Chapter 4: Environmental Sustainability

Featuring:

- Environmental Overview
- Green Infrastructure
- Resilient Communities

ENVIRONMENTAL OVERVIEW

INTRODUCTION

Environment refers to the physical conditions surrounding an individual or group of individuals living in a certain habitat. Environment can be the out-of-doors over a vast, far-reaching geographic area, or it can be conditions within a single room, dwelling, or office cubicle. Environmental conditions can either occur within nature or be created or affected by humans. Therefore, environment is not the same as nature, which refers exclusively to out-of-doors, non-man-made conditions.

Humans are the Earth's dominant species. We can communicate, use tools, and organize ourselves into clans, tribes, and societies. Because we have these skills, we also have a responsibility to use and preserve the rest of nature wisely.

Preserving the natural environment requires that we:

- Be aware of natural resources, where they come from, how much we're using, if and how they can be replenished, and then strive to use renewable resources.
- Appreciate all other species, including animals, plants, microorganisms – whether we can see them or not – and respect the habitat in which they live.
- Construct our own habitats (houses, dwellings, and commercial/industrial centers) in a manner that blends into the natural conditions of the out-of-door space in which they are constructed.

This chapter examines existing environmental conditions, emerging trends, recommendations for future action, and provides information on funding sources. Environmental conditions include:

- Geology
- Topography
- Pre-settlement vegetation
- Climate
- Watercourses
- Floodplains
- Wetlands
- Shorelands
- Soils
- Woodlands
- Wildlife habitat

Black River - Grant Township

Belle River - Columbus Township


Mill Creek through Yale City Park


Farmland in Berlin Township

- Threatened and endangered plants and animals
- Invasive insects, animals and plants
- Minerals, natural gas and oil
- Unique features
- Air quality
- Water quality
- Contamination sites
- Waste and landfill facilities
- Recycling and Resource Recovery

Because natural environmental conditions exist both within St. Clair County and beyond its borders, the information in this chapter examines the county's environment within itself and in relation to our neighbors in the Great Lakes region.

GEOLOGY

Geology refers to the physical features and processes that have occurred, or are occurring, in a region of the earth and which result in general subsurface and land surface formations.

More than 570 million years ago during the Precambrian Era, much of the Great Lakes region was a crater-like basin, now called the Michigan Basin. The soils derived from this bedrock are generally acidic and not agriculturally productive.

After the Precambrian Era, however, marine and near-shore sediments - limestone, dolomite, evaporates, sandstone, and shale - were deposited over the bedrock. The soils derived from these marine deposits are typically less acidic loams and clays that contain more nutrients and moisture and are better suited for agriculture.

Salt, oil, and natural gas deposits are also found below the surface in St. Clair County. Mining these subsurface geological resources affects land use activities above the ground.

TOPOGRAPHY

Topography refers to the elevations, relief features, or surface conditions of a geographic area.

The land surface of the county is a glacial landform known as the Washtenaw-Maumee Lake Plain, consisting primarily of clay soils, along with several one- to three-mile-wide end moraines that have been reshaped by

water and runoff. Beach ridges and small sand dunes are common on the sand channels, which are visible from Fort Gratiot Township to St. Clair, running parallel to the shoreline.

Elevations throughout the county range from 580 feet to 800 feet above mean sea level. The highest points are in a glaciated area in the western part of the county, along the Black River in the northern part of the county, and along Lake Huron and the northern part of the St. Clair River. The lowest part of the county is in the south in an area known as St. Clair Flats, which is within the Lake St. Clair floodplain.

CLIMATE

Climate refers to the weather pattern that can be expected in a geographical region, based on the average weather for a month or season in previous years.

The climate in St. Clair County is the product of latitude, air masses that flow across the land predominantly from west to east, and the county's proximity to Lake Huron.

Weather conditions affect the community's economic base. Variations in average conditions, especially during the summer months, can cause fluctuations in tourism and outdoor recreation activities, upon which the local economy is dependent.

The Great Lakes are a major control factor on the climate for the Midwest; however, St. Clair County is less strongly influenced by climate because of its southeastern location in the State. The most obvious effect of the lakes on the county is the increased percentage of cloudiness in late fall and early winter, when prevailing westerly winds move cold air across the warmer lake water. In addition, the county's southeastern location provides it with five to ten percent more sunshine than those counties at the same latitude on the western side of the State.

Because the day-to-day weather is controlled by the movement of pressure systems across the U.S., the county rarely experiences prolonged periods of hot, humid weather in the summer or extreme cold during the winter. July and August are the warmest months in St. Clair County, with an average bi-monthly temperature of 71 degrees Fahrenheit. In contrast, temperatures average near 23 degrees Fahrenheit in January and February.

The growing season in St. Clair County ranges from 150 to 180 days, with the greater number of days along the shoreline of Lake St. Clair and Lake Huron. The county receives an average of 31 inches of rain annually, primarily during April through September. Average snowfall is 42 inches annually, but this varies considerably from year-to-year. According to the Michigan Department of Natural Resources, In a calendar year, there will be an average of 13 days above 90° F and five days below 0° F.

