CHAPTER 1 - STATE OF THE ANCHOR BAY WATERSHED

1.0 ANCHOR BAY WATERSHED OVERVIEW

The original Anchor Bay Watershed Management Plan (WMP) provided a comprehensive overview of the characteristics of the Anchor Bay Watershed (Watershed).

1.01 LOCATION

The Watershed is part of the Lake St. Clair Drainage System and provides recreation and aesthetic beauty to residents of Macomb and St. Clair Counties, as well as many visitors from throughout the United States and Canada (Figure 1-1). The Watershed encompasses 171 square miles (443 km2), including the Delta islands (Harsens and Dickinson islands), in Macomb and St. Clair Counties. In St. Clair County, the Watershed includes all or part of Casco, China, Clay, Cottrellville, and Ira Townships, and the Cities of Algonac and Marine City. In Macomb County, the Watershed includes all of the City of New Baltimore and parts of Chesterfield, Clinton, Harrison, Lenox, Macomb, and Richmond Townships, the Village of New Haven, and the Cities of Mt. Clemens and Richmond. Major tributary streams within the Watershed include Auvase Creek, Beaubien Creek, Crapau Creek, Marsac Creek, Swan Creek, the Marine City Drain, the Salt River, and all contributing drains (Figure 1-2).

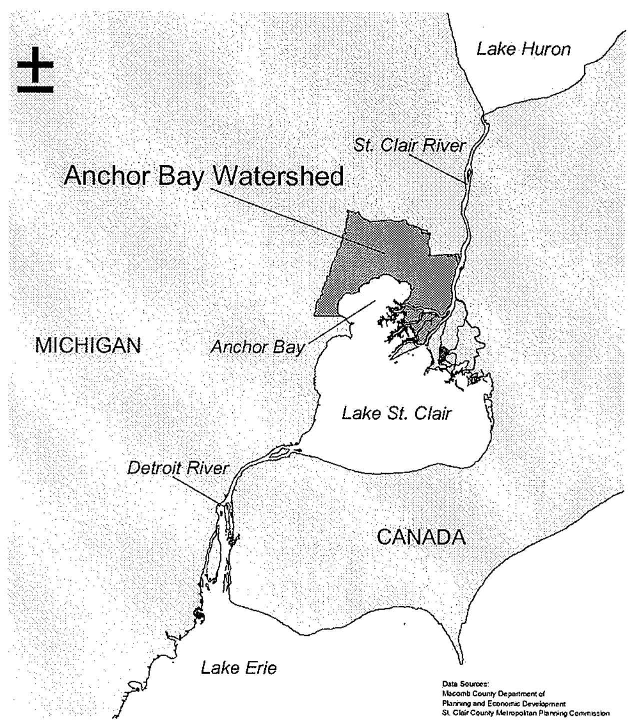


Figure 1-1: Location of the Watershed within the Great Lakes

1.02 HYDROLOGY

The Watershed contains 473 miles of waterways, including 104 miles of drains in agricultural areas. The majority of the flow into Anchor Bay comes from the north channel of the St. Clair River, from the northeast. Depending on wind conditions, flow from the middle channel, to the southeast can also enter Anchor Bay. Under certain climatic conditions, flow enters the bay from Clinton River, to the south. The specific residence time in Anchor Bay will fluctuate depending on the circulation patterns, which vary according to the dominant wind and current. Information pertaining specifically to the Anchor Bay hydrology is included in Section 1.1.4.4 of this chapter.

Additional studies and modeling were conducted to update this WMP to provide accurate information regarding flow patterns into the bay under various climatic conditions.

1.03 TOPOGRAPHY AND SOILS

Topography of the Watershed varies from level to gently sloping terrain. The majority of the Watershed is characterized as lake plain with some limited glacial till in Macomb County. Although there is a limited area of sandy soil within the Watershed, the soils are generally characterized as poorly drained with high clay content.

1.04 HISTORY OF THE WATERSHED

Lower reaches of the St. Clair River and Lake St. Clair generally remained unaltered until about 1900. The U.S. portion of the St. Clair basin, including Anchor Bay, was initially settled because the St. Clair River and Lake St. Clair provided numerous resources, including a transportation corridor and an abundance of fish and wildlife. Throughout the 1800s, settlers changed the land from primarily deciduous forests and lakeplain prairies into land cleared for agriculture. The lake and river continued to serve as an important regional transportation corridor. In the late 1800s, two significant developments occurred that led to rapid alterations in land-use patterns: 1) passage of the federal Swamplands Act of 1850, and 2) introduction of new technology that vastly improved transportation.

For many years, access to the land was limited by the very nature of the property. In 1815, the U.S. Surveyor General reported that a large part of southeastern Michigan was a swamp and practically worthless. As a result, the Swamplands Act of 1850 provided swampland to individuals at no cost if they agreed to drain the land and develop it into a useful parcel. This law stimulated settlers to drain and fill vast areas of wetlands along the St. Clair River and Lake St. Clair. By 1873, the land between the Detroit and Clinton Rivers and Anchor Bay had been almost entirely converted to agriculture.

In turn, improved transportation made drained land more accessible. The advent of electric and steam railways, along with a dredged shipping channel through Lake St. Clair, led to an increased human population, multiple private and public recreational activities, and industrial development along the St. Clair River.

Development, particularly on the Michigan shoreline, intensified in the 1950s, and by the mid-1970s, much of Michigan's Lake St. Clair shoreline was fully developed.

To date, Anchor Bay's recuperative powers have exceeded man's ability to inflict harm. The rapid development of the Lake St. Clair shoreline stressed the ecosystem, but the lake proved to be resilient. Because much of the drainage area contributing to Anchor Bay remained undeveloped into the 1980s, the assimilative capacity of the contributing streams and the nearshore waters helped the habitat remain intact. However, recent nearshore algae blooms and beach closings suggest that this capacity is now being tested.

1.05 Recreational Opportunities

Many people choose to live in southern St. Clair and eastern Macomb Counties because recreational opportunities presented by Lake St. Clair add quality to their lives and value to their property. These recreational opportunities include:

- Boating, swimming, and fishing, including wintertime ice fishing.
- Hunting (Anchor Bay is one of southeast Michigan's premiere duck hunting areas.)
- Walking and bicycling along the Bridge to Bay Trail in St. Clair County and the Macomb Orchard Trail in Macomb County. (Plans are being discussed to link these trails.)
- Points of interest, such as Cherry Beach dock in Cottrellville Township; Selfridge Air National Guard Base in Harrison Township; Algonac State Park; St. Clair Flats State Wildlife Area in Clay Township; Ira Township Park; Boat Launch in Chesterfield Township; Brandenburg Park along the bay and Pollard Park Nature Area on the Salt River in Chesterfield Township; and New Baltimore Beach and St. Johns Marsh in Clay and Ira Townships.

Because of these recreational opportunities, the health of Lake St. Clair and Anchor Bay is of tremendous importance to area residents. In many ways, Anchor Bay's water quality is quite good. Ongoing development, however, continues to negatively impact these resources.

1.06 Fish and Wildlife Habitat

The Watershed contains approximately 38,000 acres of ecologically sensitive land. Various wetland types include open-water wetlands, beach and shoreline wetlands, cattail wetlands, sedge wetlands, abandoned channel wetlands, wet meadow wetlands, and shrub wetlands (Figure 1-3).

Wetlands are critical if diverse populations of fish and wildlife unique to the area are to be preserved.

St. Johns Marsh is one of the largest coastal wetlands in the Great Lakes. This 2,500-acre marsh in Clay and Ira

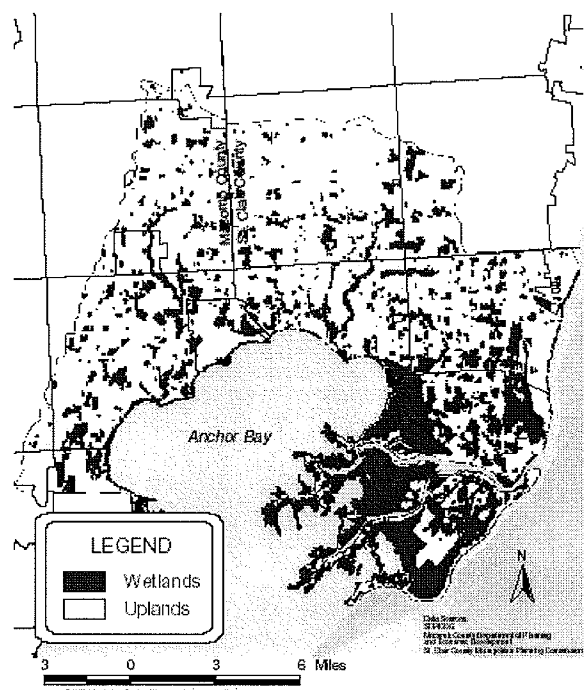


Figure 1-3: Anchor Bay Watershed Wetland Areas

Townships is within three-quarter miles of the lakeshore and is directly influenced by water level changes in the bay. Compared to inland wetlands, coastal wetlands are more dynamic, display a greater diversity of landforms, and are less influenced by groundwater inflow. It is currently home to rare and endangered plants and wildlife, including fox snakes, and prairie-fringed orchids and birds, such as the king rail.

The diverse fish and wildlife species that inhabit Anchor Bay require more than simply a pollutant-free environment. They are dependent on the diverse food web that supports larger animals upon which many sport recreational opportunities depend. At least 12 varieties of submerged plants in Anchor Bay provide an excellent habitat for waterfowl and 117 fish species that are either permanent residents or enter the system from Lake Huron and Lake Erie to spawn. Anchor Bay has one of the highest densities of fish flies in the St. Clair-Detroit River System. Fish flies, although sometimes viewed as a nuisance, provide food for fish and wildlife and are indicators of a healthy water body because they are intolerant of pollution. The fish fly larvae is just one of the 300 species of bugs, known as benthic macroinvertebrates, which live on or in the bottom of Anchor Bay. These bottom-dwelling plants and animals are the food source for larger sport fish and animals.

1.07 LAND USE

Land use in a watershed has a direct impact on the water quality, which, in turn, affects the health of ecological diversity in the aquatic system. Between 1990 and 2000, the land use trend leaned toward an increase in residential, commercial, and industrial areas, resulting in a decrease of woodlands, wetlands, cultivated grasslands, and shrub areas (Figures 1-4 and 1-5). This trend is predicted to continue. The Southeast Michigan Council of Governments (SEMCOG) forecasts that the Watershed population will increase 40% and households will increase by almost 58% between 2000 and 2030. The anticipated increase in impervious area and decrease in areas that provide natural treatment and reduction for such things as storm water runoff will tend to increase harmful impacts on the watercourses with respect to sediment, nutrients, bacteria, and chemical contaminants. This development trend will also decrease available habitat for fish and wildlife, increasing stress on the limited remaining natural habitat.

