Southeast Michigan
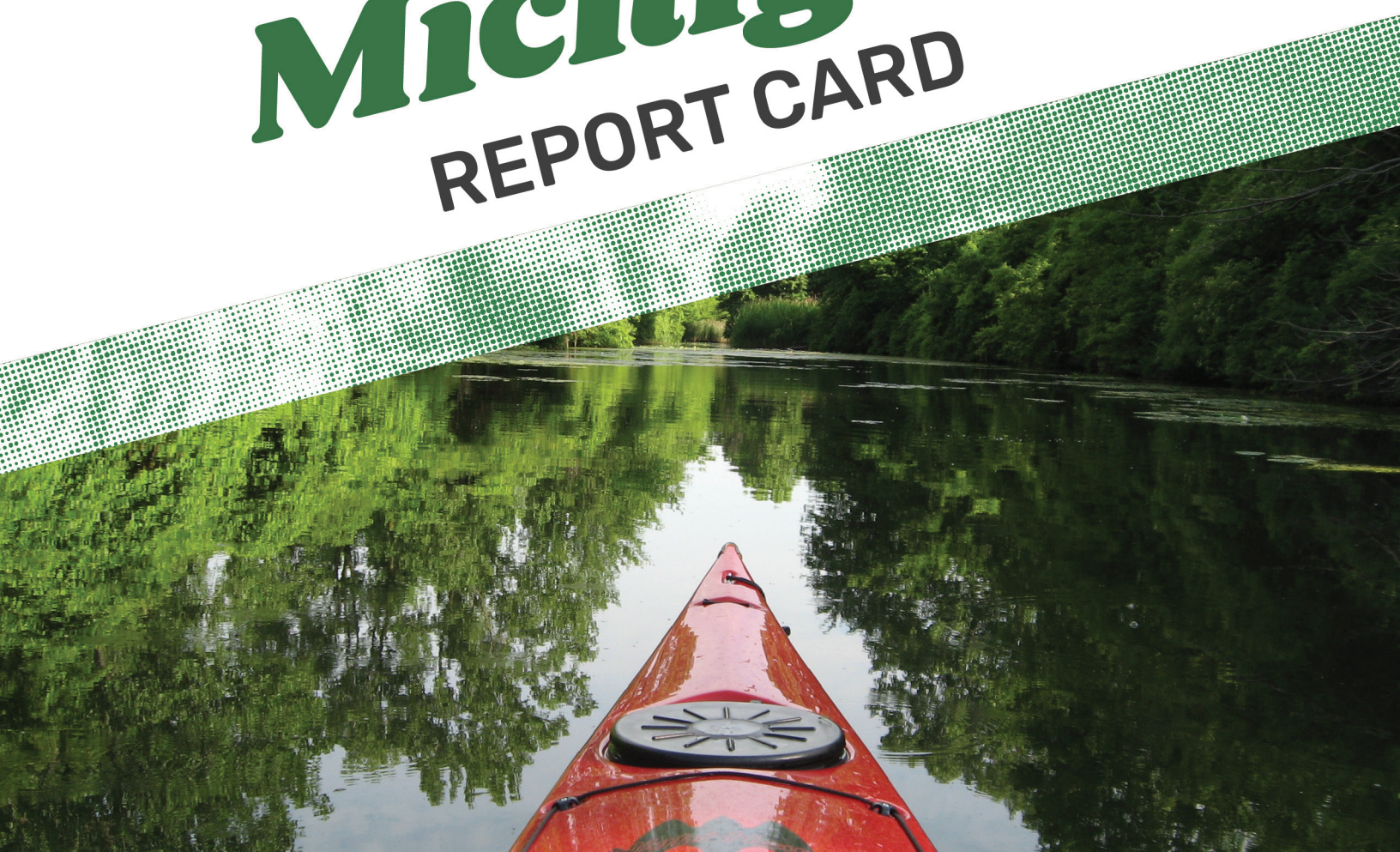## REPORT CARD

SOCIOENVIRONMENTAL REPORT CARDS ARE USEFUL TOOLS FOR ASSESSMENT

Watershed report cards are powerful tools used around the world to describe ecosystem status, increase public awareness, and inform decision makers. This is the first iteration of holistic report cards in Southeast Michigan. These documents assess the condition of the rivers themselves and the surrounding watersheds. The development of a watershed report card is collaborative. A variety of stakeholders—scientists, government officials, business owners, and interested civilians—come together to define what is valuable about an ecosystem and what threatens that value. The resulting report cards are "socioenvironmental" because they contain more than just environmental concerns; rivers have recreational and economic value to the people who live in their watersheds. Report card scores are calculated based on data-driven thresholds for each facet of watershed condition. A high report card score reflects more than current conditions; communities and ecosystems that are in good condition are well-prepared for future changes. In Southeast Michigan, a combination of increasing development and changing climate requires careful planning and management of resources based on scientific data and collaboration.

MICHIGAN'S ENVIRONMENT AND ECONOMY ARE LINKED

The Southeast Michigan region has a rich culture, economy, and environment. It includes Detroit, the second-largest metropolitan area in the Midwestern United States. The economic vitality of this region supports over 4 million people. While industry and development are strengths of the economy, they have also led to degradation of the environment and water that people rely on. Having a healthy environment can provide opportunities to improve the economy. Clean water and natural areas provide recreational opportunities and support tourism. They also support human health and environmental justice. River economy is an indicator showing the status of economic sectors that are influenced by the rivers in this region.

