Chapter 1 – Watershed Profile

The State of Michigan is unique in that it is surrounded on three sides by the Great Lakes, the largest source of fresh surface water in the world. St. Clair County (SCC) and Sanilac County are two of the fortunate communities that have direct access to this resource. Their eastern boundaries front the shores of Lake Huron, Lake St. Clair and the St. Clair River (Figure 1.1). Because of this relationship, water has helped to define the Counties' histories, development patterns, economies, and cultures. As discussed through this watershed plan, water resources played a major role in European development of the Counties, and currently support modern-day industry, shipping, and other economic drivers in the area, such as boating and fishing. Lake Huron, the St. Clair River, and Lake St. Clair are also the sources for drinking water for St. Clair and Sanilac Counties, as well as many suburban Detroit communities. As such, the wealth of water resources within and offshore of the Counties must be protected to preserve the health and way of life for residents within the subject area of this plan.

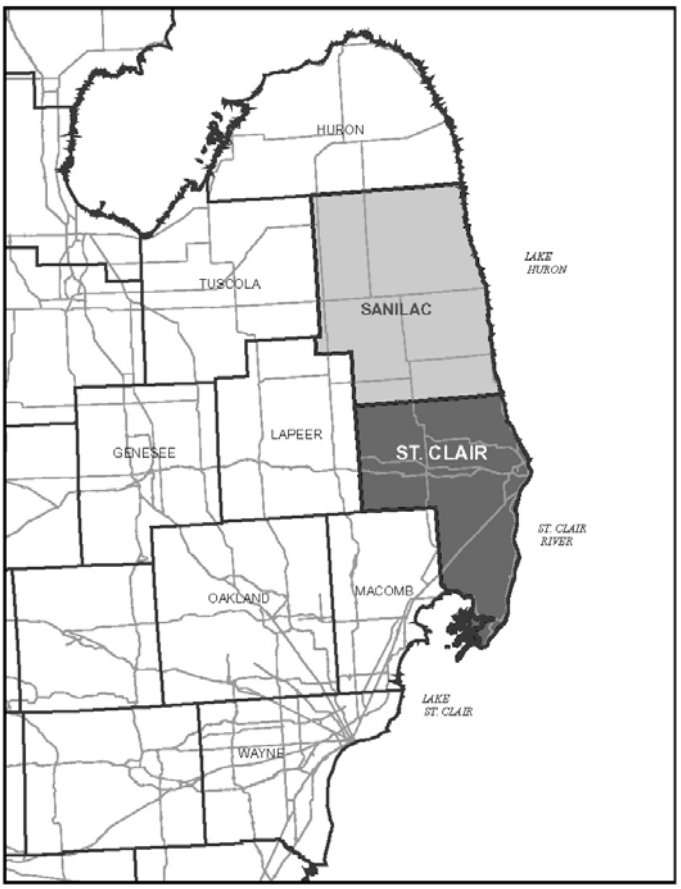

Figure 1.1 Sanilac and St. Clair County Boundaries

This Watershed Management Plan (WMP) seeks to identify and prioritize water pollutant sources and threats, and the actions needed to manage storm water discharges in St. Clair County's Northeastern Watersheds (NEW). This WMP will also help governmental entities fulfill the Environmental Protection Agency (EPA) and Michigan Department of Environmental Quality (MDEQ) Phase II National Pollutant Discharge Elimination System (NPDES) regulations.

To develop this WMP, governmental entities that have jurisdiction over land use and storm water discharges in the NEW have formed St. Clair County's Northeastern Watersheds Advisory Group (NEW WAG). A list of participating governmental entities is provided in Table 1.1. In addition, the St. Clair County Health Department (SCCHD) also represents the interests of the SCC Parks and Recreation Department (SCCPRC), the SCC Maintenance Department (SCCMD), SCC Metro Planning Commission., SCC Environmental Services Department (ES), and SCC MSU Extension and SCC's nested Phase II partners: St. Clair County Community College, and the East China School District. These nested Phase II entities do not attend WAG meetings on a regular basis, but are solicited for input on aspects of the WMP affecting their jurisdictions.

Table 1.1 Local Government Watershed Representation

Jurisdiction	Sub-watershed(s)	Representative Attending Meetings	Signed operating agreement
St. Clair County			
Burtchville Township *	LHD	Township Supervisor	√
Clyde Township	LBR, LHD	Township Planning Commissioner	√
East China Township	SRD	Township Supervisor	√
Fort Gratiot Township	LHD, LBR	Township Engineer	√
Kimball Township	LBR, SRD	Township Planning Commissioner	√
City of Marine City	SRD	City Building Inspector	√
City of Marysville*	SRD	City Engineer	√
City of Port Huron*	LHD, LBR, SRD	City Engineer	√
Port Huron Township	LBR, SRD	City Engineer & Dep. Supervisor	√
City of St. Clair	SRD	WWTP Superintendent	√
St. Clair Township	SRD	Township Planner	√
Grant Township Θ	LHD, LBR	No representative	√
Brockway Township Θ	LBR	Township Supervisor	√
Greenwood Township Θ	LBR	Township Supervisor	
City of Yale Θ	LBR	**No representative**	
Kenockee Township Θ	LBR	**No representative**	
St. Clair County	LHD, LBR, SRD	HD, RC, DO, MPC, PWO	√
Sanilac County			
Speaker Township Θ	LBR	**No representative**	
Fremont Township Θ	LBR	**No representative**	
Buel Township Θ	LBR	**No representative**	
Worth Township	LBR	**No representative**	
Sanilac County	LBR	**No representative**	

* = Subwatershed Chairman
DO = Drain Office
HD = St. Clair County Health Department
LHD = Lake Huron Direct Drainage Watershed
LBR = Lower Black River Watershed
MPC = Metropolitan Planning Commission
Θ = not an NPDES Phase II entity
PWO = Public Works Office
RC = Road Commission
SCC = St. Clair County
SRD = St. Clair River Direct Drainage Watershed
WWTP = Waste Water Treatment Plant

1.1 Geographical Scope

St. Clair County is located approximately 60 miles northeast of Detroit and borders Lake Huron, the St. Clair River and Lake St. Clair. These waterbodies are part of the Great Lakes System and form an international border between the U.S. and Canada. The geographical area referred to in this plan as St. Clair County's NEW is a U.S. subwatershed of the St. Clair River, and drains the northeast corner of St. Clair County and southern Sanilac County. The NEW contains three subwatersheds which are comprised of the Lower Black River (LBR), Lake Huron Direct Drainage (LHD), and the St. Clair River Direct Drainage (SRD) subwatersheds (Figure 1.2). These subwatershed boundaries were approved by the Michigan Department of Environmental Quality (MDEQ) in 2004 for SCC's NPDES Phase II storm water permits.

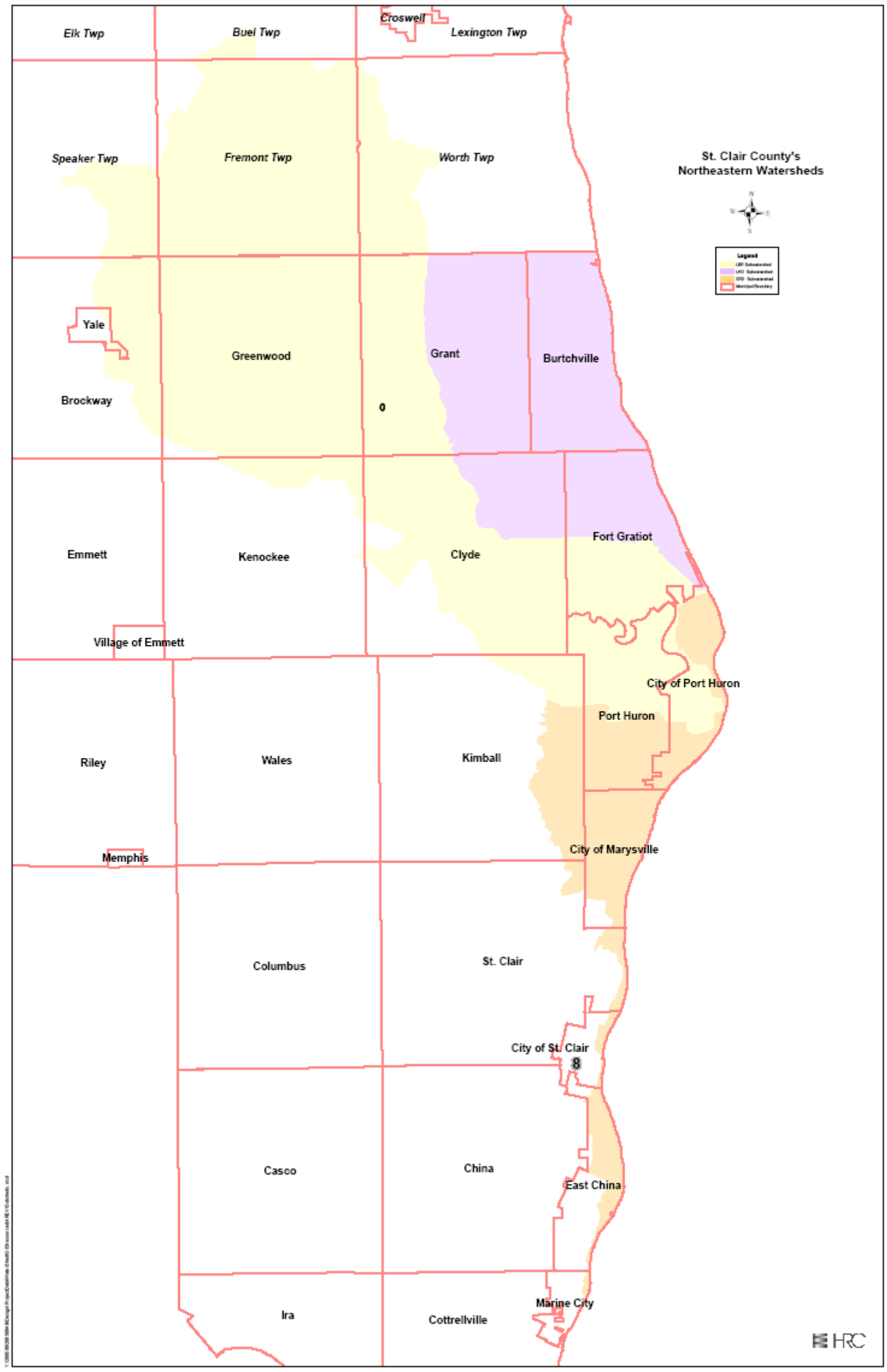

Figure 1.2 Location of St. Clair County's Northeastern Watersheds in Michigan

The NEW encompasses approximately 31% of the total land in St. Clair County draining 144,000 acres of land into 376 miles of tributaries that all ultimately drain into the St. Clair River. The NEW also contains 46.8 miles of shoreline along Lake Huron and the St. Clair River.

1.1.1 The NEW Subwatersheds

1.1.1.1 Lower Black River Subwatershed

The hydrologic boundary of the entire Black River watershed is 746 square miles. For planning purposes, this large watershed was divided into three smaller subwatersheds, the Upper Black River, Lower Black River and Mill Creek subwatersheds. This WMP will primarily focus on the Lower Black River subwatershed (LBR). The LBR encompasses an area of land that is 97,189 acres (151 square miles) and contains approximately 205 miles of tributaries that drain to the Black River. It is comprised wholly or partially of the following St. Clair and Sanilac County municipalities (Figure 1.3):

1. Brockway Township
2. Clyde Township
3. Fort Gratiot Township
4. Grant Township
5. Greenwood Township
6. Kenockee Township
7. Kimball Township
8. Port Huron Township
9. Buel Township
10. Fremont Township
11. Speaker Township
13. Worth Township
14. City of Port Huron

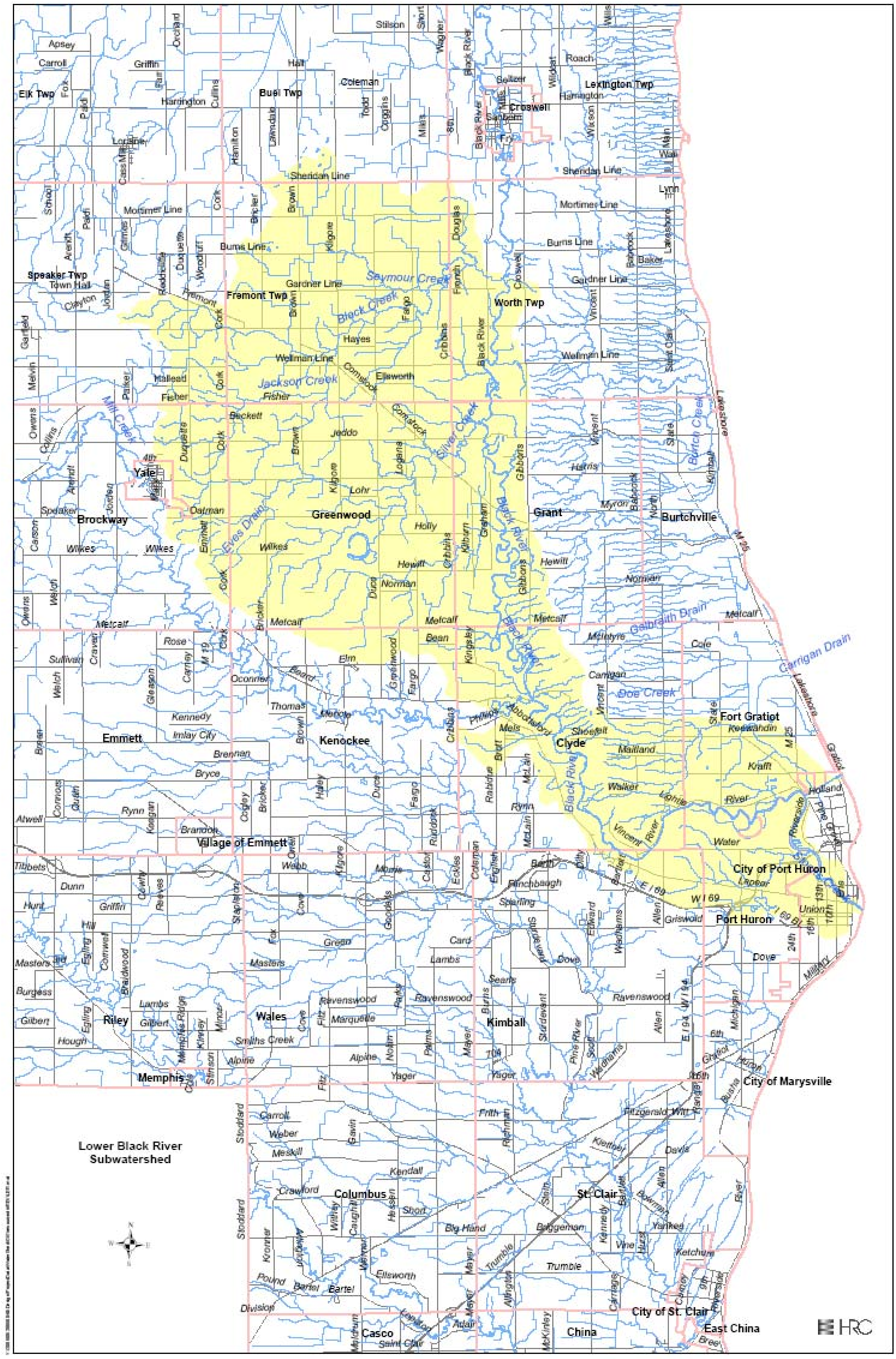

Figure 1.3 Lower Black River Subwatershed

1.1.1.2 St. Clair River Direct Drainage Subwatershed

The St. Clair River Direct Drainage subwatershed (SRD) encompasses 15,788 acres (25 square miles) and contains approximately 50 miles of tributaries that drain directly to the St. Clair River. This subwatershed is made up of the portions of the following St. Clair County municipalities (Figure 1.4):

1. City of Marine City
2. City of Marysville
3. City of Port Huron
4. City of St. Clair
5. East China Township
6. Kimball Township
7. Port Huron Township
8. St. Clair Township

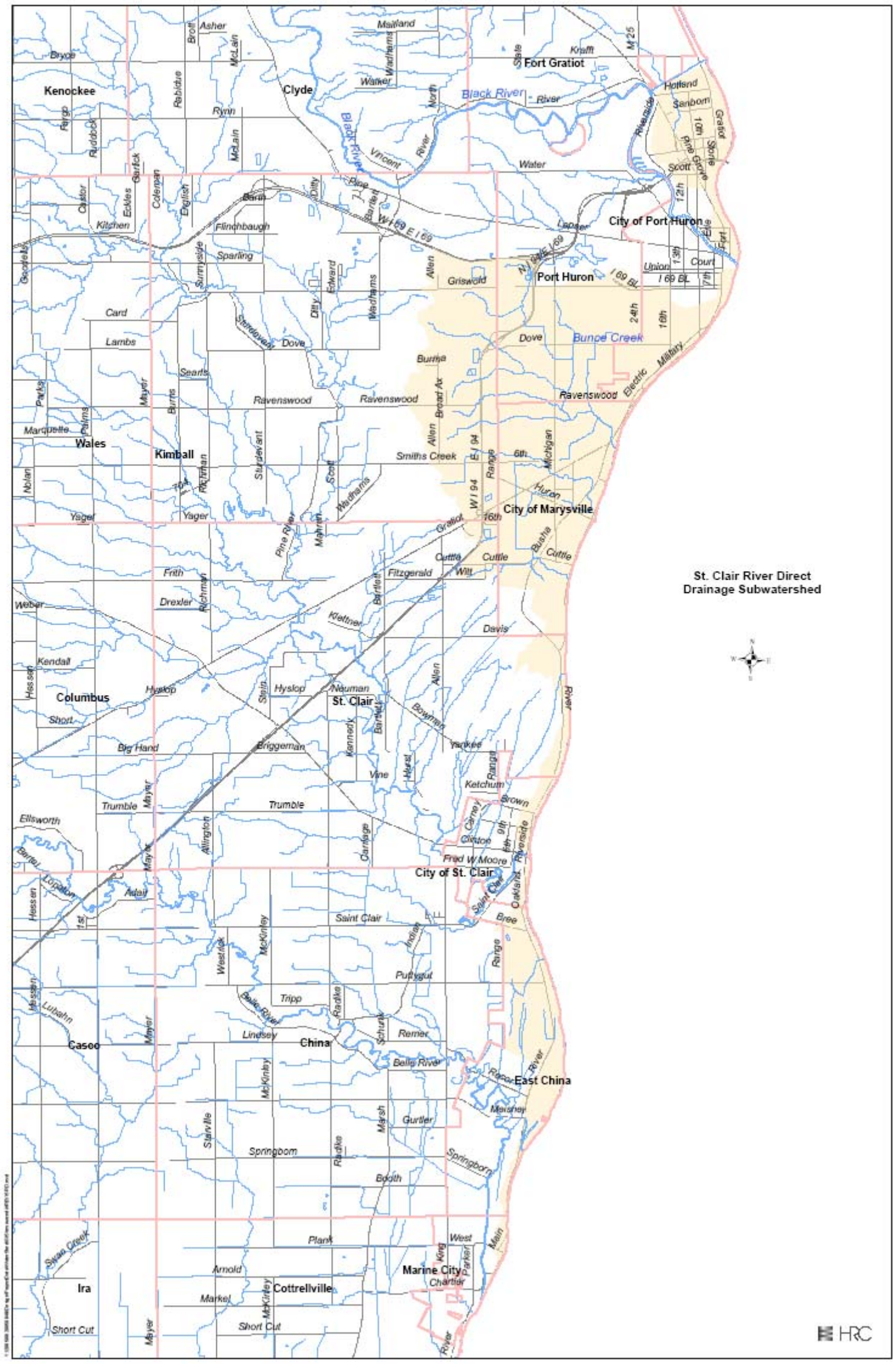

Figure 1.4 St. Clair River Direct Drainage Subwatershed

1.1.1.3 Lake Huron Direct Drainage Subwatershed

The Lake Huron Direct Drainage subwatershed (LHD) encompasses a land area of 30,881 acres (48 square miles) and contains 121 miles of tributaries that drain directly into Lake Huron. This subwatershed is made up of portions of the following St. Clair County municipalities (Figure 1.5):

1. City of Port Huron
2. Burtchville Township
3. Clyde Township
4. Fort Gratiot Township
5. Grant Township

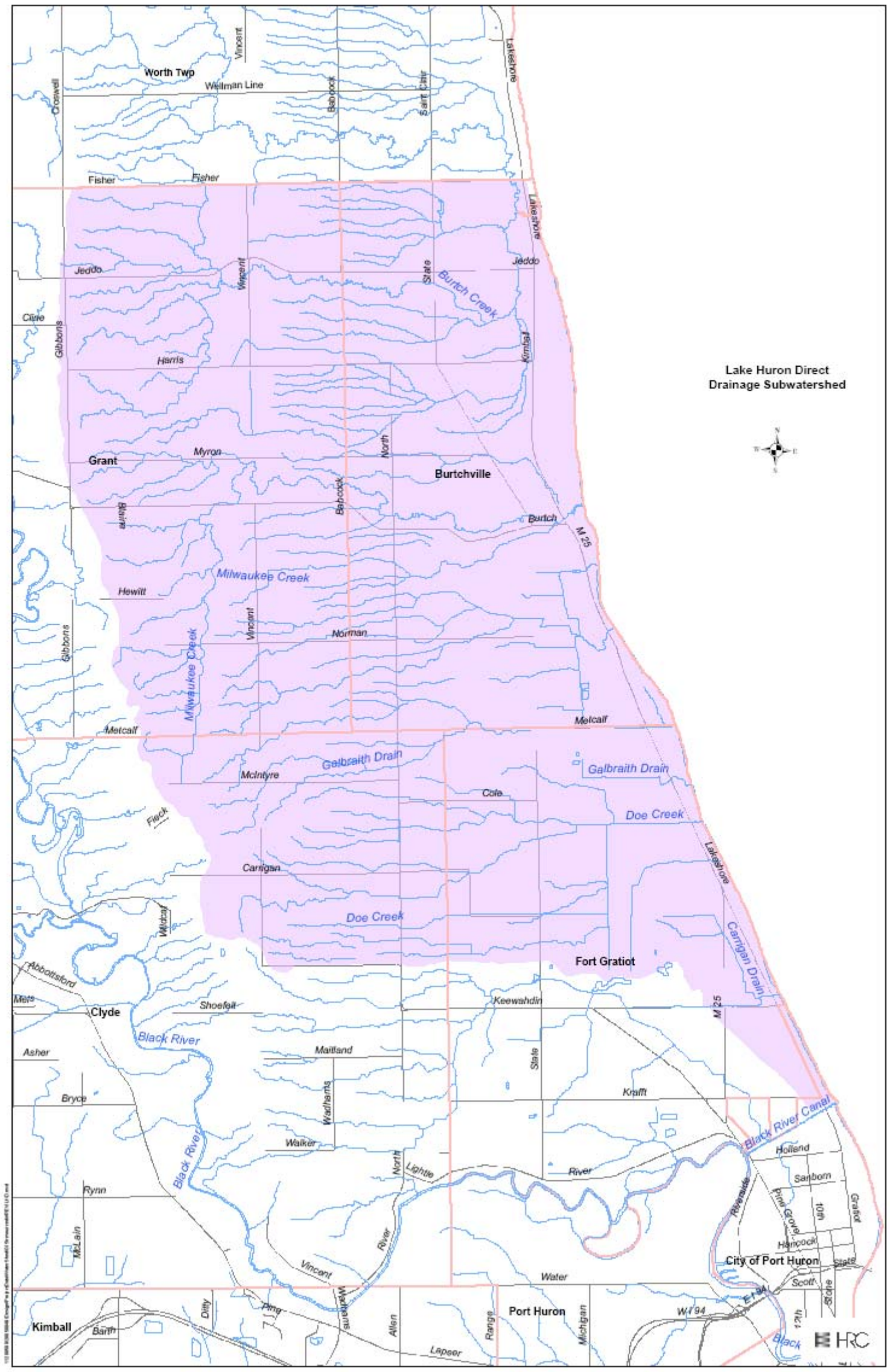

Figure 1.5 Lake Huron Direct Drainage Subwatershed

1.2 Historic Overview

A history of the NEW since the early 1800s to the present gives perspective on the land use and water quality changes that have occurred over time and ultimately lead to the water quality conditions of the watershed today.