Figure 1-4: 1990 Land Use for the Anchor Bay Watershed

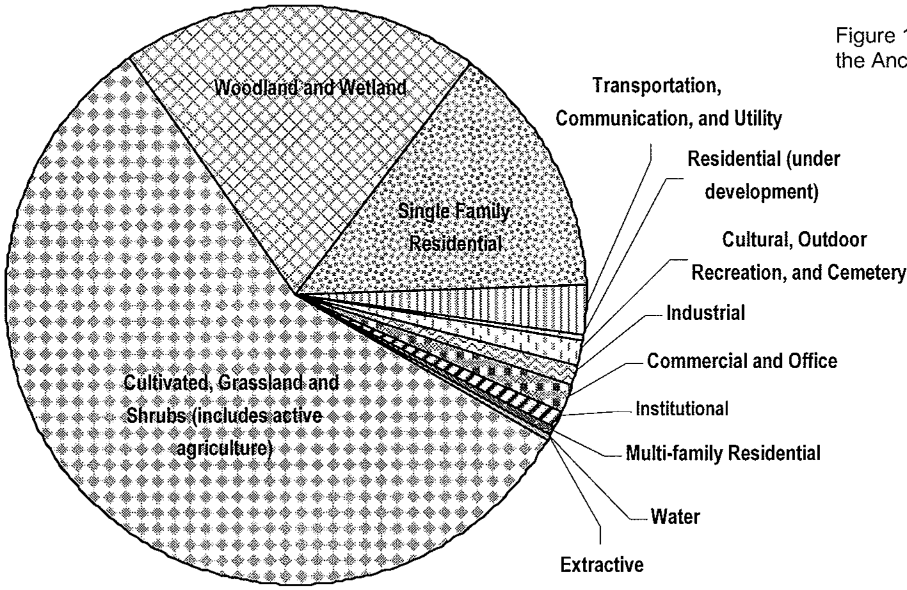
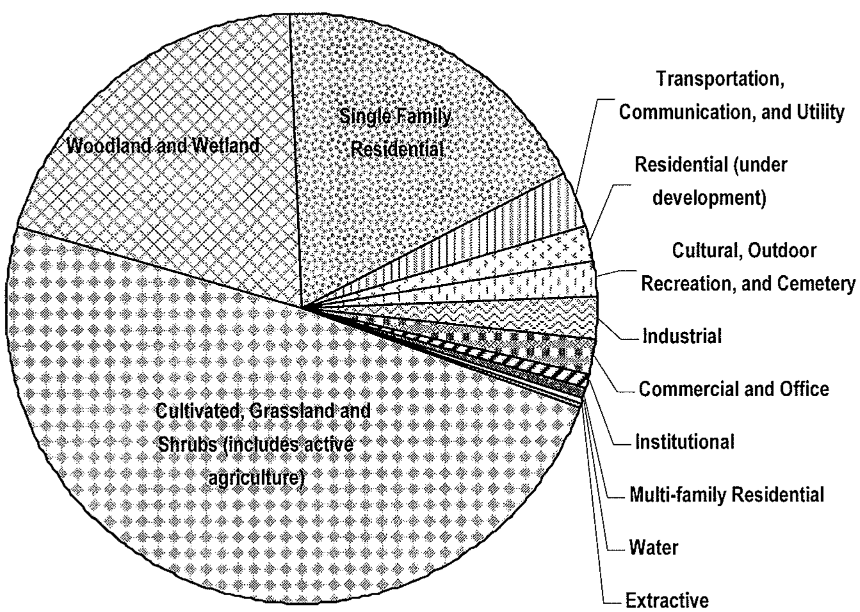


Figure 1-5: 2000 Land Use for the Anchor Bay Watershed



1.1 ANCHOR BAY POLLUTANTS, SOURCES, AND MONITORING DATA

The major stresses, such as reduced habitat, increased contamination of habitat, elevated bacteria concentrations at beaches, limited public access, and increasing numbers of invasive species, are now generally associated with residential development and human impact, rather than industrial activities.

The pollutants that once discharged from industrial outfalls are now controlled, but pollutants associated with construction, residential, and recreational activities continue to challenge Anchor Bay's natural recuperative powers.

1.11 WASTEWATER AND INDUSTRIAL DISCHARGES

Since the onset of environmental laws, a great deal of effort has gone into controlling pollutants associated with wastewater and industrial discharges, which are regulated under permits issued by the Michigan Department of Environmental Quality (MDEQ). This program has been in place since the early 1960s and continues to be an effective mechanism for environmental control. Sixteen permitted point source discharges exist within the Watershed (Table 1-1), as indicated in the list provided by MDEQ at http://www.deq.state.mi.us/documents/deq-swq-npdes-prmtlist.xls (last updated March 9, 2005). The vast majority of these are treated domestic wastewater discharges from municipalities or private developments, schools, and highway rest areas. MDEQ personnel have indicated that permittees within the Watershed are generally in compliance with discharge permits issued to them by the MDEQ under the federal Clean Water Act (CWA) and the Michigan Natural Resources and Environmental Protection Act. Much treated domestic wastewater also discharges to the Watershed, and the number of these discharges is increasing as more development occurs outside of the established sewer service area.

TABLE 1-1: ANCHOR BAY WATERSHED PERMITTED DISCHARGERS

Designated Name	Permit No.	Expiration Date	Facility Type	Permittee Name
Millstone Pond MHP	MI0055816	10/01/2004	Non-Industrial Sanitary Wastewater	John Anton Builders
New Haven Foundry	MI0038032	10/01/2004	Standard (All others)	New Haven Foundry, Incorporated
Richmond WWTP	MI0023906	10/01/2004	Non-Industrial Sanitary Wastewater	City of Richmond
Americana Estates of Casco MHP	MI0027073	10/01/2004	Non-Industrial Sanitary Wastewater	Americana Estates of Casco, LLC
Chesterfield Twp WWSL	MIG960033	04/01/2005	Non-Industrial Sanitary Wastewater	Chesterfield Township
Algonac WFP	MIG640228	04/01/2005	Standard (All others)	City of Algonac
Colony Clinic	MIG081041	04/01/2005	Standard (All others)	Dr. Leonard Kasperowicz, Colony Clinic
Macomb Co Girl Scouts	MIG760006	04/01/2005	Standard (All others)	Macomb County Girl Scouts
Old Club WWTP	MIG570210	04/01/2005	Non-Industrial Sanitary Wastewater	Old Club
Selfridge ANGB	MI0055328	10/01/2005	Standard (All others)	United States Department of Defense
New Baltimore WWTP	MI0023680	10/01/2008	Non-Industrial Sanitary Wastewater	City of New Baltimore
St Clair County-Algonac WWTP	MI0020389	10/01/2008	Non-Industrial Sanitary Wastewater	St. Clair County
Hawthorn Hollow GS Camp	MIG580383	04/01/2009	Non-Industrial Sanitary Wastewater	Girl Scouts of Macomb County-Otsikita Council Inc.
Anchor Bay Schools-Casco	MIG580328	04/01/2009	Non-Industrial Sanitary Wastewater	Anchor Bay Schools
Sunrise Convenience-Emmett	MIG580370	04/01/2009	Standard (All others)	Sunrise Convenience Stores, Inc.
MDOT I-94 WB/SB Rest Area	MIG580027	04/01/2009	Non-Industrial Sanitary Wastewater	Michigan Department of Transportation
MDOT I-94 EB/NB Rest Area	MIG580026	04/01/2009	Non-Industrial Sanitary Wastewater	Michigan Department of Transportation
US Army Tank Command - R&D	MI0055948	10/01/2009	Standard (All others)	United States Army Tank Command

In addition to the discharges listed in Table 1-1, many industrial and municipal discharges within the St. Clair River Watershed have the potential to make a significant impact on the Anchor Bay area. These discharges are discussed in more detail in the St. Clair River Remedial Action Plan.

1.12 STORM WATER RUNOFF

Like all urbanizing areas, pressure from development within the Watershed has resulted in increased runoff due to reduced pervious area and development of storm water drainage systems. Changing land use patterns have dramatically altered the natural drainage throughout the area, and environmental degradation continues to result from an increased number of impervious areas, increased peak flows of storm water with resulting accelerated erosion, and decreased natural drainage and infiltration capacity.

Although storm water runoff is a natural result of the hydrologic cycle, it does carry excessive pollutants of various types, including suspended solids, oils and greases, chemicals, nutrients, and bacteria. Little site-specific monitoring data exists regarding the quality and quantity of storm water being discharged to the Watershed.

However, data that is available shows that runoff contributes elevated levels of nutrients and bacteria directly to the bay. In addition, based on data available from similar rural and urban areas, it can be concluded that these discharges are, in fact, a significant source of local contamination within the Watershed.

Many contaminants in storm water runoff are a result of day-to-day activities by Watershed residents and visitors. A major source of nutrients in storm water runoff is from over-fertilization of residential lawns. Yard waste deposited in streams and drains by riparian property owners can elevate nutrients in the streams, cause aesthetic problems, and clog small tributary streams. Littering or improper waste disposal results in solids and floating materials that degrade the aesthetics and interfere with the flow in the bay and tributary streams. Careless disregard for domestic animal waste results in elevated bacteria contamination. Accumulated small overflows of petroleum products result in oil sheens on the bay and streams that cause aesthetic problems and interfere with oxygen transfer into the tributaries.

Storm water runoff has traditionally been considered as a nonpoint source (NPS) discharge to a watershed. However, because most runoff, particularly in urban areas, is diverted through a series of curbs, gutters, ditches, and pipes, most storm water discharges are now regulated as point sources. This change in philosophy has resulted in a storm water control program, known as the Phase I and Phase II National Pollutant Discharge Elimination System (NPDES) Storm Water permit program. The major impact of this program in the Watershed is under the NPDES Phase II program, which requires urbanized areas with a population greater than 10,000 people to develop a control program for their storm water discharges. These programs require implementation of Best Management Practices (BMPs) that will reduce the quantity and improve the quality of storm water discharged to watershed tributaries and directly to the bay. Municipalities within the Watershed required to obtain an NPDES Phase II permit are listed in Table 1-2.

TABLE 1-2: MUNICIPALITIES REQUIRED TO OBTAIN NPDES PERMITS

Municipal NPDES Permitees	Permit Number	County
Macomb County	MIG610052	Macomb
Chesterfield Township	MIG610310	Macomb
Clinton Township	MIG610299	Macomb
Harrison Township	MIG610313	Macomb
Lenox Township	MIG610301	Macomb
Macomb Township	MIG610312	Macomb
City of New Baltimore	MIG610303	Macomb
City of New Haven	MIG610302	Macomb
St Clair County	MIG610055	St. Clair
Casco Township	MIG610259	St. Clair
China Township	N/A	St. Clair
City of Algonac	MIG610255	St. Clair
Clay Township	MIG610254	St. Clair
Cottrellville Township	MIG610258	St. Clair
Ira Township	MIG610253	St. Clair

This program was adopted in March 2003, by the federal and state government in recognition of the facts that 1) storm water runoff is a significant contributor of pollution within watersheds, and 2) the traditional approach of controlling point source discharges from industrial facilities and municipal treatment plants and sewer systems would not accomplish the "fishable, swimmable, drinkable" goals established under the CWA. To be successful, the WMP must establish a similar approach that looks at all sources within the Watershed and develops goals, objectives, and actions that will mitigate any impacts from all sources. Otherwise, industrial and municipal discharges could be held to exceedingly stringent standards, while larger, less defined sources, such as storm water runoff, would go uncontrolled. This double standard could prevent the Watershed from ever accomplishing needed corrections.