A beautiful clear day in Algonac. The Great Lakes are a major control factor on the climate for the Midwest.


Blue Water Bridge over the St. Clair River


Black River in Downtown Port Huron

WATERCOURSES

Watercourse refers to a stream of water, such as a river or creek, the bed of a stream that flows only seasonally, or a natural channel that conveys water. In addition to Lake Huron, six major watercourses flow in, through, or adjacent to St. Clair County.

Lake Huron

Lake Huron is the largest neighboring watercourse. It creates a 12.5-mile shoreline boundary on the northeast corner of the county and is an integral recreational and economic factor. The cities of Detroit (60 miles south), Flint (75 miles west), and 90 other communities pump 400 million gallons of water per day from Lake Huron. The quality of the water, from Lake Huron and the Great Lakes has been, in general, an environmental concern since the mid-1970s due to degradation through urbanization, poor agricultural practices that contaminate tributaries, sedimentation, temperature change and a number of other factors that affect water quality.

St. Clair River

The St. Clair River is 34 miles long and borders most of the east side of St. Clair County. The St. Clair River extends from Lake Huron in the north, from which it receives water at a rate of 194,000 cubic feet per second, to Lake St. Clair to the south, where it empties at a rate of 184,000 cubic feet per second. The city of Port Huron gets its water from the St. Clair River. Other cities located along the St. Clair River include Marysville, St. Clair, Marine City, and Algonac.

Except for a few drains that flow into Lake Huron or Lake St. Clair, the St. Clair River is the receptor of all drainage basins within St. Clair County, and water level fluctuations of two to three feet are common. This fluctuation, plus rapid currents, causes tree mortality, shoreline erosion, and major alterations on the composition and habitat of marshes and wet prairies. Six locations along the St. Clair River, plus one in Lake Huron, are monitored monthly to determine water level fluctuations. Water levels are usually lowest in February, then rise through July, and decline through the rest of the year.

The St. Clair River's predominance of large lake freighters result in enhanced recreational and tourism opportunities, especially in areas such as Algonac State Park and Vantage Point in Port Huron, which provide visitors with prime viewing locations as the freighters drift by. All of the cities along the St. Clair River have city parks with public access on the shoreline.

Shipping has also brought an infestation of non-indigenous aquatic species that are potentially detrimental to the environmental health of the river. The St. Clair River Binational Public Advisory Council (BPAC) is having remarkable success in improving the quality of both water and habitat in and along the river.

Lake St. Clair

Lake St. Clair borders 11 miles on the southern corner of St. Clair County and is a recreational destination for boaters, anglers, and sightseers. The largest fleet of pleasure boats on the Great Lakes is on Lake St. Clair, and about 1/3 of all the fish caught on the Great Lakes are caught there. However, the general public has limited access to the lake.

The largest remaining marshland in the Great Lakes Basin is located at Canada's Walpole Island near Lake St. Clair. Environmental concerns abound in Lake St. Clair , evidenced by beach closings due to bacterial contamination, visible changes in the lake, and changes to lake plants and animal populations.

Black River

The Black River is the major tributary of the St. Clair River. It flows south from the Minden Bog in Sanilac County through Port Huron. Along with its major tributary Mill Creek, the Black River drains almost all of the northern and western parts of St. Clair County.

The river's watershed – 159,930 acres – is the largest in Southeast Michigan and is primarily a broad, flat plain bounded on three sides by hills ranging from 20 to 100 feet high.

According to the Michigan DNR, the river traditionally supported diverse and high-quality fish populations and sport fisheries. In recent years, fish populations have been degraded in numbers and species due primarily to man-made channelization, siltation, and other poor land management practices. However, significant angling fisheries still exist for smallmouth bass, channel catfish, panfish, and various members of the sucker family.

DNR biological surveys indicate diverse mussel and fish populations; however, sedimentation is a threat. The Black River also provides high quality wildlife habitat along its riparian shoreline.

Pine River

The Pine River is a tributary of the St. Clair River and is the largest watershed – 126,110 acres – contained within St. Clair County. It flows through flat land from the central part of the county and through the city of St. Clair.

Belle River

The Belle River is also a tributary of the St. Clair River. It originates in the west central part of the county, passes a short distance through a corner of Macomb County, then continues southeast through Marine City, draining 83,000 acres of relatively flat land. The largest power generating facility in the county is located near the Belle River across Recor Road.

Clinton River

In addition to the watercourses within St. Clair County, the North Branch of the Clinton River drains 8,600 acres in the southwestern part of the county, even though the river itself does not flow through the county.