When the area was beginning to be populated by European settlers, the lakes and streams offered a wealth of fish, and the forests provided game, wild fruits, herbs, and in some cases, corn.

The natural hydrology of the NEW was first disrupted in the early to mid 1800s when agricultural communities and the lumbering industry attracted population growth in the area. Early settlers engaged in clearing the land and timber cutting for lumber export and farming. Several sawmills were built along the Black River as well as the first steam mill at the mouth of Bunce Creek (SRD). In the 1840s eight of the twenty-one steam sawmills in the state were located in SCC, attesting to the intense lumbering activity of the area. As one resident described the transportation of logs in the Black River in 1852, "The Black River was filled with logs as far as the eye could see" (Figure 1.6). The clearing of the forested land must have had severe effects on the hydrology of the NEW, as forested land absorbs and filters more storm water than developed or agricultural land.

Figure 1.6 Logs floating down the Black River

Between 1850 and 1900, the population spread throughout the county but people increasingly left lumber jobs and turned to farming. As a result of the county being largely flat and poorly drained, channelization drainage practices began in the 1840's to increase agricultural

productivity. Channelization drainage practices and field tiling became increasingly used throughout the early 1900s and climaxed in the 1950's (Figure 1.7).

Figure 1.7 1917 Dredging Project in St. Clair County

These practices must have had a dramatic effect on local water quality as channelized drainage typically results in increased erosion and transportation of sediment, and in many time, tile fields result in the drainage of wetlands.

As timber began to dwindle in the late 1800s and early 1900s, so did rural populations. Manufacturing and industry continued to grow along the Black and St. Clair rivers and populations in waterfront city centers, like Port Huron, the City of St. Clair, and Marine City flourished. The Port Huron Paper Company, the Michigan Sulfite Company, two large coal companies, Acheson Colloids Company, Mueller Brass Company and several shipyards and fisheries were established along the Black River in Port Huron, and multiple large industrial, manufacturing, and public utilities were established along the St. Clair River's U.S. and Canadian shorelines. Point source discharges were not regulated until the 1970s, leaving the Black and St. Clair Rivers full of agricultural runoff, slaughter and fish house waste, sanitary sewage, and paper manufacturing waste. By 1912, the Black River was so polluted that the City of Port Huron began construction of a canal from Lake Huron to the Black River to dilute and flush it out. During this same time period, many farmlands were allowed to revert to fallow fields (taken out of agricultural production and left to return to a "naturalized" state) and the agricultural drainage system in the NEW was neglected.

From the 1960's and accelerating to the present, NPDES regulations have dramatically reduced point source discharges from industry and public utilities resulting in dramatic improvements in the quality of the Black and St. Clair Rivers. Today storm water discharges are the most threatening source of water pollution. Increasing populations and sprawling communities of the late 1900s and continuing today are producing more impervious surfaces and more pollutant sources which create larger volumes of polluted storm water discharges to local waterways. In March 2003, NPDES Phase II regulations began regulating storm water discharges to improve the health of streams, creeks, drains, ditches, rivers and lakes.

1.3 Soils and Topography

Soil and topography characteristics are critical for understanding how water drains through soil and over the land. The NEW is made up of a glacial landform containing an ancient lake bed, end moraines, beach ridges, and small sand dunes along sand channels. The topography is

relatively flat and the watershed contains a large amount of hydric soils. Hydric soils are soils that have been saturated with water for extended periods of time, such as wetlands. The majority of the watershed is characterized as having loam (clay, silt and sandy loams), soils that are classified as the Londo Series. The majority of sandier soils are located along, and a few miles inland from the western shores of Lake Huron and the St. Clair River.

1.3.1 Soils

The soil maps produced for each subwatershed in the NEW illustrate the soils generalized into four (4) hydrologic soils groups: A, B, C, and D. These classifications indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. A brief description for each generalized soil type based on soil texture is summarized in Table 1.2 below and can be used to interpret the soils maps for each subwatershed:

Table 1.2 Summary of Hydrologic Soil Groups (NRCS, 1986)

Hydrologic Soil Group	Soil Texture
A	Sand, loamy sand, or sandy loam
B	Silt loam or loam
C	Sandy clay loam
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay

In the NEW, the soils are predominated by group C and D soils in upstream, smaller tributary reaches, and group A and B soils predominate the area flanking the length of the Black River, as well as downstream areas of the LBR subwatershed in Fort Gratiot and Port Huron Townships, the shoreline areas along Lake Huron in the LHD subwatershed, and portions of the St. Clair River shoreline near Port Huron, Marysville, and East China Twp, and much of the SRD subwatershed in Port Huron Township (see Figures 1.8 through 1.11).

The National Resources Conservation Service has indicated that urbanization has a greater effect on runoff in watersheds with soils having high infiltration rates (sands and gravels, or A/B type soils) than in watersheds predominantly of silts and clays (C/D type soils) which generally have low infiltration rates. Based on current and future land use in the communities with type A and B soils, they also happen to house the more urbanized areas of the NEW; as such, these areas likely have the greatest impact on nonpoint source pollutants entering into area waterways and should prioritize efforts to promote low-impact development strategies which aim to reduce impervious surfaces and promote the use of vegetative best management practices and other practices that minimize disturbance to soils during construction and other land clearing activities.

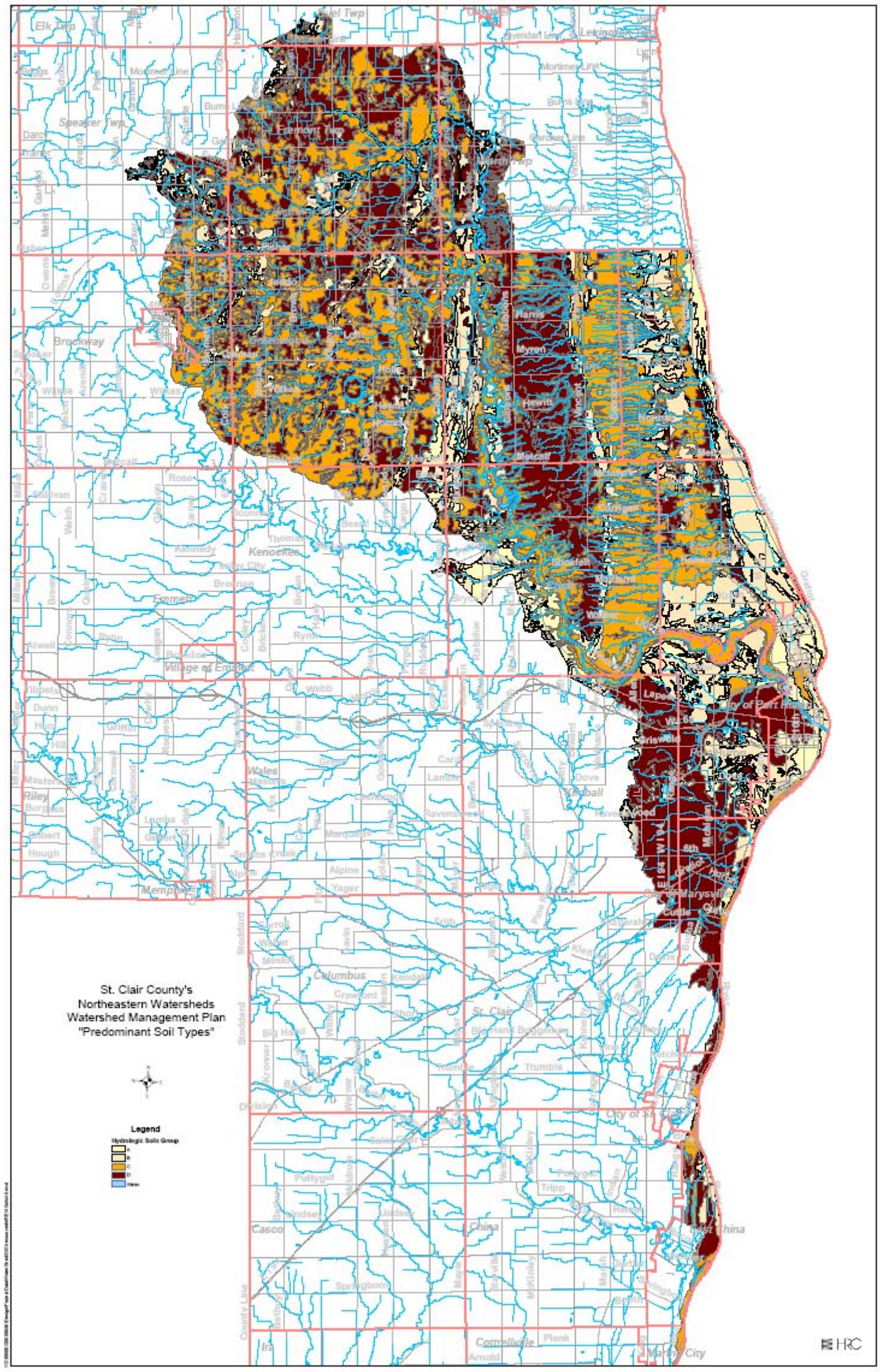

Figure 1.8 Predominant Soil Types in St. Clair County's Northeastern Watersheds

1.3.1.1 Lower Black River Subwatershed

Most of the soil in this subwatershed is of the Londo Series although the soil changes to coarse sand in the downstream reaches just east of North Road and Allen Road. Londo soils are formed in limy loam glacial till, occur on gently undulating water laid moraines and till plains, have level to gentle slopes, and are drained somewhat poorly. In a typical profile, the surface is very dark and grayish-brown loam 8 inches thick. The subsoil is 10 inches thick. The surface runoff is slow to medium and depends on the percentage of slope. Permeability is moderate. Available water capacity is high. Artificial drainage is needed for good crop growth, but Londo soils are among the best soils in the country for farming. The wetness of these soils limits many non-farm uses (USDA Soil Conservation Service, 1974). Figure 1.9 illustrates the generalized soil types throughout the LBR subwatershed.

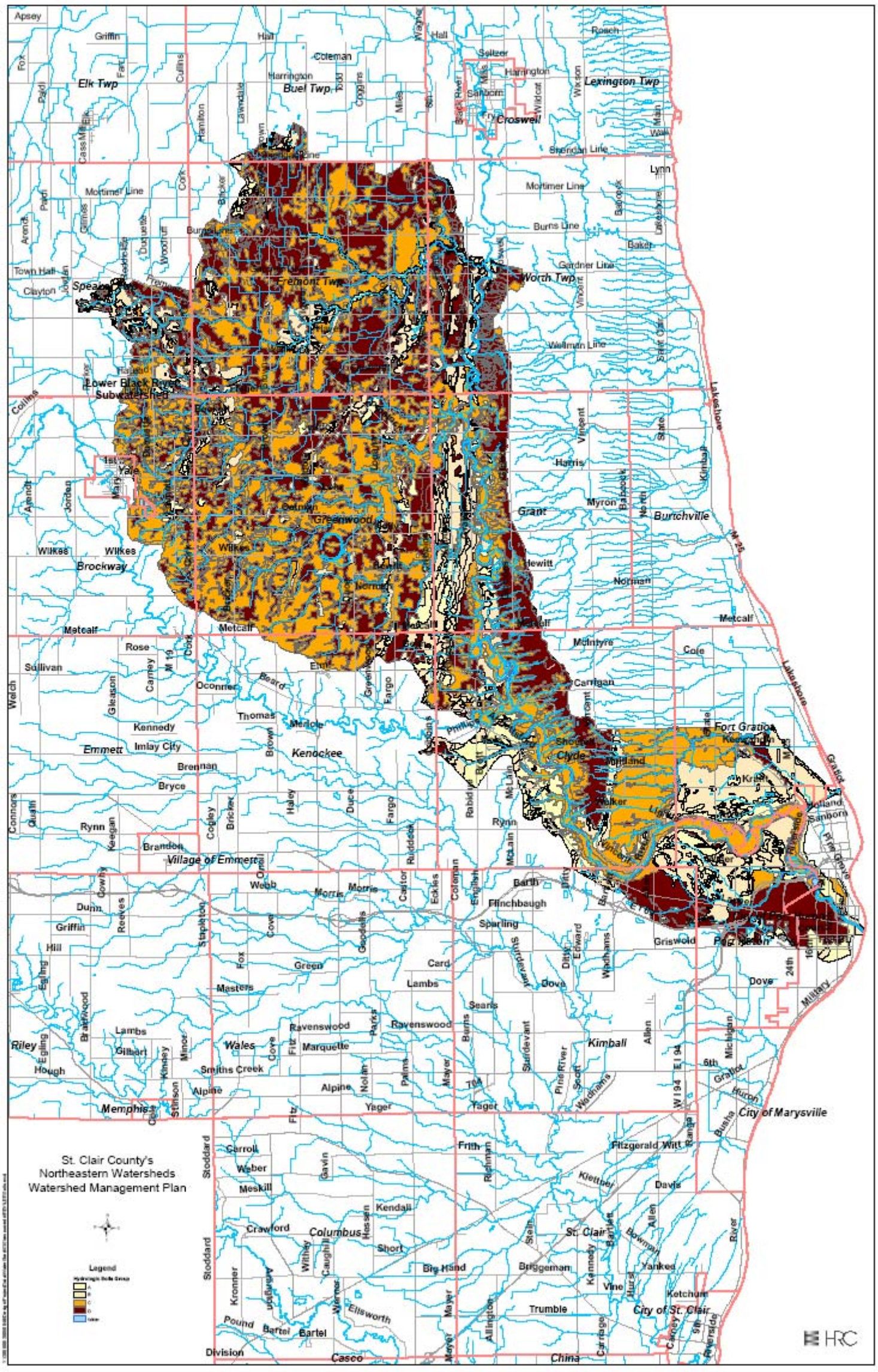

Figure 1.9 Generalized Soils in the Lower Black River Subwatershed

1.3.1.2 St. Clair River Direct Drainage Subwatershed

The majority of the SRD soils are Hoytville-Allendale-Nappanee association although the soils changes to fine textures and clay along the thin strip of land along the southern shoreline. The Hoytville-Allendale-Nappanee association of soils is very poorly drained and somewhat poorly drained soils that have a clayey to sandy subsoil. Surface runoff is slow. Permeability of water is rapid in the sandy upper part of the profile and very slow in the underlying clay. Available water capacity is low in the sandy upper part of the profile and moderate in the underlying clay (USDA Soil Conservation Service, 1974). Figure 1.10 illustrates the generalized soil types throughout the SRD subwatershed.

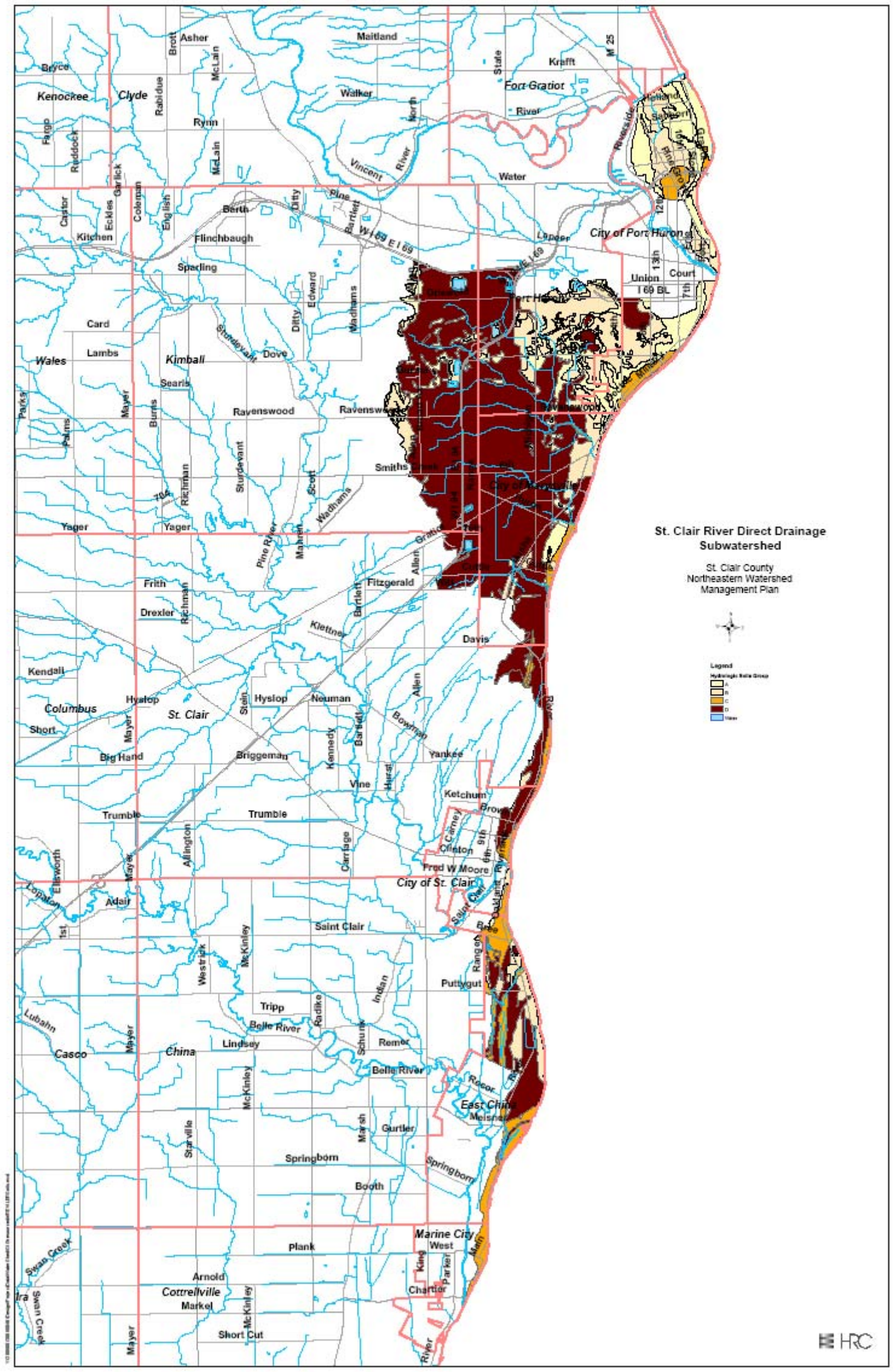

Figure 1.10 Generalized Soils in the St. Clair River Direct Drainage Subwatershed

1.3.1.3 Lake Huron Direct Drainage Subwatershed

The soils along the shoreline and extending into patches of the downstream areas of the watershed are Eastport sand. The eastern portion of the subwatershed is characterized by unstable drainage networks where depressions are very poorly drained and filled with muck whereas the dunes are excessively drained and subject to wind erosion especially if it is cultivated. Eastport sands are end moraines of fine-textured till, lacustrine clay/silt, and dune sand and not suited to intensive farming because of moderate erosion hazard, low natural fertility, and very low available water capacity. The soils along the western boundary, known as the Port Huron Moraine, are unconsolidated fines, sand and gravel covered with loam. Figure 1.11 illustrates the generalized soil types throughout the LHD subwatershed.

