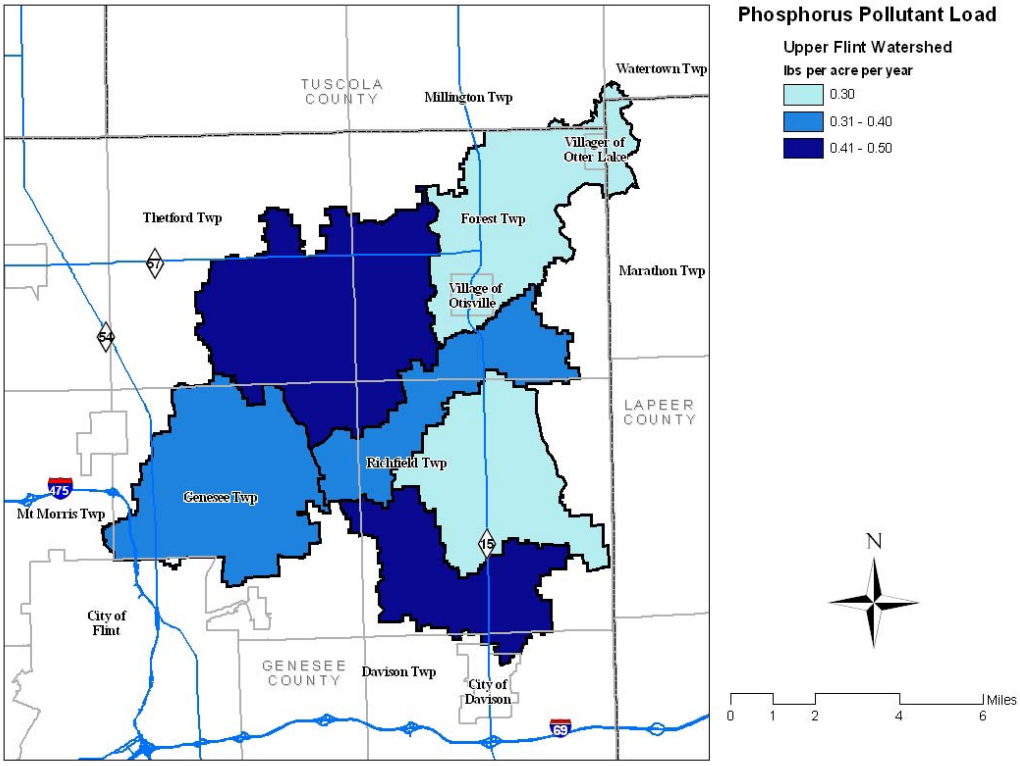

Figure 4-3 Phosphorus Pollutant Load

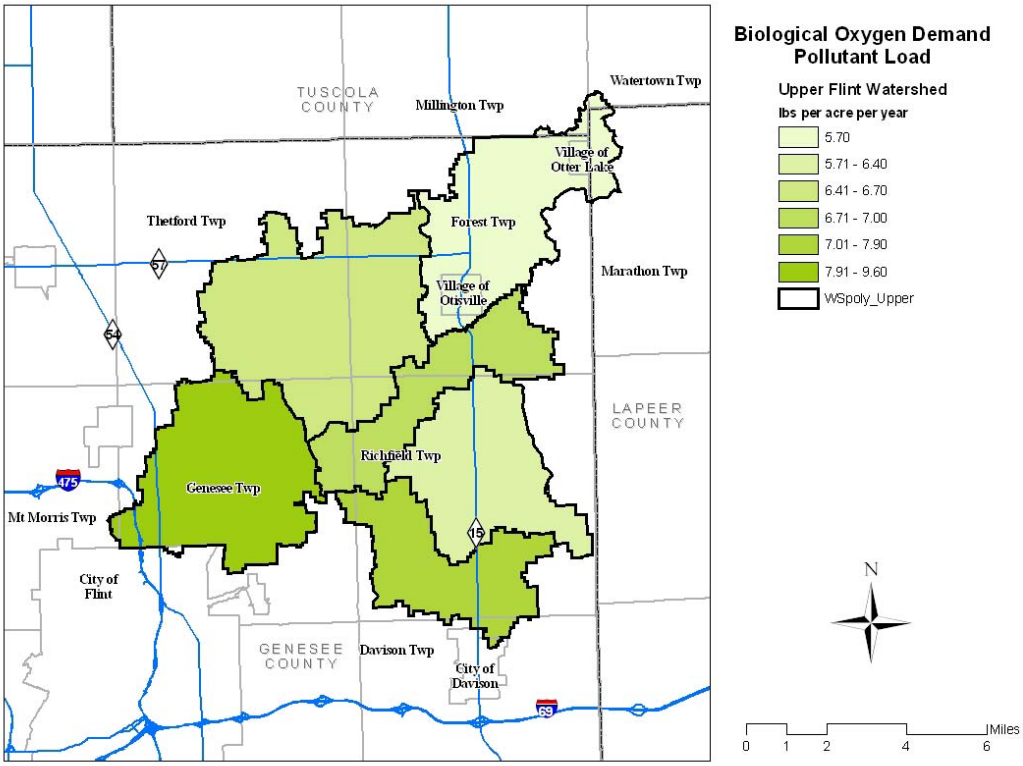

Figure 4-4 BOD Pollutant Load

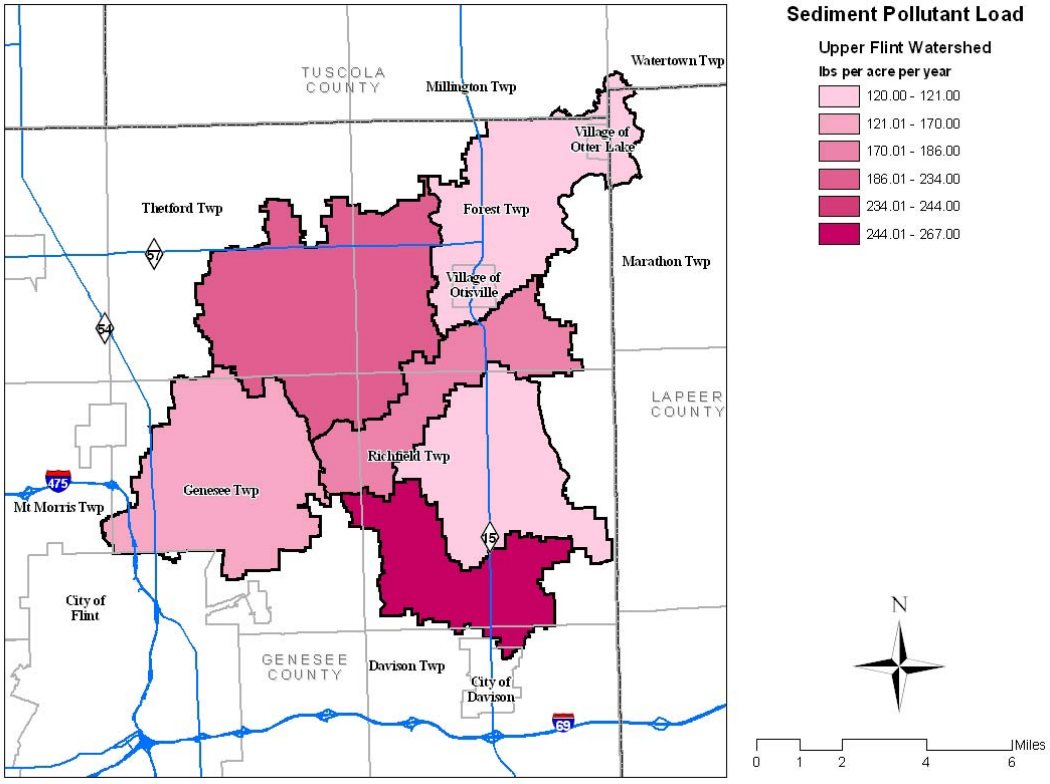

Figure 4-5 Sediment Pollutant Load

SECTION 5 - COMMUNITY OUTREACH

PUBLIC PARTICIPATION PROCESS

The Public Participation Plan (PPP) for the Upper Flint River was submitted In September 2005. Due to many of the Stakeholders expressing a concern about the repetition between the watershed plans, the process was streamlined into a Combined Watershed PPP. The Combined PPP was for the Lower Flint River, the **Upper Flint River** and the Shiawassee River. This Plan outlines the roles of the steering committee, stakeholder groups, and the general public in developing the watershed management plan and how the information would be used during the decision-making process.

The goal of the PPP was to effectively involve stakeholders and the public throughout the watershed management planning process so that they contribute during the process and understand the plan recommendations to gain support for implementation. Key stakeholders in the watershed were identified. Materials for stakeholders to use, to educate their constituents was developed. Lastly, the plan sought to obtain useful, measurable social feedback information throughout the public participation process.