As environmental river health improves, so will the river-related economic conditions. In particular, if ecosystem indicators like wetlands and forests are restored, this can reduce flooding in the region. Less flood damage will improve the cost of flooding indicator, one of the poorest economic indicators in the report card. This is just one example of how healthy ecosystems support healthy economies and communities. To help these communities prepare for and adapt to future changes in climate and development, an equitable and environmentally sustainable economy is essential.
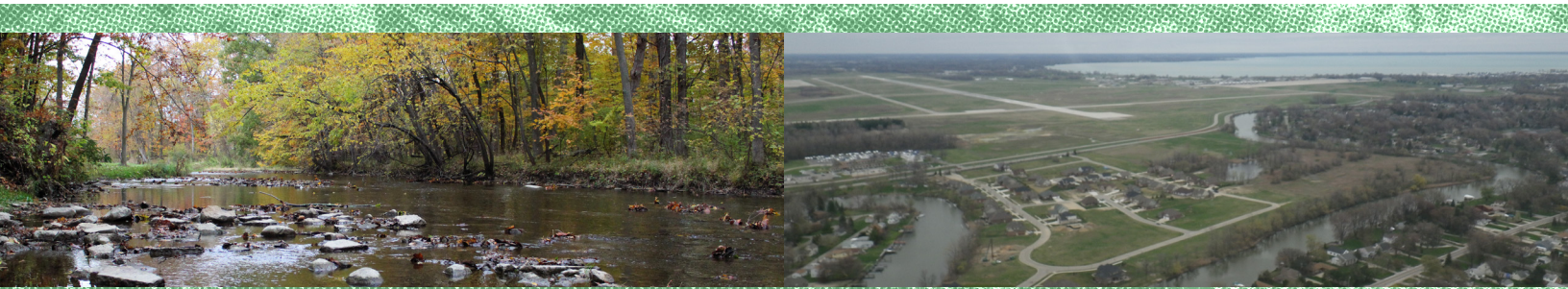
Photos courtesy of the Clinton River Watershed Council.

NUTRIENTS ARE DEGRADING WATER QUALITY

Human development and intensive agriculture can negatively impact water quality. Roofs and roads deflect rain water rather than absorbing it, so chemicals and debris are can be washed into rivers and streams. Pesticides and fertilizers used on agricultural fields or private lawns also end up in waterways. Fertilizers contain nitrogen and phosphorus to help plants grow; in rivers and lakes, these nutrients can cause algal growth. This can lead to low dissolved oxygen as the algae decomposes. Algal blooms can lead to biodiversity loss and be a nuisance to people. Particularly alarming are the Harmful Algal Blooms (HABs) that can form in the summer. These blooms are harmful because of the chemicals produced by the algae, which impact the safety of drinking water for millions of people. Watershed organizations in Southeast Michigan work to prevent nutrient loading and HABs in many ways. Healthy and intact riverfront habitat absorbs runoff from developed areas. Tree or wetland buffers around agricultural fields can reduce fertilizer runoff. These measures help protect river ecosystems and keep the water drinkable and usable for the people of Southeast Michigan.