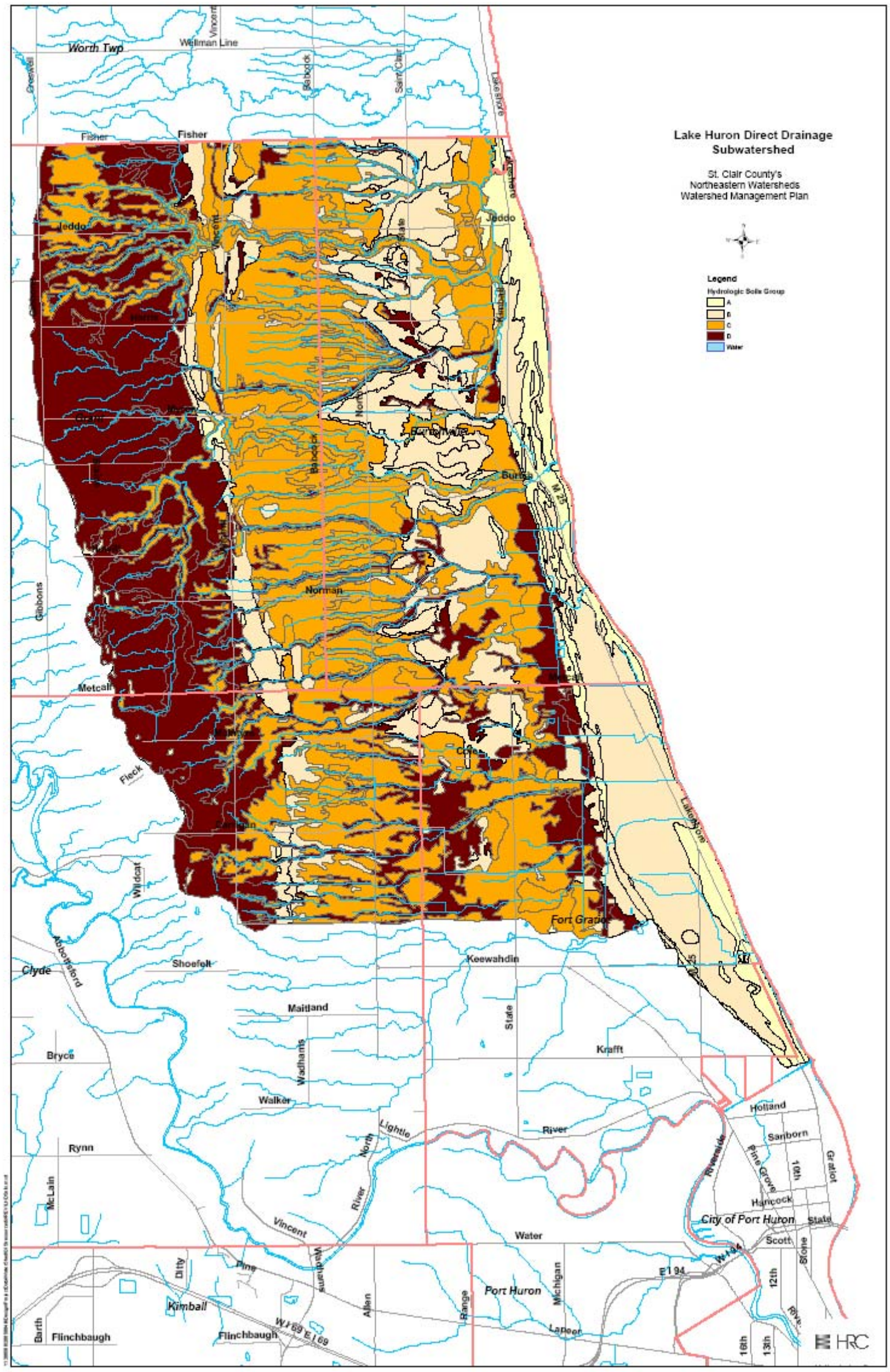

Figure 1.11 Generalized Soils in the Lake Huron Direct Drainage Subwatershed

1.3.2 Topography

In the NEW, topography is relatively flat along the Lake Huron and St. Clair River shorelines, and the greatest relief in topography occurs along the upper reaches of tributaries in the LHD subwatershed, and along the Black River corridor in the LBR subwatershed (Figure 1.12).

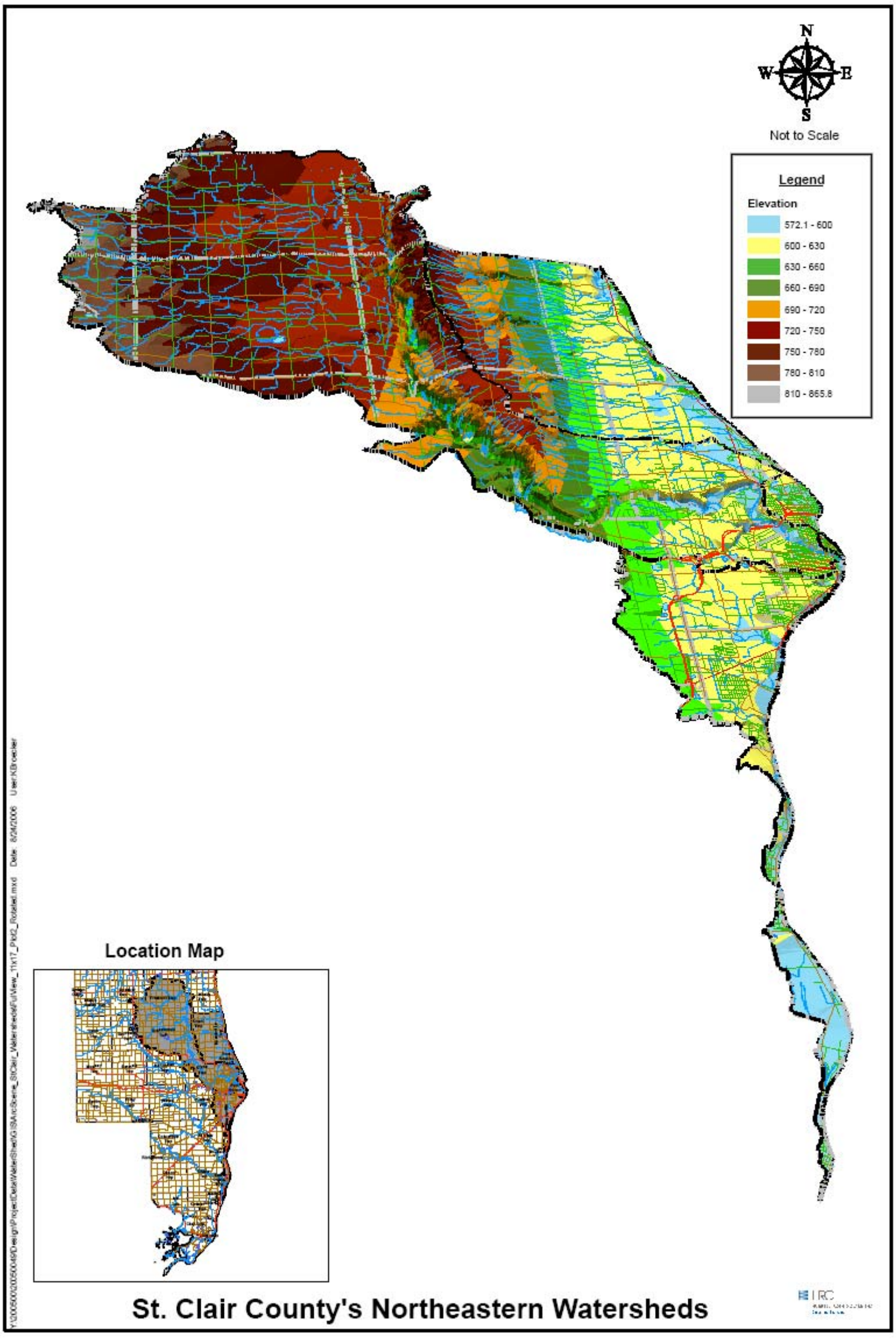

Figure 1.12 Topography of St. Clair County's Northeastern Watersheds

1.3.2.1 Lower Black River Subwatershed

Slopes within the LBR are generally level to shallow (0 to 3 percent) on water laid moraines and till plains, and steeper (6 to 12 percent) along the land bordering the Black River. Overall the surface runoff is considered slow to medium. The highest point in the LBR is located in Brockway Township on the northwestern edge of the LBR at an elevation of 830 feet above mean seal level and falls to an elevation of 580 feet above mean seal level at its lowest point around Wadhams Road in Clyde Township. The elevation of the river remains around 580 from Wadhams Road to the St. Clair River, making the river very slow moving in the lower reaches (Figure 1.13).

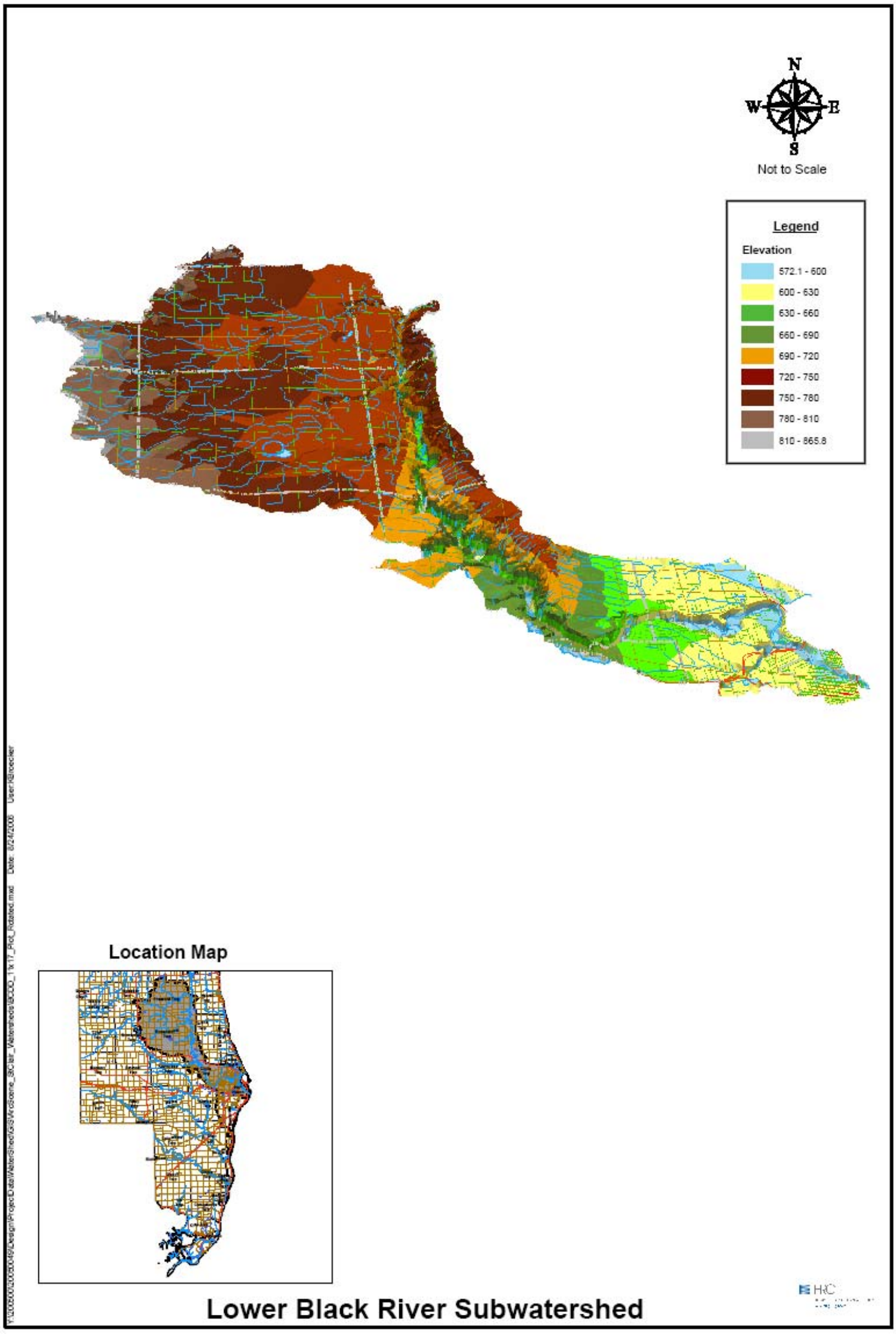

Figure 1.13 Topography of the Lower Black River Subwatershed

1.3.2.2 St. Clair River Direct Drainage Subwatershed

The topography of the north western portion of SRD generally has slopes of 0 to 6 percent with the majority of them being level to shallow (0 to 3 percent). The remainder of the SRD is a thin strip of land bordering the shoreline and contains an elevation loss of approximately 10 feet from the western edge of the strip to the water. The highest point in the SRD is located in the southeastern portion of Kimball Township at an elevation of 670 feet above mean sea level and drops down to an elevation of 590 feet above mean sea level along the southern shoreline (Figure 1.14).

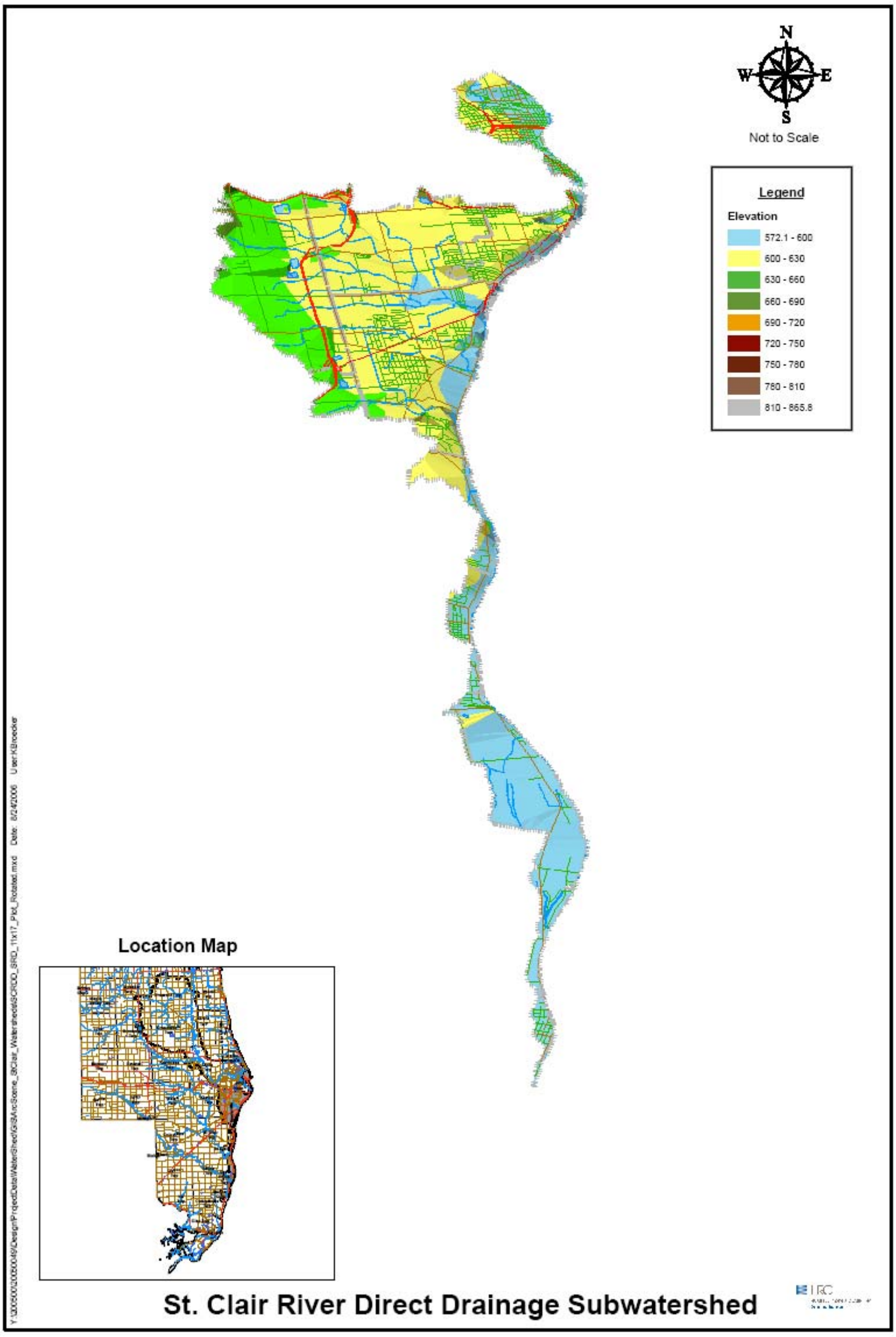

Figure 1.14 Topography of the St. Clair River Direct Drainage Subwatershed

1.3.2.3 Lake Huron Direct Drainage Subwatershed

The eastern portion of the LHD is characterized by an ancient lake plain that is generally flat to rolling with slopes averaging 1 to 2 percent. It rises approximately 80 feet onto the Port Huron Moraine to the west. The moraine area is hilly to undulating with slopes typically ranging from 2 to 12 percent. (USDA, 1961) The highest point in the LHD occurs along its western edge at an elevation of 775 feet above mean sea level and drops to an elevation of 580 feet above mean sea level along the shoreline (Figure 1.15).

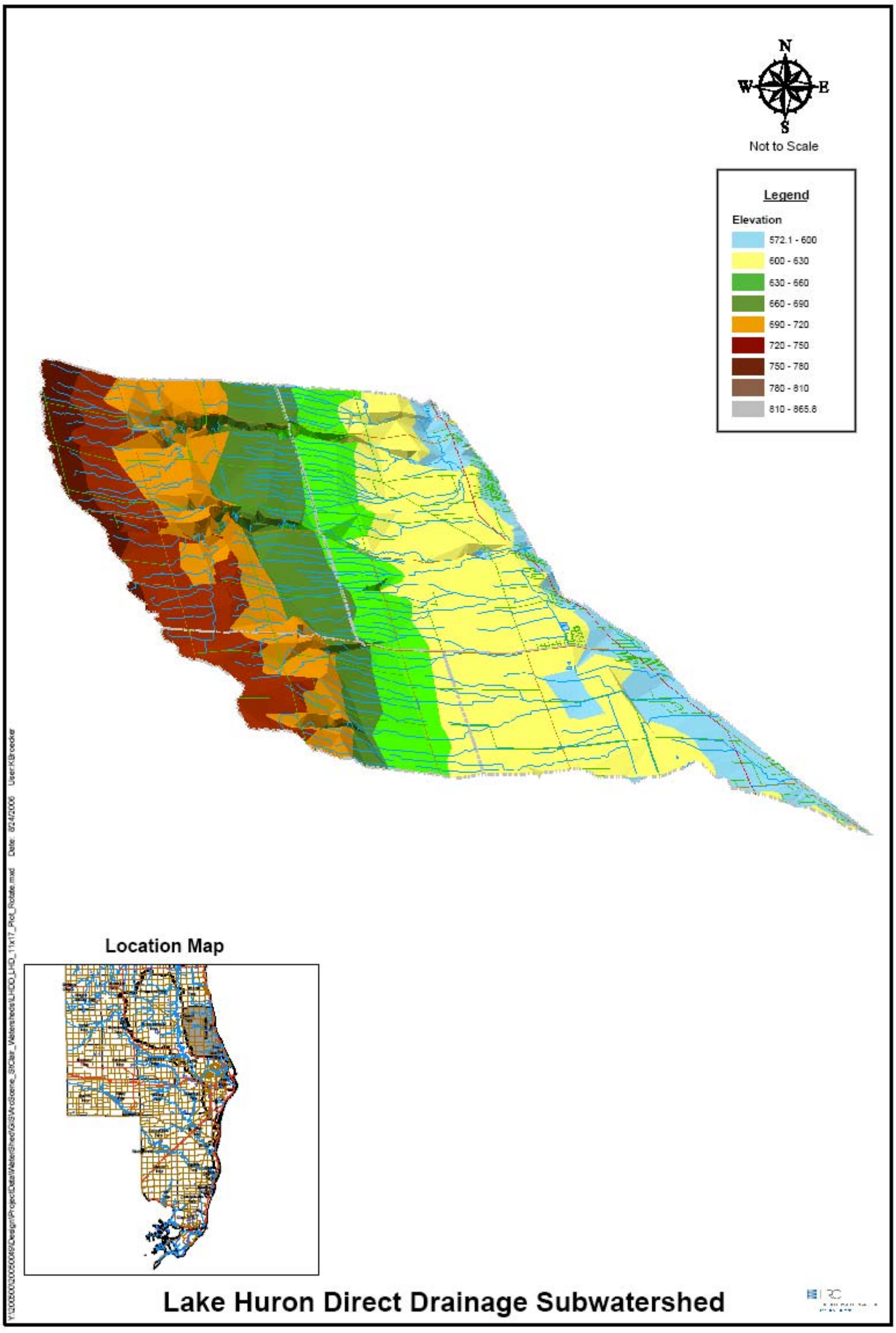

Figure 1.15 Topography of the Lake Huron Direct Drainage Subwatershed

1.4 Hydrology

The entire St. Clair River is 34.3 miles long and is the receptor of all the NEW's sub-basin drainage, as well as drainage from Lake Huron. The water level in the river commonly fluctuates two to three feet during the year with levels being lowest in February, rising through July, and declining through the rest of the year. The St. Clair River receives water from Lake Huron in the north at an average rate of 182,000 cubic feet per second (cfs). Historically a considerable portion of the NEW was wetlands or swamps. Because of agricultural and development activities, the majority of these wet areas have been drained and reclaimed and many natural streams have been dredged and managed through the St. Clair County Drain Office. Despite these drainage efforts, slow moving water continues to be a challenge in much of the lower reaches of tributaries in the NEW because of the relatively flat topography (see Figure 1.12).

1.4.1 Dredged Channels

Although dredged channels in the NEW have been used to improve drainage, it has been found that dredged channels increase soil erosion, produce excessive siltation, and need perpetual dredging to maintain the channel's design. Dredged channels are almost always stripped of riparian tree canopy, straightened, and excavated to a clay bottom (Figure 1.16). These conditions create unstable banks, excessive vegetation growth inside the channel, flashy conveyance of water, and a constant source of suspended clay particles in the water. The results are perpetually turbid water with a high suspended solid content, depletion of dissolved oxygen, high water temperatures, increased algae growth, and excessively low water levels between rain events. Only the most common aquatic species are able to survive these conditions. Dredged channels are commonplace throughout the NEW, although many of these drains have not been maintained in recent years (see Section 2.3.6.3 in Chapter 2 for further discussion of the impacts from altered hydrology).