One criteria was that the Public Participation Process needed to be flexible to allow for changes along the way. Obtaining sufficient public input on watershed projects takes creativity, persistence, and commitment. While the PPP for this watershed outlines specific activities that were to be completed, the activities were modified as needed.

The following list summarizes the main venues in which public involvement will be sought.

- Public Briefing
- Stakeholder Workshops
- Focus Groups
- Report to Municipal Officials

There have been 4 **stakeholder /public meetings** for the Upper Flint River Watershed. These were done as combined meetings with the Lower and Shiawassee watersheds. Attendances had fluctuated between 2 and 35 people for these meetings. One **Focus Group** was held the superintendents of the school districts to discuss nested jurisdiction. That meeting was countywide. Regular updates on the progress of the program are given to the **Municipal officials** at their regular Advisory meeting. Part of reporting to the Municipal officials was education. The Public Education survey was given to the elected and appointed municipal officials. This was to determine what their educational needs were. The first of an Update Report was sent out to the municipal officials in May of 2005. The purpose of the update is to discuss what all the workgroups and subcommittees are doing. It is the intent that regular updates will follow on a regular basis. As part of this process, a member of the Genesee County Drain Commissioner's Office has gone around to each phase II communities to meet with their representative, to answer questions and get their local commitments for section 8 as required by the MDEQ.

