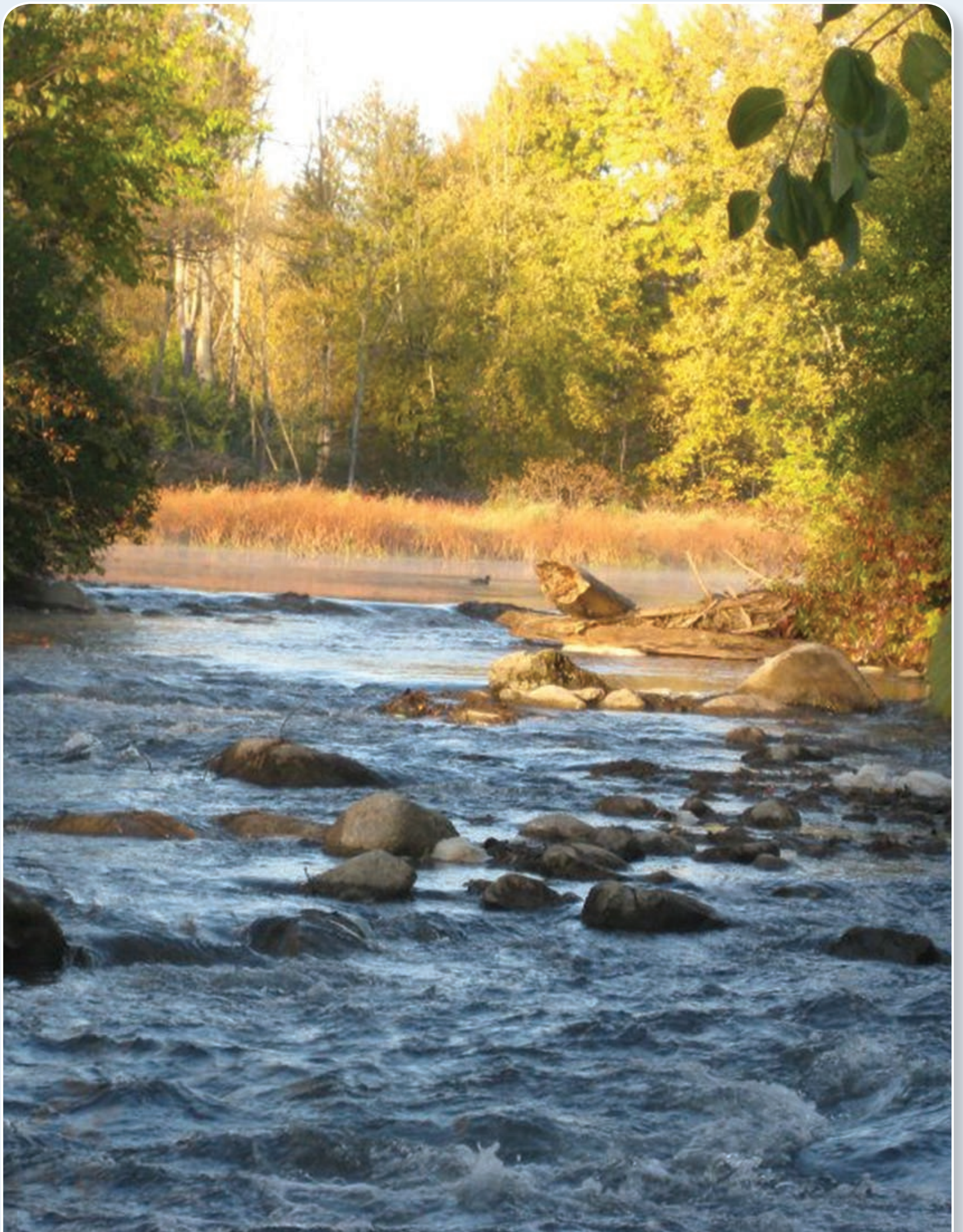
Climate Resilient Communities

Improving information access and communication among dam operations of the Huron River main stem



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March, 2013

Creating Climate Resilient Communities

The familiar patterns of rainfall, snow, and our four seasons are becoming less recognizable.

County Officials, Public Works Directors, Municipal Planners, and Natural Areas Managers in the Huron River watershed are noticing how the increase of extreme temperature and precipitation events is challenging how they do business and assess risk. Many feel ill-equipped to respond to this "weirdness" that results in overtaxed infrastructure, changes to natural systems, public health risks and costs to already-stressed community budgets.

In response, the Huron River Watershed Council (HRWC) is bringing together community partners up and down the river to examine the topic of a changing climate and how communities in the watershed, and Michigan, can maintain quality of life under projected scenarios.

Creating Climate-Resilient Communities is an effort to address local climate change impacts by building resiliency in the watershed. Over the course of a year, HRWC convened interested stakeholders to determine information needs and climate adaptation strategies. An opening plenary session in December 2011 was held to share current climate science and identify project participants. Participants then attended a series of working group sessions to develop and begin implementation of priority climate adaptation strategies. Three working groups were established for key sectors. These sectors are particularly likely to be impacted by climate change, and also able to reduce risks created by these changes.