1.13 WATERSHED INVENTORY METHODOLOGY

A Watershed inventory was conducted to further define the sources and causes of impairments to water quality. The following activities and sources of information were used to identify the NPS sites in the Watershed:

- The inventory contained in the original WMP, Appendix B - Location of Examples of Sources and Causes, now Appendix 1A of this report, describes sites of NPS pollution. These sites, listed below, were plotted as accurately as possible on a watershed map and then entered into a spreadsheet. Sites requiring a field check were visited in December 2004, to verify the sources and causes of the NPS pollution. Measurements were also taken to calculate the loadings and reductions at that site.
    - Shoreline habitat replaced (or being replaced) with seawalls
    - Tributary streams being replaced with enclosed piping
    - Residential building encroachment upon watercourses

- Lack of soil erosion control on farms and development sites
- Obstructions (human-caused and development-worsened)
- Stockpiling foreign materials near watercourses
- Dumping of refuse near watercourses
- Lack of adequate septic systems
- Poorly designed stream crossing structures
- Destruction of wetland areas
- Road salt damage culverts
- Lack of enforcement of environmental laws
- Direct runoff from dense residential developments, parking lots, and roadways
- Leaking valves and embankments at water treatment facilities
- Unlimited livestock access to streams
- The loss of floodplain function when natural watercourses are altered as drains
- Children playing in watercourses
- General lack of education and values that promote watershed protection

- Digital ortho quarter quadrangle photographs were used to note obvious areas of erosion, significant impacts from development, and other sources of pollutants not identified in the WMP. These areas were also entered into the spreadsheet, plotted on the map, and field checked in December 2004, to verify the information and take measurements.

- In 2002 and 2003, MDEQ conducted road crossing surveys to evaluate the condition of road crossings within the Watershed. The surveys included a physical assessment on 58 major road crossings. The MDEQ Stream Crossing Inventory provided information about the physical and habitat conditions, erosion conditions, stream shape, stream appearance, and stream sediment composition, as well as surrounding land use and cover, on both the upstream and downstream sides of road crossings. The overall site conditions given to the crossing that were ranked showed that 8% were in good condition, 59% were in fair condition, and 33% were in poor condition. The information was reviewed and only the pollutant sources noted as high in the survey sheets were entered into the spreadsheet and mapped. Additional stream crossing inventory sheets were completed in December 2004, for flagged sites. The sites investigated were entered into the spreadsheet and plotted on the Watershed map.

- The St. Clair County Drain Commissioner's drain inventory study was reviewed. More than 60 erosion sites were reviewed and problem sites were mapped. Information from the field notes was entered into the spreadsheet and the photographs for selected sites were linked to the Geographic Information System (GIS). Photographs are included in a document available for review. The St. Clair County Drain Office (SCCDO) physical inventory of the St. Clair County portion of the Watershed highlighted some key concerns, including: seawalls replacing shorelines, enclosed piping on tributary streams, development along the watercourse, soil erosion, the dumping of refuse in or near the watercourse, wetland destruction, inadequate septic systems, and lack of public education. Information from the study is presented in Appendix 1A.

- Stream survey photographs, taken during the week of November 8, 2004, to November 10, 2004, by the Fishbeck, Thompson, Carr & Huber, Inc. field crew, collecting information for the hydrologic analysis, were reviewed for possible sites of NPS pollution.

- Photographs taken during a reconnaissance of the Watershed, conducted on September 10, 2004, were reviewed for possible sites of NPS pollution. These sites were entered into the spreadsheet and mapped.

- The field crews collecting information for the hydrologic study took notes and photographs of various sites to determine if they would be accepted or rejected for the hydrologic study. The photographs of the sites were reviewed to determine if any NPS pollution was evident.

A data sheet was completed at each site visited, as a result of the above investigations. Basic information was recorded about the size of the stream, surrounding land use, presence of stream buffers, and weather conditions. Twelve categories were described on the sheets: debris and trash, stream crossing, rill or gully erosion, livestock access, upland sources, tile outlet, streambank erosion, construction sites, urban/residential, marinas, row crop runoff, and other. Within each category, characteristics were described to group and rank the sites. Sample inventory forms are included in Appendix 1B.

The information from the data sheets was compiled into a spreadsheet identifying each NPS site with estimates of measurements to use to calculate pollutant loadings from those sites. The sites requiring a follow-up field visit to collect more accurate measurements were flagged. The data was verified and checked for inconsistencies, then converted to a point file into ArcMap GIS. Figure 1-6 displays the sites that were identified as contributing NPS pollutions as points on the map. The photographs of each site are linked to the points. The data was also sorted by category and ranked according to severity as recorded on the data sheets. The spreadsheet is included in Appendix 1C.

1.14 Watershed Inventory Findings and Critical Areas

The NPS sites were ranked for severity using the characteristics and measurements taken at each site. The lack of riparian buffers was noted most frequently, with a total of 35 sites identified. Streambank erosion was noted at 33 sites. Stream crossings were contributing pollutants at 30 sites. General urban runoff was observed at 29 sites. Other NPS sites and number of observation are listed in Table 1-3.

Table 1-3: Sites of Pollutant Sources

Lack of Buffer (12)	35
Bank Erosion (7)	33
Stream Crossing (2)	30
Runoff (13)	29
Nutrient Sources (14)	18
Rill/Gully/Ditch Erosion (3)	16
Other (15)	16
Debris/Trash (1)	14
Construction (8)	10
Agricultural Sources (5)	9
Urban/Residential (9)	8
Livestock Access (4)	5
Tile Outlets (6)	4
Row Crop Runoff (11)	3
Marina (10)	1

1.1.4.1 Bacteria Monitoring Programs and Studies

The Macomb County Health Department (MCHD) was one of the first government agencies in Michigan to perform regular surface water monitoring of beaches to protect public health. The program was established in 1948. In the late 1980s, the monitoring program was expanded to include watershed-monitoring and a Lake St. Clair assessment program. Since then, the Macomb County Public Works Office (MCPWO), the St. Clair County Health Department (SCCHD), and the SCCDO have established water quality monitoring programs. Over time, these programs have become better coordinated and expanded. The data collected in these programs form the baseline for this Watershed management effort.

Macomb County

From 1948 through today, the MCHD has continued to augment their on-going monitoring efforts to include more detailed monitoring in the Watershed. This monitoring program sampled for standard water quality parameters under wet and dry weather conditions. A limited number of sites with elevated bacteria levels were also identified. The results of the monitoring are published in a yearly *Lake St. Clair Water Quality Assessment*.

Each year, the MCHD samples Lake St. Clair's nearshore and offshore waters during three periods, spring, summer, and fall. In 1998, they also sampled inshore waters. Fourteen parameters were sampled at these locations, although not all parameters were sampled all three years.

- Nearshore testing was conducted near outfalls entering the lake, including storm drains and river mouths.
- Offshore samples were taken approximately one-quarter mile from shore.
- Inshore sampling, in wet and dry weather, was conducted upstream of nearshore sites, generally one-quarter mile upstream from waterway discharge points.

The MCHD currently performs surface water sampling at 11 locations in the Watershed. One grab sample is collected at each location on a weekly basis. Sampling sites have been added as illicit discharges are suspected and as more resources become available (Table 1-4). The Salt River and Crapau Creek sampling locations have routinely exceeded the total body contact standards for *E. coli* throughout the monitoring period. Table 1-5 shows the results of sample analysis at these locations from 1995 through 2002.

TABLE 1-4: MACOMB COUNTY HEALTH DEPARTMENT SURFACE WATER SAMPLING SITES

Began Sampling	Sites Sampled
1995	Site 46 - Crapau Creek at Main Street
	Site 45 - Salt River at Lake St. Clair
	Site 47 - Salt River at Washington Road
1998	Site 37 - Salt River at 29 Mile Road and Gratiot
1999	Site 46.3 - Crapau Creek at County Line Road south of 25 Mile Road
	Site 46.7 - Crapau Creek at Ashley Street
2000	Site 46.9 - Crapau Creek upstream of Site 46
	Site 46.2 - Crapau Creek at County Line Road south of I-94
2001	Marsac Drain at Lake St. Clair

TABLE 1-5: MACOMB COUNTY HEALTH DEPARTMENT *E. COLI* ANALYSIS (MPN/100 ML)

	Site 37 Salt River at 29 Mile Road			Site 39 Marsac Drain at 29 Ruedisale Park		
Year	Yearly High	Yearly Low	Geo. Mean	Yearly High	Yearly Low	Geo. Mean
1995	*	*	*	*	*	*
1996	*	*	*	*	*	*
1997	*	*	*	*	*	*
1998	9,000	100	494	*	*	*
1999	12,033	47	500	*	*	*
2000	19,863	31	575	*	*	*
2001	4,884	10	242	9,804	1	60
2002	32,820	10	289	43,520	1	59

	Site 45 Salt River at Jefferson Avenue			Site 46 Crapau Creek at Main Street		
Year	Yearly High	Yearly Low	Geo. Mean	Yearly High	Yearly Low	Geo. Mean
1995	1,800	1	65	4,000	20	260
1996	11,500	10	135	6,000	50	338
1997	5,794	1	75	4,800	20	198
1998	500	20	93	37,000	20	398
1999	9,208	1	32	24,192	5	309
2000	5,794	1	75	12,997	20	470
2001	3,076	1	49	6,240	20	269
2002	3,076	1	44	24,192	1	191

Note: *Not Sampled

	Site 46.2 County Line Ditch at Hobarth			Site 46.3 Crapau Creek at County Line Road		
Year	Yearly High	Yearly Low	Geo. Mean	Yearly High	Yearly Low	Geo. Mean
1995	*	*	*	*	*	*
1996	*	*	*	*	*	*
1997	*	*	*	*	*	*
1998	*	*	*	*	*	*
1999	*	*	*	7,701	4	174
2000	17,329	134	1,013	14,136	10	364
2001	7,701	10	248	5,172	10	119
2002	48,840	1	238	8,164	1	146
	Site 46.6 Vanderbenne Drain at Fox Pointe			Site 46.7 Crapau Creek at Ashley		
Year	Yearly High	Yearly Low	Geo. Mean	Yearly High	Yearly Low	Geo. Mean
1995	*	*	*	*	*	*
1996	*	*	*	*	*	*
1997	*	*	*	*	*	*
1998	*	*	*	*	*	*
1999	*	*	*	9,208	22	835
2000	24,192	30	726	19,863	10	709
2001	14,136	1	229	19,863	10	321
2002	17,329	1	202	24,192	10	317
	Site 46.9 Crapau Creek at Green Street			Site 47 Salt River at Washington Street		
Year	Yearly High	Yearly Low	Geo. Mean	Yearly High	Yearly Low	Geo. Mean
1995	*	*	*	8,000	10	469
1996	*	*	*	13,600	10	811
1997	*	*	*	2,700	20	328
1998	*	*	*	6,600	100	634
1999	*	*	*	15,531	100	598
2000	12,033	1	250	24,192	10	387
2001	3,873	10	209	6,131	10	236
2002	19,863	1	113	10,462	20	264

Note: *Not Sampled

Table 1-6 shows the sediment *E. coli* analysis from samples that were collected to determine if there was a correlation between sediment and water bacterial levels. These samples indicate no apparent correlation between the two media.