SOUTHEAST MICHIGAN'S **INDUSTRIAL HISTORY** PERSISTS TO **THE PRESENT**

Michigan has been synonymous with American industry since at least 1900. Once a center for timber and mining, Michigan became home to many industries, including copper, iron, steel, paper, oil, breakfast cereal, and, most significantly, automobile manufacturing. While industry was the heart of Michigan's economy, its environmental and health impacts were enormous. In 1948, 11,000 ducks and geese were killed by oil discharges on the Rouge and Detroit rivers. In 1969, the floating oil and debris on the Rouge River caught on fire. Chemical and heavy metal contamination have rendered fish inedible and caused risk or harm to human health over and over again, with mercury, lead, and PFAS continuing to cause concern today. The Clinton, Rouge, and Detroit Rivers all remain active Great Lakes Areas of Concern, as established by the Great Lakes Water Quality Agreement in 1987. Environmental activism led to decreases in pollution and industrial regulations, but more work remains to be done to clean up contamination from the past and keep Southeast Michigan a beautiful and safe place to live.

The mouth of the Rouge River, in 1965, depositing sediments and other pollutants into the Detroit River. Photo courtesy of the Friends of the Rouge.

URBANIZATION CAUSES **INCREASED FLOODING** DURING STORMS

Flooding is one of the most devastating natural disasters many communities face in Southeast Michigan. Replacing forests and wetlands with hard surfaces, channelizing and burying streams, and building developments in floodplains has made floods more common and more dangerous. Worryingly, the number of floods is increasing in recent years and flooding may only get worse as climate change brings more rain and more frequent, heavy storms to the Midwest.

The impact of flooding is felt across social, economic, and environmental indicators. The high cost of floods drags down the economy by damaging properties and destroying crops. In the highly developed Rouge and Detroit rivers, floods overwhelm aging wastewater infrastructure and release diluted raw sewage into waterways. This in turn can impact human health, water, recreation, and environment scores by increasing harmful bacteria in local waters. Solving flooding issues will be essential to the long-term vitality of Southeast Michigan. The promotion of wetland restoration and green infrastructure development will improve flood resilience in the region. Local watershed organizations restore ecosystems across their watersheds, install and maintain large- and small-scale green infrastructure solutions like rain gardens, and promote sustainable development to local businesses and homeowners. Continued efforts at the household, municipal, and county levels will ensure that future floods are less likely to be destructive to communities.

Above photos, left to right: rain gardens capture and filter stormwater (photo courtesy of the Friends of the Rouge); sprawling suburbs throughout southeast Michigan increase runoff (photo by Ken Lund); riparian restoration projects protect rivers from runoff (photo courtesy of the Clinton River Watershed Council). Both left-page photos courtesy of the Clinton River Watershed Council.

REPORT CARD **INDICATORS** EVALUATE **HEALTH**

The indicators used in this report card were carefully selected by a group of diverse stakeholders. The thresholds for each indicator are based on existing goals and determined by input from experts. Indicators are separated into six categories; each category score is the average of its component indicator scores. Category scores are averaged together to obtain the overall score for each Southeast Michigan watershed. The overall regional score reflects the average score of each indicator across all five watersheds. For detailed information on indicator thresholds and scoring, please visit **MichiganReportCards.org**

WATER

The **Water** category includes five indicators. **Nitrogen** measures the amount of total nitrogen in the water. **Phosphorus** measures the amount of total phosphorus in the water. High nutrient levels in a river lead to overgrowth of algae. **Dissolved Oxygen** measures the amount of oxygen dissolved in the water, which is good for animals. **Water Temperature** measures the temperature of the water; some fish species are sensitive to extreme temperatures. **Turbidity** measures the amount of light that passes through the water.