WATER INFRASTRUCTURE

for practitioners involved with water utilities, wastewater treatment facilities, stormwater management

IN-STREAM FLOWS

for dam operators, fisheries biologists, and hydrologists

NATURAL INFRASTRUCTURE

for land managers involved with natural areas preservation, restoration, and management

HRWC partnered with the Great Lakes Integrated Sciences and Assessments Center (GLISA)—a collaboration of the University of Michigan and Michigan State University whose goals are to contribute to the long-term sustainability of the region in the face of a changing climate, and facilitate smart decision-making backed by scientific knowledge. GLISA provided data and technical expertise on climate change to the project. Over the course of a year, HRWC, GLISA and project participants reviewed various climate scenarios, discussed best practices and case studies on adaptation strategies and gained commitments for action. The project contributes to the creation of "climate-resilient communities" that know how to reduce their vulnerability and risk associated with current and forecasted conditions.

In this report we detail the outcomes of the Instream Flows Workgroup.

1 Climate adaptation is any action that leads to a reduction in harm or risk of harm, or realization of benefits, associated with climate variability and climate change.

Climate Change in the Huron River Watershed

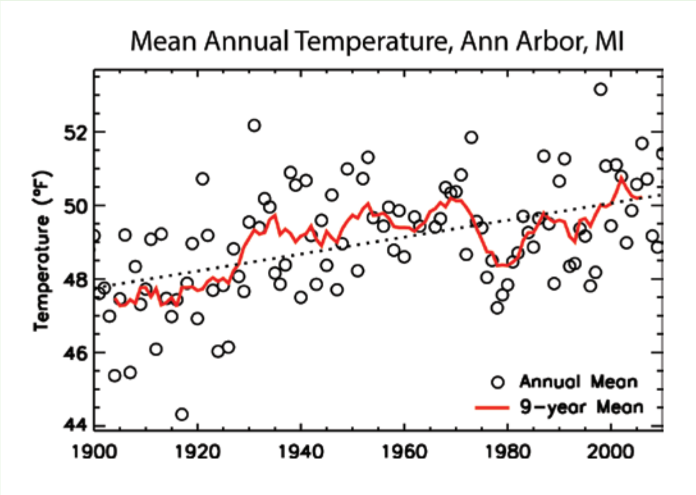
Climate influences daily, seasonal, annual and longer-term weather patterns. History serves as a benchmark for what to expect and what to plan for. In a changing climate, history no longer reliably indicates what is possible or likely. Changes in temperature, precipitation and everything these factors influence are creating a new normal for communities, with implications for planning, development and emergency preparedness.

The Huron River and its watershed, is already experiencing the effects of climate change in the form of more intense and frequent storms, rising temperature and changing precipitation patterns. Winters have shortened, and snow and ice cover have declined. These trends are predicted to continue. These physical changes, among others, will exacerbate existing environmental concerns in Southeast Michigan. Of particular interest in the Huron River watershed are the changing form, frequency and intensity of precipitation events that could drive changes in the distribution and quality of water resources.

The following summary is based on data analyzed by GLISA. The source of the data is the National Climatic Data Center (NCDC) GHCN Daily dataset. GLISA provided the most localized assessment of current and future climate trends that can be made given the availability and quality of source data, reliability and resolution of model projections and appropriateness of scale for a particular climatic variable. Given these limitations, they present results at three geographic scales. Results may be presented for Ann Arbor (as a representative location in the Huron River watershed with good data availability), for the local climatic zone (10 county region in Southeast Michigan), or for the entire Great Lakes region.

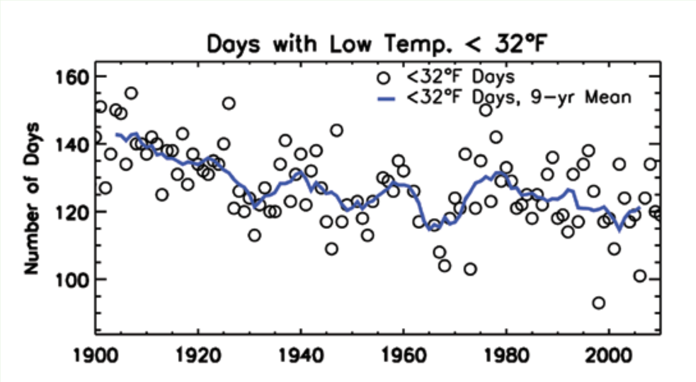
Temperature

Increased air temperatures have already been observed in the region. Between 1968 and 2002 the average annual air temperature in the lower Great Lakes basin increased by 2.3°F (1.3°C) (Dobiesz and Lester, 2009). Ann Arbor has seen only a modest increase in annual temperature since the 1951-1980 period. The greatest warming has occurred in winter, where the average temperature for 1981-2010 was 1.0°F higher than the average for 1951-1980.



Mean annual temperatures from 1900 to 2010 for Ann Arbor, MI. The solid line represents the 9-year running mean. The dotted line is the linear trend over the period of record.

Throughout the Great Lakes region, winters have typically become shorter as well. Compared to start of the 20th century, the frost-free seasons today are about one week longer, primarily due to earlier dates for the last spring freeze. In Ann Arbor, there are about 3 fewer days per year seeing freezing temperatures when compared to the 1951-1980 average. This trend is consistent with other stations throughout the region. By 2100, the frost-free season is projected to be 4-8 weeks longer (Wuebbles and Hayhoe, 2004).



Open circles represent the number of days per year in which the daily low temperature dropped below 32°F. The solid line is the 9-year running mean.

Temperatures will continue to increase over most of the Great Lakes region, but projections vary widely on how much. Recent projections suggest that average annual air temperatures in the region will increase by 1.8°F to 5.4°F (1 to 3°C) by 2050 (Hayhoe et al., 2010; Lofgren et al., 2002). Estimates for 2100 range between increases of 3.6 and 11°F (2 and 6.2°C) (Hayhoe et al., 2010; Scheller and Mladenoff, 2005; Wuebbles and Hayhoe, 2004).

