

Exploring Policy Recommendations for Promoting Climate Resilient Watersheds

MS-STEP Capstone Paper | Spring 2022



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Sean Cullen, Hannah Dunn, Noah Fribley, Kayla Kirtz, and Madeline K. Lydon

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Acronyms

1W1P - One Watershed, One Plan

BMPs - best management practices

BWSR - The Board of Water and Soil Resources

CWMP - Comprehensive Watershed Management Plan

CC - Climate Change (figures only)

NOAA - National Oceanic and Atmospheric Administration

Terms

Planning Partnerships – Local governments and stakeholders within watershed boundaries that work together to develop a CWMP under the 1W1P program.

Technical Service Area – A group of Soil and Water Conservation Districts in Minnesota that sign a Joint Powers Agreement to share resources and information for conservation work.

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Executive Summary

This report was prepared for the Board of Water and Soil Resources (BWSR) by students from the Humphrey School of Public Affairs. The goal of this report is to convey the results of our investigation of the extent to which currently published Comprehensive Watershed Management Plans (CWMPs) are addressing and/or incorporating climate resilience strategies, to support BWSR's ultimate goal of creating more resilient watersheds throughout Minnesota, and to provide recommendations for encouraging increased adoption of climate resilience strategies. These recommendations are:

- Do Not Require Climate Resilience
- Shift from Prioritization Framework to Risk Framework
- Improve Consultant Relationships
- Leverage Regional BWSR Staff Involved in 1W1P
- Conduct a Climate and Equity Audit
- Increase Funding
- Provide Technical Resources
- Promote Climate Resilience Outside of BWSR
- Improve Public Engagement

We arrived at these recommendations after conducting an analysis of the 27 available CWMPs; a survey of 225 planning partners; and interviews with four consultants, one climate scientist, and BWSR staff.

Introduction

BWSR is a state agency whose mission is "to improve and protect Minnesota's water and soil resources by working in partnership with local organizations and private landowners." BWSR administers the One Watershed, One Plan (1W1P) program which brings together local governments and stakeholders (planning partnerships) within watershed boundaries to prioritize shared issues and goals into a comprehensive planning document. The final product, a CWMP, is intended to guide the watersheds with actionable steps to address watershed related issues over the course of 10 years.

Minnesota's climate is undergoing changes, which will likely impact humans and resources within Minnesota's watersheds. Increased precipitation patterns and more frequent extreme weather events will affect environmental systems such as soil health, water quality, and infrastructure integrity.ⁱⁱ It is necessary that planning partnerships address climate change on a

watershed scale. Currently, there is a lack of clarity about the extent to which CWMPs created through the 1W1P program are acknowledging and/or incorporating climate change and associated impacts. This lack of clarity may lead to inadequate implementation of climate resilience strategies, which is an identified concern of the 1W1P program. The research team was tasked by BWSR to investigate the extent to which currently published CWMPs are addressing and/or incorporating climate resilience strategies, thus supporting BWSR's ultimate goal of creating more resilient watersheds throughout Minnesota.

First, it was important to develop a comprehensive understanding of how the currently published CWMPs are incorporating climate change and climate resilience. This question guides the overall process of our research, during which we compiled the depth and range of climate change mentions as well as climate change related strategies articulated in CWMPs. These objective efforts were supplemented by interviews and a survey of questions that ranged from inquiry into attitudes and perceptions about climate change to feasibility of climate resilience strategies to the implementation process of climate strategies. Planning partners and stakeholders provided valuable insight into how climate resilience strategies could be expanded in the 1W1P framework. We determined barriers to addressing climate resilience in watershed planning and analyzed potential strategies that would assist stakeholders in overcoming these barriers. The identification of tools and priority actions for BWSR to take is intended to inspire future action for the development of the 1W1P program as it pertains to climate resilience.

Our team intentionally considered equity as a critical component of this research. The effects of climate change in Minnesota will be felt more significantly by historically marginalized populations.ⁱⁱⁱ Therefore equity must be considered in watershed planning as it pertains to climate resilience.

The methods, results, as well as pertinent background information comprise the following sections of this report. Finally, this report concludes with a series of recommendations for BWSR to adopt in order to create a more holistic 1W1P program that incorporates climate resilience into all elements of the planning process. Stakeholders within planning partnerships have a large influence on the content of CWMPs. It is therefore imperative that planning partnerships prioritize climate change and resilience as an integral part of their CWMPs. This cannot be accomplished without ample support, tools, and collaboration from BWSR as administrators of the 1W1P program.

Background and Context

Minnesota's Changing Climate

Minnesota's climate is projected to undergo changes over the coming decades that may have significant impacts on human and non-human systems at the watershed scale, including fundamental changes to hydrological regimes of watersheds.^{iv} Increases in mean annual precipitation, as well as more frequent extreme precipitation events, could mean more flash flooding, soil erosion, nutrient runoff, and threats to human infrastructure. Rising average temperatures could also lead to changes in freeze/thaw cycles, warmer surface water temperatures, and a greater likelihood of drought. As a result of these changes, biotic communities will likely face new pressures and threats that could impact their ability to survive and/or flourish.^v

Climate Resilience in Water Systems

Definitions of resilience, in the context of water resources and otherwise, can vary widely, and terms like resilience, adaptation, and adaptive capacity are sometimes used interchangeably.^{vi} Climate resilience may generally be thought of as the capacity of a water system to sustain a desired set of conditions in the face of disturbance and ongoing climatic changes.^{vii}

While what constitutes a water system is equally convoluted, the concept of a social ecological water system (such as a municipal drinking supply or a river system) provides some structure to the term water system.^{viii} Social ecological water systems can be disaggregated into:

- **Ecosystems**, defined by the interactions and dynamics among living and non-living entities (such as species composition, rainfall patterns, and soil types).
- **Engineered systems**, which includes human modifications (such as dams, impervious surfaces, or water treatment facilities) to watersheds in ways that impact the fate of water and the systems that depend on it.
- **Social/institutional structures**, which determine how and why decisions that impact water resources are made.

A social ecological water system's resilience to abrupt and ongoing disruptions due to climate change is thus a function of the interactions between, and the interdependence of, these components.^{ix,x} Resilience in a social ecological water system stresses interconnectivity and holism, in that any one aspect of the system cannot be properly understood and analyzed without consideration of the system itself.

Climate Resilience in Water Management and Planning

Most discussions of, and tools for, climate resilience planning in the water sector are in the context of municipal water systems – stormwater, wastewater, and drinking water infrastructure. Climate resilient water plans attempt to prevent, and adapt to, likely shocks and stressors throughout a municipal water system, as well as likely impacts. These efforts often focus on infrastructure, sometimes to the level of a specific facility or network of facilities.^{xi} Minnesota governor Tim Walz’s 2020 state budget proposal included close to \$300 million towards resilient stormwater, waste water, and drinking water infrastructure — with little consideration towards ecosystem health or reforms to decision making processes.^{xii}

Increasingly, in the spirit of holism and interconnectivity that resilience theory promotes, water system resilience planning is included in city-wide (and sometimes county-wide) resilience plans. Water resilience planning in this model stresses the importance of responding to extreme weather, the interplay between systems like stormwater infrastructure, drinking water supply, energy and transit systems, and disaster response mechanisms.^{xiii} Human health and wellbeing outcomes are frequently cited as important considerations for planning decisions, as well as the realities of inequitable impacts across demographic groups.^{xiv}

Some examples of resilience planning programs and toolkits on a larger (watershed or basin) scale do exist (see Table 1). As resilience planning at this scale is a very new practice, little evidence of program and/or planning efficacy is available. Additionally, best practices in resilience planning suggest a variable process depending on the idiosyncrasies of the planning entity and the social ecological water system it serves.^{xv} Directly comparing the strategies and outcomes across plans can therefore be difficult.

Resilience Effort	Description
Iowa Watershed Approach	State-level voluntary planning program, similar to 1W1P, but mainly focused on flood resilience.
The Community and Watershed Resilience Program (California)	Local planning program, instigated in response to a singular event, that works with communities within a specific watershed. No overseeing authority or planning structure.
The Adaptive Watershed	Training program through the International Institute for Sustainable Development intended to “expose local decision-makers to

	a range of issues and build understanding and capacity for implementing integrated, equitable, adaptive management in watersheds.”
A Framework for Resilience: Responding to Climate Change in the Deerfield River Watershed	Watershed-specific framework intended for use by water managers throughout a watershed in Massachusetts.

Table 1 Examples of water resource resilience planning at the watershed scale.