ECONOMY

The **Economy** category includes six indicators. **Household Income** measures the median household incomes in a community, while **Income Equality** measures the economic gap between the richest and poorest in a community. **Local Ownership** measures the locally owned businesses in a community by using company size as a proxy. **Cost of Flooding** measures the financial risk of flooding to a community. **Trade** measures the trade balance per capita, which assesses the amount of money leaving the local economy. **River Economy** measures the jobs and income generated by river-related businesses.

ECOSYSTEM

The **Ecosystem** category includes seven indicators. **Wetlands**, **Tree Cover**, and **Forests** evaluate the change in different types of land cover over time. Loss of natural land cover reduces available habitat, and often increases pollutant runoff. **Fish Populations** evaluates five metrics of the fish community structure based on different species types. **Bird Diversity** calculates the Simpson's Diversity Index for all bird species in the region; a higher number of bird species in an area means that there is adequate habitat available. **Benthic Community** evaluates the health of benthic macroinvertebrate species living on the stream beds, which reflects the overall health of the stream. **Protected Lands** measures the amount of land area protected in the region.

HUMAN HEALTH

The **Human Health** category includes five indicators. **Fish Consumption** assesses the type and severity of fish consumption advisories in the region. **Bacteria** assesses the amount of *E. coli* in the water, a proxy for other bacteria that can cause human illness. **Heat Vulnerability** is an index that assesses a community's vulnerability to climate change-driven heat waves. **Air Quality** assesses air pollutants and includes particulate matter (PM2.5) and ozone (O_3). The **Environmental Justice** indicator is an index developed by the CDC that integrates environmental, social, and health factors to assess the impacts of environmental inequality on human health. Environmental and economic inequality are often linked.

INFRASTRUCTURE

The **Infrastructure** category includes five indicators. **Affordable Housing** measures the amount people spend on housing costs compared to their income. **Farmland** evaluates the change in farmland area over time. Farmland maintains plant-based ground cover but can still contribute to water quality issues. **Impervious Surfaces** measures the amount of surfaces that are impervious to water infiltration in the region. **Sewer Overflows** evaluates the number of overflow events from Sanitary Sewer and Combined Sewer Systems. **Flooding** evaluates the number of floods reported in a region.

RECREATION

The **Recreation** category includes five indicators. **Fishing** measures the number of fishing licenses that have been issued. **Watercraft Access** measures the number of watercraft launch points along stretches of navigable river. **Beach Access** assesses the time when beaches are closed during the beach season. **Parks** assesses the median park size and percentage of park land in an urban area. **Walkability** assesses if people in urban areas can walk to a park in 10 minutes.