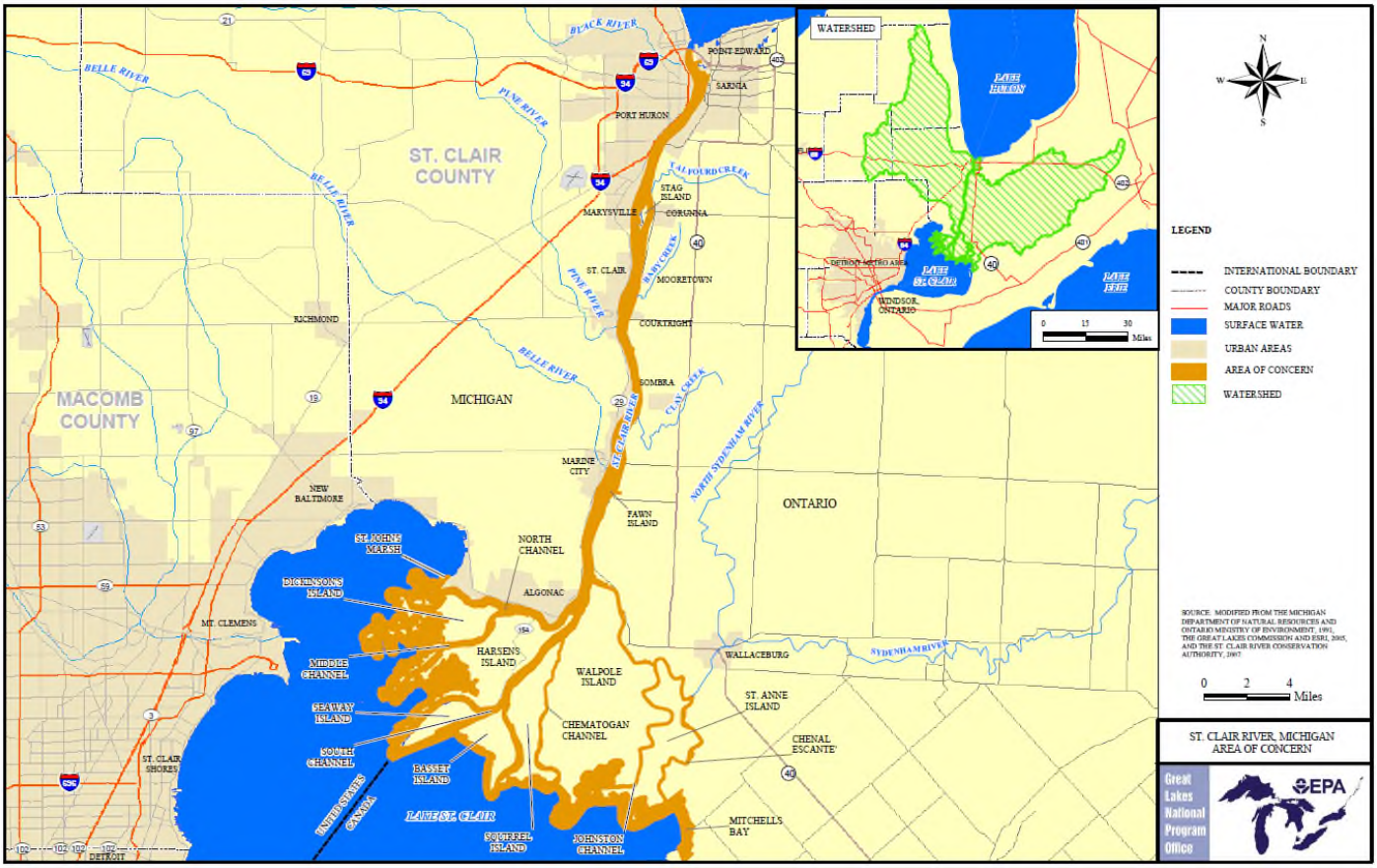
St. Clair River Area of Concern

The United States-Canada Great Lakes Water Quality Agreement (Annex 2 of the 1987 Protocol) defines AOCs as "geographic areas that fail to meet the general or specific objectives of the agreement where such failure has caused or is likely to cause impairment of beneficial use of the areas ability to support aquatic life." In short, an AOC is an area that is suffering degradation of environmental resources.

The St. Clair River branches into several channels near its mouth at Lake St. Clair, creating a broad delta region. The Area of Concern (AOC) includes these important wetlands from St. Johns Marsh on the west (near Anchor Bay) to the north shore of Mitchell's Bay in Ontario. See the AOC boundary map from the U.S. Environmental Protection Agency on the next page.

Agriculture is the predominant land use within the river's watershed, but intensive development has occurred in and near the cities of Port Huron and Sarnia. The heaviest industrial concentration (including a large number of petrochemical facilities) lies along the Ontario shore near Sarnia. Several communities along the

St. Clair River Area of Concern (AOC) Boundary Map



Source: US Environmental Protection Agency (EPA), www.epa.gov/greatlakes/aoc/stclair, accessed July 22, 2013

FIGURE 4-1: BENEFICIAL USE IMPAIRMENTS

- Restrictions on Fish and Wildlife Consumption
- Tainting of Fish and Wildlife Flavor *(Removed 2012)*
- Bird or Animal Deformities or Reproductive Problems
- Degradation of Benthos *(Removed 2014)*
- Restrictions on Dredging Activities *(Removed 2009)*
- Restrictions on Drinking Water Consumption or Taste/Odor
- Beach Closings *(Removed 2016)*
- Degradation of Aesthetics *(Removed 2012)*
- Added Costs to Agriculture or Industry *(Removed 2011)*
- Loss of Fish and Wildlife Habitat

Source: Environmental Protection Agency, September 2015

St. Clair River rely on the river as their primary source of drinking water, including Algonac. Industrial facilities such as petroleum refineries, manufacturing facilities, paper mills, and power plants need high quality water for successful operations as well.