Climate Resilience and Equity

Discussions of, and frameworks for, climate resilience, as they relate to water resources specifically and environmental concerns more broadly, are increasingly integrating equity as a foundational consideration. Current and future effects of climate change will have significant yet differing impacts across geographies based on the physical properties of a specific watershed or area, but those effects will also disproportionately impact the human communities whose lives and livelihoods are tied to the natural environment. Increasingly, water resource managers and planners are reckoning with the human impacts of their decisions as codified in strategies like CWMPs.

The ability of individuals and communities to not just survive, but thrive, in a world with a changing climate is in part dependent on pre-existing inequities. Access to financial resources for extreme weather preparation, vulnerabilities to changes in water quality over several time scales, and loss of human and/or economic health can all be tied to baseline levels of income, ease of participation in governance and programs, and systemic structures that are unevenly distributed across demographic groups. While CWMPs are often perceived as water resource management tools, the priorities identified in CWMPs will have direct and indirect impacts on human communities within their respective watersheds. Particularly as climate change impacts the natural resources of a watershed, considering equitable priorities and outcomes in plans is a necessary component of climate resilience.

One Watershed, One Plan

The 1W1P program, administered by BWSR, brings together local governments and other stakeholders within watershed boundaries in Minnesota to discuss and prioritize their shared issues and goals. The final product of this program is a CWMP that provides actionable steps to address those challenges and determines how progress will be measured over the 10-year lifespan of the CWMP. The CWMPs created through 1W1P replace plans defined in Minnesota statutes for non-metro (outside the 7-county Twin Cities Metropolitan Area) counties, soil and

water conservation districts, and watershed districts. CWMPs created through 1W1P must analyze and prioritize issues of concern within a specified watershed, provide measurable goals to address those issues of concern, and clearly define an implementation schedule to accomplish those goals. Although participation is voluntary, the legislature directed BWSR to write a transition plan to reach a goal of full statewide participation (excluding the metro area) by 2025.

Sixty-one geographic planning boundaries are currently delineated by BWSR for the development of CWMPs. As of March 2022, 25 of these boundaries had CWMPs approved as a part of the 1W1P program (Figure 1). At the time of our research, there were two boundaries that had plans in the final 90-day review process. As 1W1P is a voluntary program, BWSR incentivizes participation in the program through financial support for the planning process. Staff also assist in the coordination of the planning process, including providing resources, facilitation, and expertise. In addition to the resources BWSR provides for participating groups, current best practices in water resource management highlight the benefits to a watershed that often accompany planning using watershed, not political, boundaries.^{xvi}

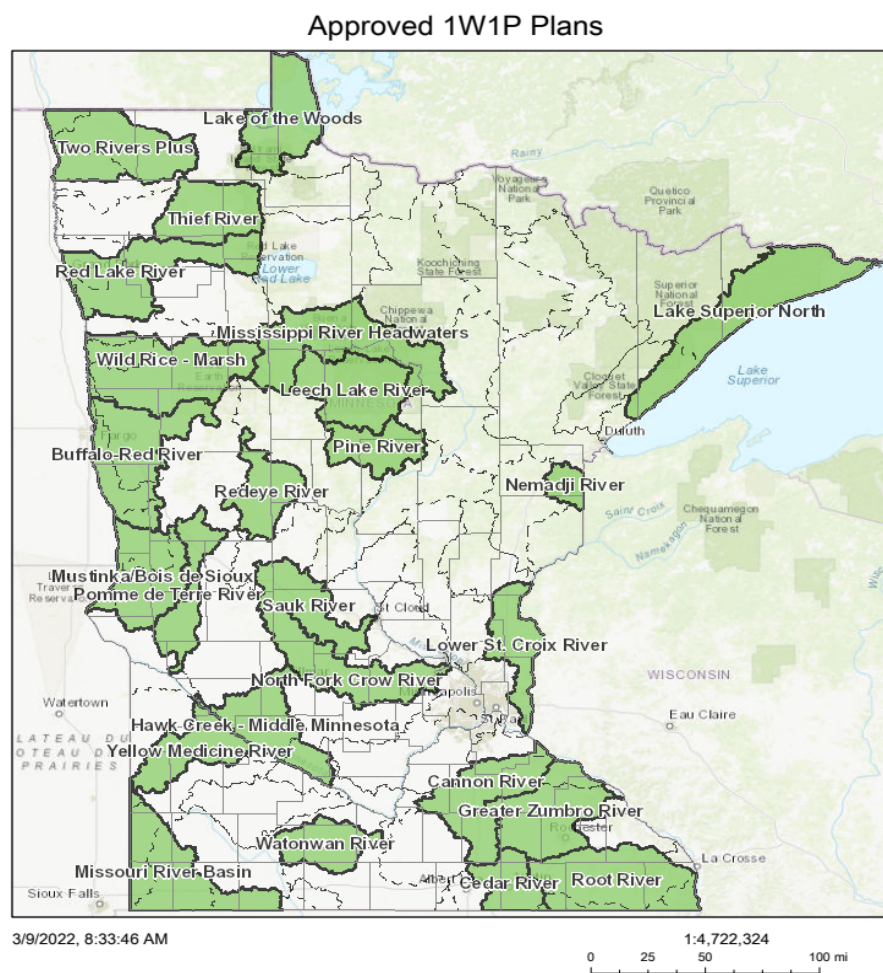


Figure 1 1W1P planning boundaries that have approved CWMPs. This map does not include the two CWMPs (Shell Rock - Winnebago and Rum River) that were in the final 90-day review process as of March 2022.

Plans created through the 1W1P program generally follow Minnesota's Water Management Framework (see appendix A), which was created in 2014 to "enhance collaboration and clarify roles in an integrated water governance structure." The framework describes an adaptive management cycle and describes roles and products of agencies during each step. This framework builds on a watershed approach for data collection and analysis and strategy development, providing information organized on a watershed basis that can be used for local planning.

Policy and advisory committees are the main groups involved in determining the contents of CWMPs created through the 1W1P program. Policy committees, which are ultimately responsible for making final decisions about plan contents, are composed of representatives from each local water planning authority, as well as any participating municipalities and tribal nations. Advisory committees, tasked with making recommendations about plan contents to policy committees, include representatives from a wider variety of subject matter experts and stakeholders (such as non-profits, state agencies, etc.) as well as staff from the participating local and tribal governments. A steering team provides logistical support and guidance throughout the process. Steering teams consist of staff from participating local and tribal governments, BWSR staff, and consultants hired by the planning group.

BWSR provides templates, guidance, and resources to help the different committees work through the process of creating a CWMP. The planning process has three central phases: 1) pre-planning, during which the participating entities commit to working together and agree to an overall process; 2) the planning phase, wherein committees work to agree on contents of the CWMP; and 3) plan review and submittal for approval by BWSR. The plan is in effect for ten years after being approved, with a review of plan implementation at the mid-point.

Methodology

Our methodology consisted of a qualitative assessment of the efficacy of the existing 1W1P program in achieving climate resilient plans. This was followed by data collection from a survey and interviews about the current mindset of watersheds and barriers to achieving climate resilient plans. Together, these three elements informed our recommendations. See Figure 2 for a description of our methodology.

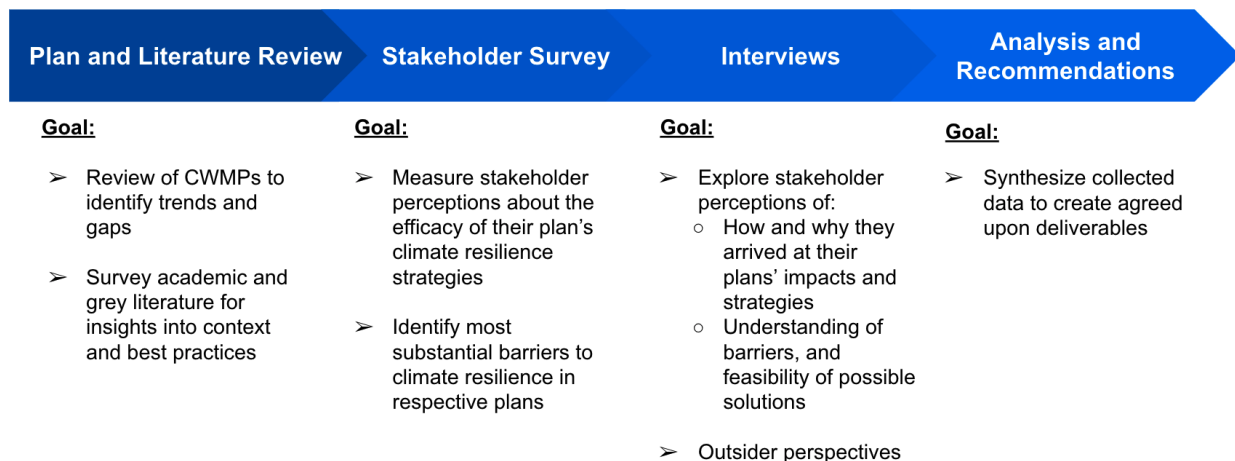


Figure 2 Process model for our research methodology, including goals of each step.