Figure 1.16 Example of the Complete Removal of Riparian Buffer along Jackson Creek in the LBR Subwatershed

1.4.2 Wetlands

Protection of the remaining wetlands is extremely important for flood mitigation, water filtering functions, and the high biodiversity they provide. The NEW, being both relatively flat and full of deep clays, retains a large amount of precipitation and runoff as surface and groundwater in large wetlands.

Much of the original wetlands in SCC were filled, cleared, and drained decades ago for agricultural drainage. More recent wetland removal has been done for development. Additional drainage has also been provided by an extensive network of road ditches. It is estimated that wetlands currently cover 8,544 acres or 6% of the NEW land area (6,319 acres in St. Clair County and 2,225 acres in Sanilac County). These remaining wetlands in the NEW are scattered and their quality varies from highly disturbed with marginal hydrology to relatively undisturbed and highly functional. Most of them can be considered vulnerable to destruction. Figure 1.17 depicts the wetlands and waterbodies mapped in 1995.

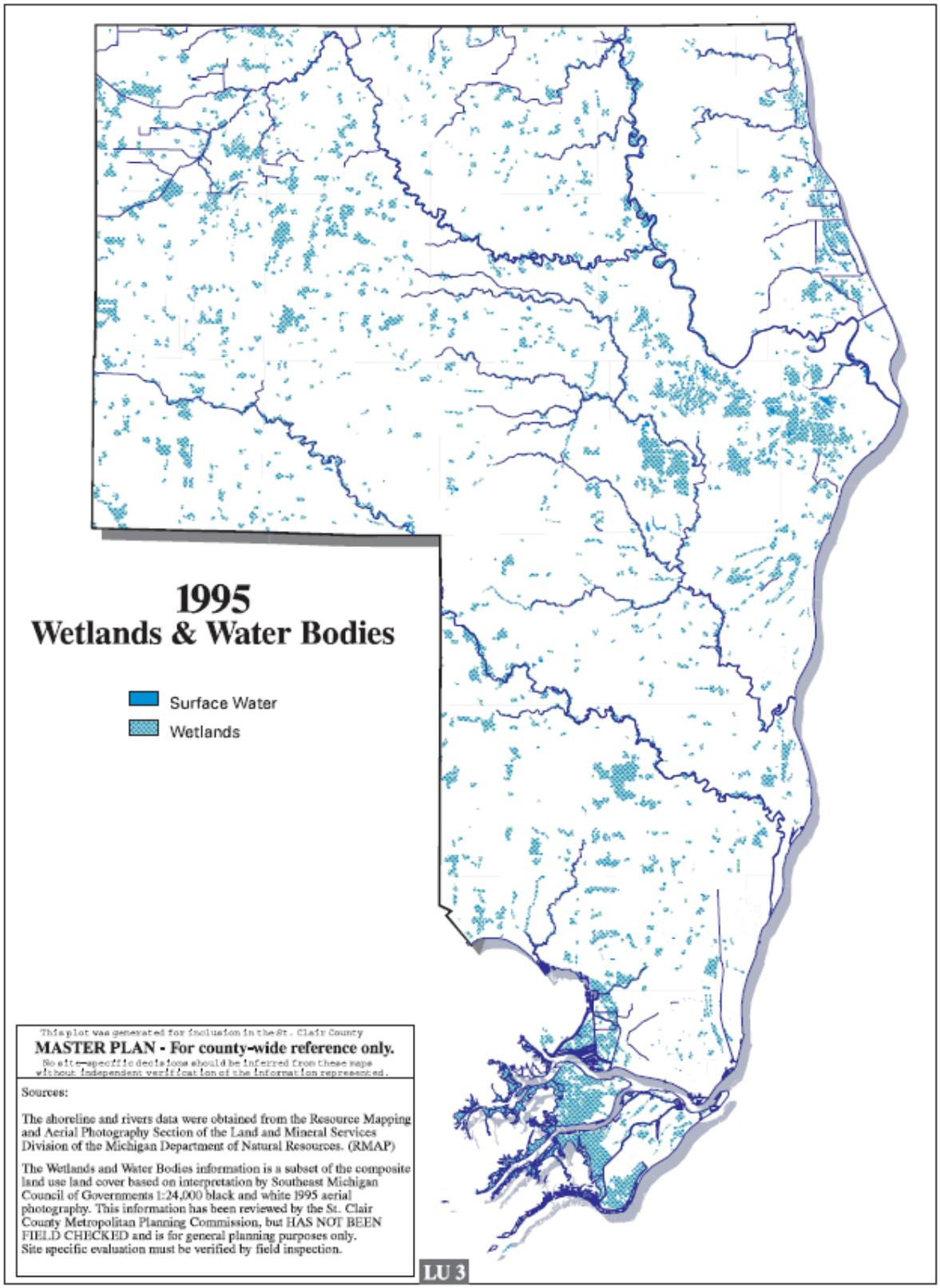

Figure 1.17 Wetlands and Water Bodies in St. Clair County (SCCMPC, 2000)

The current Michigan wetland statute (Part 303 of Public Act 451 of 1994) and local effort to preserve these wetlands falls extremely short of providing comprehensive protection in the NEW. State regulations cover a wetland area greater than 5 acres and/or those contiguous to waterways which leaves many of the smaller wetlands open to destruction. Additionally dwindling state resources to enforce regulations, ambiguous wetland boundary definitions, and "farming wetland loopholes" prevent state regulations from adequately protecting many regulated wetlands. These factors in combination with the lack of local support for wetland preservation results in the continual destruction of the small number of wetlands remaining in the NEW.

1.4.3 Floodplains

A floodplain is an area of relatively level land that borders a stream, creek, lake or river, or may even be a watercourse in its own right. This land is normally inundated during annual flooding. Floodplains serve as a natural retention area for floodwaters and, thus, reduce the destruction storm water can produce downstream. Reduction in storm water downstream not only reduces structural damage due to flooding, but it also reduces the amount of erosion and aquatic habitat destruction that can occur with high volume and flashy flows.

The historical and future destruction of floodplains in the NEW poses a substantial threat to public safety, the quality of water, and riparian habitat. Identification and regulation of floodplain areas unsuitable for conventional construction or fill is critical for protecting riparian habitat, water quality, and preventing flooding downstream. FEMA is currently updating its floodplain maps of areas along major water bodies (new maps should be available in 2008). Unlike the maps from the 1970's, the new FEMA maps are being developed using modern Geographic Information Systems (GIS) computer mapping software and will be much more accurate and reliable than previous maps. In addition, this data will be readily available on the internet so that flood hazard areas can be easily identified. Figure 1.18 depicts the current flood hazard areas based on soils and FEMA data.

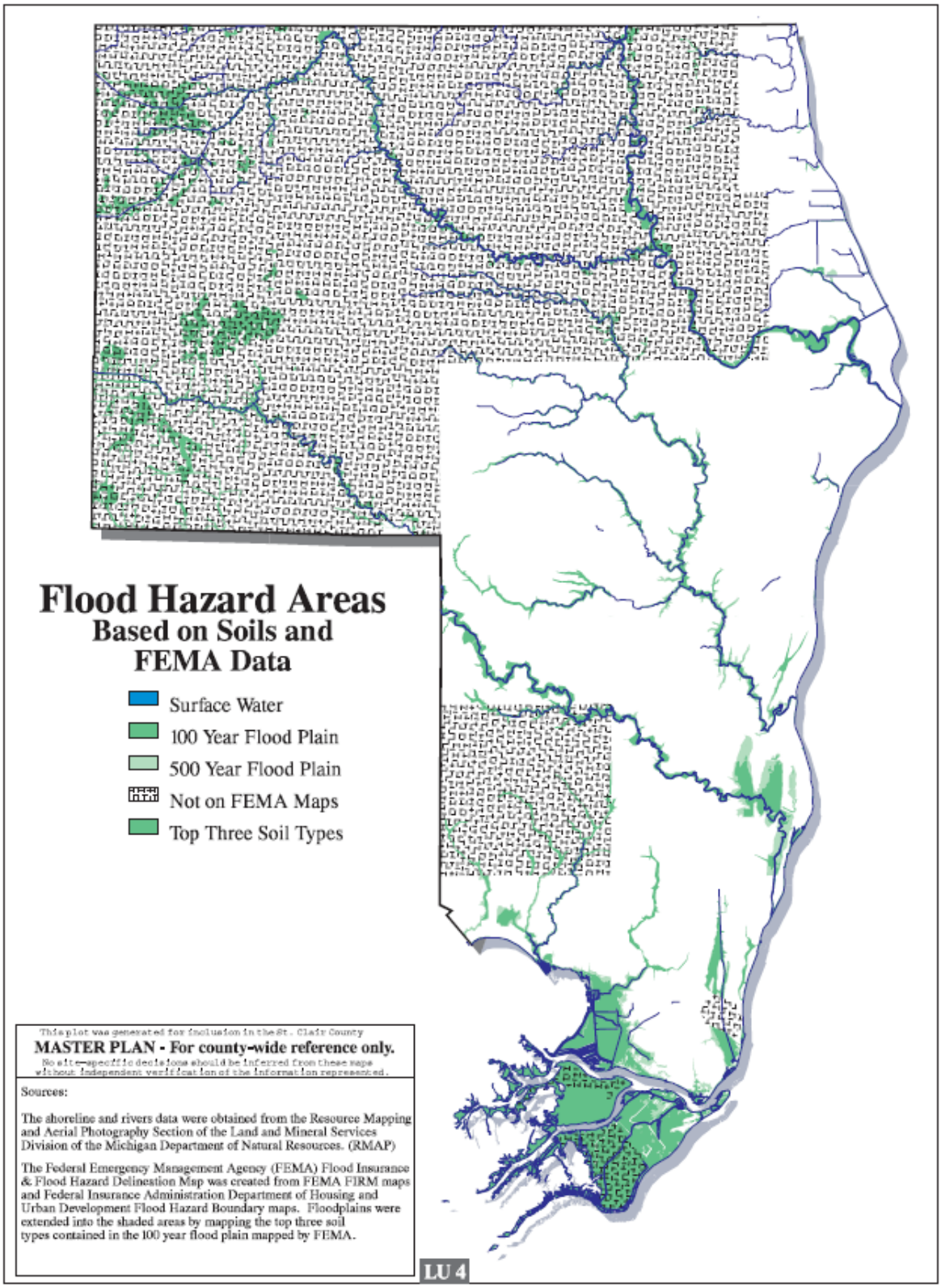

Figure 1.18 Flood Hazard Areas in St. Clair County (SCCMPC, 2000)

1.4.4 Lower Black River Subwatershed

The Lower Black River is the largest tributary of the NEW and receives water from the Mill Creek and Upper Black River subwatersheds. The Lower Black River flows south from Sanilac County, into the northeastern portion of St. Clair County, and eventually outlets through Port Huron (see Figure 1.3).

The waterways of the LBR subwatershed are characterized by a predominance of dredged channels, warm temperatures, turbidity, and slow movement predominately in the lower reaches. The flow regime has been altered by a low head dam in the City of Croswell in Sanilac County. Historically, the Black River drained many peatland bogs and swamps such as the Capac Swamp at the headwaters of the Mill Creek. Most of these have been drained, farmed, or accidentally burned, decreasing their sponge effect on storm water . The Minden Bog at the northern headwaters of the Black River is one of the last surviving of these natural peat lands (USDA, 1997).

The LBR receives approximately 29.6 inches of rainfall per year and contains approximately 205 miles of tributaries that drain to the Black River, which in turn drains to the St. Clair River. Approximately 37% of the river's flow is derived from groundwater (Frey, 2001). The furthest headwaters in the LBR to the outlet of the Black River measures approximately 50 miles with an elevation drop of approximately 250 feet. The LBR contains areas with the lowest overall gradient in comparison to the SRD and LHD which results in some of the most difficult drainage. Older residents recall a time when tree trunks were placed in gravel roads every spring to allow travel, giving testimony to the poor drainage that once existed and still exists to a lesser extent today. Because of the river's extremely slow movement, locals sometimes call the river in the southeastern portion of Clyde Township, "the dead river." In this area, the Black River's elevation bottoms out at 580 and its elevation does not change all the way to the St. Clair River. This makes for very slow moving water that at times seems to flow backwards. There is one large, privately-owned dam in Clyde Township (located within the Port Huron State Game Area) where the crest is reached 6 hours after the Jeddo USGS station in Grant Township. The City of Port Huron also maintains a canal that was completed in 1912 which conducts Lake Huron water into the Black River just north of the City of Port Huron.

The fourteen main tributaries in the LBR are as follows:

1. Black Creek
2. Upper Black River
3. Black River Canal
4. Lower Black River
5. Howe-Brandymore Drain
6. Eves Drain
7. Jackson Creek
8. Livergood Drain
9. Mill Creek
10. Plum Creek
11. Robertson Drain
12. Seymour Creek
13. Silver Creek
14. Stocks Creek

1.4.5 St. Clair River Direct Drainage Subwatershed

The St. Clair River Direct Drainage subwatershed (SRD) is characterized by poor drainage and slow moving water in the northwestern portion, but has better drainage along the shoreline where steeper slopes occur. The SRD receives an approximate annual rainfall of 30.7 inches per year and contains approximately 50 miles of tributaries that drain directly to the St. Clair River. The largest SRD tributaries are located in the northwestern portion of the subwatershed and are called Bunce Creek, the Huffman Drain Branches, and Cuttle Creek. These waterways flow over approximately 5.2 miles of waterway from their headwaters to the St. Clair River (see Figure 1.4). The SRD's other tributaries, located along the thin strip of land bordering the river, are

relatively smaller with lengths averaging approximately 2.7 miles from their headwaters to the river. Flooding is a big concern in Marysville, and Port Huron and Kimball Townships.

The main tributaries in the SRD are as follows:

1. Huffman Drain Branches
2. Bunce Creek
3. Cuttle Creek

1.4.6 Lake Huron Direct Drainage Subwatershed

The Lake Huron Direct Drainage subwatershed (LHD) receives an average of 28 inches of rainfall per year, contains approximately 121 miles of tributaries that flow from the top of a glacial moraine in the west to Lake Huron in the east, and contains approximately 11 miles of Lake Huron shoreline. The average length of the tributaries from the top of the moraine to the shoreline is about 7.4 miles long. In the western half of the watershed, slopes are the steepest and drainage is very good. Slopes in the eastern portion flatten out making drainage more difficult. Many of the tributaries are seasonal—only flowing during rain events and wet seasons. Because of the LHD's proximity to the St. Clair River, its drainage remains near the shoreline until it enters the St. Clair River along its western shore (see Figure 1.5).

The five main tributaries in the LHD are as follows:

1. Burtch Creek
2. Galbraith Drain
3. Milwaukee Creek
4. Carrigan Drain
5. Doe Creek

1.5 Significant Natural Resources

Native American historical accounts of St. Clair County describe abundant game, expansive woodlands, and rivers and streams plentiful with fish. While much of the NEW's aquatic and land habitat has been altered and degraded, significant pockets of high quality habitat and diverse species still remain. The extent and ecological quality of these open spaces and adjoining aquatic habitats directly impact water quality and quantity in the waterways of the NEW. Research has repeatedly shown that mature forests, deep-rooted native plants, wetlands, protected floodplains, and riparian areas are very effective at protecting a watershed from flashy hydrology, increased storm water quantities (rate and volume of runoff), and providing essential functions such as pollutant filtering, flood mitigation, surface and groundwater recharge, erosion control, and air purification. In addition, diverse habitats have high aesthetic, economic, and public health protection values. The St. Clair County Metropolitan Planning Commission (SCCMPC) has mapped several of these natural resources throughout St. Clair County and they have been included in this chapter where applicable. Each map is a very useful tool for conservation planning purposes. Figures 1.19 and 1.20 below provide a general overview of sensitive environments and unique natural features and wildlife habitat in SCC.

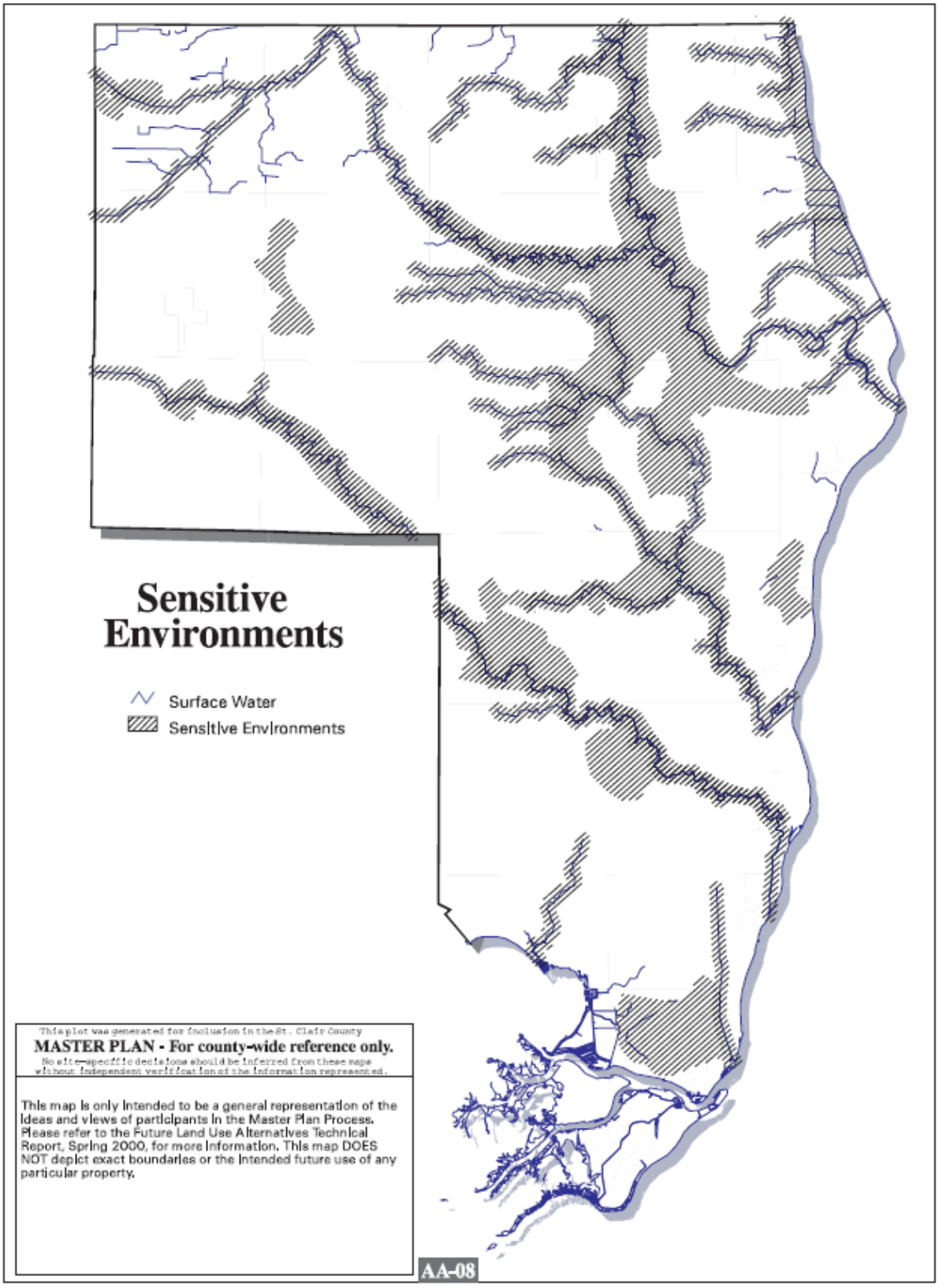

Figure 1.19 Sensitive Environments in St. Clair County (SCCMPC, 2000)

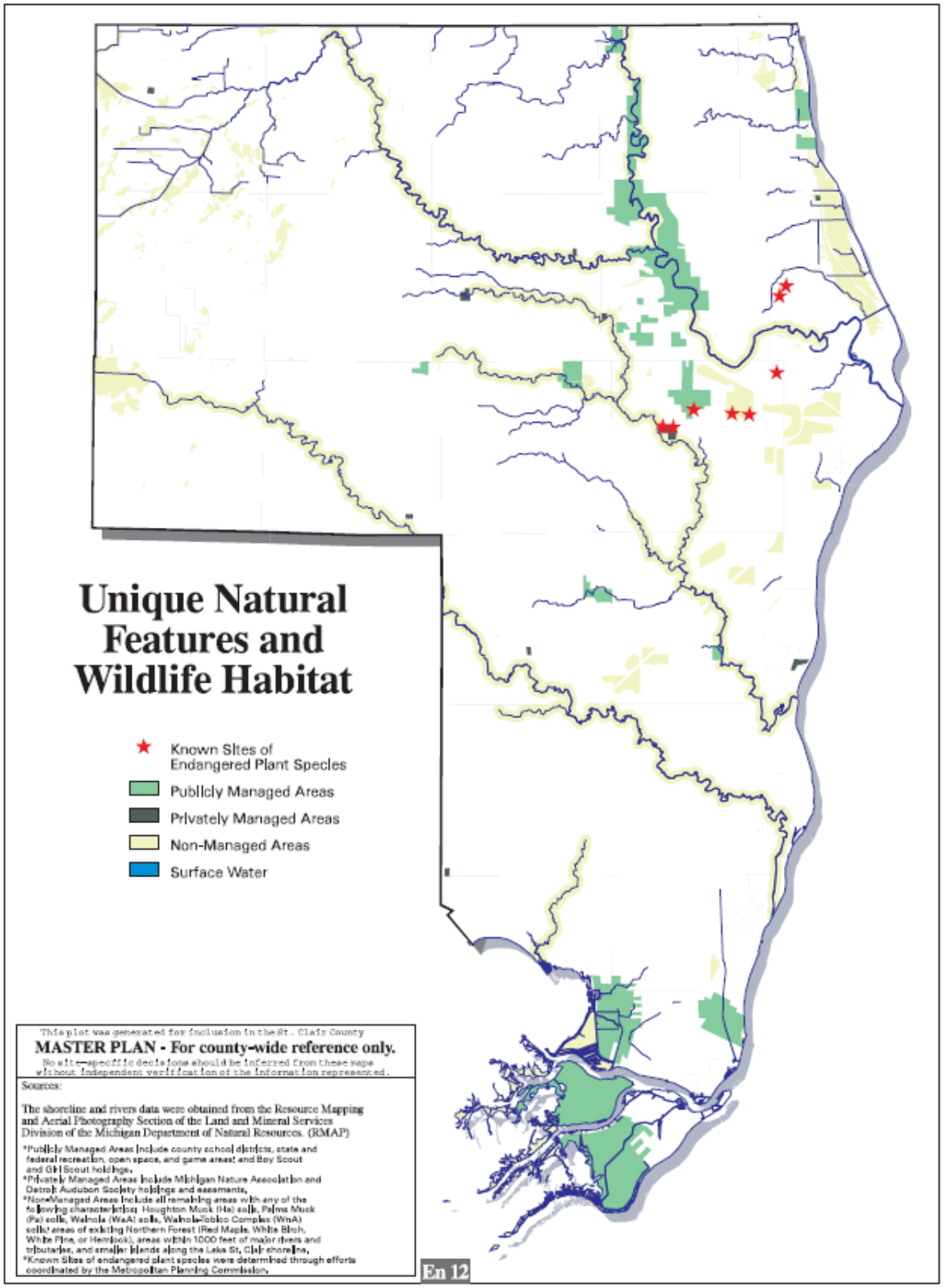

Figure 1.20 Unique Natural Features and Wildlife Habitat in St. Clair County (SCCMPC, 2000)

1.5.1 Mature Forest: Conservation Priority throughout the NEW

It is estimated that prior to European settlement, mature forest habitats occupied the majority of the Michigan landscape, perhaps as much as eighty to ninety percent. Currently in SCC, what remains of this forest are only small fragmented "woodlots" usually relegated to the interior portions of township sections. According to the 2000 SCC Master Plan, approximately 15% of SCC is forested. Of that 15%, it is estimated that less than 10% is mature or relatively undisturbed forest. If you subtract the Port Huron State Game Area's large tracts of forested land from that 10%, it becomes obvious that mature forest within the NEW is very rare and should be protected. While old agricultural fields that have reverted back to forests and shrub lands (early-successional type forest) are important for preservation, they do not have the biodiversity or the absorptive qualities of the relatively undisturbed and older second-growth type forests.