According to the International Joint Commission (IJC), a "Beneficial Use Impairment" is a change in the chemical, physical, or biological integrity of the Great Lakes system sufficient to cause any of 14 different use impairments or other related uses, such as the microbial objective for waters used for body contact recreational activities. Figure 4-1 identifies the remaining beneficial use impairments on the American side of the river as of the end of 2015.

In recent years, significant progress has been made to clean up the St. Clair River and remove beneficial use impairments. As of September 2015, only 5 BUIs remained. The IJC, the Bi-national Public Advisory Council (BPAC), and other stakeholders have been working toward getting the St. Clair River AOC delisted.

FLOODPLAINS

Floodplain refers to a nearly flat plain along the course of a stream or river or around a lake that is naturally subject to flooding. When flooded, floodplains serve as a natural retention area for floodwaters and, thus, reduce the danger of vast amounts of water moving too rapidly downstream.

100-year flood refers to a floodplain where there is a 1-in-100 chance that a flood to that level will occur in any given year. 100-year floodplains exist in St. Clair County along the lower portions of the Black, Pine, and Belle rivers and along numerous creeks and drains.

WETLANDS

According to the federal Wetland Protection Act of 1979, wetland refers to "land characterized by the presence of water at a frequency and duration sufficient to support - and under normal circumstances does support - wetland vegetation or aquatic life and is commonly referred to as a bog, swamp or marsh."

Because wetlands are a valuable natural resource, they are protected by Part 303 Public Act 451 of 1994. Part 303 requires that permits be acquired from the Michigan Department of Environmental Quality (DEQ) prior to altering or filling a regulated wetland.

In Michigan, regulated wetland refers to wetlands that are:

- Adjacent to the Great Lakes or Lake St. Clair, an inland lake or pond, or a river or stream.
- Not adjacent to these watercourses but are greater than five acres and located within counties with populations greater than 100,000 people, which includes St. Clair County.

Wetlands cover approximately 62 square miles, or 8.6% of St. Clair County's land area. These wetlands are scattered throughout the county, but are more abundant along the eastern and southern coastline and along inland rivers. They are covered with lowland hardwoods, lowland conifers, shrub or scrub growth, or aquatic beds.

SHORELANDS

Shoreland refers to the banks and adjacent land along a lake or stream. St. Clair County has a total of 58 miles of shoreland along Lake Huron, the St. Clair River, and Lake St. Clair. Most of this shoreland is fully developed or is not suitable for development. Much of the shoreline, especially along the St. Clair River, has been stabilized with sea walls.

SOILS

Soil refers to the portion of the Earth's surface that consists of disintegrated rock or humus - the ground used for vegetation and for cultivating crops.

Prime farmland is defined by the U.S. Department of Agriculture (USDA) as land with soils best suited to produce food, feed, forage, fiber, and oilseed crops. Prime farmland differs from **unique farmland**, which refers to land used to grow high-valued vegetables and specialty crops. The USDA defines cropland as pasture, woodland, or other land that is not urban, built upon, or water. **Appropriate farmland** refers to land that has soil quality, growing season, and moisture supply necessary to economically produce a sustained high yield of crops if acceptable farming methods are used.

Soils in St. Clair County are largely wet loam and clay. These are calcareous (non-acidic) at shallow depths, have low permeability, and generally require drainage for agricultural purposes.

Sand is common along – and a few miles inland from – the St. Clair River and Lake St. Clair. These areas are poorly or very poorly drained in depressions, excessively drained on dunes, and subject to wind erosion if cultivated. Sand in lower slope positions is calcareous, while sand on ridges is acidic.

The majority of St. Clair County has drainage problems and more than 95% of the soils are severely limited for development, especially near the shoreline and on farmland. The soils most suitable for development are away from the shoreline and in areas that are flatter and less susceptible to flooding, erosion, and fading or sinking.

Hydric soils refer to wet or moist soils that merit particular consideration because they cover nearly 444 square miles, or more than half of St. Clair County, chiefly in the southern portions. Hydric soils generally have been exposed to water saturation conditions for extended periods, such as in a wetland. They are very poorly drained, saturate easily and retain large quantities of water. If artificially drained, they are often suitable for farmland use. They are commonly populated by cattails, sedges, bulrushes, water plantain, wild rice, wild celery, duckweed, and other wetland vegetation. Hydric soils are another limitation on development.