OVERALL CONDITIONS ARE MODERATE—POOR
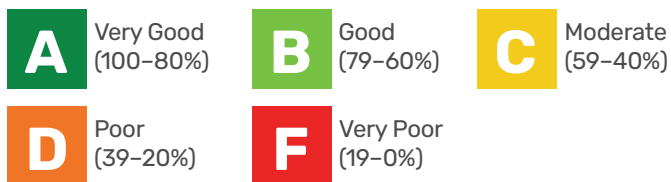# HUMAN HEALTH INDICATORS ARE A CONCERN

Overall, the Southeast Michigan region scored 49%, a C. This suite of indicators and scores reflects the unique challenges faced by urbanized watersheds. Of the six categories, the highest scoring was **Recreation** with 63%, a B-. Although the state of Michigan boasts 8.5 million acres of public land, only 250,000 of those acres are in Southeast Michigan. This high score indicates that outdoor recreation is still accessible to the area's residents. The lowest-scoring category was **Human Health** with 38%, a D+. **Infrastructure** and **Economy** both had C- grades, with 42% and 44%, respectively. **Ecosystem** and **Water** were slightly better (both moderate) with 49% and 58%, respectively. The lowest-scoring indicator was **Bacteria**, with a very poor score (9%). The highest-scoring indicator was **Bird Diversity** with 91% (A), a very good score.
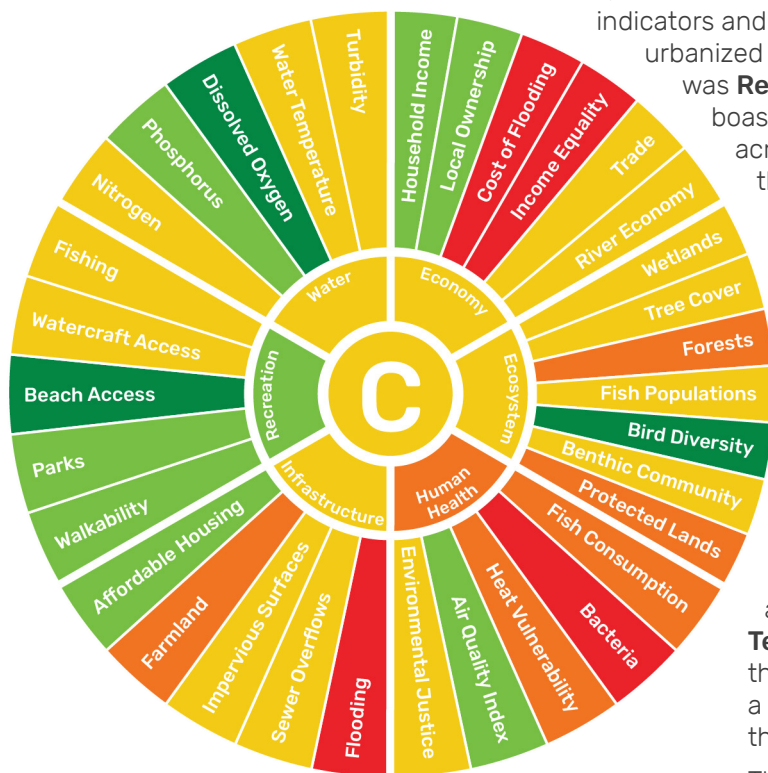
Water quality in this region is driven by nonpoint source pollution, like agriculture and urban runoff, and point source pollution from industry. Because of this, **Water** (58%) indicators for **Turbidity** (45%) and **Nitrogen** (47%) received moderate scores. **Water Temperature** also had a moderate score (48%), indicating that river temperatures are rising. **Dissolved Oxygen** had a very good score (88%), so there is adequate oxygen in the river for fishes and other organisms.