CWMP Analysis

First, we systematically reviewed each of the 25 approved plans and the two plans submitted for review to assess the extent to which the CWMPs created through the 1W1P program acknowledge and/or incorporate climate change and associated impacts. We divided the plans amongst our team and analyzed them for specific terms related to climate change and resilience, as well as language that alluded to climate change and its impacts. Specific terms and phrases we searched for included *climate change*, *resilience*, *changing precipitation patterns*, *extreme weather*, *National Oceanic and Atmospheric Association (NOAA) Atlas 14*, and *model*. We identified these as terms for our analysis based on expert study of the changes Minnesota is likely to experience due to climate change.^{xviii} We created a spreadsheet to track data – including relevant quotes, tables, and plan sections – that revealed how plans were explicitly stating the aforementioned terms and phrases. During this process, we noticed that climate change was frequently being discussed under the “Emerging Issues” section of CWMPs. We decided to quantify this because labeling climate change as an emerging issue is not consistent with the reality that Minnesota’s watersheds are already being impacted by it. Following this preliminary analysis of CWMPs, we determined the depth and range of climate change impacts and related strategies as articulated in the plans. A second spreadsheet was created, which we used to track whether or not plan content could answer the following questions:

- Does the plan explicitly mention “climate change?”
- Does the plan include any goals, action items, or intent to address effects of climate change?
- Does the plan consider climate change an “emerging issue”?

- Does the plan explicitly mention “resilience”?
- Does the plan include any goals, action items, or intent to address the effects of resilience?
- Does the plan explicitly mention “changing precipitation patterns” or “extreme weather events”?
- Does the plan include any goals, action items, or intent to address “changing precipitation patterns” or “extreme weather events”?
- Does the plan mention the use of NOAA Atlas 14?
- Does the plan mention the use of predictive precipitation modeling?

From this information, we created a table that easily visualizes the patterns our analysis uncovered.

Survey

After examining the approved CWMPs from watersheds participating in the 1W1P program, we conducted a survey targeting participants in 49 active or completed 1W1P efforts. The purpose of the survey was to measure stakeholder perceptions about the efficacy of the climate resilience strategies in their CWMPs and identify the most substantial barriers to incorporating climate resilience. The survey recipients were provided with an explanation of our project, which made it clear that although our research was sanctioned by BWSR, it was ultimately the sole responsibility of our team.

There were four sections to our survey, which are summarized below. Recipients were provided with context and relevant information at the beginning of each section.

- **Section 1:** We sought to understand the participants’ experiences during the CWMP planning process.
- **Section 2:** We sought to understand potential options for increasing climate change resilience through watershed planning.
- **Section 3:** We sought to understand the perspectives of the CWMP authors and participants on incorporating climate change resilience into the planning process.
- **Section 4:** We sought to gather additional information from respondents.

Most questions allowed respondents to provide text answers. A copy of the survey form that was sent to each participant – including introductory text – is in Appendix B.

The survey was created using Qualtrics, a web-based survey software, and individualized participant links were distributed via email. BWSR provided our team with a comprehensive list of 1W1P participants. This list included policy committee members, advisory committee members, BWSR staff, and consultants. Using this contact list as a foundation, we created a smaller list of survey recipients, comprised of only policy and advisory committee members

from across the state. The survey was sent to 857 possible respondents and was open from March 3rd to March 25th, 2022. After filtering out respondents who opened the survey without completing any questions, we had 225 total responses.

After the survey closed, a CSV file of results was exported from Qualtrics to analyze the written comments for common themes. For quantitative summaries of our survey results, we used the graphs generated by Qualtrics and modified them for export.

Interviews

Interviews were conducted to gather perspectives from BWSR staff, consultants, and subject-matter experts. The main purpose of these interviews was to validate themes and key takeaways from our survey and plan analysis. We interviewed a subject-matter expert to better understand NOAA Atlas 14 and predictive climate and precipitation modeling. We also interviewed four consultants from firms heavily involved in the 1W1P process and conducted a focus group with staff from BWSR's Water Planning Team. We chose these interviewees once we had completed the CWMP analysis and received some preliminary survey responses. We sourced our potential interviewees through our personal networks and with the assistance of BWSR personnel. Our informed consent script and example interview questions are located in Appendix C.

The following section will present our findings from the CWMP analysis and the survey.

CWMP analysis findings will be broken down into four categories:

- Patterns Identified by CWMP Analysis: Climate and Related Issues are Mentioned Far More Than They are Addressed
- Climate Change
- Resilience
- Modeling

Results from the survey will be presented in three sections:

- Understandings of Climate Change and Resilience
- Personal Opinions of Climate Change and Resilience
- Incorporation of Climate Resilience into CWMPs

A summary of our key takeaways from the CWMP analysis and the survey will be presented before we begin our discussion of barriers to incorporating climate resilience in future plans. That section was informed by our CWMP analysis, survey, and interviews. Finally, we will

provide recommendations for incorporating climate resilience into future CWMPs created for the 1W1P program that are based on our findings.

Current Status of Climate Change and Resilience in Approved Plans

CWMP Analysis

Watershed	Climate change	Climate change goals/action items/intent	Climate change classified as an emerging issue	Resilience	Resilience goals/action items/intent	Changing precipitation patterns and extreme weather events	Precip/weather goals/action items/intent	NOAA Atlas 14	Future looking precipitation models
Root River	X	X	X	X	X	X		X	
Yellow Medicine River	X		X	X	X	X		X	
Lake Superior North	X	X		X	X	X	X	X	
Red Lake River	X			X				X	
North Fork Crow River	X		X	X	X	X	X	X	
Leech Lake River	X	X		X	X	X		X	
Lake of the Woods	X		X	X	X	X		X	
Pine River Watershed	X		X	X	X	X			X
Missouri River Watershed	X			X		X		X	
Cedar - Wapsipinicon						X		X	X
Thief River	X		X	X	X	X	X	X	
Cannon River	X	X		X	X	X		X	
Pomme de Terre River	X			X	X	X			
Leaf, Wing, Redeye	X			X	X	X			
Buffalo-Red River	X		X	X	X	X	X	X	
Lower St. Croix	X	X		X	X	X	X		
Nemadji	X	X		X	X	X	X		
Wild Rice - Marsh River	X	X	X	X	X	X	X		
Watonwan River	X		X	X	X	X	X	X	
Bois de Sioux and Mustinka Watershed	X		X	X		X		X	
Two Rivers Plus	X	X	X	X		X		X	
Sauk River	X		X	X	X	X		X	
Mississippi Headwaters Watershed	X			X	X	X		X	
Greater Zumbro	X	X		X	X	X	X	X	
Hawk Creek-Middle Minnesota	X	X		X	X	X			
Rum River	X	X	X	X	X	X	X	X	
Shell Rock - Winnebago	X		X	X		X	X	X	
Total	26	10	14	26	20	26	11	20	2
Percent	96%	37%	52%	96%	74%	96%	41%	74%	7%

Table 2: Consolidated CWMP Analysis

This section will present findings from our analysis of the 27 existing CWMPs in the 1W1P program. First, we will present how climate change is represented and talked about in the CWMPs. Second, we will present how resilience is represented and addressed. Third, we will look at the language around changing precipitation patterns. Finally, we will discuss the presence of climate modeling and its use in CWMPs.

Patterns Identified by CWMP Analysis: Climate and Related Issues are Mentioned Far More Than They are Addressed

Of the 27 available CWMPs, 96% explicitly mention “climate change”. Only one plan did not explicitly mention climate change. Of the plans that explicitly mention the term “climate change,” over half (51.9%) classify climate change as an “emerging issue”. Delineated goals, action items, or explicitly expressed intent to address the effects of climate change within their watersheds are found in 37% of the plans. These patterns are indicated in the columns labeled “Climate change,” “Climate change goals/action items/intent,” and “Climate change classified as an emerging issue” in Table 2 (an “x” indicates we identified language in that specific plan).