More than half of the soils in St. Clair County are classified as prime farmland soils. Crops grown on these soils will produce the highest yields with the smallest input of energy and economic resources. This land is primarily north and west of a line from Port Huron to Memphis.

WOODLANDS

Woodlands refer to land covered with woods or trees. Some of the largest woodlands in St. Clair County are along the inland banks of the Black, Pine, and Belle rivers. Other smaller patches of central hardwoods, lowland hardwoods and conifers are scattered throughout the county. Woodlands cover roughly 113 square miles, or 15% of the county; two-thirds of that land is managed by the Michigan Department of Natural Resources. Mature trees represent a valuable resource in maintaining the aesthetic character of the area, not to mention their overall importance to wildlife and the natural environment.

WILDLIFE HABITAT

Wildlife habitat refers to land and water, including wetlands, that have appropriate soils, vegetative cover, and/or water resources to provide animals and birds with food and protection from predators during mating, nesting, and migratory seasons.

Nearly all of the Great Lakes Basin is potential wildlife habitat. The wetlands, shoals, open waters, rural areas, and some urban land provide ecosystems that have appropriate soils and food to support a wide variety of plant and animal organisms. St. Clair County's wooded areas provide habitat for turkey, squirrels, deer, foxes, coyotes, and numerous other animals.

The Great Lakes Basin is also a major flyway for thousands of North American waterfowl and breeding territory for several hundred species. Bird species tend to be the leading indicator of wildlife habitat quality. Many bird species are highly visible and easily tabulated within much of St. Clair County. Bird sightings indicate that the county is rich with wildlife habitat, not only for birds but for less noticeable vertebrate, invertebrate, and micro-organic species, especially in aquatic places, on publicly-owned land, and at the edges of agricultural land.

UNIQUE FEATURES

Unique features refers to land, recreational parks, archeological and historical areas, vistas and lookouts, countywide events, and miscellaneous sites or businesses that are rare in the region or found only in St. Clair County.

Historic photo of the Fort Gratiot Light Station

The historic St. Clair Inn in Downtown St. Clair

Many of St. Clair County's unique features include the natural environment features, such as St. Johns Marsh, St. Clair Flats, the St. Clair River, watercourses within the county, Goodells County Park, the Regional Educational Service Agency's (RESA's) Pine River Nature Center, and hiking/biking trails.

St. Clair County is also the home of Michigan champion black oak, red maple, alternative-leaf dogwood, and scarlet oak trees. Other species include birch, burr, chestnut, pin oak, sycamore, filbert, beech, sugar maple, and silver maple, among others.

More than 100 archeological and historical sites, as designated at the federal, state, or local levels, are located within St. Clair County. These include Indian villages, mounds, and burial grounds, Fort Gratiot, which was built by the U.S. Army during the War of 1812, sawmill and gristmill sites, shipwrecks, the Blue Water Bridge, the Huron Lightship, preserved or utilized buildings and houses, and sites of houses that have been destroyed or removed. Additionally, the Fort Gratiot Light Station in Port Huron is the oldest lighthouse in Michigan.

WATER QUALITY

Water quality refers to the capability of water to support healthy aquatic life, to be used for recreational purposes, and potability.

Surface water refers to bodies of water on the surface of the Earth. For St. Clair County, surface water includes the waters of the neighboring Lake Huron, rivers and streams, and inland lakes and ponds.
Groundwater refers to water below the surface of the Earth.

Point source pollution refers to pollution that flows into a watercourse from an easily identifiable single source or point, such as a drain pipe from an industrial complex or a sewage system.

Nonpoint source pollution refers to pollution that flows into a watercourse from any number of sources that are not easily identifiable. These points may be hidden by natural surroundings or visible only during certain times of the year or under certain conditions. Examples of nonpoint source pollution include sewage leaching from underground septic systems, fertilizers and pesticides running off agricultural fields and urban lawns, E coli contamination of streams from cattle or wild animals, and oil from roadways.

Surface Water

The Great Lakes contain 20% of the world's fresh surface water, and are a vital resource for both Michigan and St. Clair County because of their commercial and recreational usage. St. Clair County is unique because its entire eastern and southern shores border on part of the Great lakes system. The water quality of the open waters of the upper Great Lakes, including Lake Huron, is quite clean, with only a few exceptions.

High nutrient levels, which cause an overabundance of algae in water, were a concern for many parts of the Great Lakes in the 1950s and 1960s. Fortunately, the nutrient level has been greatly reduced in recent decades due to the reduction of phosphorous loading from point sources.

Other problematic pollutants include the persistence of toxic substances, such as polychlorinated biphenyl (PCB), chlordane, and dioxin. PCB and the pesticide DDT were banned in the 1970s, and levels found in fish have declined. But the rate of decrease appears to have slowed, and fish samplings from this area show that Michigan Water Quality Standards for these chemicals are not being met.

In 1986, the St. Clair River was declared an Area of Concern (AOC) by both the Canadian and U.S. governments. Industry was determined to be the main source of pollution. Municipal sewage treatment plants and other point source and nonpoint source pollutants were also contributors to the problem.