Table 5-1 Meeting Dates

	Surface Water Advisory Committee	Monitoring and Mapping	Public Education and Participation	BMP Committe	Work Group	Stakeholders Workshops	Combined Stakeholder/ Public Meetings
September 2004		20th			2nd		
October 2004		5th &13th	25th				
November 2004	17th		29th				
December 2004	15th						
January 2005			3rd & 19th			31st	
February 2005	16th		7th				
March 2005	23rd		2nd & 21st				
April 2005	20th		18th &25th				
May 2005	18th		5th & 17th			23rd	
June 2005					29th (2)		
July 2005					27th (2)		
August 2005	17th				31st (2)		29th (2)
September 2005	21st			10th & 24th	28th (2)		
October 2005	19th				26th (2)		
November 2005	16th						30th (2)
December 2005							
January 2006	18th		23rd		4th (2) & 23rd		
February 2006	15th		27th				1st (2)
March 2006	15th		20th				
April 2006	19th						
May 2006	17th		15th		31st		
June 2006	21st		19th				
July 2006			17th				
August 2006						2nd	
September 2006	20th		18th				
October 2006	18th		16th		25th		
November 2006	22nd						
December 2006	20th		18th				
January 2007	17th		22nd				
February 2007	21st		26th		16th		
March 2007	28th		19th				
April 2007	18th	23rd					
May 2007	16th		21st	15th			
June 2007	20th	5th		19th			
July 2007		24th	16th	17th			
August 2007				21st			
September 2007	19th	25th	17th	18th			
October 2007	17th		15th				