



**Title:** Climate Adaptation & Watershed Model Update

**Prepared by:** Name: Becky Christopher and Brian Beck  
Phone: 952-449-1389; 952-471-8306  
bchristopher@minnehahacreek.org; bbeck@minnehahacreek.org

**Purpose:**

To provide an overview of a proposed framework for the District's climate adaptation strategy and an update on progress to date under the first phase of the process.

**Background:**

Climate Adaptation Framework:

The Minnehaha Creek Watershed District (MCWD or District) recognizes that climate change is already impacting our state and its water resources, and the effects of climate change are expected to accelerate in the coming decades. The changes in precipitation and temperature patterns pose a threat to both natural and built systems and impact the communities we serve. In order for the District to continue to work toward its vision of a Balanced Urban Ecology, it must develop a strategy to ensure that the watershed remains as resilient as possible.

Given the scope, scale, and complexity of this challenge, the District has begun this planning effort with a discovery phase of work to ensure that it is taking a thoughtful and strategic approach. Over the past year, staff has engaged the Citizens Advisory Committee (CAC) in a series of discussions to help the District explore its role and strategy for responding to climate change in coordination with state, regional, and local agencies. The CAC's role has been to provide advice, vet staff work product, and test the clarity of the District's messaging. This process included a situational assessment, consisting of three components:

- Climate Science – review of temperature and precipitation changes across our region
- Governance Scan – review of existing plans and defined roles in climate adaptation across state, regional, and local governments
- SWOT Analysis – discussions exploring the threats and opportunities posed by climate change and MCWD's strengths and weaknesses for responding

Staff has used these discussions with the CAC to draw insights about the District's role in responding to climate change and develop a high-level framework for its climate adaptation strategy. This draft framework serves to map the District's role in climate adaptation across three areas:

1. Understand and Predict – The District will utilize and expand its capabilities in data collection and analysis to understand and predict the impacts of climate change, establish goals, and evaluate potential solutions.
2. Communicate, Convene and Plan – The District will convene its partners to build consensus around the issues, align goals, and guide the development of a coordinated watershed-wide implementation plan.
3. Implement, Measure and Adapt – The District will implement projects, programming, and policy changes, in coordination with its partners, to achieve measurable progress toward the goals.

These three roles also represent three largely-sequential phases of work, with each informing the next. Staff plans to use this framework to build out a more detailed and refined Climate Adaptation Strategy in 2021. The findings and

insights from the CAC discussions, and the resulting framework, have been summarized in the attached CAC Climate Adaptation Series Report.

#### Phase I: Understand and Predict:

Work under Phase I of the Climate Adaptation Framework (Understand and Predict) is already underway thanks to recent investments by the Board of Managers aimed at expanding the District's tools to understand and predict how water moves through the watershed at a granular level. These tools, and progress made in 2020, include:

- Real Time Sensor Network (RESNET): High resolution water level, flow, and water quality data collection system to provide real time water level information to the public and to support model development.
  - *Progress Update*: In 2020, the RESNET system was operationalized through equipment infrastructure installation, data pipeline coding, and web data dashboard development in partnership with Hennepin County Emergency Management (HCEM).
- Machine Learning: Development of a machine learning model that can forecast future water levels based on the vast quantity of newly available real-time data, which will provide short-term water level forecasting at 25 locations throughout MCWD.
  - *Progress Update*: In 2020, District staff developed a machine learning model that predicts Minnehaha Creek water levels using stream data from the USGS and weather data from the HCEM's MESONET system.
- Two-Dimensional (2D) Watershed Model: Integration of regional landscape data and municipal infrastructure data to create a high resolution planning tool that pinpoints, quantitatively evaluates, and drive decisions on climate adaptation projects and policies.
  - *Progress Update*: In 2020, the Board of Managers authorized staff to submit an application to LCCMR, which was not selected by the LCCMR members for funding. District staff spent the remainder of 2020 and the beginning of 2021 improving the coalition of support, expanding staff's technical understanding of 2D watershed models, and exploring other potential funding sources.