TABLE 1-6: SEDIMENT *E. COLI* READINGS (CFU/G)

Site	05/19/98	07/28/98	09/22/98	05/27/99	07/15/99	09/09/99	05/11/00	07/06/00	08/31/00
Irwin Drain (N24)	1400	7200	400	3	0	2	2	0	5
Salt River (N28)	5600	6800	1100	11	0	3	0	24	260
Crapau Creek (N29)	5100	1200	800	*	*	*	*	*	*
Salt River (O3)	*	*	*	*	*	*	*	*	*
Irwin Drain (O4)	*	*	*	*	*	*	*	*	*

Note: *Not Sampled

MCPWO and MCHD received two Clean Michigan Initiative (CMI) grants in 2001 to conduct an Illicit Discharge Elimination Program (IDEP) on county storm drains and waters of the state in the Lake St. Clair and Anchor Bay Watersheds. As of December 2004, the MCPWO completed its inventory of all county drain outfalls within the Watershed. Follow up continues and will continue on all county drains with elevated *E.coli* counts until the levels meet MDEQ water quality standards (WQS). As of June 2005, a survey of the county drain outfalls within the Watershed was completed and an inventory of outfalls entering waters of the state and open county drains is approximately 90% complete. The goal of this program is to locate sources of pollution entering county drains, waters of the state and Lake St. Clair. This is accomplished through field crew surveys of inland watercourses, road ditches, county storm drains, and along the shoreline of Anchor Bay. These crews look for signs of failing onsite sewage disposal systems (OSDS), illegal dumping, and pollutants from municipal storm sewers. The Macomb County Road Commission is also sampling for *E.coli* and developing an inventory of all their outfalls within the county. In places where a source of *E. coli* contamination appears to be entering a drain or waters of the state, the MCPWO and MCHD have initiated a more extensive investigation that includes additional sampling and dye testing. They also work with local municipalities to locate and eliminate pollution sources.

ST. CLAIR COUNTY

The SCCHD collected water quality samples for *E. coli* analysis at several locations within the Watershed in 2000 and 2001. Although the resultant data shows no exceedances of the Michigan WQS for *E. coli* for partial body contact, the standards for total body contact recreation were exceeded in the Harsens Island

Main Drain at the North Channel, the Marine City Dredge Cut, and the waterway at Golf Course Lane and Cottage Lane on Harsens Island.

The SCCDO and SCCHD received two CMI grants in 2002 to conduct an IDEP on county drains, natural waterways, and road drains in the Anchor Bay and Pine River Watersheds. The Watershed was surveyed and 117 failing septic systems were found. SCCHD IDEP staff noted that, although there were few problems found on Harsens Island, a weekend survey might be needed to assess discharges from seasonal homes. Most septic system failures were found in Casco and Cottrellville Townships, and the least number were found in Ira Township, which contains sewered areas. The majority of all violations were found entering road drains and ditches. As of June 2005, 95% of these systems have been repaired or rebuilt.

BACTERIA LOADING

E. coli is present in the feces of warm blooded animals, and the detection of *E. coli* in a waterbody often indicates that other dangerous bacteria are present. WQS for *E. coli* are 130 *E. coli* per 100 ml, as a 30-day geometric mean, and 300 *E. coli* per 100 ml, as a daily geometric mean. Leakage from lagoon systems and package treatment plants in Casco Township could also be adding *E. coli* to the system. Additional sources include agricultural operations that allow livestock unlimited access to the stream and feedlot runoff. Non-human sources have been identified through DNA testing to be contributing *E. coli* to the Salt River and could be a source in other urban and lakeshore areas. Loadings of *E. coli* are difficult to determine without extensive sampling and investigation. Therefore, loadings have only been determined for Crapau Creek and the Salt River, both of which are on the State's 303 nonattainment list for not meeting WQS. The total maximum daily load (TMDL) reports for Crapau Creek and Salt River are included in Appendix 1D.

CRAPAU CREEK

The MDEQ sampling for the TMDL study on Crapau Creek had a range of 66 to 2,417 *E. coli* per 100 ml, as a 30-day geometric mean. For Crapau Creek, the Waste Load Allocation (WLA) for the two permitted dischargers, the City of New Baltimore Wastewater Treatment Plant (WWTP) and Millstone Pond Mobile Home Park WWTP, is 200 fecal coliform per 100 ml, as a 30-day geometric mean. Since *E. coli* is a subset of fecal coliform, the 130 *E. coli* per 100 ml WQS will be met if WLAs are met by the permittees. The Load Allocations (LAs) for NPS discharges are distributed according to the land area of each jurisdiction within the Watershed, since the TMDL is concentration-based and assumes that all land, regardless of use, will be required to meeting the WQS. This loading is limited to 130 *E. coli* per 100 ml, and the land area gives an indication of the amount of effort that will be required by each community to meet that loading limit.

The government entities and percentage of land within Crapau Creek are the City of New Baltimore (39%), Ira Township (22%), Casco Township (15%), Chesterfield Township (13%), and Lenox Township (11%). Urban storm water runoff and illicit discharges are likely the dominant sources of *E. coli* to Crapau Creek (Thelen, 2001).

SALT RIVER

The MDEQ sampling for the TMDL study on the Salt River had a 30-day geometric mean range of 23 *E. coli* per 100 ml in September at 26 Mile Road to 698 *E. coli* per 100 ml in July at 23 Mile Road. The highest observed concentrations in the Salt River were located at the 23 Mile Road station. For the Salt River, the WLA for the two permitted dischargers, the City of Richmond WWTP and Northhampton Mobile Home Park WWTP (when constructed), is 200 fecal coliform per 100 ml, as a 30-day geometric mean. The LAs for NPS discharges are distributed according to the land area of each jurisdiction within the Watershed. This loading is limited to 130 *E. coli* per 100 ml, and the land area gives an indication of the amount of effort that will be required by each community to meet that loading limit. The government entities and percentage of land within the Salt River are Lenox Township (48%), Chesterfield Township (32%), Village of New Haven (9%), Casco Township (4%), the City of Richmond (3%), Richmond Township (2%), and the City of New Baltimore (2%). Agricultural runoff, failing septic systems, and pet and/or wildlife wastes are likely the dominant sources of *E. coli* to the Salt River (Alexander, 2005).

POTENTIAL SOURCES OF BACTERIA

OSDS

The Watershed has sanitary sewers in the developed western portion, but is heavily dependent on septic systems, also known as OSDS, in the more open, agricultural areas in its eastern portion. If properly sited, constructed, used, and maintained, these systems will provide reliable service over many years. However, MCHD and SCCHD personnel have indicated that soils in much of the Watershed have generally very limited permeability for sewage disposal. Much of the area has a high water table and, as a result, onsite systems generally need to be specially designed and constructed to compensate for the soil types. The relatively impervious soils result in higher costs, higher failure rates, and shorter system life than in areas with highly pervious sands and gravels.

Failing onsite septic systems result in illicit discharges or a discharge of semi-treated or untreated sewage to a watercourse. These discharges often take the form of sewage seeping into a nearby improved drainage course or through “cheater pipes” that alleviate sewage backups caused by a failed drain field.

To put the issue in perspective, the average residence uses 100 to 300 gallons of water daily, meaning that each failing system could contribute over 35,000 gallons of untreated wastewater to its watershed annually. This, along with system failure rates higher than 25% in some areas, underscores the importance of local programs to assure proper installation and use of onsite systems.

The SCCDO conducted a limited physical inventory in 2003 of all or parts of 24 county drains within the St. Clair County portion of the Watershed to determine sources of pollution and establish concerns. Detailed findings of this inventory can be found in Appendix 1A. This physical inventory substantiates that septic system failures were a considerable source of bacteria for county drains. A current survey would need to occur in order to establish if failing septic systems are still a large problem after the repair and rebuilding of the 117 septic failures reported by the SCCDO and SCCHD. Language regarding the need for maintaining septic system inspections in St. Clair County has been developed now that the initial survey is complete.

On August 1, 2003, Macomb County's regulations governing OSDS became effective. In the first year of the program, OSDS failure rates were equivalent to the rates predicted and similar to those reported in other jurisdictions operating an equivalent program. OSDS failures ranged from small minor repairs (i.e. replacing the broken or missing tank outlet device), to complete replacement of the septic system. The information obtained from the results of the first year of operation revealed much insight into the operation and maintenance of OSDSs in Macomb County. Evidence indicates that many sites lack routine maintenance (i.e. scheduled tank pumping), on the owner's behalf. Future analyses planned will include detailed breakdowns as to the type and location of failure. Macomb County's regulations are developing into a program that enhances the quality of life for all residents of Macomb County through increased system maintenance and owner education.

SEWERED AREA SOURCES

Three potential sources of contamination within sewered areas are illicit connections, sanitary sewer overflows (SSOs), and combined sewer overflows (CSOs).

An illicit connection is a sewer pipe connected to a storm drain rather than to a sanitary sewer. Typically, these are connected inadvertently at the time of construction and are difficult to isolate because they discharge intermittently. If left uncorrected, however, these intermittent discharges contribute a significant pollutant load.

SSOs occur when sanitary sewers cannot carry all water that falls during a rain event. Rather than cause sewage backups into area basements, a pump or bypass structure diverts flow to a local tributary stream. Technically, sewer breaks or equipment malfunctions that result in overflows from sanitary sewers to streams/drains are also considered to be SSOs. While there are no known SSOs within the Watershed, the age of some of the development within the Anchor Bay drainage area suggests that undetected SSOs could exist.

Like SSOs, CSOs are caused by rain events. CSO discharges to the Watershed come from the Clinton River, which is not part of the designated watershed. However, when certain wind and current conditions are present, contaminants from Clinton River sewer systems, such as bacteria, organic chemicals, and metals, can add sediment accumulations and loadings that contribute to decreased water quality.

Lagoon Systems and Package Treatment Plants

Proliferation of small lagoon systems and package wastewater treatment facilities discharging to the bay and its tributaries is a concern for many county and local government officials. Increased use of these facilities can result in degradation of local and watershed-wide water quality when facility operation and maintenance is not closely monitored and regulated. Likewise, negative cumulative effects can occur when monitored and regulated discharges from various facilities are not well coordinated.