Groundwater

Groundwater from wells is an unseen resource and is therefore particularly vulnerable to poor management and contamination. The leading causes of groundwater contamination in Michigan are from small businesses

and agriculture.

The origin of the problem stems from careless storage and handling of hazardous substances. On paved surfaces where hazardous materials are stored, substances can seep through or flow off the edge of the pavement. Materials can get into floor drains which discharge to soils, wetlands or water courses.

The depth of groundwater in St. Clair County ranges from 50 to 170 feet below the Earth's surface. In the eastern part of St. Clair County, wells dug into glacial deposits generally yield a low volume of less than 10 gallons of water per minute. Water pumped from greater depths is highly mineralized, which limits household use. In the western part of the county, wells dug into glacial deposits provide greater yields and mineralization is generally not a problem.

The St. Clair County Health Department issues all water well and septic system permits. The number of permits issued is significantly lower than the previous decade. In 2005, there were 565 permits issued and in 2006, there were 381 permits issued. More recently, there were 135 permits issued in 2013, 185 permits in 2014, and 222 permits issued in 2015. Several large areas of the county have natural water well problems, including salty taste, sporadically dry or low-pressure yield, and gaseous odors.

There are no known areas of groundwater contamination from human sources within the county. However, there is a threat to ground water by a chemical known as Methyl Tertiary Butyl Ether (MBTE), an oxidation additive that helps automotive gasoline burn cleaner. The chemical leaches quickly into groundwater from damaged underground gas station storage tanks. Leaking underground storage tanks are a problem throughout St. Clair County.

GREEN INFRASTRUCTURE

INTRODUCTION

Green infrastructure is our system of natural resources that provide the critical ecological services necessary to maintain a healthy environment for humans and wildlife. The various components of the natural environment function, change, and interact as part of a delicate ecosystem that must maintain a balance of biodiversity to remain healthy. Because hydrology is a critical component of the ecosystem, the impact of stormwater runoff needs to be considered. For development to be sustainable, communities must ensure that it occurs in a manner that has the least impact on the overall system.

Green infrastructure helps sustain life on the planet. It provides important natural benefits like maintaining air

Black River in Clyde Township

Brockway Township Park

SEMCOG GREEN INFRASTRUCTURE VISION FOR SOUTHEAST MICHIGAN: HIGHLIGHTS

In May 2014, SEMCOG completed the *"Green Infrastructure Vision for Southeast Michigan."* The vision, for the first time:

- Benchmarked green infrastructure in Southeast Michigan,
- Established a regional visions for where we want to go, and
- Identified regional policies on how to get there.

Among other things, the Green Infrastructure Vision examined green infrastructure's impact on the economy, tourism, transportation, infrastructure, water quality, air quality, vacant land, and health. It also zoomed in on each of the seven counties in Southeast Michigan, including St. Clair County, and identified existing green infrastructure assets, connections, and goals.

Among the highlighted green infrastructure assets in St. Clair County, the document focuses on the Blueways of St. Clair, the Belle River Watershed Plan (and other watershed planning efforts), the Blue Water River Walk, and the numerous assets of the St. Clair County Parks and Recreation Commission (PARC).

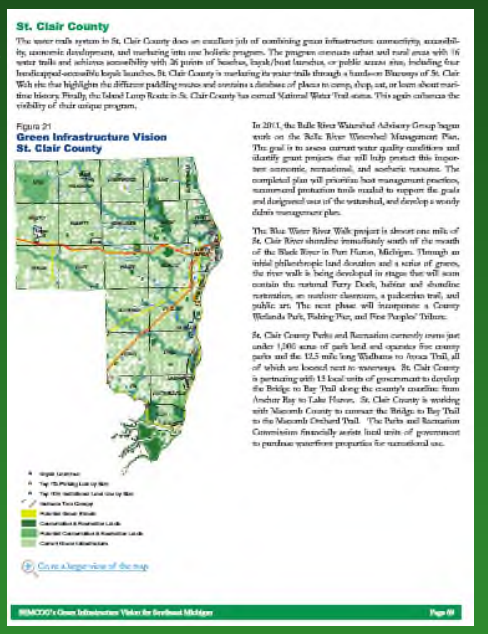

St. Clair County

Figure 21
Green Infrastructure Vision
St. Clair County

Regional policy areas identified in the Vision include:

- Increasing tree canopy in SE Michigan;
- Protecting existing high quality wetlands through land use regulation;
- Using green infrastructure to manage stormwater runoff;
- Increasing public green infrastructure in local and regional parks;
- Encouraging preservation of high-valued agricultural lands and development of community gardens to provide a quality local food network and continue the economic vitality of the agricultural industry;
- Increasing green infrastructure along riparian corridors and connecting these corridors to parks and other natural areas;
- Seeking opportunities to construct green infrastructure in priority areas such as roadways, institutional properties, parking lots, riparian corridors, and downtown areas;
- Ensuring natural areas have maintenance plans to maintain quality;
- Increasing public access to public parks in small towns within rural areas;
- Using access to green infrastructure as a means to attract young professionals;
- Increasing public access along the Great Lakes and connecting channels, including the St. Clair River and Lake St. Clair;
- Prioritizing funding for trail improvements to fill gaps within the Southeast Michigan trail network;
- Integrating water trails with public green infrastructure along riparian corridors to the extent possible, including canoe/kayak launch areas;
- Coordinating nonmotorized trail planning with green infrastructure planning to assist in meeting the needs of a green infrastructure network that uses trails as a linkage;
- Incorporating green infrastructure elements into publicly-funded projects;
- Promoting the use of complete and green streets as appropriate in transportation improvements; and
- Using vacant land to increase protected green infrastructure around existing parks and natural areas.

and water quality and protecting people and property from flood hazards. This is especially important in St. Clair County communities that have poorly draining soils and where most drinking water comes from lakes, rivers, streams, and wells.

Parks and open space are important components of green infrastructure. This includes local, state, and federal parks, land conservancy properties, and other natural areas. Open space that extends across community boundaries provides opportunities for parks and recreational use. It can also conserve natural features such as habitat for plants and animals.

Green infrastructure also provides recreational resources that help us live healthy lives. A system of linked natural areas creates places for bike paths, trails, river trails, beaches, and other outdoor recreation that help us remain active. Greenway systems along natural drainage courses can also be integrated into the community's stormwater management system.

Land that has major development constraints can be targeted as future protected open space or parks. Areas with steep slopes, poorly draining and unstable soils, and poor access should be identified to help plan future land acquisition priorities.

A community's open space and greenway network should connect to the network of neighboring communities to create a connected regional network. This will help ensure ecological health as well as expand recreational opportunities for all residents.

Our master plan surveys and community visioning input consistently tells us that the residents of St. Clair County value clean water and air, as well as great parks and trails. Key strategies in melding growth and development with environmental goals are found in implementing green infrastructure techniques.

TOOLS FOR ENHANCING GREEN INFRASTRUCTURE IN ST. CLAIR COUNTY

Tools and techniques that communities in St. Clair County can utilize to enhance green infrastructure assets include:

Native Landscaping

Native plants are well adapted for local weather conditions, and require minimal maintenance. Landscaping with native plants can be maintained with minimal use of fertilizers, pesticides, or water, all of which contribute to water quality problems. The impact of non-native plants is that they quickly replace native plants unable to compete for available sunlight, water, and nutrients.

Plants found natively within the community have many advantages, including hardiness to Michigan weather, resistance to pests and disease and longer root systems that naturally retain and absorb stormwater while minimizing soil erosion. Because native plants require less irrigation, yards landscaped with a significant portion of these materials will use less water and create less runoff.

St. Clair County communities should adopt regulations that will require native landscaping in new development and development proposals should be checked during site plan review to verify that native landscaping provisions are being met.

Native landscaping along waterways will help stabilize shorelines from erosion. The vegetation will also intercept sediments that are contained in sheet flow runoff prior to entering a waterway.

Tree Protection

Trees have been shown to have a significant effect on reducing runoff. Trees not only reduce the amount of impervious surface, but they slow drainage from a site by providing a location where water may be absorbed. A tree preservation ordinance can be implemented to reduce the number of trees removed from a new development site. A natural features inventory and a site design that incorporates natural features are typical requirements.

Local site plan review processes should require the identification of all trees and plants on a site prior to development. Forest vegetation moderates the effects of winds and storms, stabilizes and enriches the soil, and slows runoff from precipitation, allowing water to be filtered through the forest floor and into the groundwater reserve. Preserving naturally vegetated areas involves no cost for construction or maintenance.

Low Impact Development (LID)

Low Impact Development (LID) techniques mimic pre-development site hydrology to store and detain stormwater runoff. This is unlike conventional approaches that typically convey and manage runoff in large facilities located at the base of drainage areas. These multifunctional site designs incorporate alternative stormwater management practices such as functional landscape that act as stormwater facilities, flatter grades, depression storage and open drainage swales. The goal of low impact development is to reduce large runoff volumes that traditionally have been created by development. LID techniques can be encouraged with all new development and incorporated into redevelopment where possible.

A LID system of controls can reduce or eliminate the need for a centralized best management practice (BMP) facility for the control of stormwater runoff. Although traditional stormwater control measures have been documented to effectively remove pollutants, the natural hydrology is still negatively affected, which can have detrimental effects on ecosystems, even when water quality is not compromised.

Long-term maintenance cost savings of living in a Low Impact Development is an incentive for many builders. Communities in St. Clair County should consider creating a stormwater BMP certification program for developers to assist in marketing strategies. Zoning regulations should have provisions for encouraging use of LID techniques and incentives such as density bonuses, reduced permitting fees or expedited review process.