#### Summary:

At the March 11 OPC meeting, staff will review and seek Board feedback on the work to date, the resulting Climate Adaptation Framework, and the proposed next steps to advance the District's climate adaptation efforts in 2021. These next steps include:

1. Continuing to progress Phase I (Understand and Predict) of the Climate Adaptation Framework by:
  - a. Finalizing implementation of RESNET and conducting a soft rollout of the web dashboard to partner agencies.
  - b. Hiring a third party entity to review the machine learning model to ensure it meets academic best practices.
  - c. Progressing the District's long term watershed prediction capabilities by building a pilot model to inform future model selection and developing a long term funding strategy.
2. Expanding and enhancing the Framework into a public-facing Climate Adaptation Strategy for Board adoption and external communication by the end of 2021.

#### **Supporting documents (list attachments):**

- CAC Climate Adaptation Series Report



Photo by: Justin Pruden

**MCWD CITIZENS ADVISORY COMMITTEE  
CLIMATE ADAPTATION SERIES REPORT**

*February 17, 2021 DRAFT*



**MINNEHAHA CREEK  
WATERSHED DISTRICT**



## Purpose

This report provides a synthesis of a series of meetings that were held with the Minnehaha Creek Watershed District (MCWD or District) Citizens Advisory Committee (CAC) to inform the development of the District's Climate Adaptation Strategy. Through these discussions, the CAC has contributed to the development of a situational assessment, insights regarding the District's role, and a high-level framework for the District's strategy. District staff will use this framework to build out a more detailed strategic roadmap for Board consideration later in 2021.

## Introduction

The MCWD recognizes that climate change is already impacting our state and its water resources, and the effects of climate change are expected to accelerate in the coming decades. The changes in precipitation and temperature patterns pose a threat to both natural and built systems and impact the communities we serve. As the effects of climate change are increasingly experienced across the watershed, the District has recognized the need to develop a clear strategy to effectively respond to these changes.

District staff worked with the CAC to conduct a situational assessment and develop insights about the District's role in climate adaptation. This process involved the following series of conversations with the CAC:

1. Climate Science – a presentation on Hydroclimatic Conditions & Changes from a State Climatologist ([March 3, 2020 CAC Meeting](#))
2. Governance Scan – review of existing plans and defined roles in climate adaptation across state, regional, and local governments ([June 16, 2020 CAC Meeting](#))
3. Role Framing – discussion and stress-testing of a high-level framework for the District's climate adaptation strategy ([October 14, 2020 CAC Meeting](#))
4. SWOT Analysis - conducting a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis to inform the District's response to climate change ([November 10, 2020 CAC Meeting](#))

The following sections summarize the key findings and insights that came out of this series of CAC meetings. This work has resulted in the development of a high-level framework for the District's Climate Adaptation Strategy. Staff will use this framework to develop a more detailed roadmap in 2021 that will guide the District as it works with its partners to develop a Climate Adaptation Implementation Plan in the coming years.

## Situational Assessment

### *Climate Science*

The first step in the process was to build a shared foundational understanding of the climate science. The District brought in Kenny Blumenfeld, Sr. Climatologist for the MN DNR State Climatology Office, to provide a presentation on precipitation and temperature trends for our region. The presentation was recorded and can be viewed on the District's [YouTube channel](#).

The presentation highlighted two main, interrelated trends for MN:

- Wetter: more precipitation, more snow, more frequent and larger extremes
- Warmer: especially at night, during winter, and when it's generally cold

Both trends have been observed already, and climate models project that these precipitation and temperature trends will continue into the future. Projections for MN show annual precipitation increases ranging from more than 4 inches in the central region of the state to less than one inch in the northeastern region of the state. It was also noted that we should still expect dry years, and even drought along the way, because of normal variations in our climate.