The **Ecosystem** indicators were mostly moderate with C grades for **Wetlands** (54%), **Tree Cover** (40%), **Fish Populations** (41%), and **Benthic Community** (55%). The amount of **Forests** (33%) and **Protected Lands** (32%) in the region is lacking, receiving poor scores (Ds). **Human Health** conditions are poor in the region. **Fish Consumption** and **Heat Vulnerability** had poor scores. The **E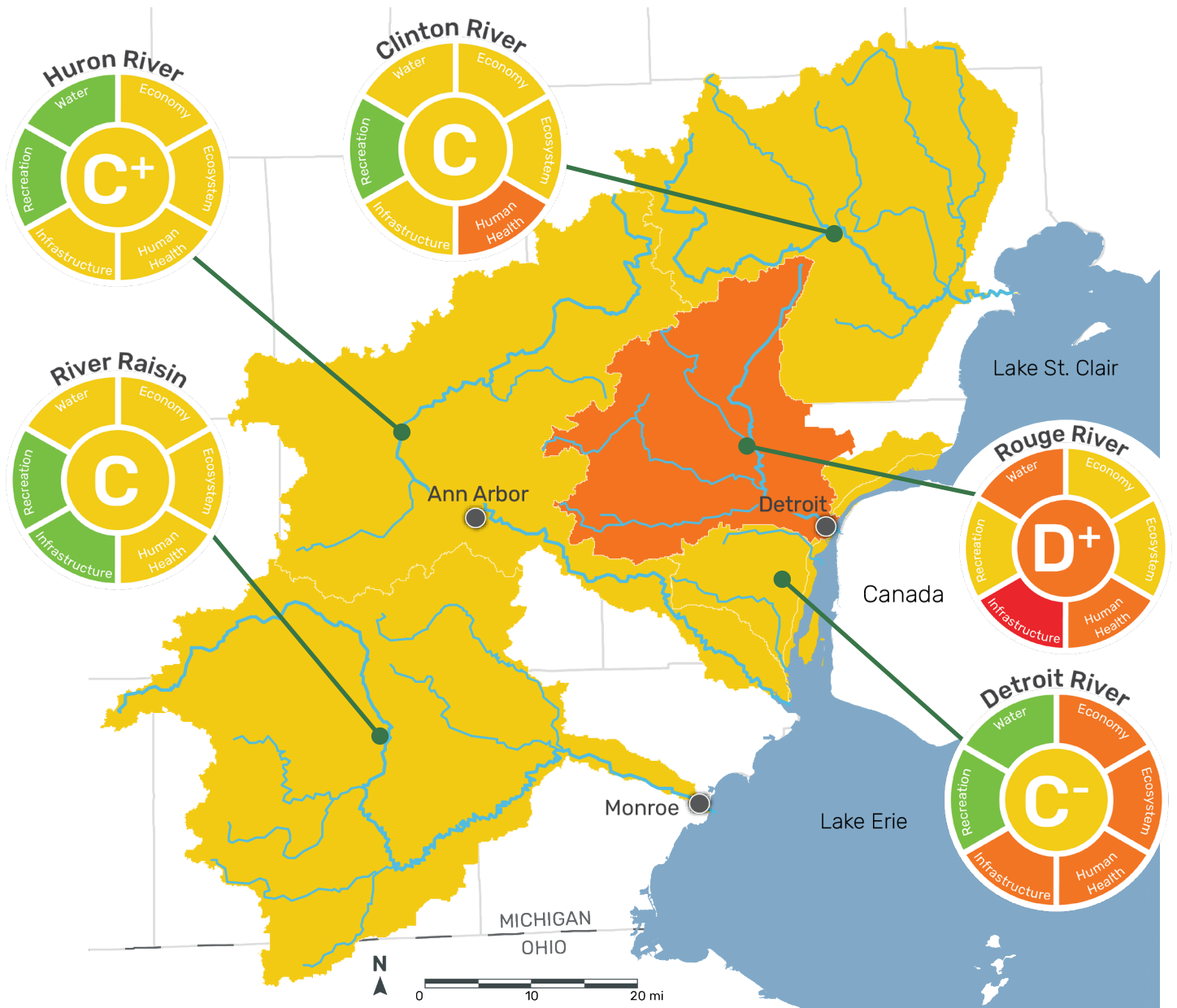nvironmental Justice** score was moderate (52%) and the **Air Quality** score was good (74%). **Infrastructure** scores ranged from poor (**Flooding**, 13%) to good (**Affordable Housing**, 65%). **Farmland** had a poor score, while **Impervious Surface** and **Sewer Overflows** both had moderate scores.

The **Cost of Flooding** (9%) and **Income Equality** (12%) both received very poor scores, while **Household Income** and **Local Ownership** are in good condition. **Trade** and the **River Economy** are both in moderate condition. **Recreation** scores ranged from moderate (**Watercraft Access**, 45%) to very good (**Beach Access**, 90%). **Walkability** and **Parks** both had good scores, while **Fishing Licenses** had a moderate score (54%). Recreational opportunities are becoming more important in the region, supported by a healthy environment, which will improve local quality of life.

Grade Scale

A Very Good (100–80%)	**B** Good (79–60%)	**C** Moderate (59–40%)
D Poor (39–20%)	**F** Very Poor (19–0%)	

Above photos, from left to right: a native bowfin fish, which looks similar to the invasive snakehead (photo courtesy of the Friends of the Rouge); rivers are popular for recreation (photo courtesy of the Huron River Watershed Council); and a spotted salamander enjoys intact forest habitat (photo by Meija Knafl).