The NEW's mature forests serve as sanctuaries for species that cannot live in regenerated early-successional type forests. Some of the more characteristic interior forest vegetation includes American Beech, Sugar Maple, Eastern Hemlock, Yellow Birch, Witch-hazel, Large Dutchman's-breeches, Christmas Fern, Maidenhair Fern, and various fungi, lichens, and slime molds. Birds such as Barred Owl, Pileated Woodpecker, Wood Thrush, Veery Ovenbird, Eastern Wood-peewee, Eastern Phoebe, and many warblers thrive only in large interior woodlands where nesting competition from edge species such as cowbirds is minimal. Other interior woodland animals include the Luna Moth, Cecropia Moth, Polyphemus Moth, Mourning Cloak Butterfly, Wood Frog, Spring Peeper Frog, Red-backed Salamander, Spotted Salamander, Red-bellied Snake, Spotted Turtle, Woodland Vole, and Northern Flying Squirrel. These lists do include many endangered and threatened species of Michigan that require mature, interior forest habitat, as well as certain mussels and fish that require the coldwater riffles, deep pools, and un-silted bed maintained in a natural forest stream (USDA, Black River Resource Plan, 1997).

1.5.2 Northern Forest: Conservation Priority throughout the NEW

The northern forest habitat holds a high conservation value throughout the NEW. This habitat is unique to southeast Michigan and results from a unique combination of sandy soils deposited in glacial lake plains, dunes and beaches, a cooler growing season due to the effects of Lake Huron, a high water table, and possibly the former influence of fire. This northern forest is characterized by Paper Birch and Eastern White Pine, a type of forest more typical of areas north of Michigan's transition zone in the mid section of the Lower Peninsula. Because of the NEW's location well south of the transition zone, this northern forest habitat is very unique and only exists in "frost pocket" areas.

The distribution of this forest seems to be limited primarily to the distribution of sand to loamy sand sub-soils of the Wainola-Deford and Hoytville-Allendale-Nappanee soil associations, and secondarily to Allendale-Latty soil associations (Soil Survey of SCC). The habitat ranges from dry to mesic (moist) to wet northern forest, but vast areas are wet, with a landscape consisting of small knolls and pits distributed across the forest floor. The knolls are drier and typically covered with Bracken Fern, Wintergreen, Bunchberry, Bristly Dewberry, Fringed Polygala, Patridgeberry, Goldthread, Canada Mayflower, Indian Cucumber-root, Bristly Sarsparilla, Lycopodium, Late Low Blueberry, and sometimes Sweetfern. The pits are damp to ponded and contain Cinnamon Fern, Royal Fern, Northern Lady Fern, and Sensitive Fern. Tree and shrubs occurring in these areas include Red Maple, Eastern White Pine, Eastern Hemlock, Paper Birch, Downy Serviceberry, Northern Wild-raisin, Nannyberry, Northern Arrowwood, Speckled Alder, and Common Highbush Blueberry (B. Collins, Natural Resources of Saint Clair County Michigan).

A Michigan endangered species that exists within the northern forest habitat type is the Painted Trillium (*Trillium undulatum*). Painted trillium (Figure 1.21) occurs at just six locations in Michigan, all of which are located in SCC. Four of the six remaining locations are in Kimball Township and the other two small colonies are in and near the Port Huron State Game Area in Clyde Township.

Figure 1.21 Michigan Endangered Species, *Trillium undulatum*

The Painted Trillium grows only in cool, moist, acidic sands, in forests of Red Maple, Paper Birch, Eastern White Pine, Eastern Hemlock, Bracken Fern, Indian Cucumber-root, Clintonia, Canada Mayflower, Bunchberry, Wintergreen, Fringed Polygala, Bristly Dewberry, and Goldthread.

1.5.3 Hemlock Ravines: Conservation Priority in the LBR Subwatershed

The dense stands of Eastern Hemlock along the ravines of the Black River hold high conservation value for the LBR subwatershed. These stands are a northern hardwood forest type, and as with the previously described forest community, are more typical of forests north of the transition zone. Adjacent ridges and plateaus are dominated by canopies of Sugar Maple, American Beech, Yellow Birch, Red Oak, Black Cherry, and occasionally White Pine. However the ravines and upper floodplains are thick with nearly pure stands of Eastern Hemlock. In some areas, Yellow Birch is the only co-dominant species. Patches of Northern White Cedar and a few Hemlock occupy the upper slopes directly along the Black River.

This forest generally occurs from southern Sanilac County to as far downstream as Fort Gratiot Township in SCC. It includes not only the slopes adjacent to the Black River, but also the slopes and ravines of the many tributaries to the Black River. Prime examples of this forest occur along Silver Creek in the privately-owned Silver Trails Scout Reservation in Grant Township, the privately-owned Wingford property (733.4 acres) in Clyde Township, and the Port Huron State Game Area (over 6,000 acres) that includes parts of both Clyde and Grant Townships. These Hemlock stands are relic communities of extensive northern forests which covered the area subsequent to the last glacial retreat. The ensuing warmer and drier climate restricted the

Hemlock, largely, to the shaded slopes and moist ravines within the Black River valley. This combination of deep ravines and ridges of hemlock among northern hardwoods that overlook the waters of the Black River make this one of the most uniquely beautiful areas in Southeastern Michigan (USDA, Black River Resource Plan, 1997).

Figures 1.22 and 1.23 below provide a preliminary analysis of the location of forest preservation and wooded areas.

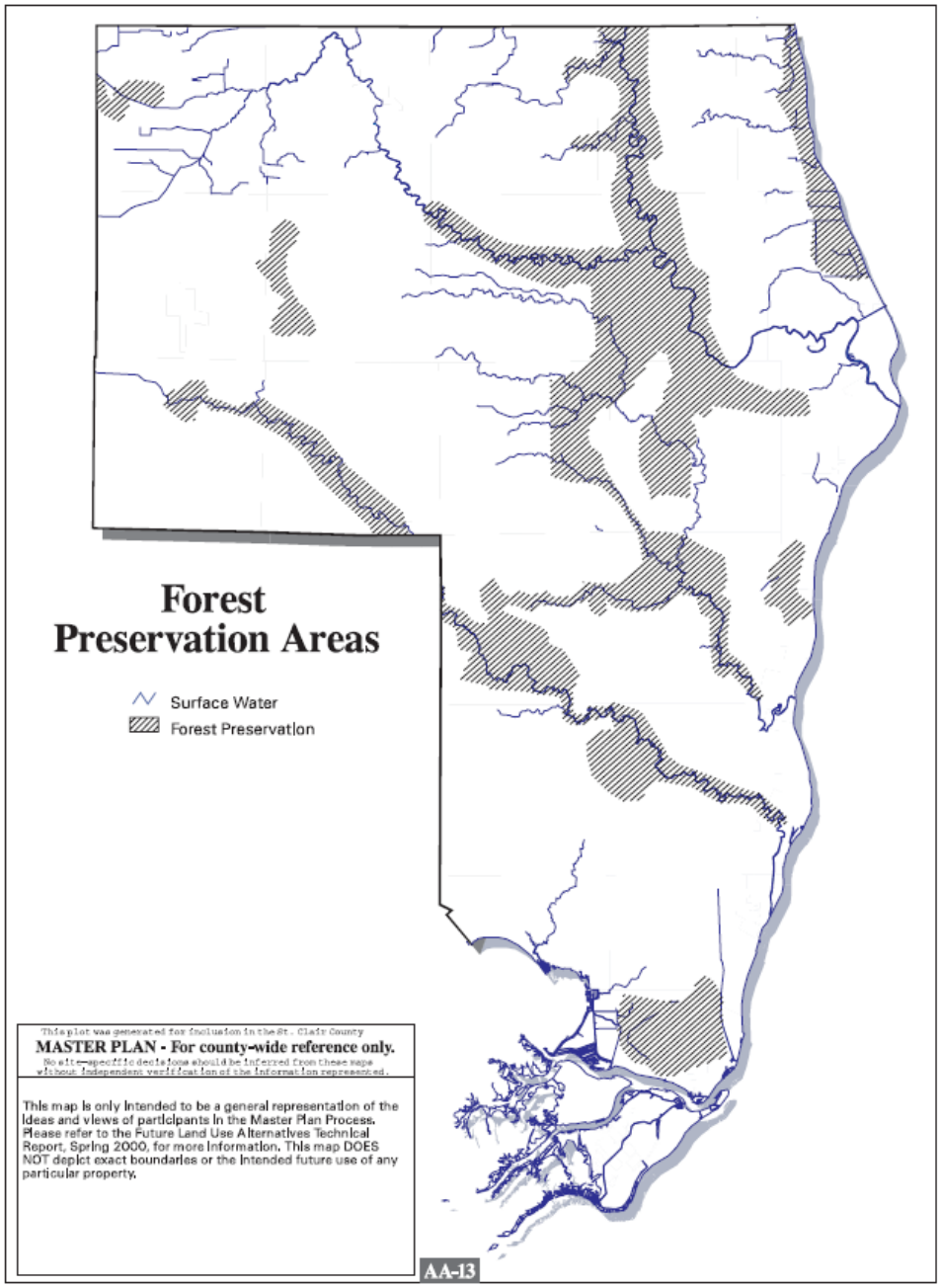

Figure 1.22 Forest Preservation Areas in St. Clair County (SCCMPC, 2000)

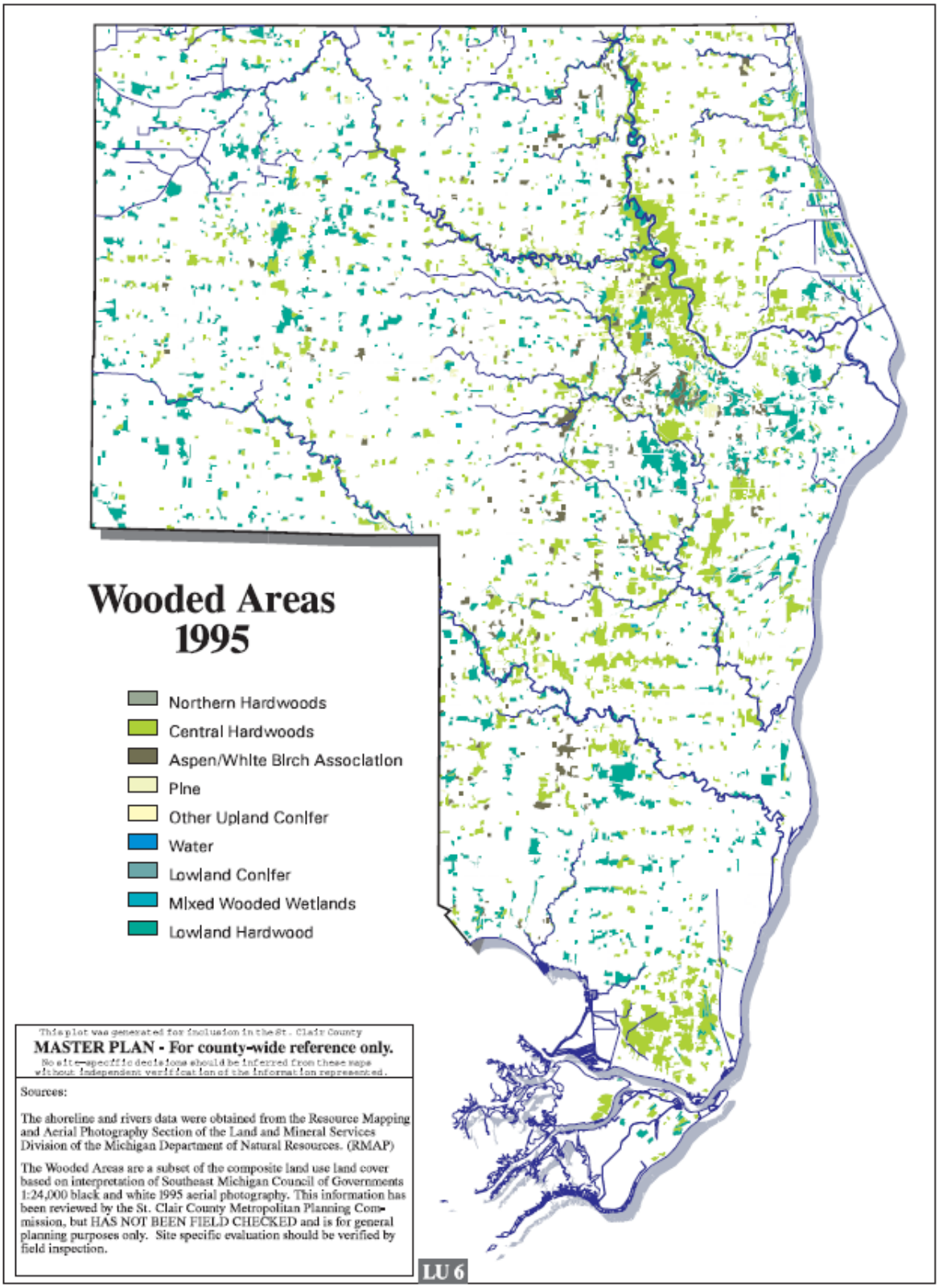

Figure 1.23 Wooded Areas in St. Clair County (SCCMPC, 2000)

1.5.4 Glacial Beach Ridges and Swales: Conservation Priority in the LHD Subwatershed

The glacial beach ridge and swale habitat, located in the Lake Huron Direct Drainage Watershed, is the largest, unfragmented occurrence of this habitat in the lower Thumb. The Michigan Natural Features Inventory considers this type of habitat to be a distinct natural community in Michigan because of the "unique assemblage of physiographic, soil, and vegetative components" (Michigan Natural Features, *Community Abstract for Great Lakes Wooded Dune and Swale Complex*).

The glacial ridge and swale habitat extends one-and-a-half miles inland from the shoreline of Lake Huron. This habitat is made up of successive beach ridges that parallel the lakeshore from west to east along Michigan's "Thumb" shoreline. Unlike wind-formed sand dunes, these ridges are old beaches, deposited by waves approximately 4,500 years ago. The most intact remaining pieces of this habitat exist in Section 9 of Fort Gratiot, north of Carrigan Road, and in section 32 of Burtchville Twp, north of Metcalf Road. The main soil type in this area is Wainola-Tobico complex, the only area in which this soil association occurs in the county. The habitat consists of sandy ridges and muck filled wetland swales that vary in widths from approximately 10 feet to a few hundred feet. The distinctly different soil types and hydrology of the ridges versus the muck areas and the cooler growing season due to the effects of Lake Huron sustains a unique combination of plant species uncommon in Michigan. Although impacted by sand and muck mining, livestock grazing, and development, the remaining ridge and swale habitat is largely intact and forested. The sand crests of the ridges support species such as Red Oak, Black Cherry, Quaking Aspen, and Paper Birch, while in Burtchville Township northern Michigan species become more prominent such as the Northern White-cedar, Eastern Hemlock, and Yellow Birch. Within a matter of feet of these ridge species, the distinctly different muck species dominate such as Silver Maple and Green Ash with uncommon under story species such as Purple-flowering Raspberry, and Yellow Lady's-slipper orchids (Figure 1.24).

Yellow Lady's-slipper (Cypripedium calceolus)
Photo credit: Dan Tenaglia, Eminence, Missouri

Figure 1.24 Yellow Lady's Slipper

Purple-flowering Raspberry (*Rubus odoratus*) is thought to be native to only seven shoreline counties in Michigan along Lake Huron and Lake Erie, including St. Clair and Sanilac. In the Thumb, it grows only in the glacial ridge and swale habitat.

The remaining ridge and swale habitat areas are now largely mature second growth forest of Silver Maple, Green Ash, and Eastern Cottonwood in the wetland swales, Paper Birch along the lower margins of the upland ridges, and Quaking Aspen, Bigtooth Aspen, Black Cherry and Red Oak on top of the ridges. As the habitat extends into Burtchville Township the Northern White-cedar, Eastern Hemlock, and Yellow Birch increase in number. It also contains uncommon species such as Purple-flowering Raspberry (Purple-flowering Raspberry once occurred on several pre-developed sites in Fort Gratiot Township, but has been greatly diminished by development over the past 10 years.), Fringed Polygala, Yellow Lady's-slipper, and Showy Lady's-slipper.

In addition to unique plant species, the ridge and swale habitat also sustains woodland birds and the Eastern Hognose snake. This area is well known as the migratory route for woodland birds that move north and south along Lake Huron.

While it is clear that glacial beach ridge and swale habitat is unique in Michigan and St. Clair County, this valuable habitat is rapidly being lost to development. Since the early 1990s, large areas have been destroyed, and now exist as a commercial strip in Fort Gratiot Township. Wetland violations were sited in this unique habitat, but mitigated wetland does not compare to the unique ridge and swale wetland habitat that was destroyed. According to the SCCMPC's Master Plan, the M-25 corridor where the remainder of this habitat is located is predicted to experience commercial growth and increased population between 2000 and 2020 (Figure 1.25) (B. Collins, Natural Resources of Saint Clair County, Michigan).

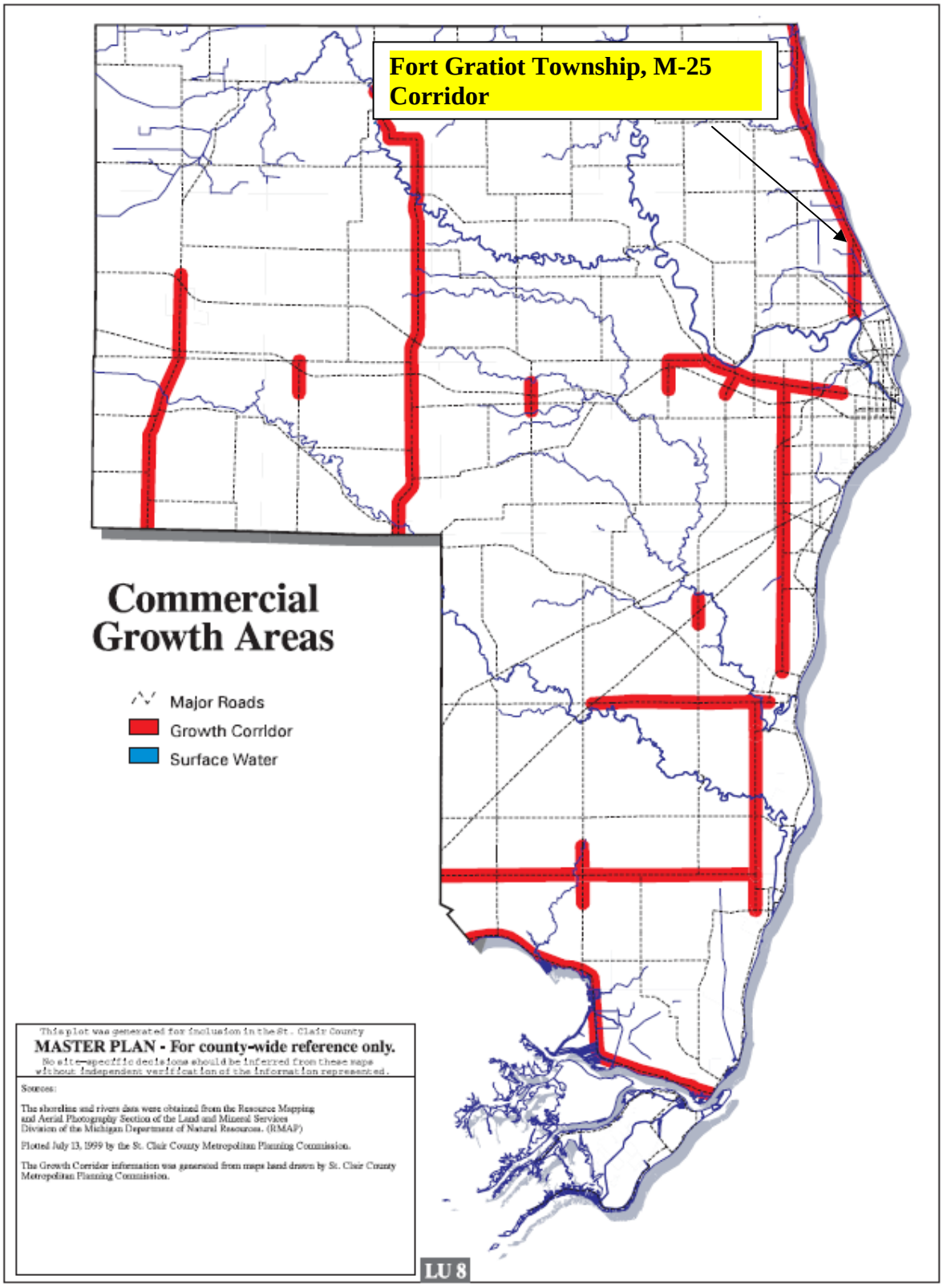

Figure 1.25 Commercial Growth Areas in St. Clair County (SCCMPC, 2000)

1.5.5 Wetlands: Conservation Priority throughout the NEW

As stated earlier in the Hydrology section, wetlands are extremely important for water detention, water quality benefits, and the biodiversity they provide. Many wetlands are rich in unique vegetation and waterfowl depend on them for "stop over habitat" as they make their international migratory flights. Wetland types common in the NEW are lowland hardwoods, lowland conifers, and shrub or scrub growth. Currently, there have not been any efforts to locate or identify unregulated wetlands with unique features by field verification (see Figure 1.17 for generalized map). This should be a priority action item (BMP) to be implemented in the NEW.