Like explicit mentions of climate change, 96% of available CWMPs explicitly mention “resilience”. Only one plan did not explicitly mention resilience. Just over half (51.9%) of the plans that mention resilience consider resilience to be an emerging issue. Nearly 75% of the plans have delineated goals, action items, or explicitly expressed intent to address resilience within their watersheds. These patterns are indicated in the columns labeled “Resilience” and “Resilience goals/action items/intent” in Table 2.

BWSR documents describe predicted changes in Minnesota’s weather patterns, including higher minimum temperatures, changes in precipitation trends, and more severe weather.^{xviii} We considered this explanation of changing weather patterns to be “de facto” inclusion of climate change. Of the 27 available CWMP’s, 96% explicitly mention “changing precipitation patterns” and/or “extreme weather events.” Only one plan did not mention precipitation or extreme weather events. Delineated goals, action items, or explicitly expressed intent to address changing precipitation or weather within their watersheds are found in 41% of plans. These patterns are indicated in the columns labeled “Changing precipitation patterns and/or extreme weather events” and “Precip/weather goals/action items/intent” in Table 2.

Of the analyzed CWMPs, 74% (20 plans) mention the NOAA Atlas 14 database and indicate infrastructure plans for the watershed rely heavily on the information provided in it. Seven percent (two plans) of the analyzed CWMPs mention predictive precipitation modeling. Of

these two CWMPs, one supplements NOAA Atlas 14 data with a predictive precipitation model, and one solely utilizes a predictive precipitation model. These patterns are indicated in the columns labeled “NOAA Atlas 14” and “Future looking precipitation models” in Table 2.

Climate Change

Fifty-two percent of the CWMPs analyzed classified climate change as an emerging issue. We determined this classification by noting which plans explicitly categorized climate change as such. For example, the Buffalo-Red River CWMP, has a subsection of their plan titled *Emerging Issues*, under which they list climate change, and state:

“This plan recognizes the potential implications of climate change by encouraging the use of updated design standards for water resource infrastructure, based on National Oceanic and Atmospheric Administration (NOAA) Atlas 14” ^{xix}

The Two Rivers Plus CWMP also has a subsection called *Emerging Issues*, under which they list “Changing Climate”. Here, the plan talks about how Minnesota’s average temperature has increased every decade, and cites climate data from FEMA, NOAA, and the Minnesota DNR.

Some plans address climate change in a blanket statement of intent. For example, the Wild Rice - Marsh River CWMP contains the following statements, which we considered to be statements of intent to address climate change throughout the plan, but not necessarily with specific action items:

“Minnesota’s climate is already changing and will continue to do so in the future; therefore, it should be considered in a long-term planning effort, as encouraged in the BWSR Climate Change Trends and Action Plan” ^{xx}

“To address the potential implications of climate change in the watershed, the activities implemented in this plan aim to include both mitigation (practices that mitigate the effects of climate change by storing carbon in the soil) and adaptation (enhancing the resiliency of the watershed to future changes) (BWSR 2019)” ^{xxi}

We considered a goal or action item as addressing climate change when an explicit connection was made between the two by the CWMP. For example, the Cannon River CWMP has a “10 Year Measurable Goal” that states:

“Evaluate the impact of climate change on the watershed’s resources and infrastructure to identify potential flooding issues”^{xxii}

The Leech Lake River CWMP explicitly connects action items to climate change in a different way. This plan has a section called “Climate and Risk”, in which there is a list called “Actions to Address Climate Change” (pg. 25), which denotes which of their action items were created to address climate change and its associated impacts.

Resilience

Ninety-six percent of the CWMPs explicitly mention “resilience”. Seventy-four percent of plans express intent to address resilience or contain concrete goals or action items.

Similar to expressing intent to address climate change, some CWMPs contain blanket statements indicating that resilience is being addressed throughout the plan, even in the absence of associated action items. For example, the Sauk River CWMP states,

“To reduce this threat and provide resiliency to these lakes, protection measures that are primarily accomplished through land use controls should be considered”^{xxiii}

Lake of the Woods also expresses intent to address resilience through an implementation action to,

“promote conservation programs that recognize and/or provide incentives to landowners for the multiple benefits resulting from implementation of BMPs [best management practices] that improve water quality, provide resilience against flood damage, and protect/enhance wildlife habitat and biodiversity”^{xxiv}

We considered a goal or action item to be addressing resilience when an explicit connection was made between the two by the CWMP. For example, the Leaf, Wing, Redeye CWMP has a goal that states:

“This water retention goal applies to the watershed outlet. The outlet is located near Staples, MN where the Redeye River joins the Crow Wing River. The current monitored discharge at the watershed outlet is 368,196 acre-feet. The short-term goal is to maintain this current average discharge, build resilience to increasing precipitation trends with soil health practices, and continue the Watershed Pollutant Load Monitoring Network program at site S001-931”^{xxv}

The Lower St. Croix CWMP outlines a goal that focuses on a different aspect of resilience from the Leaf, Wing, Redeye CWMP. They intend to address resilience in their watershed by pursuing the goal to

“Increase in the number of diverse landscape designs and plantings resilient to climate change”^{xxvi}

Some examples of action items that address resilience can be found in the Buffalo-Red River and Rum River CWMPs, which are respectively highlighted below

“Investigate potential locations for developing water storage in municipalities, shoreland areas, and small developments to improve water quality and increase resiliency to extreme weather events”^{xxvii}

“Coordinate with MNDNR on Forest Resilience Planning in the Watershed”^{xxviii}

Changing Precipitation Patterns and Extreme Weather Events

Ninety-six percent of the CWMPs explicitly mention “changing precipitation patterns” and/or “extreme weather events”, while delineated goals, action items, or explicitly expressed intent to address changing precipitation or weather within their watersheds are found in 41% of plans.

Examples of blanket statements that express intent to address changing precipitation patterns and extreme weather events can be found in the Yellow Medicine and Sauk River CWMPs:

“Data indicate temperatures and precipitation patterns are increasingly changing, including intensity, frequency, and duration of precipitation events as well as increased length between precipitation events. These precipitation patterns will influence the way agriculture, the major industry, and land use of the watershed require and use surface water and groundwater in the future”^{xxix}

“To fully address future planning efforts, the impact of extreme climate and precipitation events must be considered”^{xxx}

The Root River, North Fork Crow River, Lake of the Woods, Missouri River Watershed, Buffalo Red River, and Watonwan River CWMPs all use very similar language – which comes from the

Minnesota Pollution Control Agency – to express their intent to take changing precipitation patterns and extreme weather events into account. For example, the Missouri River Watershed CWMP says:

“It is important to understand these changes in regional climatic trends because they impact water resources and their management” xxxi

Goals and action items to address changing precipitation patterns and extreme weather events vary greatly in scope from plan to plan. Here are two examples for Greater Zumbro and North Fork Crow River, respectively:

“Mitigate/minimize increases in peak flow (relative to currently estimated conditions) resulting from increased precipitation and climate trends” xxxii

“Monitor precipitation and increase the number of volunteer rain gauge readers to evaluate short and long-term trends and their relationship to groundwater supplies and lake levels” xxxiii

Modeling

Twenty of the CWMPs mention the NOAA Atlas 14 database, while two plans mention utilizing predictive modeling. The plans that supplement the NOAA Atlas 14 data with predictive models are the Pine River Watershed and Cedar-Wapsipinicon CWMPs. Cedar-Wapsipinicon supplements NOAA Atlas 14 data with the predictive model, while Pine River solely utilizes predictive modeling.

The predictive model utilized by the Cedar-Wapsipinicon CWMP came from the University of Minnesota,^{xxxiv} while the Pine River Watershed used a model that was utilized in their Pine River Watershed Restoration and Protection Strategy.

While the Sauk River CWMP currently utilizes NOAA Atlas 14, they identify a strategy to implement stormwater monitoring in their watershed with the goal of creating a storm water model specific to their area.

Survey

In addition to the CWMP analysis, survey results informed our research team about the incorporation of climate change and resilience into existing plans and planning partnerships’ attitudes about these topics. This section will present some of the findings from the survey,

particularly the questions that more specifically target the perceptions and proceedings from CWMP planning efforts that have already taken place and that may inform potential challenges and recommendations.

Understandings of Climate Change and Resilience

We designed some of our survey questions to gain an understanding of how participants within planning partnerships currently understand climate change and resilience. This section dives into these questions to form a foundation for the type of information that respondents use in order to comprehend these topics.