CONDITIONS VARY ACROSS THE REGION, AND SOME WATERSHEDS NEED MORE SUPPORT

Huron River — C+ (Water, Economy, Ecosystem, Human Health, Infrastructure, Recreation)

Clinton River — C (Water, Economy, Ecosystem, Human Health, Infrastructure, Recreation)

River Raisin — C (Water, Economy, Ecosystem, Human Health, Infrastructure, Recreation)

Rouge River — D+ (Water, Economy, Ecosystem, Human Health, Infrastructure, Recreation)

Detroit River — C- (Water, Economy, Ecosystem, Human Health, Infrastructure, Recreation)

Lake St. Clair

Canada

Lake Erie

Ann Arbor

Detroit

Monroe

MICHIGAN
OHIO

N

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MONITORING DATA IS VALUABLE

Watershed report cards are driven by scientific data and carefully selected thresholds. These thresholds and the resulting scores inform management decision-making. In order to calculate scores that fully reflect conditions in a watershed, consistent and rigorous data is necessary. A larger number of samples better captures normal watershed conditions and any seasonal variation or unexpected highs and lows. Some suggested indicators are discarded if there is not sufficient data. Unfortunately, many datasets are lacking in some way: data is not collected regularly or by the same method, and some data is sparsely labeled. Because of this inconsistency and scarcity of data, indicators were scored at varying time scales. Some indicators only use recent data, while others look at historic data to track changes.

Water quality data, for example, was temporally and spatially inconsistent. Some water quality sites are sampled on a rotating or temporary basis, meaning that some streams are only sampled a handful of times within a couple of years. The water quality data analyzed in this report card includes data collected from 2015 to 2022. Detailed information about data sources and time frames is available on the project website.

WATERSHEDS WERE SCORED SEPARATELY

CLINTON

The Clinton watershed has an overall score of 51%, a C. The highest-scoring category was **Recreation** at 64%, reflecting the many recreation opportunities along and on the river. High **Bacteria** loads and **Heat Vulnerability** make **Human Health** the lowest-scoring category at 39%, which is a D. At 98%, **Sewer Overflows** was the highest-scoring indicator, due to only one combined sewer in the Clinton watershed. However, it must be noted that sections of the Clinton River suffer from frequent discharges of screened, disinfected stormwater, and wastewater from heavy rain events. The lowest-scoring indicators were **Flooding**—many floods took place over the last five-year span—and **Bacteria**, both at 0%.

DETROIT

The Detroit watershed has an overall score of 44%, a C-. **Water** was the highest-scoring category at 74%. For **Water**, the Detroit watershed was split into two sub-regions. The River scored an 86%, an A, while the Tributaries scored an 62%, a B- because of slow-moving, shallow water in a heavily urbanized area. Little **Farmland**, lots of **Impervious Surface**, and excess **Sewer Overflow** all put **Infrastructure** as the lowest-scoring category at 22%. The highest-scoring indicator was **Nitrogen** (99%). There were many indicators with very low scores, which reflects the Detroit's long industrial history and heavily developed present.

HURON

The Huron watershed has an overall score of 58%, a C+. The highest-scoring category was **Recreation** at 74%. All recreation indicators received a good score or higher (>60%). Low **Income Equality**, along with many **Flooding** events and high **Bacteria** loads, make **Economy** and **Human Health** the lowest-scoring categories at 45% each. At 96%, **Beach Access** was the highest-scoring indicator, showing public beaches were nearly completely open for the beach season. The lowest-scoring indicators were **Bacteria** and **Income Equality**, both at 13%.

RAISIN

The Raisin watershed has an overall score of 54%, which is a C or moderate. With little **Impervious Surface** and few **Sewer Overflows**, the highest-scoring category was **Infrastructure** at 69%. High **Nitrogen** and **Phosphorus** nutrient pollution make **Water** one of the lowest-scoring categories at 44%. At 100%, **Beach Access** was the highest-scoring indicator, showing public beaches were completely open for the beach season. One of the lowest-scoring indicators was **Protected Lands** (12%), showing only some progress toward the goal of 30% protected land in the watershed.