Increases in temperature will not be evenly distributed, however. Nighttime temperatures may warm more than daytime temperatures, and winters will probably warm more than summers during the early 21st century. Later in the century, summer and spring temperatures may rise more than temperatures in the winter and fall.

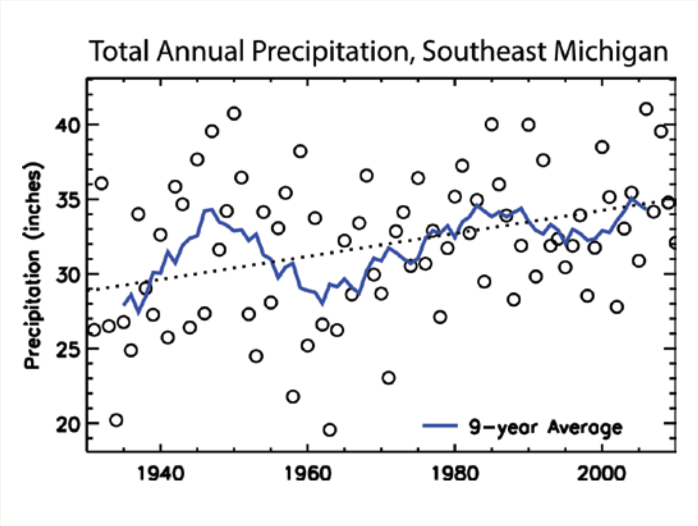
As average temperatures rise, so will daily maximum temperatures, increasing the probability of more frequent summer heat waves. The number of days that exceed 90°F (32°C) could increase from 15 per year (in 2010) to between 36 and 72 days per year, and events as intense as the 1995 Chicago heat wave are projected to occur as frequently as once every two years to three times in a single year (Vavrus and Van Dorn, 2010; Hayhoe et al., 2010).

Photo by John Lloyd

Precipitation

The frequency, form, and intensity of precipitation falling in the Great Lakes region will continue to change, but model projections vary on exactly how precipitation will change and on what areas will experience the largest changes. Most researchers expect the amount of precipitation in the Midwest to increase overall. Others expect that the amount of total annual precipitation will remain relatively stable as the seasonal distribution of the precipitation changes. Most models project an increase in winter precipitation of up to 20-30 percent, with potential increases in the autumn and spring as well (Hayhoe et al., 2010).

So far, total annual precipitation has increased in Ann Arbor and southeastern Michigan, mostly due to increases in winter and fall totals. From the 1951-1980 period to the 1981-2010 period, annual precipitation increased by 11% in southeastern Michigan. Ann Arbor saw a more dramatic increase of 25% over the same time period, but local factors may have played a role.



Annual precipitation totals for southeastern Michigan (Climatic Division 10) for 1931 to 2010. An open circle represents the total precipitation for a single year. The solid line represents the 9-year running mean. The dotted line is the linear trend over the period of record.

Snow cover in the Great Lakes region has already experienced one of the most dramatic declines in North America. Since the mid-1970s, the number of days that had snow on the ground decreased at a rate of five days per decade, and the average snow depth across the region dropped by 2 inches (Stewart et al., 2007). As spring temperatures warm, the snowfall season will become shorter and lake-effect rainstorms may replace some lake-effect snowstorms.

The frequency and intensity of extreme storm events has been increasing in this region, and this trend will likely continue as the effects of climate change become more pronounced. Over the Midwest as a whole, the number of 24 hour, once-in-5-year storms was found to have increased by about 4% per decade since the beginning of the 20th century (Changnon, 2009a; Changnon, 2011; Changnon and Westcott, 2002; Hejazi, 2009; Wilson and Sousounis, 2000; Vavrus and Van Dorn, 2010).

The Great Lakes region could experience more frequent droughts despite increases in total annual precipitation. As more precipitation is delivered disproportionately in more intense events, the probability for dry periods may also increase. The region may also become drier overall due to increasing temperatures, increased evaporation, and reduced soil moisture (Frelich et al., 2009; Hayhoe, 2007; Hayhoe and Weubbles, 2008; Karl et al., 2009; Wuebbles, 2006). Droughts and dry periods would be felt most strongly in summer, when groundwater recharge is reduced and there are more low-flow periods (Hayhoe, 2007; Karl et al., 2009).

Great Lakes

The Great Lakes dominate the climate of the region. Changes to the Great Lakes have implications for the weather experienced locally. An increase in lake temperatures and decrease in ice cover are already measureable on the Great Lakes. Lake levels have also continued to decline in recent years, but it is unclear that the observed lake level drops are solely the result of climate change. Taken together, these changes have the potential to impact regional climate patterns and the water cycle responsible for maintaining the natural systems of the area.

Water Resources

Climate change will influence the water resources in the Great Lakes region. The region is expected to experience more extremes in precipitation patterns with wet periods getting wetter and dry periods drier. The timing and duration of these wet and dry periods is also expected to change impacting the hydrologic cycle and the availability of water resources.

Warming winter temperatures shorten the freeze period, reduce snow cover and replace some snowfall with rain. Between 1920 and 1995, input into Lakes Michigan and Huron has shifted to autumn and winter, resulting in less runoff and lake-level rise in the spring. A similar shift in timing can be expected in SE Michigan. Warmer winter temperatures are also expected to lead to earlier peak flows, increased runoff in fall and winter and decreased runoff in the spring. Runoff will likely become more variable, decreasing during dry periods and increasing during spells of more intense precipitation.