1.5.6 Port Huron State Game Area (PHSGA)

The Port Huron State Game Area (PHSGA) contains the largest tracts of northern forest, trillium, hemlock ravines forest, mature forest, and wetland habitat in the NEW. It is under the jurisdiction of the Department of Natural Resources and is largely comprised of land parcels scattered throughout Clyde and Grant Townships. The main section of the Game Area is located approximately 10 miles west of Port Huron, close to Abbotsford Road, between Highways M-21 and M-136. In this main section, the Black River flows in a generally southward direction and is surrounded by rugged terrain and steep-sided banks as high as one hundred feet. Perpendicular to the main branch, tributary streams run into the Black River and they contain areas of steep ravines and large floodplains. It is in these areas, adjacent to the river and its tributaries, where unique features exist. The upland areas between tributaries and generally surrounding the main section are largely flat, dry land comprised of regenerated upland oak woodland.

The habitats alongside the water are lush in vegetation and vary considerably. Some ravines are covered in pure hemlock stands where ground cover is sparse and the forest floor is very dark. In other areas the forest is mixed hardwoods or a mixture of conifers and deciduous trees. In some areas seepage from higher ground creates moist and shady conditions where bog-like vegetation exists and ferns are particularly abundant.

Except for areas of pure hemlock stands, the spring flora of the ravines is particularly unique and abundant. Vegetation of special interest is the Broad leaf sedge, a large number of different orchids (eight species), and the endangered Painted Trillium. Other unique species include trailing arbutus, pink moccasin flower, red baneberry, twisted stalk, twinflower, flowering raspberry, golden saxifrage, rattlesnake plantain orchid, and beaked hazelnut. To date over 300 species of plants have been catalogued in the PHSGA.

The wide variety of habitats and the varied terrain attracts many species of birds and mammals to the area. Bird species of interest are the scarlet tanager, rose-breasted grosbeak, blue-gray gnatcatcher, black-throated green warbler, black burnian warbler, and the cerulean warbler. The alternation of woodland and open fields creates edge, which attracts a number of different species of smaller mammals such as fox, deer, rabbit, raccoon, possum, skunk, mink, weasel, beaver, muskrat, woodchuck and the fox, red, and gray squirrels.

The PHSGA is a unique area containing a variety of habitats that must be preserved for biodiversity and health of the Black River and its tributaries. As the Cranbrook Institute of Science described it, "No comparable ravine country of such rugged and varied terrain is found in this section of Michigan. The combination of features occurring here is unique and every effort should be made to preserve this valuable area." While the preservation of these lands is very valuable, there are still more floodplains along the Black River that retain the same characteristics

as described for the PHSGA that need protection. Figure 1.26 provides an overview of the land area comprising the PHSGA.

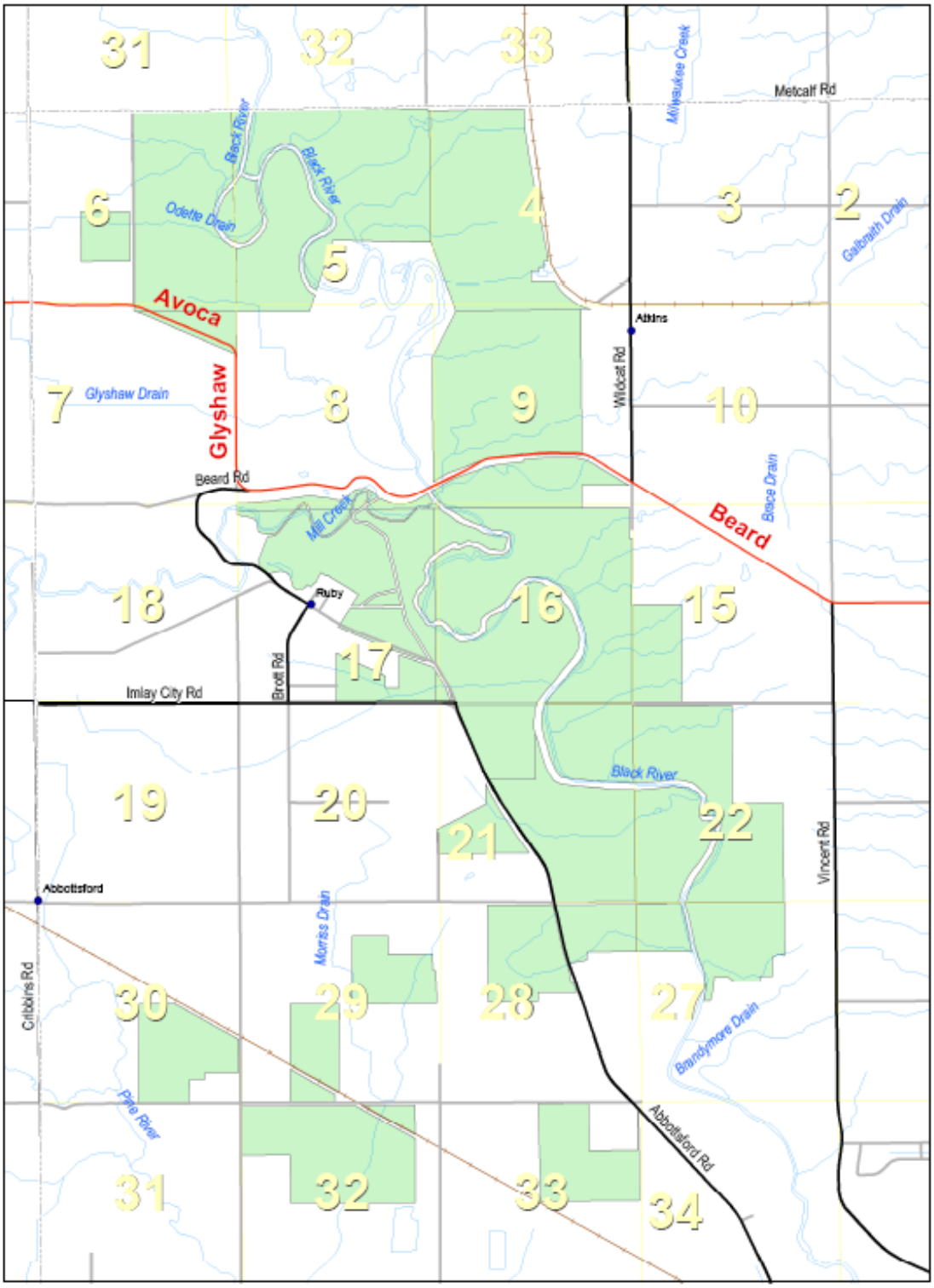

Figure 1.26 Port Huron State Game Area Lands (green-shaded areas)

1.5.7 Nature Sanctuaries

Mature forest exists in the 66.24 acre Michigan Nature Association sanctuary called the Alice W. Moore Woods Nature Sanctuary. Inside the city limits of St. Clair, this sanctuary provides protection of a mature oak-hickory forest. This forest is unique because of the lack of disturbance it has endured, the size and variety of oak trees, and the habitat they provide for a variety of plant and animal species. Many of the trees are three foot in diameter and the oak species commonly found are northern red, white, and bur oaks. The predominant hickory species is pignut hickory. Because Oak-Hickory forests tend to have a more open canopy, this allows for understory plants to become established. Examples of small trees that typically grow in this environment include witchhazel, hazelnut, flowering dogwood, and sasafrass. Shrubs include new jersey tea, arrowleaved viburnum blueberry, and black huckleberry. Groundcover species include mayapple, pennsylvania sedge, wild strawberry, asters and goldenrods.

This forest type generally grows in areas with a relatively warm climate, long growing season, and xeric to dry-mesic, well-drained soils. Historically, this forest type was not predominate in southeastern Michigan, but because of the lack of fire and extensive modifications to the hydrology in the area due to ditches and drain tiles, this allowed dry mesic forests to establish in areas that were previously unsuitable. As such, areas that were once lakeplain prairie or lakeplain oak openings gradually changed to oak-hickory forests and other vegetation communities.

Because of the acorns and nuts produced by Oak-Hickory forests, many mammals live in or near this vegetation community. Examples include fox squirrel, southern flying squirrel, white-tailed deer, chipmunks, deer mice and voles. Many birds also live in Oak-Hickory woodlands because of the acorns, nuts, open canopy structure and dead trees (snags) that provide shelter and nesting sites. Examples include wild turkey, wood duck, red-bellied woodpecker, downy woodpecker, black-capped chickadee, cardinal and blue jay among others.

In 2004, the Sharon Rose Leonattie Memorial Nature Sanctuary was established by the Michigan Nature Association and protects painted trillium habitat land in Kimball Township.

1.5.8 Fisheries

Both commercial and sport fishing in the NEW is an immense economic factor and cultural activity within the watershed. While it is difficult to quantify revenues generated by fishing activities, many people live and have vacation homes within the watershed because of the available access to Lake Huron, the St. Clair River, and Lake St. Clair. The fish populations in the subwatershed also represent an important environmental resource for the area. Recent sampling by the Michigan Department of Natural Resources of the Black River above a private dam in the Port Huron State Game Area found 1,200 to 1,400 fish where they only expected to find 300 – 800. The sampled fish include a wide variety of shiners, darters and minnows. "While I encountered some areas that have been ruined by dredging, in most areas I was amazed at the number of smaller fish I found," said Jim Francis, Department of Natural Resources.

The fisheries of the St. Clair River and Lake Huron have been dramatically altered since the arrival of European settlers and invasive species. While many species of game fish have prospered, certain species such as the lake sturgeon and whitefish have dramatically decreased. The continuing influx of invasive species makes the Department of Natural Resource's job of managing healthy fish populations very difficult.

Lake Sturgeon almost disappeared around the turn of the century and is still considered an endangered species in the St. Clair River and Lake Huron. Breeding grounds for the Sturgeon have been found under the Blue Water Bridge and downriver of the NEW in the North Channel near Algonac. In recent years Lake Sturgeon populations have increased due to stringent state protection regulations.

Numbers of game fish in the St. Clair River and Lake Huron, such as walleye, perch, and lake trout, have increased in recent years; rainbow trout (steelhead) numbers have remained steady; and salmon numbers have decreased. It is thought that salmon numbers have decreased due to a decrease in their primary forage, alewife. Because the lake trout, a bottom feeding fish, eats a larger variety of species, they have not been as severely affected. Many salmon tagged in Lake Huron have been found in Lake Michigan where alewife numbers are still abundant. Because of the increases in game fish in Lake Huron, the number of smelt (an introduced species) has also decreased. Although salmon fishing is an important economic issue in the "thumb" area of Michigan, salmon do not receive protection from the state because it is a non-native species.

Historically, the Black River has afforded high-quality fishing, but fish populations have dramatically diminished in recent decades. Aquatic habitat has been severely degraded through easily eroded soils that produce highly turbid waters, and the presence of a dam in Clyde Township which prevents spawning and travel of fish north of Mill Creek. Despite these factors, the Black River and Mill Creek still provide important spawning grounds for salmon, rainbow trout, carp and suckers. North of the dam, a few rock bass and small mouth bass may be found, but numbers are few. Carp is commonly found throughout the Black River.

Historically, the tributaries in the LHD provided spawning grounds for large populations including the smelt. Today, reports indicate a dramatic decrease in spawning activity, with the smelt fishery almost non-existent. As mentioned above, the increase of game fish in Lake Huron is thought to have decreased smelt numbers although it is unknown why most of the remaining populations do not spawn in these tributaries. While many fishermen miss these annual runs, smelt do not receive any protection or restoration efforts from the state because it is an artificially introduced species.

Invasive species continue to present one of the largest threats to the fisheries of the NEW's tributaries, Lake Huron, and the St. Clair River. Recent outcry has demanded more protection from foreign ballast waters discharged from ocean-going freighters, but until these discharges are completely prohibited, the fisheries are very vulnerable to the hazards of foreign species. It has been estimated that one new invasive species enters the Great Lakes every sixty to ninety days. Because of this, maintaining healthy fish populations has become very difficult for the Michigan Department of Natural Resources.

1.5.9 Endangered and Threatened Species

A variety of threatened, endangered, and special concern species, high-quality natural communities, and unique geologic forms have been identified in the NEW. The Michigan Natural Features Inventory (MNFI) maintains databases of all known occurrences of these species, as well as high-quality natural communities occurring within the watersheds of Michigan. This list is based on known and verified sightings and represents the most complete data set available. Because of the inherent difficulties in surveying and inconsistencies of inventory efforts across the state, species may be present in the watershed and not appear on this list.

An *endangered* species is any species whose ability to survive and reproduce has been jeopardized by human activity. A *threatened* species is any species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. A *special concern* species, although not endangered or threatened, is extremely uncommon in Michigan, or has unique or highly specific habitat requirements and deserves careful monitoring of its status. An *extirpated* species is a species that no longer exists in the wild in one geographic region, but occurs elsewhere. A summary of all of these species in the NEW is summarized in Table 1.3 through 1.6 below.

Table 1.3 Endangered, Threatened, Special Concern and Extirpated Plants Occurring in the NEW (All Subwatersheds)

Scientific Name	Common Name	Status
Castanea dentata	American Chestnut	Endangered
Cuscuta indecora	Dodder	Special Concern
Dalea purpurea	Purple Prairie-clover	Extirpated
Draba reptans	Creeping Whitlow-grass	Threatened
Galearis spectabilis	Showy Orchis	Threatened
Gymnocarpium robertianum	Limestone Oak Fern	Threatened
Lithospermum incisum	Narrow-leaved Puccoon	Extirpated
Obovaria subrotunda	Round Hickorynut	Endangered
Plantago cordata	Heart-leaved Plantain	Endangered
Polygala incarnata	Pink Milkwort	Extirpated
Polygonum careyi	Carey's Smartweed	Threatened
Ranunculus rhomboideus	Prairie Buttercup	Threatened
Trillium undulatum	Painted Trillum	Endangered
Vitis vulpina	Frost Grape	Threatened

Table 1.4 Endangered, Threatened, Special Concern and Extirpated Species Occurring Only in the St. Clair River Direct Drainage Subwatershed

Scientific Name	Common Name	Status
PLANTS:		
Gentiana flavida	White Gentain	Endangered
Hiodon tergisus	Mooneye	Threatened
Solidago bicolor	White Goldenrod	Special Concern
ANIMALS:		
Clemmys guttata	Spotted Turtle	Threatened
FISH:		
Stizostedion canadense	Sauger	Threatened

Table 1.5 Endangered, Threatened, Special Concern and Extirpated Species, Plant Communities and Geologic Features Occurring Only in the Lower Black River Subwatershed

Scientific Name	Common Name	Status
PLANTS:		
Carex platyphylla	Broad-leaved Sedge	Threatened
Dentaria maxima	Large Toothwort	Threatened
Gentianella quinquefolia	Stiff Gentain	Threatened
Hydrastis canadensis	Goldenseal	Threatened
Jeffersonia diphylla	Twinleaf	Special Concern
Lithospermum latifolium	Broad-leaved Puccoon	Special Concern
Monarda didyma	Oswego Tea	Extirpated
Panax quinquefolius	Ginseng	Threatened
Poa paludigena	Bog Bluegrass	Threatened
Pterospora andromedea	Pine drops	Threatened

Table 1.5 Endangered, Threatened, Special Concern and Extirpated Species, Plant Communities and Geologic Features Occurring Only in the Lower Black River Subwatershed (continued)

Scientific Name	Common Name	Status
PLANT COMMUNITIES:		
	Mesic northern forest	
ANIMALS:		
Ammodramus henslowii	Henslow's Sparrow	Threatened
Clemmys guttata	Spotted Turtle	Threatened
Epioblasma torulosa rangiana	Northern Riffleshell	Endangered (State & Federal)
	Great Blue Heron Rookery	
Rallus elegans	King Rail	Endangered
FISH:		
Notropis anogenus	Pugnose Shiner	
Stizostedion canadense	Sauger	Threatened
GEOLOGICAL FEATURES:		
	Moraine	

Table 1.6 Endangered, Threatened, Special Concern and Extirpated Species, and Geologic Features Occurring Only in the Lake Huron Direct Drainage Subwatershed

Scientific Name	Common Name	Status
PLANTS:		
Jeffersonia diphylla	Twinleaf	Special Concern
Pterospora andromedea	Pine drops	Threatened
ANIMALS:		
Epioblasma torulosa rangiana	Northern Riffleshell	Endangered (State & Federal)
Rallus elegans	King Rail	Endangered
GEOLOGICAL FEATURES:		
Moraine		

1.6 Farmland

Increasingly, agricultural lands in the NEW are disappearing as they are split and sold off for development. Although agricultural lands can produce water quality problems because of poorly implemented Generally Accepted Agricultural Management Practices (GAAMPs), their preservation does maintain a much lower runoff rate than that of developed areas and helps maintain the rural character of the watershed. As a result, preservation of farmland and increased implementation of GAAMPs are important means to protecting the water quality of the NEW. Most of the agricultural areas in the NEW occur in the LBR and LHD subwatersheds. Figure 1.27 outlines the prime agricultural areas that have been delineated by the SCCMPC, and it also shows the status of farmland acreage enrolled in the Farmland Preservation Act.

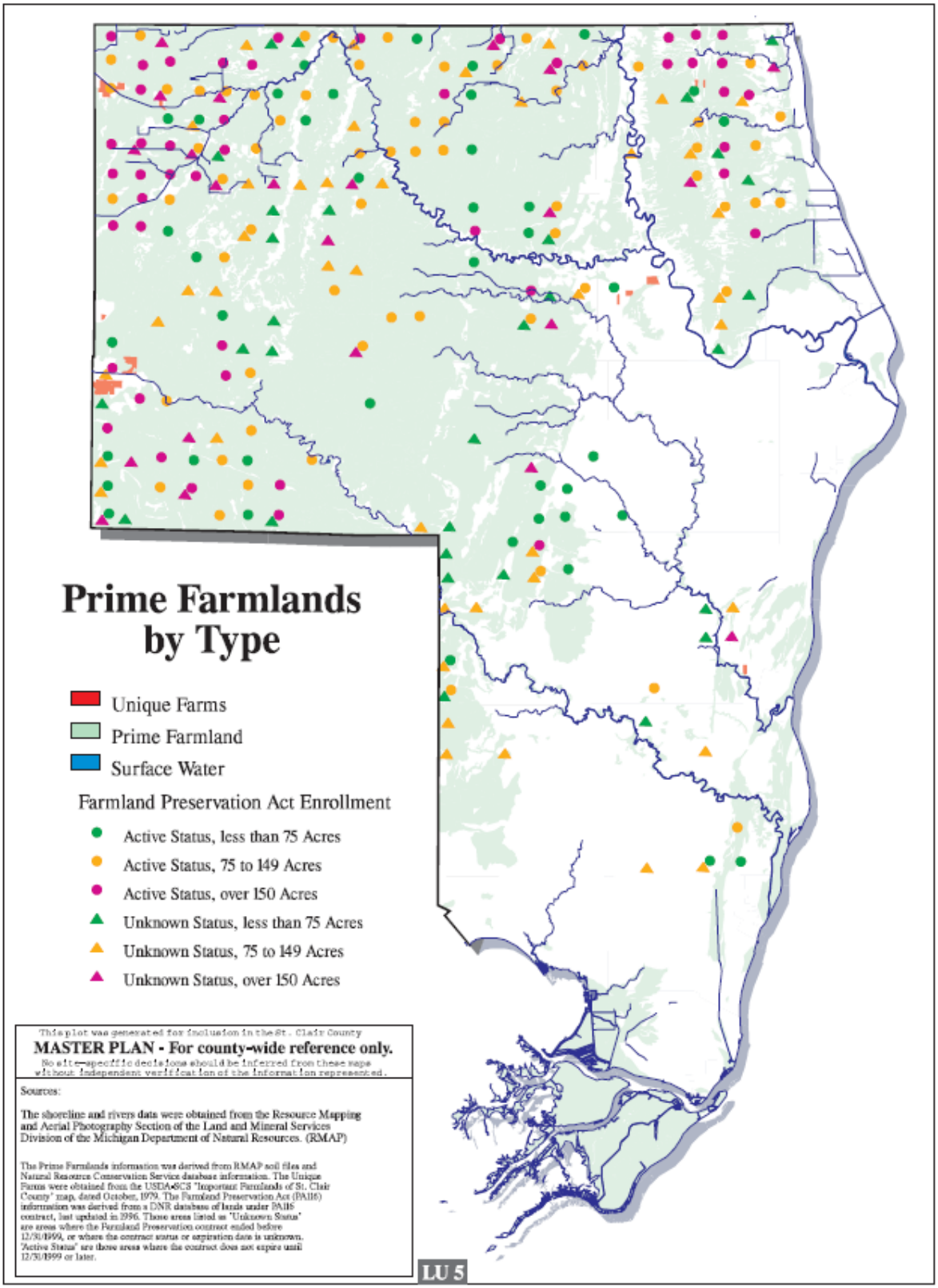

Figure 1.27 Prime Agricultural Lands in St. Clair County

As stated in the soils discussion, the NEW consists of soils that are dominated by loam. According to the Natural Resources Conservation Service (NRCS), soils within the LBR and LHD provide moderately productive to some of the most productive agricultural lands in SCC. Soils in the SRD are generally not productive for farming and many of the agricultural fields are fallow with white pine and white birch regenerating. The majority of farming in the LHD and LBR are small dairy operations, and row-crops including soybeans and corn (Frey, 2001). There are no Concentrated Animal Feeding Operations (CAFOs) in the NEW.