The presentation included some recent statistics for the Twin Cities that illustrate the magnitude of change that is already being observed:

- 2019 was the wettest recorded year for the Twin Cities and State
- 2010-2019 was the wettest decade on record for the Twin Cities
- 2010-2019 had the most precipitation coming from "heavy" rain events (1 inch or more/day)

The presentation also reviewed impacts that are occurring elsewhere in the world, but have not yet been observed in MN:

- Heat extremes: not yet observed, but likely to occur in MN by mid-century
- Drought: not yet observed, but possible increases by mid-century
- Tornadoes: trends and projections are unclear

The MN Environmental Quality Board's (EQB) [2020 State Water Plan](#) summarized the changes as follows:

"We know that some seasons can be far warmer, colder, wetter or drier than normal. The high variability we expect from Minnesota's climate can make it difficult to notice where, when and how climate has changed in our state. However, rapid, widespread changes are already underway, and more changes are coming. In the past several decades, our state has seen substantial warming that is most pronounced during winter and at night, increased precipitation and heavier downpours.

An overwhelming base of scientific evidence projects that Minnesota's climate will see additional, significant changes through the end of this century, with even warmer winters and nights and even larger rainfalls—along with the likelihood of increased summer heat and the potential for longer dry spells. Although we will experience occasional cool or dry years, climate scientists expect these increases to continue through the 21st century."

### *Governance Scan*

Given the scale and complexity of the challenges posed by climate change, as well as the scale and jurisdictional complexity of the watershed, the District recognizes that it does not have the capacity, authority, or resources to respond on its own. Effectively responding to these challenges across the

watershed will require coordinated action across various local, regional, state, and federal agencies. To understand the current state of climate adaptation planning across this broader governance framework, the District conducted a [scan](#) of existing plans across state, regional, and local governments. The following findings and conclusions were drawn from this scan:

#### State Agencies:

- Since July 2009, MN state agencies have been collaborating on climate adaptation efforts through the Interagency Climate Adaptation Team (ICAT). In 2017, the ICAT produced a report, [Adapting to Climate Change in Minnesota](#), which describes actions that state agencies are already taking in climate adaptation and provides recommendations for further priority actions.
- In December 2019, Governor Walz's Executive Order 19-37 established a Climate Change Subcabinet and Advisory Council to identify policies and strategies across state agencies to meet MN's greenhouse gas reduction and resilience goals.
- In September 2020, the EQB completed its [2020 State Water Plan](#) which established a framework for aligning state agencies, legislative priorities, and local government policy, programs and actions for the coming decade related to climate change. The plan defines goals, strategies and actions for key water issues related to climate.
- The District's scan of state plans found many priorities and goals around climate change adaptation and resilience, and corresponding actions in areas of monitoring, modeling, coordination, and education/outreach. The state has also lead the way in summarizing the impacts of climate change and is working to produce downscaled climate models to help communities plan for climate change. State agencies have not yet introduced changes to the regulatory framework or new standards in response to climate change.

#### Counties:

- Counties across MN have focused climate adaptation efforts primarily on gathering data (monitoring and modeling), providing education and outreach, and coordinating with other government entities.
- Hennepin County is in the final stages of developing its [Climate Action Plan](#) which includes initiatives to reduce greenhouse gas emissions and strategies to adapt to climate change in ways that reduce vulnerabilities and ensure a more equitable and resilient Hennepin County. The District is closely tracking the County's process and will continue to work with them to align our planning and implementation efforts.
- Neither the Carver County's Comprehensive Plan or the Carver County Watershed Management Organization Plan reference climate change.

#### Watershed Districts:

- Generally, watershed district plans throughout the state acknowledged that water levels are rising and that they are analyzing those trends. However, a minority of watershed districts (8 of 42 plans reviewed) have plans that identify climate adaptation policies or implementation actions.
- Several watershed district plans do state clear goals, priorities, and implementation activities related to adapting resource protection strategies in response to climate change. These include

additional monitoring, modeling/forecasting, identifying stormwater BMPs that need increased capacity, stricter permitting requirements, conducting education and outreach, and coordinating with other units of government.