The first question in the survey was **“During the planning process, do you feel like you had the information you needed about likely climate related changes in your watershed over the coming decades?”** This question had 218 total responses. More people (n = 125) responded yes to this question but there were still 93 respondents (only 32 less than the yes respondents) that felt like they did not have the necessary information about climate changes in their watershed.

In this question, survey respondents identified some specific information gaps that they thought would be necessary to fill in order to effectively consider climate change and resilience. Since this was the first question and provided the chance for respondents to write in a text box, some respondents took the opportunity to voice their overall opinions of the survey and of climate change discussions during the planning process. It is clear that ideology and political beliefs play a role in the CWMP planning process.

Most people who felt like they **did not have** enough information expressed that there is a lack of available information.

“I responded no because the current set of data and information is insufficient to provide guidance for this level of watershed planning.”

“Many of the northern communities of the HUC 8 watershed do not have the data necessary to consider climate change.”

“There was little information on potential changes to precipitation, temperature, and the impacts to fish and wildlife.”

People who felt like they **did have** enough information responded with elaborations similar to the following:

"There is a lot of information to understand but yes it has been available."

Others responded that climate change was not a consideration in their planning process, therefore they did not need such information. Others explicitly responded that they themselves did not believe in climate change or that local officials did not want it included.

"Climate change was not discussed during the 1w1p planning process."

"Stop promoting climate change lies at all levels. Forever."

"We have the information, but local electeds often doubted its veracity and would refuse to incorporate it into the plan."

Additionally, it is possible that some respondents did not know what information they were missing or did not identify certain issues as related to climate change.

"We knew and incorporated many anticipated changes, but there may be more effects. Your question makes me wonder..."

"Some might be climate related but some of the issues are additional landowner drainage that maybe took a day or two to get into the ditch system."

Another interesting finding highlighted the importance of consultants in the planning process.

"models were presented by engineering company"

"The consultant hired to prepare the plan address [sic] this just as they should. Not too much and not too little."

The responses to the question of whether survey respondents thought they had the necessary climate change and resilience information provided our research team with an understanding of the spectrum of views on the topic - ranging from a desire to include better information to climate change is not real. Responses also shed light on the fact that there are indeed gaps in

the information available or provided to those who have a desire to incorporate climate change and resilience into CWMPs.

This next question asked respondents about **what sources of information they are most likely to use to learn about impacts of climate change**. This question had 202 responses, with “local, state, or federal government resources” receiving the most responses (n = 158). This demonstrates that people are looking to BWSR and other agencies for information that is currently lacking (as many indicated above when responding that they did not have the necessary information about likely climate change related watershed impacts).

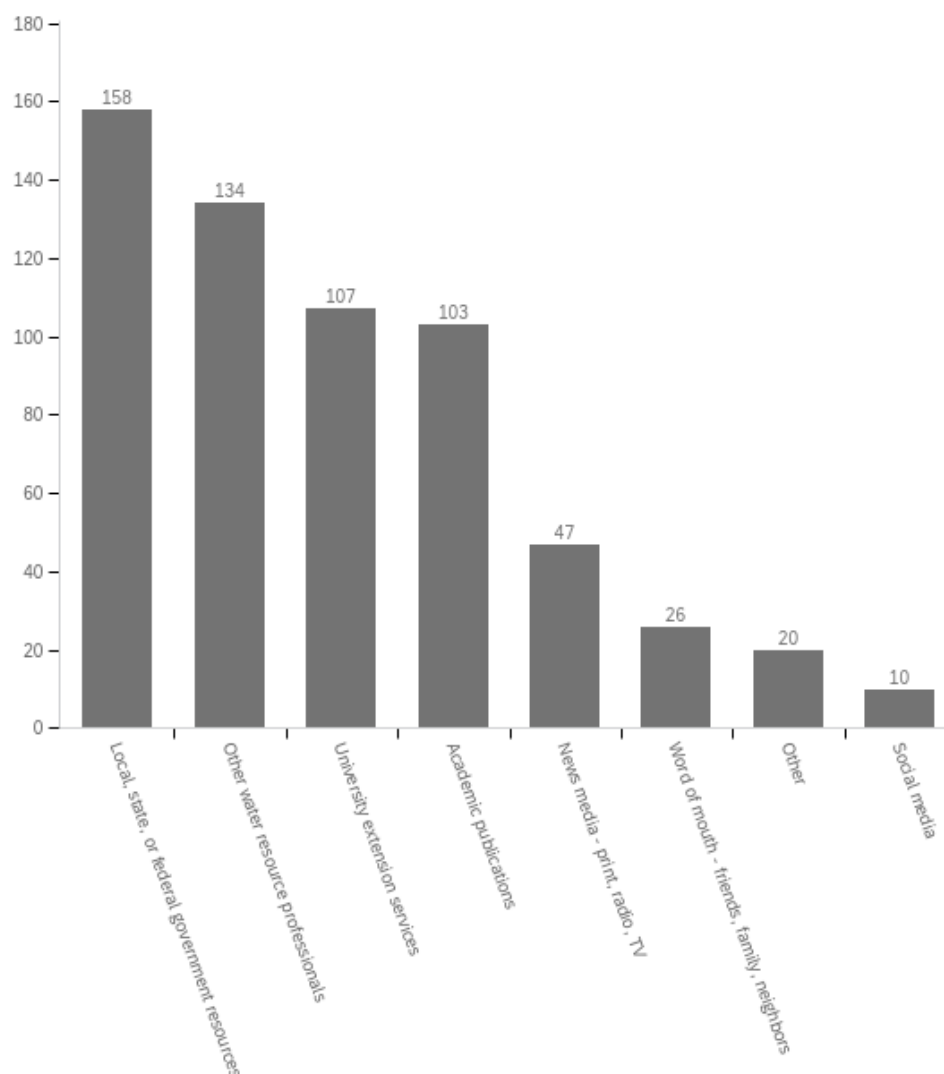


Figure 3 What sources of information are you most likely to use to learn about the impacts of climate change on your watershed (check all that apply)? n = 202

The sources of information that come from experts (government resources, water resource professionals, University extension, academic publications) received the most responses, whereas sources of information from media (news and social) and from friends received fewer responses.

The following question asked respondents how **comfortable they personally felt describing both the impacts of climate change and strategies to deal with the impacts of climate change**. The question received 203 total responses with the options “comfortable” and “somewhat comfortable” receiving the most responses for both describing impacts and strategies. When describing the **impacts** of climate change, 64 respondents felt “somewhat comfortable” and 55 respondents felt “comfortable”. When describing the **strategies** to deal with the impacts of climate change, 61 respondents felt “somewhat comfortable”, and 45 respondents felt “comfortable”.