While total annual precipitation will likely increase, dry periods may last longer, reducing soil moisture and available surface waters. These effects would be felt most strongly during the summer, when groundwater recharge is expected to decrease most severely and droughts are most probable. As severe precipitation events become more intense, summer streamflows are expected to increase in flashiness and variability.

Climate Impacts to Stream Flows

The observed changes in the seasonality, form, frequency, and intensity of precipitation are expected to continue in the future. Waterway management could be particularly affected by increases in the occurrence of extreme precipitation events and shifting seasonal peak flows. Improvements in the coordination of water resources and streamflow management are required to alleviate current vulnerabilities that will likely worsen in the future.

Waterway Management & Infrastructure

A higher frequency of severe precipitation events will increase the magnitude and occurrence of sudden peak flows. When inadequately dealt with, these flows can lead to flooding and erosion, damaging infrastructure, interfering with transportation, and causing economic disruption. When coupled with more severe storms, the use of impervious surfaces and inappropriate land use practices amplifies flooding risks by delivering stormwater more directly and quickly to the river.

In general, dams and infrastructure along the Huron River are prepared for the magnitude of flows accompanying even low probability, high-volume storms. More intense storms, however, also lead to flashier flows, and in many cases the current operating procedures of dams inhibit the response time to these events. Even under the current climate, storms expose vulnerabilities in coordinating flow along the river, and as severe storms become more frequent, problems arising from these vulnerabilities will become more common. Additionally, more severe events tax instream structures such as dams, culverts, bridges and other lake level control devices. Public safety concerns arise. Structures may require additional maintenance or reach the end of their safe use sooner; this will increase funding needs.

Larger precipitation events will result in overbank flows impacting the definition of floodplains, inundation areas and emergency action plans. Infrastructure and developments in inundation areas may require additional planning and insurance to protect facilities, personal property and human life.

Water Quality

Flooding can increase erosion and overload sewage systems, reducing water quality in lakes and rivers and increasing the risk of waterborne disease. Increased erosion adds sediments and pollutants to surface waters. Wetlands are known for their ability to filter sediment and contaminants from water, but are predicted to decline in area due to rising temperatures and evaporation rates and declining stream levels. In lakes, warmer waters and more stratification can mobilize bottom-sediment nutrients like phosphorus and lead to increased algae growth.

Future land use changes are likely to have a far greater impact on water quality than climate change, but changes in temperature and precipitation can amplify the effects of land use. For example, the construction of impervious surfaces (such as pavement and roads) can increase runoff from more intense rainstorms. Increased runoff from urban and agricultural lands is a major source of pollution and excess nutrients in surface and ground waters.

Water Supply and Availability

Climate change will have an impact on water supplies throughout the region. Particularly during the summer months, longer dry periods experiencing warmer temperatures and greater evaporation rates could lead to reduced soil moisture, surface water, and groundwater supplies. In some cases, the changing seasonal distribution of water resources may create greater conflicts over the management of lakes and waterways. Mechanisms to maintain mandated lake levels that were suitable for sustaining both recreation and natural aquatic environments under past climate conditions may be inadequate in the future. Restricting flows to preserve lake depths in some areas may further stress wetland areas that are at the same time experiencing greater evaporation. Holding lake levels during drought conditions will also stress river systems due to lowered baseflows or in some cases, dry river beds. There are already incidents of this in the watershed, and the frequency and area impacted are likely to increase as the climate changes. New compromises between human use and wetland and riverine protection may need to be found to address these tensions.

Many communities of the Huron River watershed get their drinking water from surface and groundwater sources within the watershed. While the area is blessed with significant water resources, periods of extended drought may tax water sources via lower availability and more demand (for lawn and garden care). The drawdown of aquifers may require deeper well drilling by both utilities and private land owners. Increased demand during low rainfall periods along with declining water quality taxes water treatment facilities.

Biodiversity

Lower summer water levels are likely to limit groundwater recharge, causing small streams to dry up, and lead to a reduction in wetlands, resulting in poorer water quality and less habitat for fish and wildlife. Wildlife that relies on wetlands may be at greatest risk, as increased evaporation rates may reduce total wetland coverage, and further stress those species.

More frequent and intense precipitation events due to climate change may amplify existing land use impacts. Impervious surfaces impair the natural flood-absorbing capacities of wetlands and floodplains, thereby increasing the risk of flooding and erosion. As severe storms increase in number and strength, watersheds and other ecosystems adjacent to agricultural and urban environments will be particularly vulnerable to damage and contaminated runoff. Additionally, impervious surface and stormwater systems deliver rainwater to rivers rapidly. Larger events led to even more extremes in peak flows in the river and it's tributaries. Extreme peak flows scour habitats, reshape channels, displace fish and invertebrates and tax infrastructure.

Fish populations throughout the Great Lakes region may become less diverse. Warmer water temperatures will likely lead to a decline in coldwater fish populations as warmwater fish populations become more abundant. The overall productivity in lakes and waterways may be reduced by lake stratification and increased frequency of hypoxic conditions.

Stream Flows in the Huron River Watershed in a Changing Climate

The Huron River has 17 dams in place on the main stem of the river which are owned and operated by nine different entities. Dams are operated to achieve multiple goals including flood control, maintenance of lake levels, and production of hydropower. Operators adjust dam structures to respond to changes in flow upstream. There are a few stream gages throughout the watershed to help provide data on flows to operators but those data only tell part of the story. There are many river reaches that can influence flow in an area dramatically, but lack gages. Also, changes to the operation of upstream dams will influence the timing and amount of flow a reservoir will receive downstream. The Instream Flows Workgroup determined access to data and better communication among dam operations in the watershed would improve the efficacy of flow management and improve preparedness for extreme events such as floods and drought.