#### Cities:

- Within the MCWD, the plans of the larger and more developed cities within the lower watershed (Minneapolis, Richfield, Edina, St. Louis Park, Hopkins, Minnetonka and Golden Valley) generally include climate change policies and action steps, while those in the upper watershed do not address the topic.
- Local entities leading in the area of climate change adaptation and resilience are engaged in monitoring climate change indicators, setting greenhouse gas reduction goals and reporting on outcomes, and community education on climate change resilience.
- The City of Edina's recently published Flood Risk Reduction Strategy is a leading example on climate adaptation planning efforts and policies.

#### *SWOT Analysis*

Based on the shared understanding of local climate trends and the state of climate adaptation planning across various levels of government, the CAC completed a Strengths, Weaknesses, Opportunities, and Threats (SWOT) workshop. Through this exercise, the CAC identified the external threats and opportunities posed by climate change as well as the District's internal strengths and weaknesses for responding. The full workshop summary can be found [here](#), and listed below are the responses that CAC members identified as most important:

#### Strengths

- MCWD has strong relationships with government entities at various levels and is viewed as a trusted and respected leader within the scientific and water resource community
- MCWD is known for its principles of sound science and has a wealth of data and the technical expertise to understand the water budget at a system scale
- MCWD has the capacity and track record for providing clear and effective communication to target audiences

#### Weaknesses

- MCWD has finite staff capacity and financial resources to address the needs and challenges presented by climate change
- MCWD has limited authority over land use change and limited ownership over the infrastructure that will be impacted by climate change
- MCWD is limited in its current technical capabilities to understand and predict the impacts of climate change

#### Opportunities

- MWCD can enhance its technical capabilities to predict and assess impacts and quantitatively evaluate management options to determine the most effective actions

- MCWD can build upon its existing relationships and position as a trusted leader to communicate threats and solutions
- As a regional agency, MCWD can act as a convener to build consensus and align resources for a larger impact
- MCWD can use this challenge as an opportunity for innovation, such as identifying new funding sources or pursuing bold demonstration projects

#### Threats

- Climate change poses numerous threats to natural resources, the built environment, and communities, including increased flooding, water quality degradation, and water contamination
- There are many agencies and stakeholders involved, each with their own interests, which could pull the District in many directions and make it difficult to align goals and priorities
- People may not trust or interpret the science in the same way which is a threat to building consensus and cooperation
- If the District takes a lead role in providing the technical understanding, there is a risk of our models being off and undermining our credibility

#### Insights

Based on this series of discussions between the CAC and MCWD staff, the following preliminary insights have been identified.

1. Given MCWD's mission, authorities, and the limited size of its operations, the District is best suited to focus its efforts on climate change adaptation (addressing impacts) rather than mitigation (addressing causes).
2. MCWD is a data driven organization, and any climate adaptation planning must be grounded in a strong quantifiable understanding of the issues climate change will bring to the watershed.
3. The District's ability to predict the impacts of climate change within our watershed and evaluate solutions is limited. The District must further develop its data-analytic capabilities to enhance its understanding as a foundation for implementation planning. It will take time and resources to develop those capabilities.
4. Climate adaptation planning at a state agency level is still in the early stages, and there is currently limited local planning guidance and no regulatory mandate for adapting to climate change within MN. Responsibilities for land and water management are dispersed across numerous agencies which are often siloed, making the development of a coordinated approach a challenge.
5. MCWD will be pressured to "solve" local manifestations of climate-driven hydrological shifts (e.g. local drainage issues). If the District doesn't develop a macro-strategy, it will get pulled into responding to micro problems that won't fundamentally address the larger drivers – versus operating at a system scale to help the watershed adapt in a sustainable and coordinated manner.