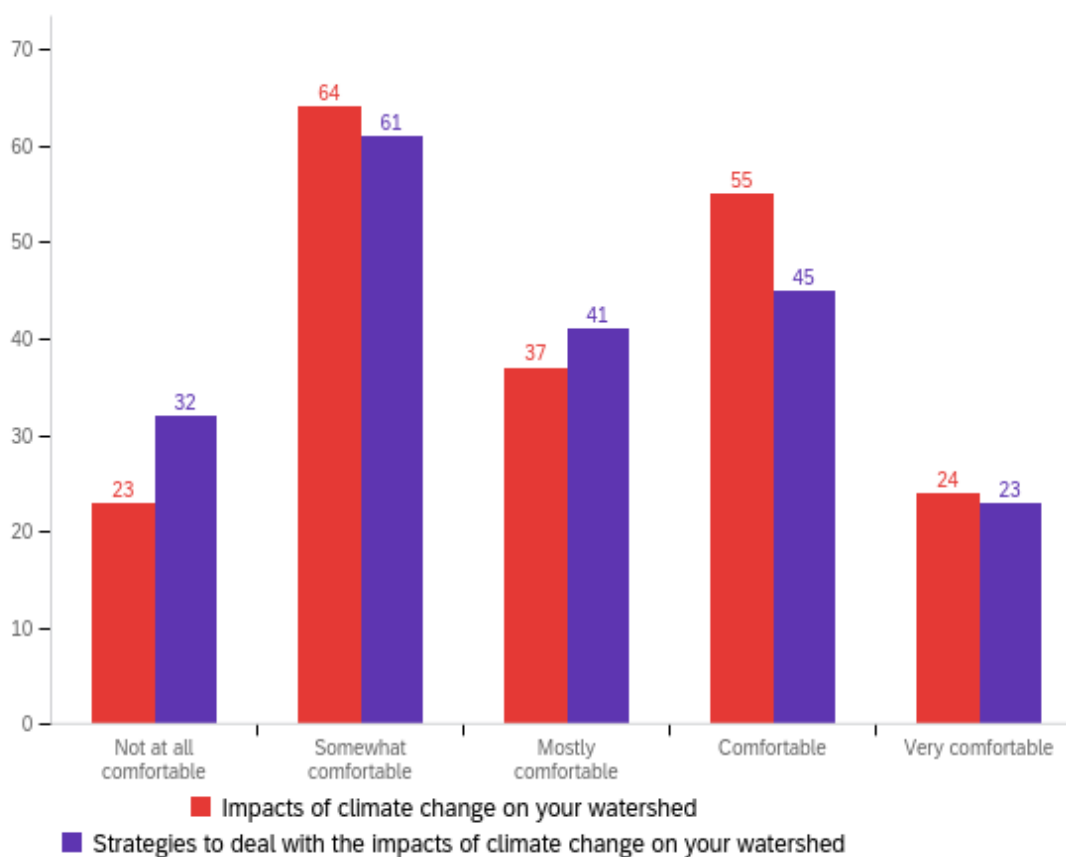


Figure 4 How comfortable do you personally feel describing the following to other members of your planning team?
n = 203

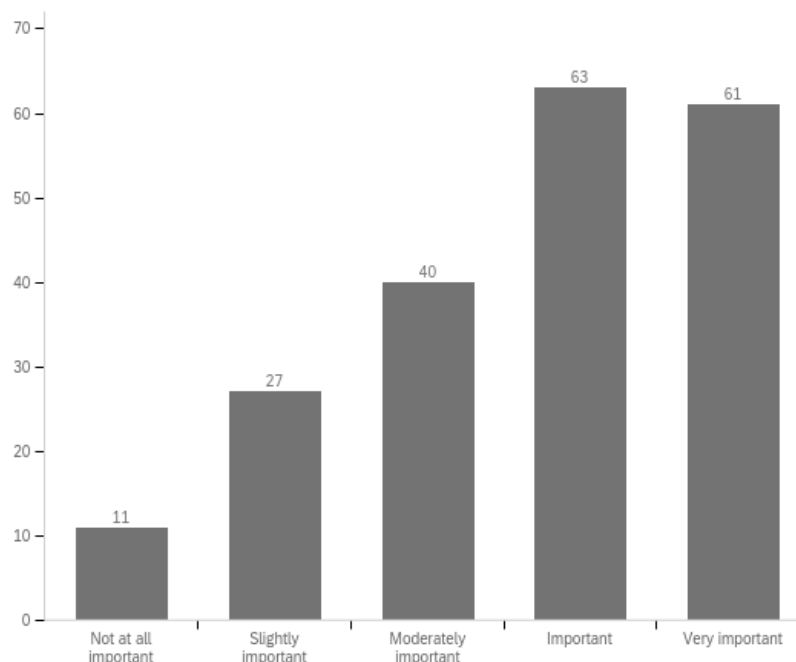
The above figure shows that there is variety among respondents in their comfort level in describing either the impacts of climate change or the strategies to deal with climate change

impacts. Because we did not ask respondents to elaborate on this answer, we cannot infer whether providing more information, more guidance, or more best practices would allow respondents to feel more comfortable. The findings do indicate that more people are less than mostly comfortable with describing climate change impacts and strategies than those who are comfortable or very comfortable.

Personal Opinions of Climate Change and Resilience

Other questions in our survey were designed to gain an understanding of how respondents personally feel about climate change. This helped the research team determine whether these active participants in the planning process oppose climate change and serve as a barrier for the successful incorporation of climate resilience in CWMPs.

To get an understanding of the mindset of respondents, we asked them **how important they personally thought the impacts of climate change were to the health of their watershed.**



*Figure 5 How important do you personally think the impacts of climate change are to the health of your watershed?
n = 202*

The majority of respondents (n = 124) felt that climate change impacts were either “important” or “very important” to the health of their watershed. There were 78 respondents who felt that climate change impacts were either “moderately important”, “slightly important”, or “not at all important”. This is an insightful finding because it makes clear that many of the respondents

from planning partnerships accept that climate change impacts have an effect on the watershed and its health.

We then asked the respondents **how they viewed the perceptions of people in their watershed in regard to climate change impacts and watershed health**. “Slightly important” received the most responses (n = 79).

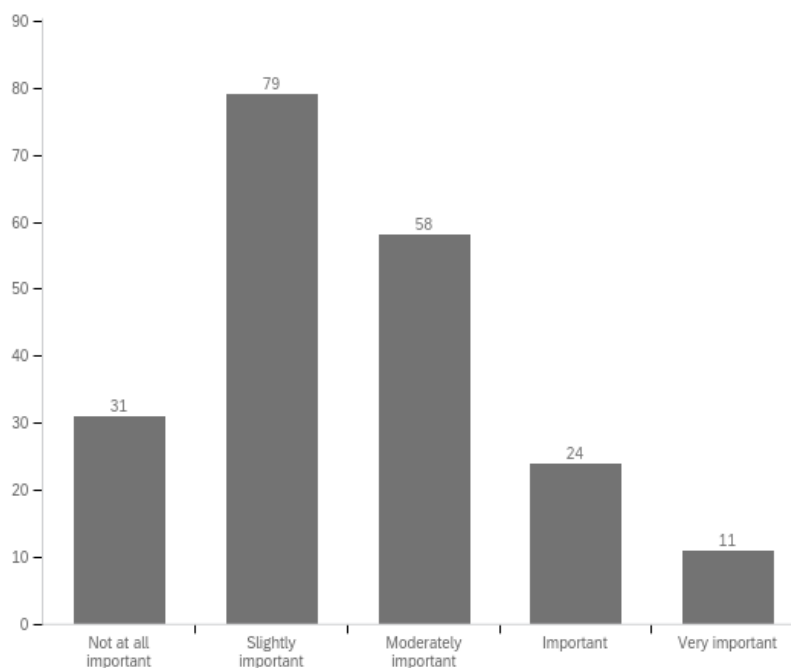


Figure 6 . In your opinion, how important do the people in your watershed think the impacts of climate change are to the health of your watershed? n = 203

Comparing Figures 5 and 6 demonstrates that there is a mismatch between how important the survey respondents view climate change affecting watershed health and how they think the people who live in their watershed view climate change affecting watershed health. The majority of respondents answered that they personally thought climate change impacts were “important” or “very important” to the health of their watershed. Then when answering how important people in their watershed thought the impacts of climate changes were to the watershed’s health, there was a shift to the majority of the survey respondents answering, “slightly important” or “not at all important”. This finding illuminates that the public’s opinion about climate change could play a role in the planning partnerships incorporation of climate change in CWMPs.

Building off of the two previous questions, our survey then asked respondents **“During the planning process, did you feel like you could productively talk with other contributors about**

climate change, and associated impacts on your watershed?" The question had 198 total responses. More people (n = 129) responded yes to this question but there were still 69 respondents who felt they could not productively talk with other contributors about climate change.

Respondents were then provided with an opportunity to elaborate on their answers. Based on comments, it is clear that there were different motivating reasons behind their responses.

Those who responded that they could not productively talk about climate change emphasized that sometimes the science is not there, that they did not have the necessary information, or that planning guidance does not contain specific criteria.

"I'm not comfortable talking about it because I don't feel the science of climate change is a settled issue I don't think we know the full science yet"

"I don't have enough information to discuss this."

"But watershed planning is a technical driven process and the planning standards do not contain specific criteria for addressing climate change."

Others responded that the divisive nature of the topic or resistance from people in the planning partnerships makes productive conversations about climate change difficult.

"climate change and especially the concept of human induced climate change is a dividing topic. Some think there is nothing we can do about huge rain events."

"There is little acceptance of climate change in rural central Minnesota."

"There was resistance from some partners to specifically EXCLUDE the term "Climate Change" from the Comprehensive Planning Document."

An interesting theme throughout the comments was that people on technical committees could productively talk about climate change and associated impacts with each other but that there was a disconnect once the topic was raised with policy committees.

"Yes with the technical committee. However, it was difficult with the policy committee from what I could gather (I did not attend policy committee meetings)"

"Usually there is good dialogue at the technical committee level, then not accepted at the policy committee level so not in the plan"

"Yes, among the TAC. No, among the policy committee (there was a 25-minute discussion that ended in the phrase climate change being taken from the 1w1p."