Recommendations of the Instream Flows Workgroup:

1. Establish additional stream gages in the watershed in order to provide more comprehensive flow data and relevant and timely data to individual operations.
2. Network dam operators and affiliates from each of the main stem operations to facilitate communication pertaining to changes in dam management and provide a forum for learning and information exchange.

Flow data for the Huron River

The main stem of the Huron River is monitored by three USGS stream gages, at Kent Lake (New Hudson), Hamburg Road (Hamburg) and Wall Street (Ann Arbor). Gages at Mill Creek, (Dexter) Allen's Creek (Ann Arbor) and Mallets Creek (Ann Arbor) also provide some useful information about incoming flow to downstream operators. These gages monitor stream discharge (cubic feet per second) and gage height (feet) in real-time. The equipment and data are managed by USGS for an annual fee. The data are shared publicly. All operations can access this information to keep an eye on flow coming into the impoundment or flow conditions below the impoundment. Additionally, individual operations may have their own monitoring equipment, often at the upstream end of the reservoir and/or at the dam itself. These data are useful to the operation but are not always available to other operations on the Huron River. This leaves operators relatively limited in their knowledge of flow conditions throughout the watershed and what flows might be coming their way, and when.

More comprehensive stream flow data has multiple benefits. At a minimum the addition of gages providing flow information provides a more comprehensive snapshot of the river at any given time. This helps improve the efficiency of dam operations and allows operators to be proactive rather than reactive when alteration to an operation is necessary. It can provide critical information in the case of extreme weather events or a dam breach. Data can also be used to develop models that can lend insights about impacts of weather events and land use change on flows and the impacts of altered flows on river habitat and biodiversity.

Stream gage data is used daily by dam operators. Rain events can be highly variable within a watershed such as the Huron, that covers over 900 square miles. Heavy rains may only occur in parts of the watershed. Rainfall can vary by inches over even small areas making it difficult to know when stream flows can be expected to rise. Operators observe closely both weather forecasts and stream gages to identify what flows to expect. This information is used to determine how much water to release and when if flooding can be expected. Operators monitor flows and adjust dam outflows as necessary. Where there are gaps in data, responses cannot be determined until flows reach the reservoir. This can lead to the need for after-hours labor costs, loss of revenue, and more reactive operational changes than would have been necessary with more warning. In extreme cases damage to infrastructure can occur.

Rainfall events, holding or releasing water at a dam, or a dam breach can all result in significant and sometimes dangerous changes in flow. Well-sited gages can give early warning to downstream operations that can then formulate an informed response and mitigate potential flooding, property damage and loss of life. Many dams have an emergency action plan that is implemented when certain conditions are met. While each operation has a call-down list of contacts, better gage data paired with a notification system can give timely warning to operators, municipal staff and emergency responders and provide those managing the emergency with relevant flow data to guide ongoing response efforts.

More flow data can allow for the development of models and management plans that optimize flows and flow regimes for multiple purposes. In a river system, flows that are too steady or too erratic can have negative impacts on habitats and species. A dammed river, such as the Huron, is a regulated river. This regulation changes the flow regime or the natural patterns in the rise and fall of water levels. These flow patterns determine habitat quality and provide the type of environment that better supports native species. Flow models can help identify the timing and magnitude of flows most important to habitat and wildlife. These flows can then be simulated through dam management. Additionally, models can

Gage #	Location	Data
Gage 04170500	*Kent Lake Dam, New Hudson*	*Discharge, Gage Height*
Gage 04172000	*Huron River near Hamburg Road, Hamburg*	*Discharge, Gage Height*
Gage 04173500	Mill Creek near Parker Road, Dexter	Discharge, Gage Height
Gage 04174490	Allens Creek outlet near Main St., Ann Arbor	Discharge, Gage Height
Gage 04174500	*Huron River near Wall Street, Ann Arbor*	*Discharge, Gage Height, Temperature, DO, pH, Specific Conductivity, Turbidity*
Gage 04174518	Malletts Creek near Chalmers Drive, Ann Arbor	Discharge, Gage Height
Gage 04174517	Malletts Creek at Mary Beth Doyle Park, Ann Arbor	Discharge, Gage Height

Table 1. Current location of USGS gages on the Huron River, with the available. Italics indicate gages on the main stem of the river. USGS gage data for Michigan can be accessed at http://waterdata.usgs.gov/mi/nwis/rt.

help fill gaps in our knowledge about what rainfall contributes to stream flows. This helps dam managers calculate what flows to expect from contributing streams that lack permanent gaging stations or main stem gages below the confluence. Data can also be used to determine how to allocate water during periods of drought.

There is a critical need for more and better flow data. Two different solutions hold promise for filling this need for the Huron River. A hybrid of both solutions is also possible. The first solution is "high cost, low touch." USGS can be contracted to install and maintain additional gages and process and share the data. Data tends to be high quality and reliable. USGS provides access to data via a public website. In addition to gage height and discharge, a station may also collect other water quality variables such as temperature, dissolved oxygen and turbidity. USGS adds value to raw data by computing daily, monthly and annual summary statistics and annual water reports. They also have a notification system, WaterAlert, that allows users to receive alerts when user -defined thresholds are reached though there is a delay of up to 60 minutes between measurement and notification. The system is part of a national network making data available for broad scale study as well.