In 2004, the SCC Board of Commissioners approved an ordinance allowing SCC agricultural lands to enter into a federal protection program, but funding is needed to buy the farm development rights. It is logical that the most productive agricultural land in the county should be prioritized for development rights acquisition and this occurs on Morley-Blount-Pewamo soils located on the glacial ridge separating the LBR and LHD subwatersheds. Farmlands in these areas have been identified by the NRCS as those best suited for food production. This means that they require minimal soil enhancement measures such as irrigation and fertilizer, and crops grown on these soils will produce the highest yields with the smallest input of energy and economic resources.

As stated earlier, implementation of GAAMPs is an important means to preserving water quality. Unfortunately, many of the NEW's agricultural sites observed in the 2004 Road/Stream Crossing Survey lacked buffer strips along riparian corridors, exhibited erosion problems in the spring (especially on untiled fields), and suffered erosion due to cattle access in waterways. In addition, many of the waterways in agricultural areas are drains where agricultural interests often demand channelized dredging of these waterways.

1.7 Growth Trends, Land Use Analysis, and Community Profiles

This analysis looks at the current land use and development conditions within SCC's Northeastern Watersheds (NEW), and identifies trends and potential future water quality issues associated with development. The analysis was created by the Watershed Advisory Group (WAG), which represents the communities and County agencies in these watersheds of St. Clair County. A draft of this section was sent to all communities within the watershed for their comments and input. The document was revised based on the comments collected.

1.7.1 Growth Trends

To understand the land use changes within the Northeastern Watersheds, it is helpful to understand the growth trends observed within the Southeast Michigan Council of Government (SEMCOG) region. While a small portion of the watershed is located in Sanilac County to the north, the majority of land area is within SEMCOG's region.

SEMCOG evaluated the changes that have occurred between the 1990 and 2000 census years. A summary of the findings is as follows:

- Developed land in the region has increased by 17% (159,300 acres). Thirty-seven percent (37%) of the region is now considered developed.

- The region's population grew by 5% (243,000 people).

- Between 1990 and 2000 the density of residential development decreased from 2.84 units per acre to 1.26 units per acre, or 55.6%.

- Average household size has decreased and the average home size has increased.

- The results of these changes are larger homes on larger pieces of land with fewer occupants.

The trends identified by SEMCOG are indicative of a growing region. The proximity of the watershed to the rapidly growing metropolitan Detroit region is reflective of these trends. SEMCOG projects that similar trends will prevail over the next thirty (30) years. It is reasonable to assume that the four watershed communities within Sanilac County will similarly experience the growth pressures described here.

The St. Clair County Master Plan paints a similar picture regarding the level of development and growth within the County. The Master Plan explains what could happen if current trends continue without pro-active planning on the parts of local communities and the County:

> *"Continuing with current trends means that development will continue in a sprawl fashion along township section mile roads. There will be an increased demand for public services, especially sewer and water, but there won't be sufficient tax base to support payment for those services. Traffic jams will become more prevalent. Health and environmental problems, especially in regard to safe and drinkable water, will increase. Historical and cultural resources will become endangered. And recreational open space will not be preserved for public use. Most of all, farmland and the rural character that St. Clair County residents say they want to retain, will be lost."*

However, the plan states that it doesn't have to be this way. It provides principal themes or goals to guide communities and the County in their thinking and planning for the future:

1) Manage growth
2) Protect and preserve water quality
3) Improve quality of life
4) Create a sustainable countywide community

Solutions discussed in the County's Master Plan to reach these principal goals include the following. While directly related to preserving water quality, they also act to reach the other Master Plan goals.

1) Target the most sensitive areas for public acquisition and protection from dense development storm water runoff
2) Create buffer zones within parks for public use in areas immediately adjacent to sensitive environments
3) Preserve forested areas where possible.

1.7.2 Community Growth Trends

Tables 1.7 and 1.8 that follow illustrate the population and housing profiles for each of the twenty (20) communities within the watershed. Note that this data is for the entire community, not just the area of the community within the NEW.

Table 1.7 Population and Housing Profiles for St. Clair County Communities

	Burtchville Township	Clyde Township	East China Township	Fort Gratiot Township	Kimball Township	City of Marine City	City of Marysville	City of Port Huron	Port Huron Township	City of St. Clair	St. Clair Township	Grant Township	Brockway Township	Greenwood Township	City of Yale	Kenockee Township
Population																
1990 Population	3,559	5,052	3,216	8,968	7,247	4,556	8,515	33,694	7,621	5,116	4,614	1,210	1,609	1,037	1,977	1,854
2000 Population	3,956	5,523	3,630	10,691	8,628	4,652	9,684	32,338	8,615	5,802	6,423	1,667	1,900	1,373	2,063	2,423
2030 Population	5,863	6,404	4,124	13,725	12,009	5,323	11,310	29,530	11,744	6,453	8,941	2,381	2,812	2,006	2,145	4,020
Households																
1990 Households	1,356	1,603	1,236	3,261	2,443	1,693	3,359	13,158	2,749	2,015	1,583	404	507	351	742	597
2000 Households	1,616	1,931	1,467	4,076	3,120	1,860	4,025	12,961	3,310	2,322	2,266	571	637	470	742	833
2030 Households	2,717	2,609	1,949	6,213	5,083	2,468	5,393	13,939	5,133	2,823	3,429	843	1,012	722	793	1,485
2000 Housing Units	1,880	1,989	1,577	4,334	3,302	2,006	4,180	14,003	3,478	2,432	2,394	606	669	492	805	866
2000 Household Size	2.44	2.85	2.38	2.56	2.74	2.50	2.40	2.43	2.58	2.49	2.83	2.90	2.97	2.91	2.63	2.90
2030 Household Size	2.16	2.44	1.94	2.13	2.34	2.16	2.10	2.04	2.27	2.28	2.60	2.81	2.77	2.77	2.36	2.70
2000 Median Household Income	$43,830	$53,986	$51,652	$50,736	$47,627	$40,146	$49,299	$31,327	$43,978	$52,957	$58,711	$58,603	$52,361	$52,604	$38,375	$54,293
2000 Median Housing Value	$116,100	$138,800	$155,200	$138,500	$100,500	$105,200	$129,700	$84,400	$124,300	$137,100	$154,300	$125,600	$130,200	$117,600	$88,800	$139,300
2000 Educational Attainment																
No High School	18%	13%	20%	12%	22%	18%	11%	23%	20%	11%	10%	13%	19%	16%	24%	16%
High School	35%	38%	34%	34%	39%	40%	35%	36%	38%	30%	35%	39%	42%	40%	40%	42%
Some College	25%	27%	23%	25%	25%	26%	26%	22%	24%	31%	27%	28%	24%	25%	22%	26%
Associates	6%	8%	7%	8%	7%	7%	9%	7%	8%	7%	10%	8%	7%	10%	6%	10%
Bachelor's	11%	10%	10%	12%	4%	6%	12%	7%	7%	11%	12%	7%	6%	5%	5%	4%
Graduate/Professional	6%	5%	5%	10%	3%	3%	7%	4%	4%	9%	6%	4%	2%	4%	2%	2%
2000 Housing Types																
One-Family Detached	70%	91%	80%	77%	82%	69%	62%	63%	77%	73%	86%	88%	89%	82%	71%	91%
One-Family Attached	1%	0%	1%	1%	0%	5%	8%	4%	2%	3%	3%	1%	0%	1%	1%	1%
Two-Family / Duplex	2%	3%	2%	1%	3%	8%	3%	10%	5%	4%	2%	0%	1%	1%	9%	3%
Multi-Unit Apartments	4%	1%	14%	14%	3%	16%	18%	23%	8%	19%	5%	0%	1%	0%	12%	0%
Mobile Homes	24%	5%	4%	7%	12%	3%	9%	0%	8%	1%	4%	10%	8%	16%	7%	6%
Other	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2004 Residential Building Permits																
Single Family	28	24	39	86	75	3	50	36	88	19	55	19	21	15	1	14
Townhouse / Attached Condos	-	-	-	-	-	-	20	16	-	-	-	-	-	-	-	-
Two-Family / Duplex	-	-	-	-	4	-	-	8	-	-	-	-	-	-	-	-
Multi-Family	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-
Total New Units	28	24	39	86	79	3	70	60	100	19	55	19	21	15	1	14

Data from 1990 and 2000 U.S. Census, and South East Michigan Council of Governments (SEMCOG) 2030 forecast.

Table 1.8 Population and Housing Profiles for Sanilac County Communities

	Speaker Township	Fremont Township	Buel Township	Worth Township
Population				
1990 Population	1,171	787	844	3,146
2000 Population	1,408	913	1,237	4,021
2030 Population	2,331	1,338	2,842	6,544
Households				
1990 Households	404	259	291	1,236
2000 Households	501	313	453	1,619
2030 Households	N/A	N/A	N/A	N/A
2000 Housing Units	546	352	497	2,778
2000 Household Size	2.81	2.92	2.72	2.48
2030 Household Size	N/A	N/A	N/A	N/A
2000 Median Household Income	$41,250	$44,250	$39,828	$37,129
2000 Median Housing Value	$99,600	$98,200	$87,900	$100,700
2000 Educational Attainment				
No High School	22%	22%	18%	21%
High School	46%	40%	50%	37%
Some College	21%	25%	19%	24%
Associates	5%	7%	6%	7%
Bachelor's	5%	5%	5%	7%
Graduate/Professional	2%	2%	3%	3%
Housing Types				
One-Family Detached	84%	85%	72%	92%
One-Family Attached	0%	1%	0%	1%
Two-Family / Duplex	1%	0%	0%	1%
Multi-Unit Apartments	2%	0%	1%	1%
Mobile Homes	14%	14%	27%	6%
Other	0%	0%	0%	0%
2004 Residential Building Permits				
Single Family	5	4	5	
Townhouse / Attached Condos	-	-	-	
Two-Family / Duplex	-	-	-	
Multi-Family	-	-	-	
Total New Units	5	4	5	

Data Sources: 1990, and 2000 U.S. Census, and East Central Michigan Planning & Development Region.
N/A = Not available.

The previous tables show that the population of all the watershed communities is increasing and projected to increase except for the City of Port Huron, which is projected to decrease slightly (9%). St. Clair County communities, on average, are projected to increase by 29% as of 2030. Sanilac County watershed communities are projected to increase an astonishing 77% by 2030. In the same vein, the number of households is increasing in all communities except for the City of Yale, where the number of households has held constant, and the City of Port Huron, which has gone down.

It is projected (where projections are available, St. Clair County only) that the number of households will increase as of 2030 on average by 44 %. This includes the City of Port Huron. Like the region, the number of people living in each household (household size) is projected to decrease, therefore requiring more units to house the same number of residents. The average number of people per household across St. Clair County communities will go down 11% by 2030. The remaining housing data shows that household incomes range (in thousands) from the low 30's to the high 50's. Median housing values range (in thousands) from the mid 80's to the mid 150's.

Educational attainment is fairly consistent across the watershed, with the majority of residents having some high school, a high school diploma, or an Associates degree. Approximately 70% to 85% of watershed citizens fall into these categories. Housing types within the watershed are comprised mainly of single-family residences (from 60% to 90%). However, most communities have some single-family attached, duplex, or apartment units. The second largest housing type in the watershed is mobile homes, ranging from 0 – 27% across watershed communities.

While the City of Port Huron's population is projected to decrease, they still constructed an additional 60 units in 2004. Port Huron Township had the most activity with 100 new units, while Fort Gratiot Township, Kimball Township, and the City of Marysville had 70 or more new residential units. The type of units being built in these communities is mostly single-family detached, but other types such as townhouses, duplexes, and multi-family units, are also being constructed. Communities in Sanilac County currently show little growth.

1.7.3 Land Use Analysis

The NEW contains a wide range of existing land use types from single-family residential to extractive. The twelve (12) land use categories used by SCC are summarized in Table 1.9 and depicted in Figure 1.28. Sanilac County uses very similar land use categories, and they are shown in Table 1.10 and in Figure 1.28.

Table 1.9 Distribution of Current Land Uses in St. Clair County's Northeastern Watersheds (St. Clair County only)

	% of SCC NEW	Total Acres	Burtch-ville Township	Clyde Township	East China Township	Fort Gratiot Township	Kimball Township	City of Marine City	City of Marys-ville	City of Port Huron	Port Huron Township	City of St. Clair	St. Clair Township	Grant Township	Brock-way Township	Green-wood Township	City of Yale	Kenoc-kee Township
Single-Family Residential	16.6%	18,883	1,667	2,632	483	2,771	1,234	75	1,264	2,589	2,651	224	187	1,456	345	1,120	14	171
Multiple-Family Residential	.5%	531	18	-	21	58	6	5	112	223	26	18	44	-	-	-	-	-
Commercial/Office	1.5%	1,692	38	21	10	429	145	21	196	545	195	30	44	9	3	-	-	6
Institutional	1.0%	1,157	36	3	39	114	36	12	185	500	178	5	7	9	13	14	6	-
Industrial	2.1%	2,403	3	-	607	14	72	-	645	633	390	16	16	-	7	-	-	-
Extractive	.5%	538	14	-	38	232	-	-	66	11	-	-	-	151	12	14	-	-
Transportation/ Communication/Utility	1.8%	2,079	14	62	29	173	234	-	46	129	650	-	48	17	11	655	-	11
Cultural/Outdoor Recreation/Cemetery	1.6%	1,775	180	48	31	386	184	2	240	276	376	5	17	22	-	9	-	-
Cultivated/Grassland/ Shrub	56.0%	63,600	5,940	9,252	422	4,116	2,064	-	995	147	1,813	-	394	13,944	3,922	18,703	106	1,782
Water	.5%	612	5	103	11	63	59	-	-	99	209	-	11	4	-	2	40	6
Woodland/Wetland	17.3%	19,692	2,043	6,204	132	1,732	1,239	-	312	37	1,757	26	127	3,486	339	2,103	10	145
Vacant	.6%	685	-	22	29	192	137	-	39	26	179	-	61	-	-	-	-	-
Total Land Area in Watershed	100%	113,647	9,958	18,348	1,851	10,280	5,410	115	4,100	5,215	8,424	324	956	19,098	4,652	22,620	176	2,120
Total Land Area of Community			9,958	23,027	4,970	10,296	23,969	1,845	5,096	5,810	8,424	2,196	23,384	19,101	21,669	22,993	873	22,964

Data from 2003 Oakland County Planning and Economic Development (OCPEDS) Department.

Table 1.10 Distribution of Current Land Uses in St. Clair County's Northeastern Watersheds (Sanilac County only)

Land Use Type	% of Sanilac NEW	Total Acres	Speaker Township	Fremont Township	Buel Township	Worth Township
Single-Family Residential	.1%	39	-	23	-	16
Multiple-Family Residential	0%	3	-	3	-	-
Commercial/ Office/ Industrial/Transportation	0%	1	-	1	-	-
Extractive	.2%	66	-	-	-	66
Cultivated /Grassland / Shrub	80%	24,260	2,317	17,700	599	3,644
Water	.1%	57	4	11	-	42
Woodland/Wetland	19%	5,788	1,066	3,120	44	1,558
Total Land Area in Watershed	100%	30,214	3,387	20,858	643	5,326
Total Land Area of Community			**22,111**	22,411	24,096	24,844

Data from the 1992 National Land Cover Data Set, developed through collaboration between the United States Geological Society and the U.S. Environmental Protection Agency.

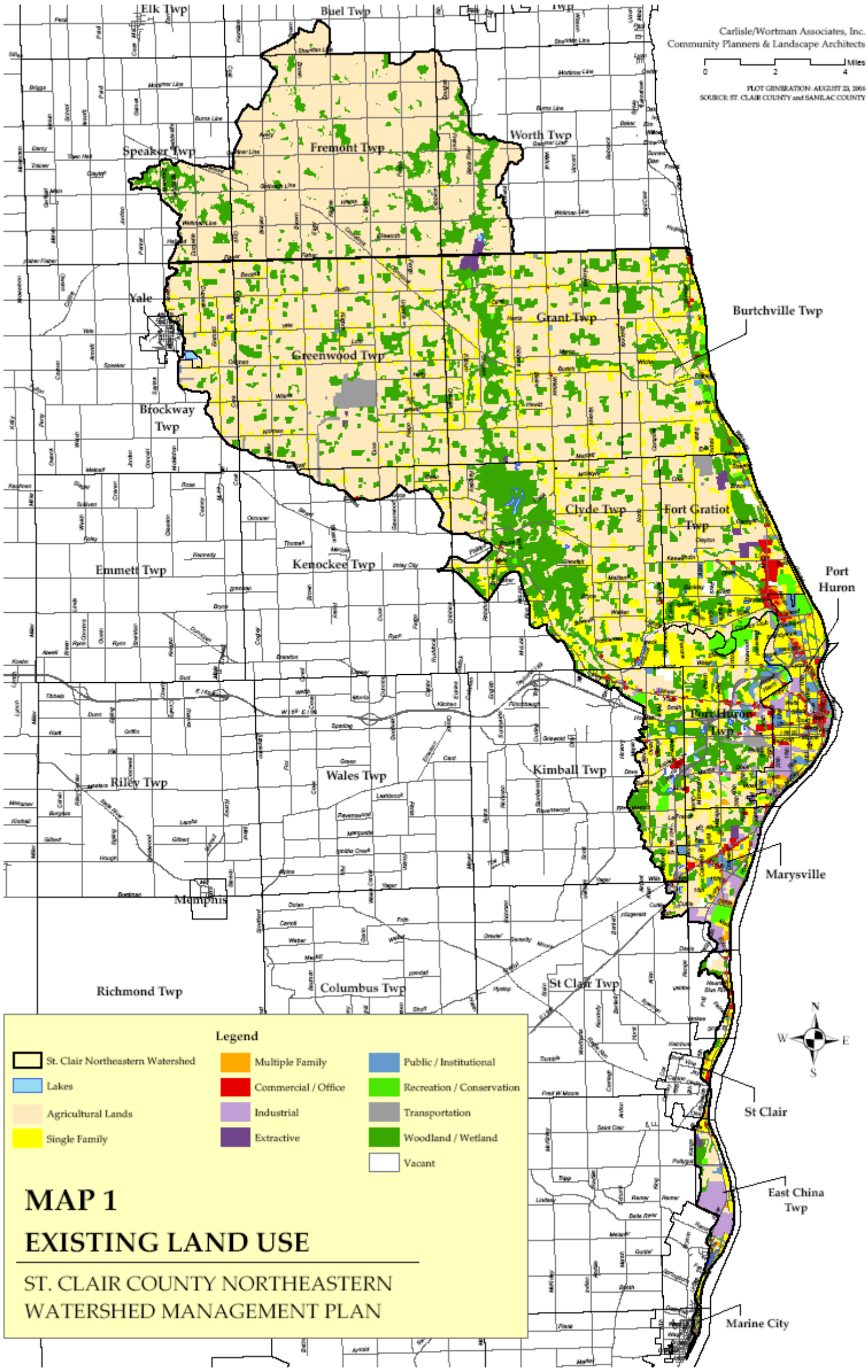

Figure 1.28 Existing Land Use in St. Clair County's Northeastern Watersheds

Combining the data from the two Counties provides a broad look at how land uses are distributed throughout the watershed. In general, urban development is clustered in the south of the watershed, and along the Lake Huron and St. Clair River shorelines. Agricultural lands are mostly located to the north and west in the watershed. Woodlands and wetlands can be found scattered across the watershed, although the largest contiguous piece is along the Black River in Clyde Township and in the Port Huron State Game Area.

The most prevalent land use is cultivated/grassland/shrub, which represents agricultural operations. Agriculture covers over 87,000 acres or 61% of the watershed, distinguishing agricultural practices as a major impact on water quality and the physical condition of streams and rivers in the watershed. Associated residential land use (farm houses and buildings) has a negligible impact on the water resources in the rural communities such as Grant, Brockway, and Greenwood Townships, as residential represents at most 8% of the land area in these communities. In Sanilac County, residential development in agricultural communities has even less impact, as it represents less than 1% of the land uses within the watershed boundaries.

The next most prevalent land use in the watershed is woodlands and wetlands at 17.7%. Wetlands alone cover 8,544 acres, or 6% of the NEW land area (6,319 acres in St. Clair County and 2,225 acres in Sanilac County). However, some of these wetlands are considered "wooded wetlands," so the distinction is not completely clear. As mentioned in the previous natural feature analysis, the amount of land covered by wetlands and woodlands has been radically reduced by agriculture and land development since the time of European settlement. However, the remaining wetlands and wooded areas still command more than 25,000 acres within the watershed, and should be carefully considered for preservation through this Plan.