"For the most part, yes. Particularly with technical staff. There was difficulty discussing climate change with a minority of Policy Committee (County Commissioner / Supervisor) members because they viewed the term as polarizing and of a political nature."

Those who said that they **could** productively talk about climate change emphasized that the dynamics of the group are important.

"This is a good group. I think everyone felt comfortable expressing themselves without any retaliation. Many things were discussed some formal and some informal after the meetings. Good discussions."

Lastly, a key takeaway is that framing climate change as something different allowed planning partnerships to have more productive conversations.

"Depending on who the audience is - if I bring up the term "Climate Change" I will lose a majority of the crowd. However, if we present it as protecting the productivity of agricultural fields from increased storm events - we will be miles ahead."

Incorporation of Climate Resilience into CWMPs

In addition to gaining an understanding about respondents' understanding of climate change and their personal opinions about it in the CWMP process, our survey also sought to better understand how climate change and resilience was being incorporated into the plans.

We asked them **whether they thought that the impacts of climate change (such as extreme weather or flooding) should have been addressed more or less in their CWMPs.**

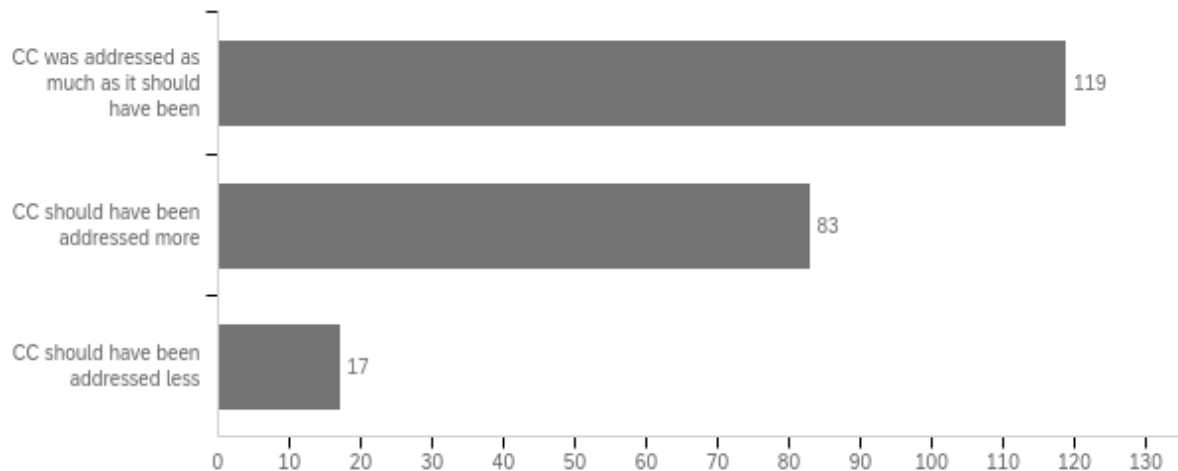


Figure 7 Do you think that the impacts of climate change (such as extreme weather or flooding) should have been addressed more or less in your CWMP? n = 217

The question had 217 final responses. The majority of respondents (n = 119) answered that “climate change was addressed as much as it should have been”. “Climate change should have been addressed more” received 83 responses, and only 17 respondents felt that climate change should have been addressed less.

The following question was asked towards the end of the survey and sought to understand whether the respondents felt that the *priorities* and *actions* in their CWMPs would adequately address potential impacts of climate change.

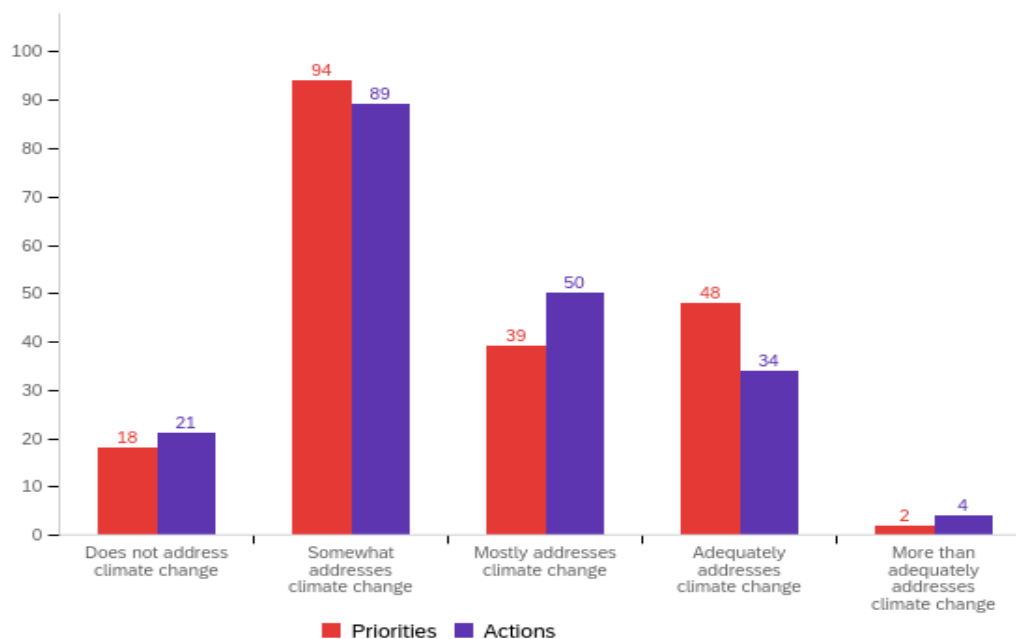


Figure 8 Do you feel like the following in your watershed's CWMP will adequately address the potential impacts of climate change? n = 201

The question received 201 final responses with the majority answering that both the priorities and actions would somewhat address climate change (priorities: n = 94; actions: n = 89).

When comparing Figure 7 results about whether climate change should have been addressed more or less to Figure 8 results about priorities and actions, there is a discrepancy in how the majority of respondents answered. When thinking about their overall plans, the majority of respondents felt that their CWMPs addressed climate change as much as they should have. But when specifically asking the respondents whether they felt that their priorities and actions would address climate change, they did not feel that their CWMPs were adequate. These contradictory results illuminate that respondents might have felt the mere mention of climate change was adequate. But when asking them to dig more into the actual priorities and actions their planning partnerships identified, they felt that their CWMPs lacked in addressing climate change.

When analyzing the comments that survey respondents provided, we found that some respondents thought that their plans did not have sufficient priorities and actions to address climate change because the CWMPs were focused on current conditions.

“main priority is to try to get a handle on existing conditions - future conditions impacted by climate change is a secondary priority.”

Other respondents said that climate change was not addressed outright but that other priorities and actions would benefit climate change.

“Climate change currently is a byproduct [sic]. The items addressed in the plan as priorities and actions will still benefit climate change implications for the majority”

“Most priorities we establish or actions we take as a watershed org (and associated orgs in this plan) address climate change obliquely. These are almost all beneficial from a climate standpoint, however may be inconsequential in addressing larger impacts.”

For other respondents, insufficiencies in expertise, knowledge, funding, and time inhibited CWMPs from having robust priorities and actions to address climate change.

“In planning processes of which I've been a part, almost all chosen action strategies address the impacts of climate change. The scale at which actions are applied, time and funds needed

to develop relevant outreach/communications, and funding to bring practices to scale have not been adequate.”

Everyone wants the best possible practices and outcomes for our watershed plan. People are open to ideas, but not everyone has the expertise or knowledge to act accordingly to those ideas.

While there were common themes in the comments from survey respondents about how their CWMPs addressed climate change, the variety of concerns highlights that each watershed faces unique challenges and barriers.

To read other relevant survey responses, please see Appendix D.

Key Takeaways

The CWMP analysis and survey results reveal:

- Discrepancies exist between discussions of climate change in CWMPs and associated priorities or goals to address climate change and climate resilience.
- Climate change remains a deeply divisive and polarizing topic amongst planning partners.
- Planning partners are using non-predictive tools for planning and there is a lack of tools and resources to address climate change and incorporate climate resilience.
- Planning partners express uncertainty about strategies to address climate change and associated impacts.

Barriers to Climate Resilience in Future Plans

Survey results also informed our team about the primary barriers that planning partnerships and the 1W1P program face. These results are supported by the CWMP analysis and interviews with consultants and experts.