The second solution is "lower cost, higher touch." Gages can be purchased directly from a manufacturer. These gages can be simpler and considerably less expensive than USGS gages, but system set-up, data processing and data sharing need to be implemented locally. Many of these gages are already being used in the Huron. Oakland and Livingston County have installed multiple units on dams throughout the counties to monitor water levels. The City of Ann Arbor also uses water level monitors and publishes the data monthly on a public website. Monitors can be connected to a notification system that can trigger high and low water alarms. This provides information dam operators use to determine when actions need to be taken at a given dam. However, most of these gages only detect water levels, not discharge rates and their data are not captured and shared in a systematic and timely manner. Most data is not shared outside of a jurisdictional unit. Even when the data are shared, the time lag involved prevents the use of the data for short-term needs such as adjusting of dam gates in response to large rain events or a dam breach. It is required that these gages have a clear owner responsible for maintenance. To be effective for the intended purpose, all entities that own dams on the Huron River would need real-time access to the data being collected throughout the watershed.

The Instream Flows Workgroup recommends developing a plan to collect additional flow data and provide access to that data to dam operators along the Huron River. The plan should prioritize locations for additional gages and identify funding mechanisms.

Early discussions revealed several high priority locations for additional stream gages. These include:

- Between Flook (at Portage Lake) and Barton (Ann Arbor)
- Between Peninsular (Ann Arbor) and Ford Lake (Ypsilanti)
- Between French Landing (Van Buren Township) and Flat Rock
- North of Kent Lake (Oakland County)

Funding will need to be identified for the equipment, installation and maintenance of any flow monitoring system. Some expenses are onetime costs but others are ongoing and will require a sustainable source of funds. The system would serve multiple municipalities covering the four counties of Oakland, Livingston, Washtenaw and Wayne. A few mechanisms for funding include:

- USGS Cooperative Funds which are available each year to defray costs of the installation of USGS stream gages. Funds can defray approximately half the initial investment (which includes the cost of equipment, installation and calibration) and must be granted to a taxing authority, tribe or state-owned educational facility.

- Special Assessments which require the establishment of Special Assessment Districts and levy against properties that benefit from the implementation of a program. The Oakland County monitors were purchased by the County and annual maintenance and operation is covered under lake level Special Assessments.
- Joint Funding Agreements can be used to share the cost of a centralized system across jurisdictional units.

Huron River Dams Network

The river is a shared resource and changes to flow, rapid or gradual, natural or human derived, impact the entire system; especially those in the downstream direction. Dams in the Huron have historically operated in isolation. Operations may be coordinated when there is a shared owner. In other cases, relationships form with immediate neighbors, often in response to a failure or crisis that punctuates the need for better communication.

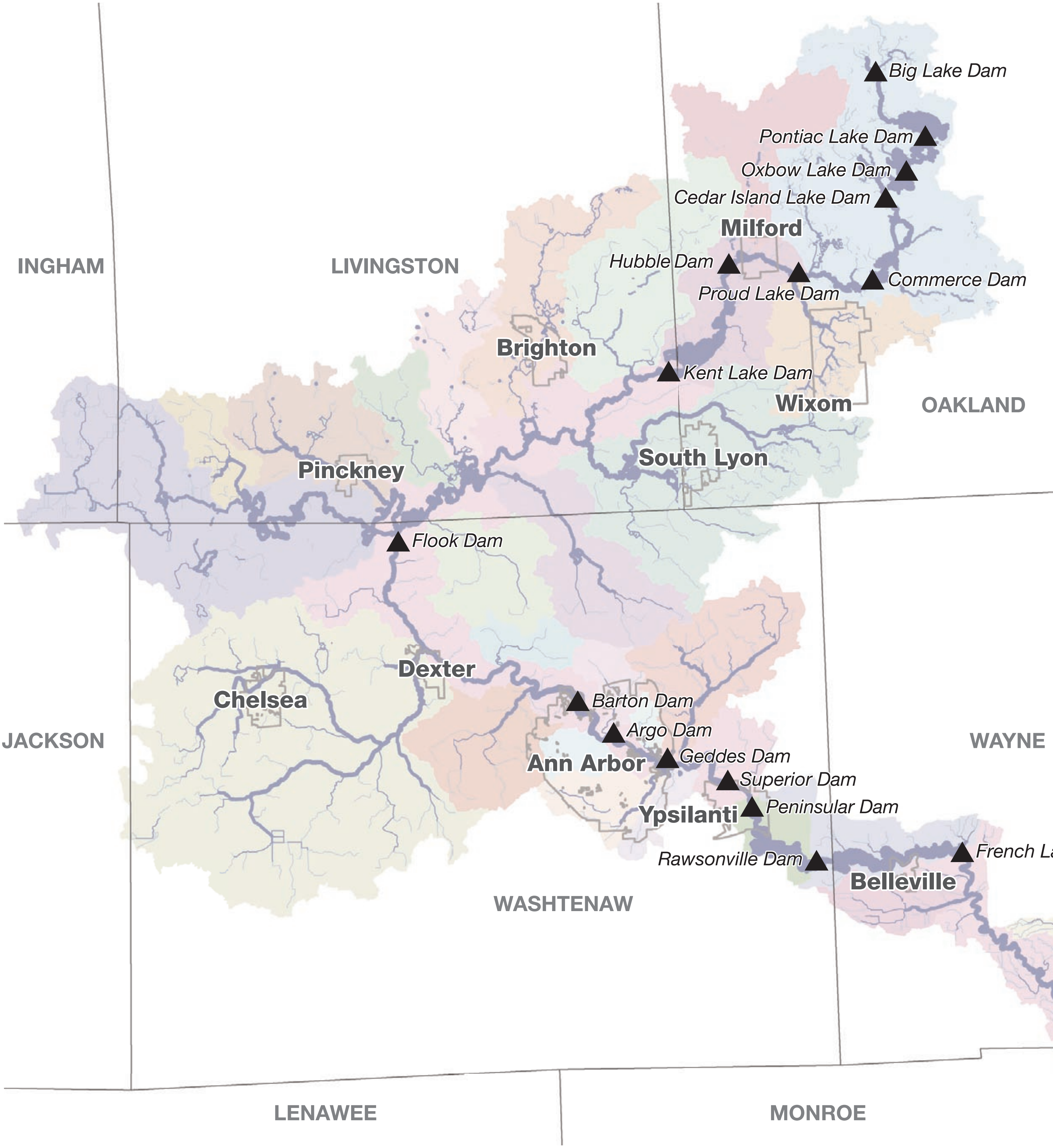
Under current conditions, and in preparation for changing climatic conditions, much stands to be gained from a connected network of dam operators and others affiliated with the operation and maintenance of dams on the Huron. On a day-to-day basis, communicating on the timing and magnitude of planned releases or withholdings, sharing flow impacts of storms hitting parts of the watershed, and reporting on planned maintenance can help individual operations run smoothly. This regular communication lays the foundation for times when crises occur in the form of severe rainfall events, prolonged drought, or dam failure. Members of the network will be able to coordinate response across this shared resource, minimizing damage to instream and floodplain infrastructure, river habitats and species and the safety of people on or near the river during such an event. Additionally, a network can help members keep pace on issues affecting the industry and tackle challenges that impede success.