6. As a regional entity, and with its technical expertise, MCWD is uniquely positioned to serve as an information broker and work with other regional partners (e.g. USGS, DNR, counties) to understand the water budget and the upstream-downstream cause and effect across communities.
7. MCWD doesn't have all of the authority, have all of the resources, or own all of the infrastructure needed to adapt the watershed to climate change. Therefore, it must translate its data-driven system understanding for a diverse audience of stakeholders and develop a coalition of willing partners to build a cohesive watershed-wide strategy to proactively manage the change.

## Framework for MCWD's Climate Adaptation Strategy

Based on the situational assessment and insights that have been drawn from these CAC discussions, MCWD staff developed a high-level framework for defining the District's role and strategic response to climate change. This framework was discussed and stress-tested with the CAC at its October meeting. It frames the District's role as falling into three categories:

1. Understand and Predict
2. Convene and Plan
3. Implement, Measure, and Adapt

These three roles also represent three largely-sequential phases of work, with each informing the next. Before the District can take action to respond to climate change, it must first build out its understanding of the current and predicted future impacts of climate change. With this enhanced understanding, the District can then work with its partners to establish goals and evaluate potential actions to achieve those goals. From there, the District and its partners can define roles and develop a coordinated and effective implementation strategy. Below is a summary of the three phases and some of associated action steps that have been identified thus far.

### *Phase I – Understand and Predict*

During this first phase of work, the District will need to identify knowledge gaps and build out its organizational capabilities to better understand and predict the impacts of climate change within the watershed. The District's current data sets and analytical tools are insufficient to predict how specific areas will be impacted, establish goals, and quantitatively compare potential solutions.

Fortunately, advances in data science have made it affordable to collect exponentially more data and analyze it in more sophisticated ways. MCWD is developing a program to integrate and maximize the value of recent public investments in data collection to better predict the impacts of changing precipitation across the watershed, and to pinpoint, quantify and evaluate solutions.

This program would draw on existing investments made by MCWD, U.S. Geological Survey and Hennepin County in monitoring precipitation and watershed response across the District, which will collect more than 1 million real-time data points per year for precipitation, surface and shallow ground water levels, and pollutant loading. It will integrate this local understanding with state investments in producing

detailed topography of Minnesota, along with local municipal investments in digitizing storm sewer information.

The tools currently being proposed for development include:

- *Machine Learning*: Develop a machine learning model that can forecast future water levels based on the vast quantity of newly available remote sensing data, which will provide real time flood forecasting at 25 locations throughout MCWD
- *2-Dimensional (2D) Watershed Model*: Integrate state topographic and municipal infrastructure data to create a high resolution planning tool to pinpoint, quantitatively evaluate, and drive decisions on climate adaptation projects and policies.

Some of the actions steps that are currently planned for 2021 include:

- Continuing to build out the District's network of remote sensors, known as RESNET, which provide real-time data on water level, flow, and pollutant loading throughout the watershed
- Soliciting third-party feedback on the development of the District's predictive machine learning model
- Using staff, Board, and CAC input to define the questions that need to be answered to inform which model(s) will provide the capabilities needed
- Developing a pilot model within the Western Growth Area of the Six Mile Creek Subwatershed to test capabilities and inform the development of a watershed-wide model
- Developing a funding strategy and building support for the watershed-wide 2D model build

### *Phase II – Convene and Plan*

The District recognizes that its strategy for responding to climate change must be not only science-based but also collaborative and built on concrete partnerships. MCWD doesn't have all of the authority, have all of the resources, or own all of the infrastructure needed to adapt the watershed to climate change. Therefore, the District cannot define its role in a silo, but must contextualize it against the roles, responsibilities, and organizational capabilities of the cities, counties, and state agencies.

As a regional entity with strong technical and outreach capabilities, the District is well-positioned to serve as a convener and help to guide the development of a cohesive watershed-wide strategy to respond to climate change.