Single-family residential land uses make up 13.2% of the watershed land area, and are mostly clustered with the more urban developments in the southern half of the watershed. This is the most prevalent type of housing in the watershed, and is projected to grow significantly by 2030. Multiple-family land uses are a distant second in residential properties, only utilizing .4% of the land in the watershed. While residential uses currently cover a relatively small amount of the watershed, individual actions have a cumulative effect on water quality including landscaping practices and fertilizer use, vehicle maintenance practices, and household hazardous wastes. As residential areas grow in the future, these impacts will be magnified, and should be addressed in this Plan to further mitigate potential impacts.

The remaining land uses can be categorized in the "above 1% of the watershed" range, and "below 1% of the watershed" range. Those land uses that occupy above 1% of the land uses include industrial (1.7%), transportation/communication/utility (1.5%), and commercial/office (1.2%). Land uses that occupy less than 1% of the watershed's land area include institutional and cultural/outdoor recreation/cemetery (.8%), vacant (.6%), and water and extractive (.5%). All of these land uses, except for water, transportation and extractive, are exclusively located in the southern half of the watershed. Transportation land uses are spread out across the watershed, and include a large Detroit Edison complex in Greenwood Township. Extractive operations are also located within the agricultural part of the watershed, in both Grant and Worth Townships.

While not a large, single source of water pollution, some of these land uses have specific concerns in relation to water quality. For instance, roadways can discharge pollutants, sediments, and salts to rivers and streams, particularly at stream crossings. Industrial operations, while most likely already regulated, may also have specific discharges that impact water quality. Another example is golf courses or other large recreation facilities, whose management could impair water resources. The presence of these unique facilities within the watershed points to the

need for further partnerships with the County Road Commission, private businesses, recreational agencies, and other land managers to pinpoint possible pollutant sources and proactive management policies to address these sources.

1.7.4 Community Profiles

As mentioned above, the NEW contains twenty (20) communities spanning two Counties (see Figure 1.2). The watershed is diversely developed, ranging from a fully built-out pattern to large tracts of agricultural land uses and undeveloped land. The following profiles provide a snapshot of each community included in the watershed, showing the variety of cities and townships involved and the diversity of land uses that impact water quality within the watersheds.

1.7.4.1 Burtchville Township

Burtchville Township is the most northeasterly Township in the watershed that is also within St. Clair County. The entire Township is located within the Lake Huron Direct Drainage subwatershed (LHD). Like other lakeshore communities, the land use pattern clusters most development along the Lake Huron shoreline, with the rural land uses located inland. Lakeshore development includes single and multiple-family residential, commercial/ office, institutional, and recreation. Of these land uses, single-family residential is the largest, representing 17% of the Township. The Township takes advantage of its proximity to Lake Huron, and has four swimming beaches including Jeddo Road Beach, Lakeport State Park, Washington Street Beech, and Burtchville Township Park. Away from the lake, the main land uses are single-family residential, agricultural, and woodlands/ wetlands. Inland residential properties are mostly located along the main roads of the Township. The largest land use within the Township is agricultural lands (cultivated/ grassland/ shrub), representing 60% of the Township. Almost all of the farms are located west of the main north-south road along the lake (State Road), except for a half-dozen or so that are east of this corridor. The second largest land use is the woodland/ wetland category, representing 21% of the Township. While transportation uses only cover 14 acres of the Township, there is an airport in the approximate middle of the community which could have significant land use implications now and in the future.

Similar to the regional trends, Burtchville Township is experiencing a rise in population, as well as a reduction in the number of people occupying each housing unit. The Township is projected to have a population increase greater than the average for the watershed (48%), and the number of housing units is also projected to increase more than the watershed average (68%). However, the household size is projected to decrease the average amount (11%). The types of households in the Township are slightly more diverse than the watershed average, primarily because of its relatively large amount of mobile homes.

1.7.4.2 Clyde Township

This community is located partially in the Lower Black River (LBR) subwatershed, and partially in the LHD. While it does not have any property along a lakeshore, it does have extensive property along the Black River. Approximately 80% of the community is located within the NEW. The distinguishing characteristics of this Township are that the main land uses are rural, including agricultural lands that represent 50% of the Township's land uses within the watershed, and woodlands/wetlands that represent 34% of the land uses within the watershed. Only 16% of Clyde's lands within the watershed are "urban" in nature. Of these categories, single-family residential represents 14%, while commercial/ office, institutional, and transportation represent

the remaining 2%. Of the lands categorized as woodlands/ wetlands, Clyde Township has a very large, intact corridor running north to south along the Black River. The Port Huron State Game Area covers part of these features. This represents the largest single area of land within the watershed designated as woodlands/ wetlands.

Development projections for Clyde Township are below the watershed averages. Based on SEMCOG's data, the Township's population should increase approximately 14%, while the number of households should increase 42%. Average number of persons per household is projected to decrease slightly more than the watershed average, or by 14%. The types of housing within the Township are slightly more skewed toward single-family residential, with the other housing categories only representing 9% of all homes within the Township. This is very indicative of a mostly rural community.

1.7.4.3 East China Township

East China Township contains a small section of the St. Clair River Direct Drainage subwatershed (SRD), which covers 37% of the Township. The remainder of the municipality is located in the Belle River Watershed, which is outside of the NEW's boundaries. Land uses in this Township vary widely, and reflect a more urban and industrial development pattern. The largest land use is industrial (33%) and comprises a large area in the middle of the watershed (adjacent to the Belle River), and along the St. Clair River front. The next largest land use is single-family residential (26%), which takes up most of the remaining St. Clair River front property in the community. Cultivated (agricultural), grassland, or shrub uses comprise 23% of the Township's watershed area, and is located west of the main north/south road (M-29). West of this is a relatively small area of woodlands/ wetlands, or 7% of the Township's watershed area. The remaining eight land use types are all represented within the Township and each covers approximately 1 to 1.5% of the land area.

The population and housing trends in East China Township follow the trends throughout the region, although with slightly less vigor. Populations are projected to increase (14% by 2030), but not as much as the watershed's average of 29%. Households are also projected to increase by 2030 by 33%, which is just slightly less than the watershed average. Surprisingly, the number of people per household is expected to fall dramatically (23%), which is more than twice the average for the watershed communities. This may be because the age group of 65 and over is also projected to double by 2030.

1.7.4.4 Fort Gratiot Township

A little over half of Fort Gratiot Township is within the Lake Huron Direct Drainage (LHD) subwatershed, with the remaining amount located within the Lower Black River (LBR) subwatershed, and has properties under all the land use categories. The primary land use is agricultural lands (40%), mostly located in the north and west portions of the Township. Since this open, undeveloped land is relatively close to local employment centers, it will make the Township desirable for future development, if this hasn't happened already. In the south and eastern sections of the Township, single-family residential (27%) and woodlands/wetlands (17%) are the main land uses. These uses are adjacent to the more urban communities of Port Huron and Port Huron Township, and the main roads of Pine Grove and M-25 extend into the Township from there. The Township is on Lake Huron, and the lakeshore is primarily developed with single-family homes, with a few recreation properties mixed in. A significant recreation area (golf course) is also located next to the Black River at the south end of the Township. Two

swimming beaches are within the Township, including Metcalf Road Beach and Keewadhin Road Beach. Commercial/office (4%) is clustered along M-25, and cultural/outdoor recreation/ cemetery (4%) is scattered throughout the Township, but a significant portion is located along the Black River between Fort Gratiot Township and Port Huron Township.

Future changes to the Township's population and housing stock are right in line with the averages for the watershed. Their population is projected to increase (by 28%) by 2030, as is the number of households (by 52%). Similar to every other watershed community, persons per housing unit will decrease.

1.7.4.5 Kimball Township

The watershed covers the easterly quarter (22%) of the Township, adjacent to several relatively urban communities. The main land uses within this Township's NEW area is made up of cultivated/grassland/shrub and woodlands and wetlands, which is equal to 61% of the land area. Single-family residential covers 23% of the area, with the other land uses (except for extractive) covering the remainder. Of these remaining land uses, transportation facilities take up more than 4%. This community may be experiencing stronger growth pressures than some others in the watershed due to its proximity to major employment centers. The current supply of cleared agricultural lands and existing natural features also make it attractive for development. To ensure that these features are not destroyed by future growth, effective land use regulations should be considered now to address advancing development.

The population and housing trends also point to greater than average growth pressures. Population within the Township is projected to increase 39%, which is greater than the watershed average. The number of households is projected to increase 63%, making it the third largest projected growth percentage among all the communities. As across the watershed, number of people per household is projected to decrease.

1.7.4.6 City of Marine City

While this City is not the smallest in the watershed, it has the least amount of land in the NEW (6%), with the remainder in the Belle River Watershed. Located at the St. Clair River Direct Drainage subwatershed's very southern tip, Marine City has 65% of its NEW property in single-family residential housing. The second largest land use category is commercial/office at 18%, and the third largest is institutional at 10%. Both residential and commercial have property along the St. Clair River. The City has several swimming beaches including Marine City Beach and Marine City Diving Area.

The City is projected to grow by 14% by 2030, although the lack of vacant property within the NEW may direct this growth outside the watershed boundaries. The number of households will increase, but less than the watershed average. And, as all other communities, the number of people per household will decrease.

1.7.4.7 City of Marysville

Eighty percent of Marysville's land area is within the St. Clair River Direct Drainage (SRD) subwatershed of the NEW. While many different land use categories are represented in the City, the main category is single-family residential, covering 31% of the watershed within the City. Most of the single-family development is clustered near several main thoroughfares, including

Gratiot, Michigan and Huron, and away from the river front. However, there are a few small residential nodes located on the river. The next largest land use is industrial (16%), which is located along the St. Clair River, and the main roadway of Busha. Most of the residential uses along the St. Clair River are buffered from the industrial uses by recreation or vacant properties. One such recreation property is Riverview Golf Course. Woodlands/wetlands make up 8% of the land area, and cultural/outdoor recreation/cemetery make up 6%. Three uses (institutional, commercial/office, and multi-family residential) cover 3 – 5% of the watershed area. The remaining land uses, except for water, are all represented in the City's watershed boundary, each covering less than 3% of the area. This community has two swimming beaches, Marysville Park and Chrysler Beach, along the River.

The population in the City is projected to continue rising (17%) into the future, but at a slower pace than the average for the watershed. Similarly, the number of housing units is also projected to rise (34%), but at a slower rate than the watershed. Both of these trends may be impacted by the fact that most of the City is already built-out, and re-development pressures are not expected to be strong. The number of people per household is projected to decrease at a similar pace to the rest of the watershed communities.

1.7.4.8 City of Port Huron

The City of Port Huron is another urbanized community within the watershed. The City's entire land area is located within the portions of all three subwatersheds (the LHD, LBR and SRD), and is comprised of all the land use categories used in this analysis. Single-family residential covers the most land area in the City (50%), followed by industrial (12%), commercial/office (10%), and institutional (10%). Cultural/outdoor recreation/cemetery (5%), and multi-family residential (4%) also cover a significant area. The residential land uses are spread across the City, with some being located along the St. Clair River and the lake to the north. Industrial areas are mostly on the western side of the City, but a few are located on the Black River. Commercial and institutional development is clustered along the main thoroughfare of Pine Grove, and in the downtown area. Recreation land uses are spread out across the City as well, including Lincoln Park to the south, Edison Parkway along the river, and Sanborn, Lighthouse, and Lakeside parks at the north end of the City. A very unique characteristic of Port Huron is its international border crossing to Canada and it being home to the Blue Water Bridges. The City has several public swimming beaches, including Krafft Road Beach, Ballentine Beach, Holland Beach, Lighthouse Beach, and Lakeside Park.

Unlike the other communities in the watershed, Port Huron's population is projected to decrease by 2030 by 9%, although the number of housing units is projected to increase by 8%. This may be a reflection of the aging population in the City, and the fact that fewer people will be living in each housing unit.

1.7.4.9 Port Huron Township

While adjacent to urban areas, Port Huron Township has a significant amount of natural areas within the SRD and LBR subwatersheds. Single-family residential makes up the largest single land use (31%), but cultivated/grassland/shrub and woodlands/wetlands cover more land area (43%). Much of the woodlands/wetlands are between I-94 and Dove Road, and south of the I-69/I-94 junction. The majority of single-family residential is located on the north side of the Township, although some is to the south. Most cultivated (agricultural) lands are also to the south. The large highways and other transportation corridors take up 8% of the Township's land.

Pockets of industrial uses are mostly along Dove Road and next to similar uses in the City of Port Huron. Other significant land uses include recreation (4%), water (2%), commercial/office (2%), and institutional (2%). The Township has several golf courses next to the Black River.

Population figures are projected to rise 36% by 2030, somewhat larger than the average population increase in the watershed. It is the fifth fastest growing community in terms of housing units (55% increase by 2030), and the number of people per unit will only decrease by 12%, which is about the same rate as the average in the watershed. These projections are not surprising given the desirable features the Township still has, as well as nearby employment centers and easy access to major transportation corridors.

1.7.4.10 City of St. Clair

Fifteen percent of the City is within the St. Clair River Direct Drainage (SRD) subwatershed, (along the shores of the St. Clair River) with the remainder in the Pine River Watershed. The majority of the City's watershed area is being used for single-family residential units (69%). The next largest land is commercial/office (9%), and woodland/wetland (8%). Industrial and multi-family housing take up about 4% each of the watershed in the City. The variety of land uses within the City's portion of the watershed may be because the watershed runs along the river front, and along one of the main roads in the City.

The City's population is projected to increase (11%), but at about half the rate of the watershed's average increase. In the same way, housing units are projected to increase about half of the watershed's projected increase (in percentage points). Also less than the watershed's average changes, the number of people per housing unit will also decrease at a slower pace. All of these indicate a relatively built-out community with little vacant land left to develop, and no significant re-development pressures. Note that the City has no vacant land within the watershed boundaries.

1.7.4.11 St. Clair Township

The Township's riverfront property is all within the SRD subwatershed, although this only represents 4% of the community's entire land area. The land use that takes up the most property in the watershed boundary is a large parcel of agricultural land to the northeast. This parcel is not on the river front, but just to the west of the main north-south road running along the river. Single-family residential runs along this same north-south route (20%), as well as commercial/office and institutional land uses (both 5%). Just to the west of the agricultural area is the main concentration of woodlands/wetlands (13%), with an additional node on the south end of the Township. Vacant parcels are also scattered throughout the watershed boundaries, including areas next to both woodland/wetland locations and along the river front. The land use types and their location provide the Township with significant opportunities for potential water quality treatment and natural feature preservation, including the river front area. All these areas could also provide recreation opportunities for Township residents.

While the population and housing trends represent the entire community, the undeveloped areas within the Township's SRD subwatershed boundaries will also attract development proposals. Population is projected to rise faster (39% projected increase) than the overall watershed, as is number of housing units (51% projected increase). The persons per housing unit will decrease, but less than the watershed average. These projections point to a community that has the

amenities that young and growing families are looking for, making it desirable for future development.

1.7.4.12 Grant Township

Grant Township is primarily a rural township dedicated to agriculture. It is located in the western portion of the LHD subwatershed inland from Lake Huron, and also contains a northeastern portion of the LBR subwatershed. Seventy-three percent of the land uses within the Township are agricultural uses, followed by 18% in woodlands/wetlands. Wooded and wetland areas create a significant line from north to south through the western half of the Township, following the Black River. Woodlots and wetland areas are also scattered through the Township, some joining to create larger tracts. Single-family residential uses make up 8% of the Township. These homes are primarily located adjacent to main roadways, leaving much of the land open for farming. One feature, an extractive operation, is located in the north of the Township, adjacent to the larger Black River woodland/wetland complex. While the extractive use only contains 1% of the Township's land area, its proximity to these significant natural features could mean that its operation has an important impact on the natural areas.

The Township's population and housing trends essentially mirror the average changes throughout the watershed. Population increases will be slightly more than the average by 2030, as will the number of housing units. However, there will be very little change in the number of people living in each housing unit. Compared to the number of housing units in the Township in 2000, the 2004 building season increased this number by 3%.

1.7.4.13 Brockway Township

As part of the LBR subwatershed's western boundary, approximately 21% of the community is within the watershed. The Township's main land use type in the watershed is agriculture (84%), with woodland/wetland and single-family residential far behind, each representing 7% of the land area. Very small areas include institutional, extractive, and transportation/communication/utility corridors (less than 1% each). This part of the watershed, like its adjacent townships, is a farm-based community. However, it surrounds the City of Yale, a more densely developed area. The Yale airport is also located within the Township's jurisdiction.

The Township's population has increased from 1990 to 2000, and is projected to increase an additional 48% in the next 30 years. In the same vein, housing units are projected to increase by 59%. This may sound like a lot of development, but the community currently has one home per 34 acres, and the increase will create a density of one home per 21 acres. If these projections are accurate, Brockway Township will continue to remain rural to 2030. The number of people per household will decrease, but by less than the watershed average. As of 2030, Brockway Township will have the highest per household size (2.77 persons per household) in the subwatershed, along with Greenwood Township.

1.7.4.14 Greenwood Township

While not wholly within the LBR subwatershed, this township has the largest land area of any community in the NEW, covering over 35 square miles. Eighty-three percent of this land is used for agricultural purposes. Additional open space is reserved in woodlands and wetlands, which cover 9% of the watershed area. Single-family residential land uses cover approximately 3%, and are primarily located along the main roads. These roadways bisect the Township into even

squares, indicating minimal topography or water features that would prohibit road crossings. An extensive Detroit Edison complex is located toward the middle of the Township, and covers 655 acres, or 3% of the Township. This property is designated as a transportation use; however a large section of it was sold for residential development in 2004.

This township is projected to grow at a slightly faster rate than the average of communities in the watershed. Population is expected to rise 48% by 2030, and housing units are also expected to increase 54% by 2030. If these projections hold, this would increase the number of households from 1 per 49 acres to 1 per 32 acres. As for Brockway Township, this would still make Greenwood Township a fairly rural community. Lastly, this community is projected to reduce its persons per household 5%, which is about half of the average reduction for the Township. It will have the highest household size by 2030 (along with Brockway Township) in the watershed. The lack of change for household size could mean that family groups (vs. singles or empty-nesters) will continue to live in the Township.

1.7.4.15 City of Yale

This City is located in Brockway Township, providing the surrounding rural community with a central commercial and residential hub. The City is relatively small (873 acres), and only 20% of this (or 176 acres) is located within the LBR subwatershed boundary. Primarily, this includes the western portion of the City which is dominated by agricultural land uses (60%) and water (23%). The remaining land uses are single-family residential (8%), woodland/wetland (6%), and institutional (3%).

Compared to the other watershed communities, the City's population is projected to increase minimally by 4% by 2030. The number of housing units will increase at a larger percentage (7%), and the number of people her household will decrease by 10%.

1.7.4.16 Kenockee Township

The northern and part of the eastern boundaries of this Township are within the LBR subwatershed (only 9% of the Township). Eighty-four percent of this land is used for agricultural purposes, 8% for single-family residential, and 7% remains in woodlands and wetlands. Like the other agricultural communities, the various land uses in Kenockee Township are scattered around the community, with residential uses following the road network. Several small tributaries flow from headwaters in this Township into Greenwood Township as part of the Black River subwatershed. Much of the remaining land in this Township is part of the Mill Creek subwatershed. Mill Creek ultimately drains into the Black River.

While only a small portion of this Township is within the watershed, Kenockee is projected to experience significant population and housing changes by 2030. Population is projected to increase by 66%, which is far greater than the watershed average of 29%. Housing units are projected to rise 78%, and the household size to drop by 7%. The watershed is just to the north of the community of Avoca, which could impact the water resources of the NEW as it expands.

1.7.4.17 Worth Township

Located in Sanilac County, the portion of Worth Township that is in the NEW is part of the Lower Black River (LBR) subwatershed. The main branch of this river flows in a north-south direction through the western section of the Township. The chief land uses in the Township's

subwatershed boundaries include agriculture, and woodlands/wetlands. Much of the woodlands and wetlands are found along the Black's riparian corridor. An extractive operation is located at the south end of the Township, coordinated with extractive land uses in the adjoining Grant Township.

Like many of the other primarily agricultural communities within the watershed, Worth Township will experience considerable population growth by 2030 (63%). However, this population will remain relatively low and spread across the Township. For example, even with the population increase, by 2030, there will be one person for every 3.7 acres in the Township.

1.7.4.18 Fremont Township

Ninety-three percent of this Sanilac County Township is located within the NEW and the Lower Black River (LBR) subwatershed. Land in the watershed is predominately made up of agricultural land uses (85%), with significant acreage in woodlands and wetlands (14%).

Population levels in this Township show that it is the most rural community in the NEW. Currently the population allows for almost 25 acres for each person who lives in Freemont. In 2030, the population is projected to increase by 46%, allowing 17 acres per person. A household to acreage comparison result in one household for every 72 acres. Even with projected growth, this community will remain rural and agriculturally-based into the near future.

1.7.4.19 Buel Township

This Township is at the very northern tip of the watershed in Sanilac County. Only 3% of this community lies within the NEW and the Lower Black River (LBR) subwatershed. These lands are used almost exclusively for agriculture, with a small area (44 acres) of woodlands and wetlands.

Population projections in this Township show that it will grow by 130% by 2030, more than doubling its current population. However, the population is still relatively low given the amount of land in the Township. For example, the current number of homes compared to the Township's total acreage results in one household per 53 acres. A similar comparison using population in 2030 results in one person for every 8 acres. While no projections for future household size exists, the average number of people living together in Buel is higher than the average for the watershed, signifying family units with children rather than empty nesters or singles. It is likely that this trend will continue in the future.

1.7.4.20 Speaker Township

The most western edge of the NEW and Lower Black River subwatershed is located in Speaker Township. Fifteen percent of this Sanilac County community lies within the watershed, and is made up mostly of agriculture (68%) and woodlands/ wetlands (31%) land uses.

This Township will also experience significant population growth by 2030, with the number of people living in the Township increasing by 66%. But like the other agricultural communities, this population could be spread across the entire Township. Comparing 2030 population projections to the Township's total land area, there will still be more than 9 acres for every resident in the Township by 2030. Currently, there are 44 acres per household in the community.