Networks of this nature do not appear common especially when operations extend beyond a single jurisdiction. Where they do exist it is often in response to a crisis. However, there are some examples of successful networks supporting the operation of dams on rivers in the United States. The Mousam River Coordination Group in Maine was established after two severe flood events caused extensive damage to the area. Similar to the Huron, the river has multiple dams operated by several different owners. The group is coordinated by the emergency management agency in the area. The network meets regularly, has set up a system for alert notification and established protocols for flood response. Even with limited water storage capacity in the system, the group has been able to avert flooding in some cases by coordinating the holding of water across dams.

On November 8, 2012, the Huron River Watershed Council, Ypsilanti Charter Township and City of Ann Arbor hosted a workshop to initiate better connection among the various dam owners and operators of the 17 dams on the Huron River. The workshop included presentations on the status of climate change in the watershed and how that may impact flows, and an overview of an emergency action plan functional exercise recently conducted by the City of Ann Arbor. Participants provided brief descriptions of their dams and priority challenges as a means of getting acquainted and identifying similarities, differences and opportunities for information exchange. The group also discussed the desire for, and options to, support better communications and coordination.

The workshop was well-received and participants expressed interest in staying better connected. This is the first step in establishing an active, productive network, improving day-to-day operations and reducing vulnerability to climate change. Initial outcomes include:

- Establishment of the Huron River Watershed Council as network coordinator
- Agreement to meet, in person, at least once a year to learn and share on topics of interest
- Establishment of a virtual network platform to allow for informal exchanges and timely updates on changes impacting flows
- Maintenance and sharing of an up-to-date contact list including emergency contact information
- Investigation of service that allows real-time exchange of time sensitive information
- Cooperation on citing and funding of additional stream flow data solutions
- Notification of training, funding and learning opportunities that may be of interest to network members



Big Lake Dam
Pontiac Lake Dam
Oxbow Lake Dam
Cedar Island Lake Dam
Milford
INGHAM
LIVINGSTON
Hubble Dam
Proud Lake Dam
Commerce Dam
Brighton
Kent Lake Dam
Wixom
OAKLAND
South Lyon
Pinckney
Flook Dam
Dexter
Chelsea
Barton Dam
Argo Dam
JACKSON
Geddes Dam
Ann Arbor
WAYNE
Superior Dam
Peninsular Dam
Ypsilanti
Rawsonville Dam
French La
Belleville
WASHTENAW
LENAWEE
MONROE

Dam	Impoundment	Owner	Location	Dam height (feet)	Pond Size (acres)	Purpose
Big Lake Dam	Big Lake	OCWRC	Davisburg	4	300	Recreation
Pontiac Lake Dam	Pontiac Lake	OCWRC	Waterford	21	640	Recreation
Oxbow Lake Dam	Oxbow Lake	OCWRC	White Lake	15	290	Recreation
Cedar Island Lake Dam	Cedar Island Lake	OCWRC	White Lake	6	134	Recreation
Commerce Dam	North Commerce Lake	OCWRC	Commerce Twp.	6	262	Recreation
Proud Lake Dam	Proud Lake	MDNR	Commerce Twp.	4	104	Recreation
Hubble Dam	Hubble Pond	Village of Milford	Milford	25	77	Retired Hydropower
Kent Lake Dam	Kent Lake	HCMA	Milford	20	1200	Recreation
Flook Dam	Portage and Base Line Lakes	WCWRC	Pinckney	13	769	Lake level control
Barton Dam	Barton Pond	City of Ann Arbor	Ann Arbor	24	302	Hydropower/ drinking water
Argo Dam	Argo Pond	City of Ann Arbor	Ann Arbor	18	92	Recreation/ retired hydropower
Geddes Dam	Geddes Pond	City of Ann Arbor	Ann Arbor	25	261	Recreation
Superior Dam	Superior Pond	City of Ann Arbor	Ann Arbor	27.5	93	Hydropower
Peninsular Dam	Peninsular Pond	City of Ypsilanti	Ypsilanti	16	177	Retired hydropower
Rawsonville Dam	Ford Lake	Ypsilanti Twp.	Ypsilanti Twp.	45	1050	Hydropower/ recreation
French Landing Dam	Belleville Lake	Van Buren Twp.	Van Buren Twp.	38	1270	Hydropower
Flat Rock Dam	Huron River	HCMA	Flat Rock	12	188	Recreation