Many strategies exist to reduce the amount of impervious surface in development areas. Designing residential streets for the minimum required width needed to support traffic, on-street parking and emergency service vehicles, can reduce imperviousness. Other practices include shared driveways and parking lots, alternative pavements for overflow parking areas, center islands in cul-de-sacs, alternative street designs rather than traditional grid patterns and reduced setbacks and frontages for homes.

Other LID techniques include bioretention areas composed of a mix of functional components, each performing different functions in the removal of pollutants and attenuation of stormwater runoff. These components could including:

- Grass buffer strips that reduce runoff velocity and filter particulates.
- Sand beds providing aeration and drainage of the planting soil and assisting in the flushing of pollutants from soil materials.
- Grass swales or channels functioning as a mechanism to reduce runoff velocity and as a filtration/ infiltration device.
- Green roofs that can minimize runoff from buildings.

- Rain Gardens that can be used to treat stormwater on-site.

Munipalities can also explore allowing permeable pavements as an effective means of reducing the percent of imperviousness in a drainage basin. Porous pavements are best suited for low traffic areas, such as parking lots and sidewalks. Permeable pavements allow stormwater to infiltrate into underlying soils promoting pollutant treatment and recharge, as opposed to producing large volumes of rainfall runoff requiring conveyance and treatment.

Best Management Practices (BMPs)
Best Management Practices (BMP) and techniques mitigate the adverse impacts caused by land development on water quality. BMPs can be structural, such as vegetated swales or bioretention facilities, or they can be non-structural practices, such as policies, plans, and educational programs. Common BMPs include:

- Rain gardens
- Green rooftops
- Vegetated swales and strips
- Grassed swales
- Porous pavement
- Water quality inlets (oil/grit separators)

BMPs provide flood control by detaining a large quantity of water from running off-site, limiting the chance for a 'flash flood'. BMPs also improve area water quality by removing sediment and runoff from entering water systems. Vegetated BMPs promote a natural appearance and contribute to area wildlife.

RESILIENT COMMUNITIES

INTRODUCTION

St. Clair County has a long history of dealing with the impacts associated with changes in climate and extreme weather situations, from more frequent and severe flooding, to changes in annual snowfall amounts, to the infestation of non-native invasive species, to the increase in total number of high heat index days and more numerous poor air quality days. These changes have a real impact on the county's built, natural, and social environments and they affect people's lives.

As changes in climate and other environmental hazards occur, it is expected there will be significant impacts to the various components that comprise the built, natural, and social environments within local communities. This means that roads, bridges, flood and stormwater control systems, forests, watersheds, public health systems, buildings, and other aspects of our communities will be impacted in both positive and negative ways.

In 2005, St. Clair County adopted its first multi-jurisdictional Hazard Mitigation Plan, which include hazard profiles and a full risk and vulnerability assessment for the county. The Hazard Mitigation Plan was updated in 2015. It will be critical going forward to review the Hazard Mitigation Plan on an annual basis and update it accordingly.

The vulnerability assessment looks at such points as population concentrations, age-specific populations, development pressures, types of housing, presence of agriculture, sprawl, and other issues that may make St. Clair County more vulnerable to specific hazards. Potential hazards should generally be evaluated by assessing the following factors:

- **Likelihood of occurrence:** The frequency with which a hazard occurs.
- **Speed of onset:** How quickly a hazard can impact a community.

Assessing damage from extreme flooding in St. Clair Township in 2004.

- **Population affected:** Determines how widespread the effects of a hazard will be by the amount of people affected.
- **Potential for causing casualties:** The number of potential fatalities that are likely if a particular hazard event occurs.
- **Environmental impact:** Impacts include damage to hydrological systems, wildlife habitats, sensitive ecosystems, groundwater, and vegetation incurred from a hazard event.
- **Adequacy of warning systems:** Describes the scale and magnitude of the warning systems required to adequately notify people of a hazard event.
- **Corollary effects:** Describe a hazards ability to cause other hazards.

Communities across the United States are facing significant risks because of rising sea levels and extreme weather events such as storms, heavy rains, and heat waves. In many places, these risks are projected to only worsen. Extreme weather events are increasing both in frequency and severity. From 2010 to 2015, the Federal Emergency Management Agency (FEMA) declared 360 major disasters.

As noted by Beth Mattson-Teig in the Urban Land Institute's *UrbanLand* publication in July 2015,

> *"Communities recovering in the wake of a disaster often want to rebuild things exactly as they were, and exactly where they were. Resilience tends to refer to an area's ability to endure a shock or stress. Yet resilience also affords the opportunity not just to bounce back, but to bounce forward and emerge as a better, stronger community because of it."*

As a county with numerous waterfront communities, it is important to consider the natural dynamics of a waterfront. These dynamics include the ecosystem, water level fluctuation, erosion and accretion, shoreline, floodplain, wetlands, and other natural elements. It is critical that community stakeholders understand these elements because they impact any activity that occurs along the shore.

Strong land use planning and management along the shorelines that are subject to erosion, flooding, and other extreme weather impacts promotes the health, safety, and welfare of residents and builds community resiliency - both environmental and economic.