In the SCCDO physical inventory, "leaking valves and embankments at water treatment facilities" is noted as a problem (Appendix 1A). The impacts of these facilities on an individual and collective basis can include elevated *E. coli* bacteria densities and nutrient concentrations as well as aesthetic and water quality degradation from excessive algae and green discoloration in facility discharges. Although these impacts are not well documented, proliferation of separate sewage treatment facilities that utilize lagoons or low-volume secondary treatment plants (package plants) is becoming an increasing concern to public officials, regulators, and the general public.

Agricultural Runoff

Although the amount of land being used for livestock and dairy operations in the Watershed has decreased over time, a significant portion of the Watershed is still used for cropland, livestock and dairy operations, and equestrian activities. Stream contamination can occur from several sources related to agriculture. Direct impacts from cattle crossing streams and horse-related activities could include elevated bacteria in the streams from manure contaminated runoff.

Waste Products from Pets, Birds, and Wildlife

All warm-blooded animals have *E. coli* bacteria in their digestive systems. Pets, birds, and wildlife in urban areas deposit waste products directly into surface water and storm sewers. This contaminates discharges to the waterways, resulting in elevated bacteria levels in the rivers and the bay.

Critical Area for Bacteria

Crapau Creek and Salt River have been on the state's impaired waters list (303(d) list) since 1998 for long-term violation of *E. coli* standards based on water quality data collected by the MCHD and the MDEQ. Therefore, those two subwatersheds are critical areas for bacterial contamination.

1.1.4.2 Soil Erosion and Sedimentation Loadings

Erosion is the process of displacing soil particles through wind and water action. This process is natural, but can be accelerated by human activities of construction and agricultural practices. Sedimentation is the process where the dislodged soil particles are deposited elsewhere on land, in streams, rivers, lakes, or wetlands. The predominantly clay soils found within the Watershed create unique problems with sedimentation control. These clay soils tend to remain in suspension and are extremely difficult to remove from the water column using conventional sedimentation techniques. The result is highly turbid runoff in tributary streams and storm water systems that tend to remain sediment-laden for an extended period of time after rainfall events. The MDEQ has stated that tributary streams within the Watershed regularly flow brown for days after significant rainfall events from increased sediment loadings.

Erosion and sedimentation impacts include deposition, turbidity, increased pollutant loading, and destruction of wildlife habitat:

- *Deposition* affects stream morphology (shape), causing the stream to widen and become shallower, making it prone to temperature changes.
- *Turbidity* is cloudiness caused by sediment in water. Highly turbid water results in degradation of habitat and impaired aesthetics within waterways. Sediment particles affect fish, aquatic plants, and animals by causing starvation or suffocation. In fish, these sediment particles adhere to gill structures and lodge in feeding or breathing structures. Turbid water may also inhibit hunting, which disrupts the natural relationship of predator and prey.
- *Pollutant Loading* is also increased by erosion and sedimentation. Pollutants, such as heavy metals, fertilizers, and pesticides, adhere to soil and are transported to the receiving water through erosion and sedimentation.

- *Wildlife Habitat* can be destroyed as sediments fill in voids created by woody debris, rocks and gravel that are used as cover by young fish and other aquatic species. Sedimentation also destroys fish and spawning areas.

The method used to provide a gross estimate of sediment loadings from the identified NPS sites in agricultural areas is based on the MDEQ's "Pollutant Controlled Calculations and Documentation for Section 319 Watersheds Training Manual," June 1999. The St. Clair and Macomb Counties' Natural Resources Conservation Service district office was contacted to get information about cropping rotations, tillage practices, slope length factors, and general soils information to use the Michigan State University's "RUSLE - Online Soil Erosion Assessment Tool" for sediment loadings from cropland runoff in the Watershed. The estimated sediment loading from agricultural areas is 13,637 tons per year. The methodologies and assumptions to estimate these loadings are included in Appendix 1E.

Loadings from urban areas were estimated using the methodology and efficiency values developed by the Illinois Environmental Protection Agency (EPA). These worksheets used land use data and associated impervious surface coefficients to determine pollutant loadings contained in urban runoff. The estimated loading for sediment from urban areas is 7,723 tons per year. The worksheets and land use data used to calculate these estimates are included in Appendix 1F.

POTENTIAL SOURCES OF SOIL EROSION AND SEDIMENTATION

CONSTRUCTION

Construction activity usually results in compacted soils due to heavy equipment and removal of natural features, such as vegetated areas, that prevent soil erosion. When vegetation is removed, the exposed soils are more susceptible to movement by water runoff and wind. Clay based soils dominate the Macomb County portion of the Watershed and much of St. Clair County. Communications from the Technical and Steering Committees for the WMP, as well as noted in the physical inventory conducted by the SCCDO, indicate that soil erosion and sedimentation control (SESC) measures on construction sites are not well maintained or are non-existent. The SCCDO physical inventory substantiates the lack of SESC measures, lack of maintenance of these measures on construction sites, and lack of enforcement of existing ordinances and programs along county drains in the St. Clair County portion of the Watershed.

FLOWS

Increased impervious area due to land use changes can result in excessive flows in receiving streams. This excessive flow can be exhibited by higher peak flows, longer peak flow periods, or both. The SCCDO physical inventory indicates evidence of high flows causing streambank erosion. The results of these excess flows are increased streambank erosion, increased bottom scour, sediment re-suspension, habitat destruction, and decreased diversity and number of fish and aquatic organisms.

AGRICULTURAL RUNOFF

Farming to the edge of streambanks can result in streambank erosion during runoff events and increased sediment loading from farm fields. Direct impacts from agricultural areas include streambank erosion where the banks have been leveled and stripped of grass from movement of the cattle and horses, and destruction of stream bottom habitat and downstream sedimentation damage to the habitat from cattle walking in the stream. The SCCDO physical inventory and recent field work substantiates the lack of consistent agricultural practices across St. Clair County and found the existence of the following activities that contribute to SESC:

- Plowing to the edge of a county drain
- Field drain ditches that cause erosion at their outlets
- Livestock traffic and tractor traffic across watercourses that erode banks and damage tree roots that would, otherwise, help stabilize soil

ROAD CROSSINGS

As evidenced by the MDEQ road crossing survey, road crossings are a source of SESC problems. Poorly designed road crossing structures, evidence of limited maintenance, and resident-built waterway crossings are also noted in the SCCDO physical inventory of county drains.

CRITICAL AREA FOR EROSION AND SEDIMENTATION

Sediments typically come from disturbed land on construction sites, agricultural areas, and eroding streambanks caused by excessive water flows. The sources of sediment in the Watershed were found to be originating from construction activities and a lack of SESC measures enforced in the Watershed. Areas that are planned to be developed, either low- or high-intensity, have been identified through a build out analysis of the Watershed.

SEMCOG

SEMCOG prepares a yearly report that documents new residential construction occurring in each county and community in Southeast Michigan. The report states that Macomb County was ranked third highest, out of the seven communities ranked, in new residential permits issued, with 5,401 permitted units. St. Clair County was ranked sixth, with 964 new residential permits issued. Macomb County was also ranked the top community for total units authorized for the eighth consecutive year (SEMCOG, 2005).

Macomb Township, in Macomb County, was the top community for total units authorized for the eighth consecutive year. Table 1-7 lists the communities in the Watershed, with their number of total units and the future percent imperviousness of those communities, projected through the build out analysis (FTC&H, 2005).

TABLE 1-7: AUTHORIZED NEW HOUSING UNITS BASED ON RESIDENTIAL PERMITS ISSUED, 2004

Macomb County	Units	Future % Impervious*	St. Clair County	Units	Future % Impervious*
Macomb Township	1,086	>25%	Clay Township	54	>25%
Clinton Township	776	>25%	Casco Township	28	<10%
Chesterfield Township	663	>25%	China Township	28	<10%
New Baltimore	142	>25%	Ira Township	26	10-25%
New Haven	130	10-25%	Cottrellville Township	19	10-25%
Harrison Township	110	10-25%	Algonac	12	>25%
Richmond	48	>25%			
Richmond Township	32	10-25%			
Lenox Township	11	10-25%			

*Based on results of build out analysis (FTC&H, 2005).

Critical areas for erosion and sedimentation control are therefore those areas with the most development occurring and highest percentage imperviousness: Macomb, Clinton, Chesterfield, New Baltimore, and Clay Townships. These communities have been determined to be part of the critical areas of the Watershed for erosion and sedimentation since runoff from construction sites is contributing to the sedimentation in the waterways. Streambank erosion, caused by flashy flows from an increase in impervious surfaces, has also been identified. Agricultural runoff is allowed to enter the stream due to the absence of stream buffers and soil erosion control structures in many areas of the Watershed.

Additional critical areas for erosion and sedimentation would be agricultural fields adjacent to waterways, including the additional acres of the contributing area. Over 104 miles of stream intersect agricultural areas, all of which could benefit from filter strips and other erosion control measures, such as conservation tillage and water and sediment control structures, which reduce erosion. Several road crossings were found to have poor designs, in terms of erosion control, and the many gravel roads add to the sedimentation problem. Specific sites are identified on the Figure 1-6.

1.1.4.3 NUTRIENT MONITORING PROGRAMS AND STUDIES

Previous water quality data collected by the MCHD from 1998 to 2000 show that water at the sampling locations exceeded levels of concern values or had higher than average readings throughout the three-year period. A majority of the locations measured total phosphorus above the standard for water quality of 0.05 mg/l at least once. Nearly half of the locations also displayed low dissolved oxygen levels of less than 5 mg/l at least once. These levels suggest that Anchor Bay is being degraded by excessive nutrients. Continued urbanization will likely aggravate this problem.

NUTRIENT LOADINGS

The method used to provide a gross estimate of phosphorus and nitrogen loadings from the identified NPS sites in agricultural areas is based on the MDEQ's "Pollutant Controlled Calculations and Documentation for Section 319 Watersheds Training Manual", June 1999. The St. Clair and Macomb Counties NRCS district office was contacted to get information about cropping rotations, tillage practices, slope length factors, and general soils information to use the Michigan State University's "RUSLE - Online Soil Erosion Assessment Tool" for nutrient loadings from the cropland runoff in the Watershed. The estimated phosphorus loading from agricultural areas is 30,466 pounds per year. The estimated nitrogen loading from agricultural areas is 15,233 pounds per year. The methodologies and assumptions to estimate these loadings are included in Appendix 1E.

Loadings from urban areas were estimated using the methodology and efficiency values developed by the Illinois EPA. These worksheets used land use data and associated impervious surface coefficients to determine pollutant loadings contained in urban runoff. The estimated loadings for total phosphorus from urban areas are 22,830 pounds per year. The estimated loadings for total nitrogen from urban areas are 203,906 pounds per year. The worksheets and land use data used to calculate these estimates are included in Appendix 1F.