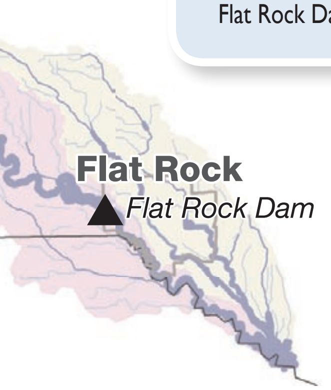


Table 2: Dams on the main stem of the Huron River watershed in Southeast Michigan. Dams are ordered from upstream to downstream. OCWRC = Oakland County Water Resources Commissioner's Office, MNR = Michigan Department of Natural Resources, HCMA = Huron-Clinton Metropolitan Authority, WCWRC = Office of the Washtenaw County Water Resources Commissioner

By implementing a communications network among dam operators and affiliates along the Huron River, members of this community will be taking proactive steps toward preparedness for crises events that are likely to become more frequent as climate change influences local weather patterns. Not only is it smart business, it is a climate adaptation strategy laying the groundwork for informed and timely responses to extreme events.

Synergistic benefits of additional data and network

The two strategies put forward by the Instream Flows Workgroup accomplish more together than either one alone. Below are a few examples of how a more robust river monitoring system and a Huron River Dams network together can improve flow management in the Huron.

Climate change will likely impact hydropower production. The ability to model rainfall-runoff processes and how these may change with anticipated changes to the climate can help facilities prepare for impacts to hydropower production. The network can be used to help determine mutually agreeable strategies for hydropower facilities in the face of changing supply.

The Michigan Lake Level Control Act sets legal limits for summer and winter lake levels for many of the lakes and reservoirs in the Huron River watershed. More frequent drought and/or flood level rainfall events require changes to the operation of lake level control structures in order to meet multiple goals such as flood control and maintenance of base flows throughout the watershed. Flow data can be used to model scenarios that challenge operator's ability to meet multiple goals. These scenarios can be used by the network to plan for watershed-wide response to extreme conditions that may otherwise result in conflict. Scenarios can also be used to work with the State and landowners to find workable solutions to a stressed system. The voice of an organized group of dam owners is more influential than any one in isolation. With high quality data and a unified voice, the network can advocate more effectively for changes necessary to gracefully managing flows under various conditions for multiple purposes.

The Huron River supports a fishery that attracts anglers from throughout Southeast Michigan. The Huron supports smallmouth bass and a steelhead run popular among sportsmen. The system could support a significant pike fishery if the fish regained access to floodplain wetlands where they spawn. We can improve the success of our fisheries by ensuring they have appropriate flows to support reproduction, maintenance of suitable habitat, migration and food sources. Models can determine key aspects of the natural flow regime that are vital to the success of fish. A river's flow regime is comprised of several components- the magnitude, frequency, duration, timing, and rate of change of hydrologic conditions (Richter et al. 1996). For example, flow is often a cue to species for a key life history transition such as reproduction or migration. Minimum base flows help ensure water quantity, temperature and oxygen needs are met. Variable flows shape habitat through the movement of sediment in a system creating the variety of habitats necessary for species success. Regulated rivers often deviate from a natural flow regime enough to compromise fish populations either through the stabilization or destabilization of flows or both (Poff et al, 1997). Flow models can determine flow parameters important to successful fisheries. No single operation can implement a meaningful environmental flow regime. The success of such a program requires the coordinated efforts of dam operators up and down the river.

An example of this approach would be using flows to help maintain a healthy smallmouth bass population. They are a popular sport fish in the Huron River, but there is evidence that they have not had successful hatches in recent years. Poor hatching success is associated with high June flows. Flow models could allow dam operators to work in concert to try and ameliorate June flooding to improve hatching success. Doing this about every three years would ensure that smallmouth bass populations in the river remain healthy, and the river remains a destination for anglers (Jeff Schaeffer, USGS, personal communication).

Conclusion

Additional gage data and data analyses coupled with a well networked group of dam operators and affiliates the communities of the Huron River watershed will support a model approach to flow management—one that is optimizing benefits across multiple water resource goals and prepared for any changes the future brings. Significant gains can be made in our knowledge of the system and our ability to forecast events. This will support smarter, more comprehensive planning and management of the river and improve preparedness for extreme events.


Photo courtesy of HCMA

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HRWC is a nonprofit coalition of local communities, businesses, and residents established in 1965 to protect the Huron River and its tributary streams, lakes, wetlands, and groundwater. HRWC works to inspire attitudes, behaviors, and economies that protect, rehabilitate, and sustain the Huron River system. Services include hands-on citizen education, technical assistance in policy development, and river protection and monitoring projects. See www.hrwc.org for information.

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Notes

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