This Phase II work will involve bringing together the District's partners at the cities, counties, and state agencies to:

1. Share the District's data-driven system understanding and build consensus around the issues
2. Establish shared goals based on the data
3. Evaluate potential management strategies to achieve the goals
4. Establish priorities, roles, timelines, and funding strategy for implementation

The District is planning to form a standing technical advisory committee (TAC) in 2021 which will be made up of technical staff from the District's cities, counties, state agencies, and other key stakeholders. The group's initial focus in 2021 will be on the District's Permitting Program Alignment and Responsive Model. It is anticipated that the TAC will be the primary venue for engaging the District's partners in climate adaptation planning beginning in 2022.

In parallel to initiating the Phase I work in 2021, the District will continue to track and engage in planning efforts of partner agencies to understand how the governance framework is evolving over time and lay the ground work for Phase II. This will include:

- Continuing to engage with Hennepin County to align the District's strategy with the County's Climate Action Plan
- Tracking developments at state agencies and the legislature
- Communicating the District's strategy to its cities and other partners to set the stage for engaging them in TAC discussions in 2022-23

### *Phase III – Implement, Measure, and Adapt*

Finally, in Phase III, the District will implement its role as defined in coordination with its partners in Phase II. Based on the District's mission, authorities, and capabilities, implementation actions by the District may include any of the following:

- Projects - Implementing high-impact capital projects to manage the volume and rate of stormwater runoff
- Management Planning – Utilizing its own Watershed Management Plan and approval authority of city local water management plans to guide the management of water across municipal boundaries
- Policy Change – Establishing its own policies, and influencing the policies of other entities, for more effective land and water management
- Regulation - Aligning District regulations with state and local agencies to appropriately manage predicted impacts while reducing duplication between agencies
- Incentives – Providing incentives, such as funding or technical assistance, for projects by public and private partners through the District's Responsive Model
- Outreach – Conducting targeted, high-quality outreach to key stakeholders to enhance understanding of the science and build support for the actions needed to respond to climate change

The scope and scale with which the District may apply these management levers and programmatic activities will be informed by the goal setting and scenario planning in Phase II. Also critical in this phase will be ongoing effectiveness monitoring and adaptive management to ensure that the District and its partners continue to make measurable progress toward the goal.

## Next Steps

By utilizing the findings and insights gathered to-date through discussion with the CAC, this high-level strategic framework provides a foundation for staff and the Board to begin mapping out the District's approach in greater detail, beginning with Phase I – Understand and Predict.

The March CAC Meeting will mark the transition into this first phase of work with the Research & Monitoring staff presenting on, and facilitating discussion around, the District's current capabilities and preliminary plans for further developing capabilities to understand and predict the impacts of climate change.

The MCWD Board is about to begin a series of strategic discussions, which have been broken into three phases of work:

1. Phase 1 – Past – Where have we been and what have we learned?
  - a. A historical analysis to derive insights that underpin MCWD's identity today, and lessons for the future
2. Phase 2 – Present – Where are we now and what needs to be done?
  - a. A status report on current strategic priorities, and assessment of what will be required near term to execute
3. Phase 3 – Future – What challenges will we face in the future, and how can we prepare?
  - a. An inventory and education on emerging strategic issues the District wishes to begin preparing for (including Climate Adaptation)

As part of this process, it is anticipated that staff will begin to engage the Board in climate adaptation discussions sometime in third or fourth quarter of 2021. The timeline for these discussions will continue to be refined as the process progresses.

At this time, it is anticipated that this work will result in a Climate Adaptation Strategy that will be adopted by the Board and amended to the District's 10-year Plan. This will allow the District to communicate its approach to its partners and stakeholders ahead of formally engaging them in the development of a Climate Adaptation Implementation Plan for the watershed. Staff will report back to the CAC with progress updates at significant milestones throughout 2021.