POTENTIAL SOURCES OF NUTRIENTS

Phosphorus and nitrogen are chemicals that are commonly used in fertilizer to encourage rapid growth. These same chemicals increase nutrient levels in open waterways and promote algae growth in Anchor Bay. Although excessive aquatic plant and algae growth is generally phosphorus limited, increased levels of nitrogen and phosphorus can lead to low, dissolved oxygen thus exacerbating growth of aquatic nuisance plants. It is suspected that increased aquatic plant growth contributes to the public health problem by trapping fecal-contaminated waters in the near shore areas, which in turn causes beach closures. This hypothesis was included as part of the August 2000, revision of the Report and Recommendations of the Macomb County Blue Ribbon Commission on Lake St. Clair.

The field investigations determined that the sources of nutrients in the Watershed are originating from urban runoff, agricultural runoff, and possibly golf courses. Excessive use and application of fertilizers on lawns and cropland cause nutrients to enter the waterways. The lack of natural filtration (private ponds) leads to urban runoff. The lack of stream buffers and other agricultural BMPs also allow nutrients to enter the streams. Golf courses use fertilizers to keep conditions at their prime for golfing, but excessive use can result in runoff going into the streams.

URBAN SOURCES

Excessive use of fertilizers is the major source of nutrients from urban residential areas. Natural wetlands can remove some nutrients from storm water runoff, but development has reduced these natural filtration areas, resulting in untreated storm water runoff to tributaries and increased nutrients in the Watershed and the bay.

AGRICULTURAL SOURCES

Improperly managed agricultural runoff can contribute fertilizers, pesticides, and herbicides to nearby water and can also create excess particulates from soil erosion and general ecosystem damage. Although there has been a general decline in livestock sites for dairy, beef, swine, and poultry, a significant equine-related agricultural industry still exists within the Watershed. A significant amount of acreage is devoted to soybean, wheat, and corn production. A consistent application of agricultural BMPs, such as buffer strips, limiting cattle access to streams, and implementation of Nutrient Management Plans will reduce these impacts within the Watershed and the bay. Although limited information is available regarding agricultural runoff, public comment indicates a lack of consistent application of agricultural BMPs within the Watershed.

CRITICAL AREA FOR NUTRIENTS

Data from the *Lake St. Clair Water Quality Assessment* report shows elevated nutrient levels from inland watercourses that drain residential and agricultural areas. Since direct runoff from residential areas is likely to cause the greatest impact, critical area have been determined to be all residential areas adjacent to waterways. Mapping these areas would simply be identifying the residential land use where it intersects any waterway. These riparian areas could benefit from filter or buffer strips, creating a protected riparian corridor.

Runoff from agricultural areas is also influenced by the proximity of the waterway. Additional critical areas for nutrients would be agricultural fields adjacent to waterways, including the additional acres of the contributing area. Over 104 miles of stream intersect agricultural areas, all of which could benefit from filter strips and other agricultural control measures, such as conservation tillage and water and sediment control structures, which reduce the amount of nutrients entering the waterways. Specific sites are identified on the Figure 1-6.

1.1.4.4 Flow Rate Monitoring and Studies

Flow monitoring was conducted in 2004 to calibrate the hydrologic model. Flows at three sites were monitored:

1. Marsac Creek at Bethuy Road
2. Swan Creek at Lindsay Road
3. Salt River at 30 Mile Road

The preliminary conclusions of the monitoring were that the bankfull flows may be lower than those calculated by MDEQ, which were used for the hydrologic modeling. The monitoring revealed that a good correlation existed between measured flows and flows calculated from the field survey results. (FTC&H, 2005. Anchor Bay Watershed Technical Report)

Potential Sources for Increased Flow Rates

The original WMP identified potential sources of increased flows. These sources were substantiated in the field work conducted in 2004.

Land Use and Impervious Surfaces

Increased impervious areas within the Watershed, caused by changes in land use, result in higher storm water runoff that quickly reaches tributary streams, often causing flooding and streambank erosion. Left unchecked, the changes to the river flow will cause serious damage to the physical and biological integrity of the receiving stream. A limited physical inventory, conducted in 2003 by the SCCDO, highlighted that high flow rates have been a problem in many county drains.

Impacts of increased impervious areas include:

- *Water quality degradation:* pollutant types and concentrations increase substantially as oils, sediment, trace metals, nitrogen, and phosphorus are washed from urban areas into waterways

- *Increased flooding:* peak flows are increasing two to five times over predevelopment flow rates, and runoff reaching the stream up to 50% faster

- *Increased erosion:* The channel may widen and undercut streambanks that may fall into the river

- *Accelerated habitat loss:* The removal of streamside vegetation and increase of flows, change the ecology needed for a healthy habitat adjacent to rivers and streams

- *Biodiversity loss:* Fish communities may become less diverse, and sensitive fish species may be lost

- *Higher water temperature:* Waterways change characteristics due to heated pavement and wider, shallower streams

CRITICAL AREA FOR EXCESSIVE FLOW RATES

The information from the hydrologic modeling and the build out analysis resulted in a model storm water ordinance for communities in the Watershed to adopt. The model ordinance provides design standards for criteria of flood control, stream protection, water quality, spill protection, groundwater recharge, and low impact development (LID). Most areas of the Watershed would follow the "Standard" criteria, minimizing the effects of storm water for each level of criteria. Alternative design criteria would be required in areas that have unique circumstances. Coastal zones are those areas with direct discharge to the Anchor Bay and the St. Clair River, which also have specific design specifications. These criteria and design specifications are described in Table 1-8. The results of the model indicate that the use of design criteria can protect the Watershed. An overall goal of reducing runoff volume and decreasing impervious surfaces should be followed to protect the Watershed.

Table 1-8: Summary of Design Standards for Model Storm Water Ordinance

CRITERIA	STANDARD	ALTERNATE	COASTAL ZONE
Flood Control	Detention of 100-year runoff volume with a maximum allowable release rate of 0.15 cfs/acre of developed site	1. Detention required to match existing flows or downstream capacity if standard detention criteria will have a negative effect 2. No detention required if un-detained discharge to pond/wetland will have no measurable effect on water levels 3. In Crapau Creek, detention of 100-year runoff volume with a maximum allowable release rate of 0.1 cfs/acre of developed site is required	Direct discharge to Anchor Bay and St. Clair River
Stream Protection	Extended detention (24-hour) of runoff produced by a 1.5-year storm event from developed site	No detention required if un-detained discharge through a pond/wetland does not increase streambank erosion	Direct discharge to Anchor Bay and St. Clair River
Water Quality	Treat first 0.5-inch of rainfall through: 1. Permanent pool 2. Extended detention 3. Infiltration 4. Other treatment device (filter, vegetation, swirl concentrator)	Same as Standard	Same as Standard
Spill Protection	Containment or treatment required in areas that have high potential for storm water contacting polluting materials	Same as Standard	Same as Standard

Table 1-8: Summary of Design Standards for Model Storm Water Ordinance

CRITERIA	STANDARD	ALTERNATE	COASTAL ZONE
Groundwater Recharge	May require infiltration to avoid an increase in runoff volume or where it is important to sustain groundwater levels, such as for perennial streams or wetlands	Same as Standard	Not required
LID (reducing runoff volume through impervious area reduction, infiltration, interception and re-use)	Encouraged to reduce runoff volume and rate of discharge	Same as Standard	Encouraged to reduce size of water quality controls

1.1.5 OTHER POLLUTANTS AND THEIR SOURCES

AIRBORNE DEPOSITION

Airborne deposition directly to the Anchor Bay drainage area and water surface area is small, but significant, due to the small surface area of its drainage basin. However, the volume of airborne deposition can become even more significant when pollutants are considered that fall into Lake Huron and its drainage basin, then flow into the Anchor Bay. It is believed that most organochlorine pesticides found in the St. Clair River - alpha-BHC, gamma-BHC (lindane), dieldrin and heptachlor epoxide - come from upstream locations, including Lake Huron. A recent study conducted by the Detroit Water and Sewerage Department, *Atmospheric Deposition Study of PCBs, Mercury, and Cadmium*, concluded that precipitation contained mercury, cadmium, and PCBs at analytically detectable levels.

The study also showed that there was a definite "first-flush" phenomenon associated with the concentration of these materials in runoff from residential and industrial sites within the study area. That is, the first storm water runoff in a storm is more contaminated because the land surface it runs over has collected pollutants over a period of time. As the runoff continues and the land surface becomes cleaner, the quality of the runoff improves. The airshed of Anchor Bay is therefore determined to be a critical are for airborne deposition.

ACCIDENTAL SPILLS

The number and size of accidental releases of materials to the environment (commonly known as spills) have been reduced significantly over the last ten years. Historical spill events have resulted in contaminated sediment and transient water quality impacts. Spills can increase chemical contamination of the water and sediment, cause fish kills and other habitat impacts, and degrade aesthetics. Critical areas for spills are the major roadways and railway corridors that carry chemicals and other potential contaminants through the Watershed.

DEBRIS AND TRASH

Dumping trash along the banks and directly into Watershed tributaries and the bay is an activity that is, unfortunately, a result of day-to-day human activities. This activity can cause fish and wildlife mortalities, blockages, disease, and reduced public enjoyment. The 2003 SCCDC physical inventory and recent field work found that dumping of refuse in or near watercourses was a common activity and resulted in degraded water quality. A lack of Watershed stewardship results in apathy toward the protection of the water resources. Since dumping can occur anywhere, the entire Watershed is considered a crucial area for debris and trash.

INVASIVE/NON-NATIVE SPECIES

Invasive plant and aquatic species pose a threat to native fish, wildlife, and natural areas in the Watershed. Unlike other Watershed impacts that may be attributed to land use change, the introduction of invasive species results from transient activities, such as shipping and recreational boating. If allowed to flourish in natural areas and watercourses, invasive aquatic species, such as zebra mussels and sea lamprey, can out-compete native species and eliminate a food source for mature fish and wildlife. Likewise, invasive wetland plants, such as purple loosestrife and phragmites, can overtake a diverse wetland habitat. Collectively, these exotic species cause great harm to fragile and unique natural areas in Anchor Bay.

- *Phragmites* is a tall plumed perennial wetland grass that ranges in height from 3 to 13 feet. This reed-like species is commonly found along roadsides, ditches, dredged areas, and in freshwater marshes. It can form colonies hundreds of acres in size. Phragmites chokes out more beneficial vegetation, such as cattails and other native plants that provide food and habitat to native fish and wildlife. Currently, the MDEQ, in partnership with the U.S. Army Corps of Engineers, Ducks Unlimited, and other state conservation groups, are participating in a research program using beetles, herbicides, and controlled burns to eradicate or control phragmites in St. Johns Marsh and nearby Algonac State Park.

- *Purple Loosestrife* is a wetland perennial that can produce more than two million seeds annually. An invasion by purple loosestrife can overtake native plants in a wetland, resulting in eventual alteration of the wetland's structure and function. No effective method of controlling purple loosestrife has yet been discovered or implemented. However mowing or cutting, burning, herbicide application, or releasing herbivore beetles to eat the plant roots has provided limited success. The Galerucella Beetle has been credited with wiping out large stands of purple loosestrife in southern Michigan.