ROUGE

The Rouge watershed has an overall score of 36%, a D+. The highest-scoring category was **Recreation** at 48%, due to high **Walkability** and **Park** accessibility. Lots of **Impervious Surface,** recent **Flooding** events, and **Sewer Overflows**, along with little **Farmland**, make **Infrastructure** the lowest-scoring category at 14%. At 89%, **Bird Diversity** was the highest-scoring indicator, reflecting a high number of different bird species present in the region. The lowest-scoring indicators were **Bacteria**, **Farmland**, **Flooding**, and **Stormwater**, all at 0%.

Above photos, from left to right: community members conduct fish surveys (photo courtesy of the Friends of the Rouge); volunteers monitor water quality (photo courtesy of the Huron River Watershed Council); and vernal forest pools provide rich terrestrial habitat (photo by Meija Knafl).

MOVING FORWARD IN A CHANGING WORLD

The watersheds of Southeast Michigan are vital to the prosperity of the region and the country. They provide drinking water for millions, water for agriculture and industry, and opportunities for recreation. These five watersheds are environmental treasures, but they face challenges. Decades of pollution and urbanization have degraded these watersheds. The watershed organizations who contributed to this project are actively tackling these challenges in their communities. Their work in water quality monitoring, green infrastructure solutions, deep community engagement, and ecosystem restoration is invaluable to the current and future health of Southeast Michigan's rivers and watersheds. Enormous progress has been made; no small feat in a densely populated and heavily urbanized region.

Adapting to a dynamic and changing landscape in Southeast Michigan requires responsible management of natural resources. In addition to protecting existing habitats, current and future development must be mindful of environmental concerns that impact people and the environment. Vulnerable, underrepresented communities are made more vulnerable by changes and require additional support. Science-based management actions will serve to protect and promote both humanity and the surrounding landscape, ensuring a sustainable and prosperous future.

Left: rain garden installations and public education can improve the management of stormwater and runoff (courtesy of the Friends of the Rouge). Right: Southeast Michigan is an industrial region (Photo courtesy of the Friends of the Detroit River).

HOW YOU CAN HELP

Improving the watersheds of Southeast Michigan is a collaborative effort between scientists, government officials, and residents. There are a variety of actions that you can take to help protect your river and watershed. At home, you can plant rain gardens, reduce use of fertilizers and pesticides, and make use of local parks and recreation areas. In your community, you can volunteer with watershed organizations, participate in river cleanups, tell your leaders to protect land and rivers, and support local small businesses.

ACKNOWLEDGMENTS

This report card is a timely, transparent assessment of five river watersheds in Southeast Michigan, the Clinton, Detroit, Huron, Raisin, and Rouge. These lands are the traditional home of the Ojibwe, Ottawa, Pottawatomi, and Wyandot peoples. This document was produced by the Clinton River Watershed Council, Friends of the Detroit River, Huron River Watershed Council, River Raisin Watershed Council, and Friends of the Rouge, and the University of Maryland Center for Environmental Science (UMCES). Funding was provided by the Fred A. and Barbara M. Erb Family Foundation. Council Fire, LLC was integral to developing economic indicators and consulted on economic data analysis. Over 100 stakeholders from 65 organizations contributed to this project.

Data sources include: Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry; Detroit Bird Alliance/Audubon Society; Federal Emergency Management Agency; Friends of the Rouge; Friends of the Detroit River; Huron River Watershed Council; Clinton River Watershed Council; River Raisin Watershed Council; Google Earth Engine; Implan; Michigan Department of Environment, Great Lakes, and Energy; Michigan Department of Health and Human Services; Michigan Department of Natural Resources; Multi-Resolution Land Characteristics Consortium; National Oceanic and Atmospheric Administration; National Water Quality Monitoring Council; Trust for Public Land; U.S. Census Bureau; U.S. Environmental Protection Agency; U.S. Geological Survey; and Your Economy. To find more information about the data and analyses used, please refer to the methodology.

For more information, visit MichiganReportCards.org