- *Zebra Mussels*, an invading species from Eurasia, was introduced into the Great Lakes through ballast water, which is used in ships to maintain stability in open waters and along coastal areas. The water, itself, can be contaminated with organisms that include plants, animals, bacteria, and pathogens all of which may displace native species, degrade native habitat, spread disease, and disrupt human social and economic activities that depend on water resources. The non-native zebra mussel, for example, has reduced plankton populations, clogged municipal water intakes, and impacted recreational boating in Anchor Bay.

Recently, the State of Michigan (State) took action to protect the Great Lakes from aquatic nuisance species. Senator Birkhortz, Representative Palsrok, and Governor Granholm secured passage of a package of bi-partisan bills in June 2005, requiring ocean-going vessels in Michigan's ports to treat ballast water and prevent the spread of aquatic invasive species. This legislation was passed to stop the spread of aquatic nuisance species and to protect against additional species that might be transported into the Great Lakes (and from the Great Lakes to other parts of the world) through ballast water. The critical areas determined for invasive species include these transportation and recreational waters and areas that have been identified as supporting endangered, threatened, or special concern species. Table 1-9 lists areas for protection, based on the Michigan Natural Features Inventory (MNFI). Figure 1-7 illustrates the number of MNFI occurrences in each Public Land Survey System section (Township, Range, Section). This database contains both historic and recent occurrence sightings. The count is based on a polygon representation of the occurrence. An individual occurrence may be present in more than one section. The darker shades of green indicate a greater number of occurrences. In the Watershed, the occurrences range from 0 to 41 occurrences. As shown, the eastern shoreline of the Watershed along the St. Clair River is a unique ecosystem that has been recognized as one of the 10 most sensitive habitats in the world (Appel, et. al).

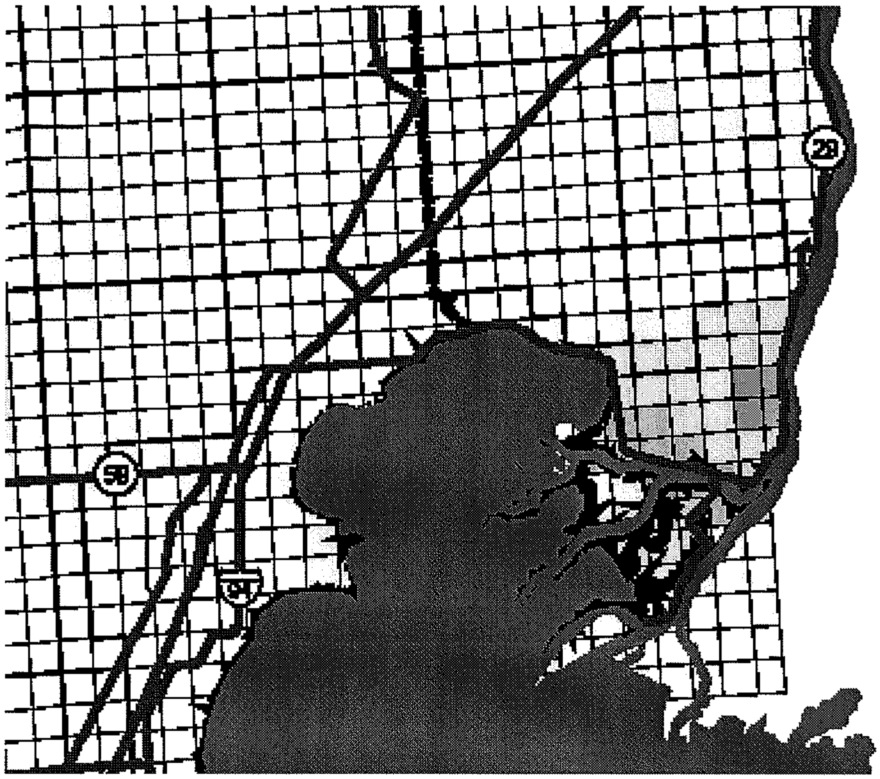


Figure 1-7: Number of Occurrences

Data sources: Michigan Natural Features Inventory database of threatened, endangered, and special concern species and high quality natural communities.

Michigan State University Extension

TABLE 1-9: WATERSHED STATUS OF ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES
(CURRENT AS OF 01/04/2005)

Swartout Drain			Marine City Drain			St. Clair River Drainage		
Scientific Name	Common Name	State Status	Scientific Name	Common Name	State Status	Scientific Name	Common Name	State Status
Acipenser fulvescens	Lake Sturgeon	T	Acipenser fulvescens	Lake Sturgeon	T	Acipenser fulvescens	Lake Sturgeon	T
Ammocrypta pellucida	Eastern Sand Darter	T	Agalinis gattingeri	Gattinger's Gerardia	E	Aristida longespica	Three-awned Grass	T
Aristida longespica	Three-awned Grass	T	Agalinis skinneriana	Skinner's Gerardia	E	Asclepias purpurascens	Purple Milkweed	SC
Asclepias sullivantii	Sullivant's Milkweed	T	Aristida longespica	Three-awned Grass	T	Asclepias sullivantii	Sullivant's Milkweed	T
Baptisia lactea	White or Prairie False Indigo	SC	Asclepias sullivantii	Sullivant's Milkweed	T	Baptisia lactea	White or Prairie False Indigo	SC
Carex festucacea	Fescue Sedge	SC	Baptisia lactea	White or Prairie False Indigo	SC	Carex festucacea	Fescue Sedge	SC
Cirsium hillii	Hill's Thistle	SC	Carex festucacea	Fescue Sedge	SC	Cirsium hillii	Hill's Thistle	SC
Clemmys guttata	Spotted Turtle	T	Cirsium hillii	Hill's Thistle	SC	Clemmys guttata	Spotted Turtle	T
Cypripedium candidum	White Lady-slipper	T	Clemmys guttata	Spotted Turtle	T	Elaphe vulpina gloydi	Eastern Fox Snake	T
Delta	Geographical Feature		Delta	Geographica l Feature		Epioblasma triquetra	Snuffbox	E
Epioblasma triquetra	Snuffbox	E	Dendroica cerulea	Cerulean Warbler	SC	Fimbristylis puberula	Chestnut Sedge	X
Fimbristylis puberula	Chestnut Sedge	X	Elaphe vulpina gloydi	Eastern Fox Snake	T	Hiodon tergisus	Mooneye	T
Lakeplain wet prairie	Alkaline Wet Prairie, Midwest Type		Epioblasma triquetra	Snuffbox	E	Ludwigia alternifolia	Seedbox	SC
Lakeplain wet-mesic prairie	Alkaline Tallgrass Prairie, Midwest Type		Fimbristylis puberula	Chestnut Sedge	X	Noturus stigmosus	Northern Madtom	E
Papaipema beeriana	Blazing Star Borer	SC	Flexamia delongi	Leafhopper	SC	Papaipema beeriana	Blazing Star Borer	SC
Percina copelandi	Channel Darter	E	Flexamia reflexus	Leafhopper	SC	Papaipema sciata	Culvers Root Borer	SC
Platanthera ciliaris	Orange or Yellow Fringed Orchid	T	Great Blue Heron Rookery	Great Blue Heron Rookery		Percina copelandi	Channel Darter	E
Polygala cruciata	Cross-leaved Milkwort	SC	Hemicarpha micrantha	Dwarf-bulrush	SC	Platanthera ciliaris	Orange or Yellow Fringed Orchid	T

TABLE 1-9: WATERSHED STATUS OF ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES
(CURRENT AS OF 01/04/2005)

Swartout Drain			Marine City Drain			St. Clair River Drainage		
Scientific Name	**Common Name**	**State Status**	**Scientific Name**	**Common Name**	**State Status**	**Scientific Name**	**Common Name**	**State Status**
Polygonatum biflorum var. melleum	Honey-flowered Solomon-seal	X	Hypericum gentianoides	Gentian-leaved St. John's-wort	SC	Polygala incarnata	Pink Milkwort	X
Prosapia ignipectus	Red-legged Spittlebug	SC	Juncus brachycarpus	Short-fruited Rush	T	Polygonatum biflorum var. melleum	Honey-flowered Solomon-seal	X
Ranunculus ambigens	Spearwort	T	Lakeplain oak openings			Ranunculus ambigens	Spearwort	T
Ranunculus rhomboideus	Prairie Buttercup	T	Lakeplain wet-mesic prairie	Alkaline Tallgrass Prairie, Midwest Type		Ranunculus rhomboideus	Prairie Buttercup	T
Scleria pauciflora	Few-flowered Nut-rush	E	Ludwigia alternifolia	Seedbox	SC	Scleria pauciflora	Few-flowered Nut-rush	E
Triplasis purpurea	Sand Grass	SC	Lycopodiella subappressa	Northern Appressed Clubmoss	SC	Stizostedion canadense	Sauger	T
			Papaipema beeriana	Blazing Star Borer	SC			
			Papaipema sciata	Culvers Root Borer	SC			
			Percina copelandi	Channel Darter	E			
			Platanthera ciliaris	Orange or Yellow Fringed Orchid	T			
			Polygala cruciata	Cross-leaved Milkwort	SC			
			Polygala incarnata	Pink Milkwort	X			
			Polygonatum biflorum var. melleum	Honey-flowered Solomon-seal	X			
			Prosapia ignipectus	Red-legged Spittlebug	SC			
			Ranunculus ambigens	Spearwort	T			
			Ranunculus rhomboideus	Prairie Buttercup	T			
			Scirpus clintonii	Clinton's Bulrush	SC			
			Scleria pauciflora	Few-flowered Nut-rush	E			

TABLE 1-9: WATERSHED STATUS OF ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES
(CURRENT AS OF 01/04/2005)

Marine City Drain	
Scientific Name	**Common Name**
Scleria triglomerata	Tall Nut-rush
Stizostedion canadense	Sauger
Triplasis purpurea	Sand Grass

Beaubien Creek			Palms Road Drain			Swan Creek		
Scientific Name	**Common Name**	**State Status**	**Scientific Name**	**State Status**	**State Status**	**Scientific Name**	**Common Name**	**State Status**
Acipenser fulvescens	Lake Sturgeon	T	Acipenser fulvescens	SC	T	Clemmys guttata	Spotted Turtle	T
Ammocrypta pellucida	Eastern Sand Darter	T	Ammocrypta pellucida	T	T	Macrhybopsis storeriana	Silver Chub	SC
Aristida longespica	Three-awned Grass	T	Aristida longespica	SC	T	Obovaria subrotunda	Round Hickorynut	E
Baptisia lactea	White or Prairie False Indigo	SC	Baptisia lactea	White or Prairie False Indigo	SC			
Carex festucacea	Fescue Sedge	SC	Carex festucacea	Fescue Sedge	SC			
Cirsium hillii	Hill's Thistle	SC	Clemmys guttata	Spotted Turtle	T			
Clemmys guttata	Spotted Turtle	T	Delta	Geographical Feature				
Delta	Geographical Feature		Fimbristylis puberula	Chestnut Sedge	X			
Fimbristylis puberula	Chestnut Sedge	X	Macrhybopsis storeriana	Silver Chub	SC			
Platanthera ciliaris	Orange or Yellow Fringed Orchid	T	Obovaria subrotunda	Round Hickorynut	E			
Polygala cruciata	Cross-leaved Milkwort	SC	Polygala cruciata	Cross-leaved Milkwort	SC			
Polygala incarnata	Pink Milkwort	X	Polygala incarnata	Pink Milkwort	X			
Polygonatum biflorum var. melleum	Honey-flowered Solomon-seal	X	Polygonatum biflorum var. melleum	Honey-flowered Solomon-seal	X			
Ranunculus ambigens	Spearwort	T	Ranunculus ambigens	Spearwort	T			

TABLE 1-9: WATERSHED STATUS OF ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES
(CURRENT AS OF 01/04/2005)

Beaubien Creek

Scientific Name	Common Name	State Status
Ranunculus rhomboideus	Prairie Buttercup	T
Scleria pauciflora	Few-flowered Nut-rush	E
Triplasis purpurea	Sand Grass	SC

Palms Road Drain

Scientific Name	Common Name	State Status
Ranunculus rhomboideus	Prairie Buttercup	T
Scleria pauciflora	Few-flowered Nut-rush	E
Triplasis purpurea	Sand Grass	SC

Marsac Creek

Scientific Name	Common Name	State Status
Clemmys guttata	Spotted Turtle	T
Macrhybopsis storeriana	Silver Chub	SC
Obovaria subrotunda	Round Hickorynut	E

Crapau Creek

Scientific Name	Common Name	State Status
Macrhybopsis storeriana	Silver Chub	SC
Obovaria subrotunda	Round Hickorynut	E

Goulette Point Drainage

Scientific Name	Common Name	State Status
Hiodon tergisus	Mooneye	T
Macrhybopsis storeriana	Silver Chub	SC
Obovaria subrotunda	Round Hickorynut	E

Salt River

Scientific Name	Common Name	State Status
Macrhybopsis storeriana	Silver Chub	SC
Obovaria subrotunda	Round Hickorynut	E

Anchor Harbor Drainage

Scientific Name	Common Name	State Status
Macrhybopsis storeriana	Silver Chub	SC
Obovaria subrotunda	Round Hickorynut	E

Auvase Drain

Scientific Name	Common Name	State Status
Armoracia lacustris	Lake Cress	T
Macrhybopsis storeriana	Silver Chub	SC
Obovaria subrotunda	Round Hickorynut	E
Quercus shumardii	Shumard's oak	SC

Anchor Bay Shores Drainage

Scientific Name	Common Name	State Status
Accipiter cooperii	Cooper's Hawk	SC
Circus cyaneus	Northern Harrier	SC
Elaphe vulpina gloydi	Eastern Fox Snake	T

TABLE 1-9: WATERSHED STATUS OF ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES
(CURRENT AS OF 01/04/2005)

Anchor Bay Shores Drainage

Scientific Name	Common Name	State Status
Nycticorax nycticorax	Black-crowned Night-heron	SC
Obovaria subrotunda	Round Hickorynut	E

1.2 DESIGNATED, BENEFICIAL, AND DESIRED USES

1.2.1 INTERNATIONAL JOINT COMMISSION (IJC) BENEFICIAL AND DESIGNATED USES FOR WATERWAYS

The MDEQ and the IJC for the Great Lakes and Connecting Channels has established 17 Beneficial and Designated Uses for waterways. Of the 17, the following 7 are considered to be impaired within Anchor Bay and/or its Watershed:

1. Total body contact
2. Partial body contact
3. Warmwater/coldwater fishery
4. Indigenous aquatic life and wildlife
5. Degradation of benthos
6. Degradation of aesthetics
7. Eutrophication impacts and excessive aquatic plant growth.

1.2.2 STATE DESIGNATED USES

The State has developed WQS under Part 4 of the Administrative Rules issued pursuant to Part 31 of the Natural Resources and Environmental Protection Act (1994 PA451, as amended). Rule 100 (R323.1100) of the WQS states that all surface waters of the State are designated for, and shall be protected for, all of the following eight uses:

- Agriculture
- Industrial water supply
- Public water supply at the point of intake
- Navigation
- Warmwater fishery (Lake St. Clair is also designated as a coldwater fishery)
- Other indigenous aquatic life and wildlife
- Partial body contact recreation
- Total body contact recreation between May 1 and October 31

The status of a designated use in a watershed can be unimpaired, impaired, threatened, or under review/unknown. The use is unimpaired if the available physical and analytical data indicates that all applicable WQS are being consistently met. If the available physical and analytical data indicates that WQS are not being consistently met, then the designated use is considered to be impaired. A threatened status occurs when a watershed is currently unimpaired but could become impaired due to: 1) actual and/or projected land use changes and/or, 2) declining water quality trends, as shown by physical or analytical data.

A use that is designated as under review or unknown means there is insufficient physical or analytical data available to determine a status for the use, and additional studies are necessary.

Table 1-10 lists the designated and beneficial uses for all watersheds and the current impairments status in Anchor Bay and the Watershed. The table differentiates between the impairment status in Anchor Bay and impairment status in the Watershed because these areas may have a different status for a particular designated use.

TABLE 1-10: IMPAIRMENTS OF DESIGNED AND BENEFICIAL USES

Designated (D) and Beneficial (B) Use Determinations	Impairment Status (k) = known (s) = suspected	
	Anchor Bay	Anchor Bay Watershed
Partial body contact (D), (B)	Impaired by elevated *E. coli* concentrations (k)	Impaired by elevated *E. coli* concentrations (k)
Total body contact between May 1 and October 31 (D), (B)	Impaired by elevated *E. coli* concentrations (k)	Impaired by elevated *E. coli* concentrations (k)
Degradation of aesthetics (B)	Impaired by excessive aquatic plant growth (k)	Impaired by excessive nutrients and sediment (s)
Indigenous aquatic life and wildlife (D), (B)	Impaired by loss of habitat (k)	Impaired by loss of habitat (k)
Eutrophication or undesirable algae (B)	Impaired by excessive aquatic plant growth (k)	Impaired by excessive nutrients (s)
Warmwater/coldwater fisheries (B), (D)	Not impaired	Impaired by loss of habitat (k)
Degradation of benthos (B)	Impaired by loss of habitat (k)	Impaired by loss of habitat in tributaries (s)
Public water supply at point of intake (D), (B)	Threatened	Threatened
Agriculture (D), (B)	Not impaired	Not impaired
Industrial water supply (D),(B)	Not impaired	Not impaired
Navigation (D)	Not impaired	Not impaired
Degradation of phytoplankton and zooplankton populations (B)	Unknown	Unknown
Restrictions on dredging activities (B)	Not impaired	Not impaired
Bird or animal deformities, reproductive problems (B)	Unknown	Unknown
Fish tumors or other deformities (B)	Unknown	Unknown
Degradation of fish and wildlife populations (B)	Unknown	Unknown
Tainting of fish or wildlife flavor (B)	Not impaired	Not impaired

1.2.3 GREAT LAKES WATER QUALITY AGREEMENT BENEFICIAL USES

Annex 2 of the 1987 Protocol of the Great Lakes Water Quality Agreement between the United States and Canada established 14 beneficial uses to evaluate changes in the chemical, physical, or biological integrity of the Great Lakes System. Annex 2 defined beneficial uses as a method for evaluation rather than as a listed use. If a body of water showed any of the following impacts, then one or more of the beneficial uses was considered to be impaired:

- Restrictions on fish and wildlife consumption
- Tainting of fish and wildlife flavor
- Degradation of fish and wildlife populations
- Fish tumors and other deformities
- Bird or animal deformities or reproduction problems
- Degradation of benthos
- Restrictions on dredging activities
- Eutrophication or undesirable algae
- Restrictions on drinking water consumption, or taste and odor problems
- Beach closings
- Degradation of aesthetics
- Added costs to agriculture and or industry
- Degradation of phytoplankton and zooplankton populations
- Loss of fish and wildlife habitat

All the designated and beneficial uses must be evaluated when developing a watershed plan. As can be seen by comparing the above list with the list of designated and beneficial uses in Table 1-10, there are many overlaps between the two lists.

As with the designated uses, beneficial use status can be unimpaired, impaired, threatened, or under review/unknown. The status definitions for designated uses also apply to beneficial uses.

Beach closings offer an example of how government officials apply these definitions. If beaches are closed for water quality reasons, then the use, which would be similar to total body contact, would be impaired. If beaches are not being closed due to water quality reasons, the use is unimpaired. If changes in the tributary area might affect the beach and cause degraded water quality, then the use is threatened. Lastly, if there is insufficient data available to determine if beach closings are a problem, the status is considered to be under review/unknown.

Desired Uses and Concerns

Desired uses are defined as how stakeholders might want to use the watershed or how they might like the watershed to look. These desired uses are often reflective of designated or beneficial uses but can be beyond the scope of one of the defined uses, such as the construction of a nature trail within the watershed.

The desired uses were established in the Watershed by polling public officials, the general public, and agricultural producers. A combination of public and steering committee meetings were held to determine the desired uses and concerns that they felt needed to be addressed in the WMP.

In addition to a pre-selected list of desired uses that the respondents were asked to rank, the questionnaire also asked for any additional concerns the respondent might have regarding the Watershed. These concerns are listed in order of priority in Table 1-11.

Table 1-11: Concerns and Desired Uses

General Public Meeting 01/23/2002 Ira Township	**Public Officials** Meeting 01/23/2002 Ira Township	**Agricultural Producers** Meeting 04/09/2002 Lenox Township Hall	**Watershed-wide Stakeholders Poll** (94 responses) 06/19/2002 thru 09/25/2002
Concerns and Desired Uses (in order of decreasing priority)			
Fishing	Healthy drinking water	Lack of open space	Remove sources of human waste in Anchor Bay that threaten public health
Swimming	Fishing	Unmanaged development	
Healthy drinking water	Educating the public	Lack of government support for agricultural buffer strips	Better control sources of fertilizer reaching Anchor Bay and the Great Lakes
Erosion	Swimming		
Recreation	Erosion		
Waterfowl and wildlife habitat	Flooding	Lack of consistent application of agricultural BMPs	Improve habitat conditions for fish and wildlife in the water
Educating the public	Recreation		Increase community planning to address development and protection of water quality
Additional Concerns:	**Additional Concerns:**		Better control soil erosion and limit sediments entering the water
Zebra mussels, aquatic weeds, boating, lack of biking and walking trails, construction site erosion, fishing access, and the North Channel dredging	New Baltimore Park		Remove paper, trash, and debris in the bay and its tributaries to improve its appearance
	Beach closing, contaminants, bacteria, sewage disposal, development and sewage disposal on Harsens Island and outer islands		Encourage investments in land along water for recreation/wildlife protection
			Expand public education about the benefits of protecting Anchor Bay