When we asked survey respondents **whether it would be feasible to implement and incorporate 1) climate change risk assessment, 2) stakeholder engagement about climate change, or 3) monitoring and reporting of climate resilience measures into their CWMPs**, it illuminated that these strategies were feasible but presented challenges.

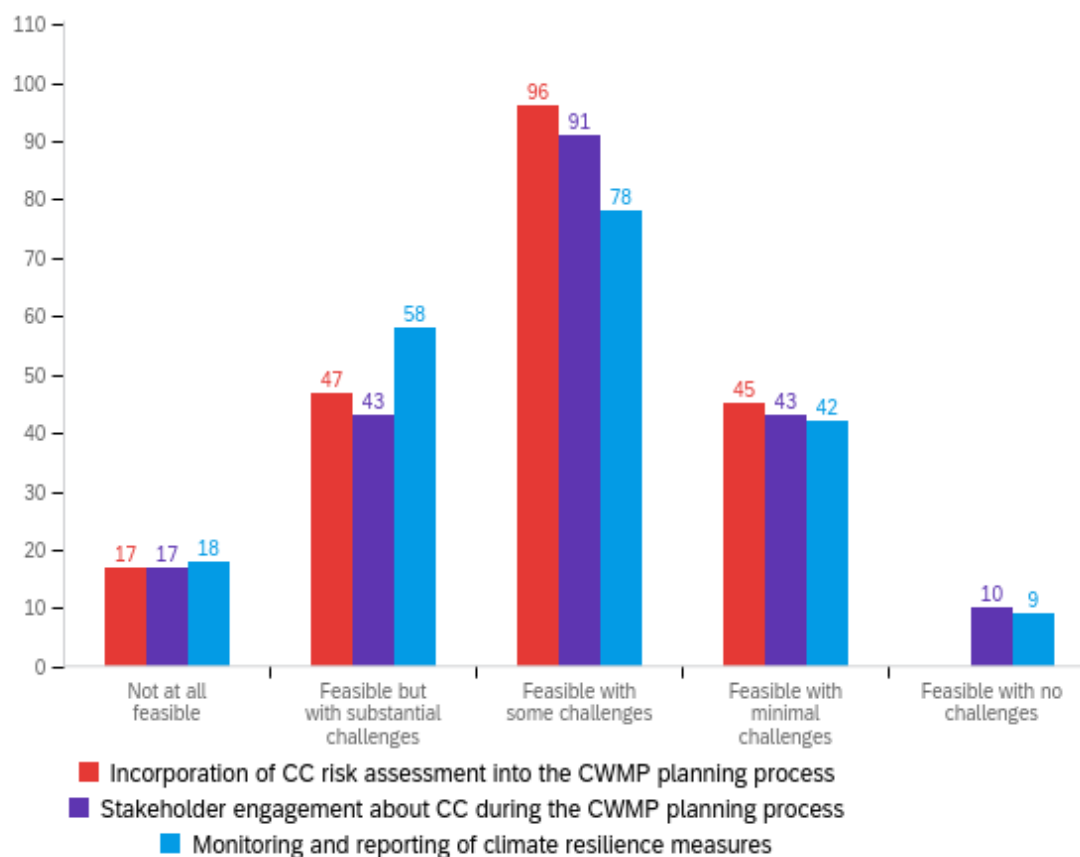


Figure 9 How feasible do you think it would be for your watershed to implement the following climate resilience strategies? n = 205

This survey question had 205 final responses. The majority of respondents said that incorporation of the three strategies presented in the question would be feasible, with some challenges. There were no respondents who said that the incorporation of climate change risk assessment into the planning process would be feasible with no challenges.

Respondents were allowed an opportunity to elaborate on this question. The written responses revealed specific barriers and challenges to incorporating strategies such as climate change risk assessments, stakeholder engagement, and monitoring and reporting climate resilience measures.

A common theme in the written responses was climate denialism, which presents a tremendous challenge to the planning process. Some watersheds attempted to circumvent this challenge by addressing climate change without calling it climate change. We will elaborate on this barrier below.

In terms of tangible resource gaps in the planning process, respondents identified a need for more technical, financial, and staffing resources. The need for these things was also identified as a barrier by consultants and experts we interviewed.

There were some responses to this survey question suggesting that prioritization should be on implementation.

“Seems like Watershed Plan money is directed toward implementation of conservation practices. I think that is what we need to focus on rather than more monitoring or studies. We should advocate for practices that make land more resilient to climate change.”

This quote was specifically responding to the examples offered in Figure 9 (above), rather than an overall assessment that planning is not important. It demonstrates that there are feelings of frustration among planning partners about a lack of traction on the implementation side of the 1W1P program.

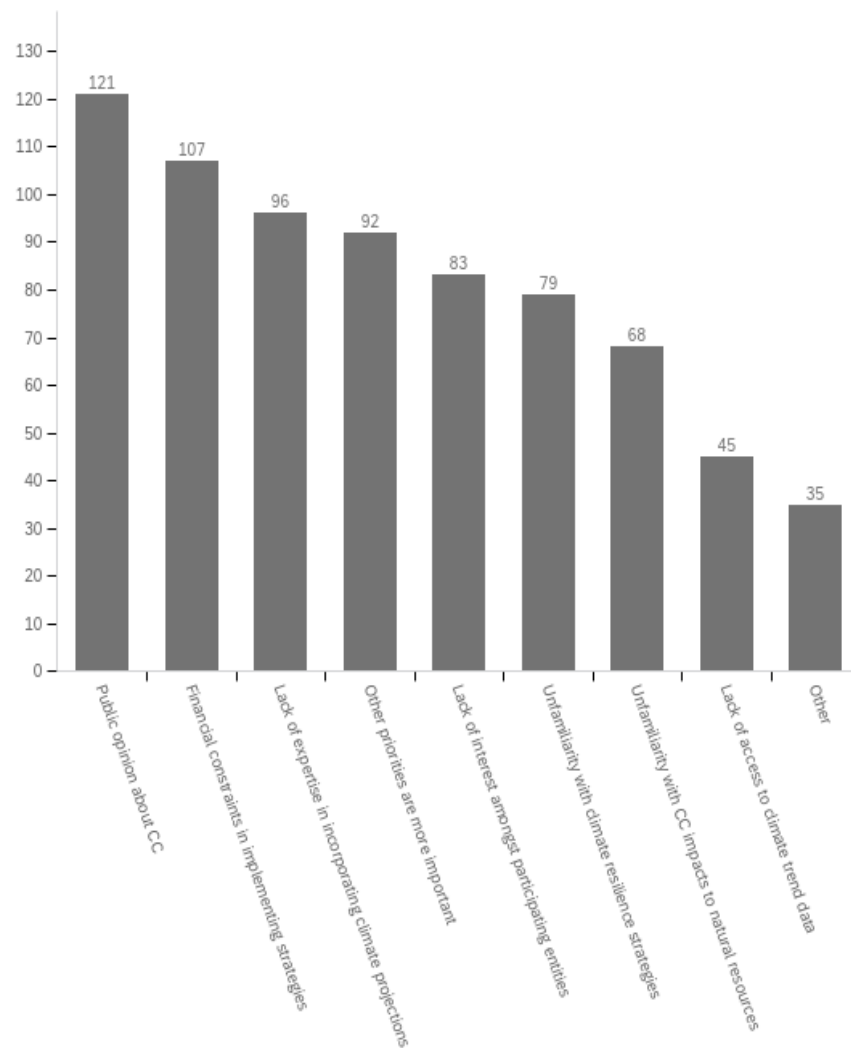


Figure 10 Considering all potential strategies discussed, what barriers or challenges would your watershed face when attempting to incorporate climate resilience strategies in your CWMP? Check all that apply. n = 207

After asking respondents whether incorporating certain strategies - climate change risk assessment, stakeholder engagement about climate change, and monitoring and reporting of climate resilience measures - would be feasible, we then asked them to **select barriers and challenges to incorporating those strategies**. These results were critical for informing our recommendations. We will further dive into them below and make connections to other survey results, the CWMP analysis, and interviews.

Climate Polarization and Politicization

The most frequent response to the barrier question was “public opinion about climate change” (see Figure 10 above). This was a common theme throughout the survey. It was also prevalent in interviews with consultants.

Another question in the survey that aimed to learn more about the tensions surrounding climate change was “BWSR policy currently states: ‘Planning partnerships are strongly encouraged to consider the potential for more extreme weather events and their implications for the water and land resources of the watershed in the analysis and prioritization of issues...’ If BWSR policy included a more stringent requirement about addressing climate change/extreme weather events, would it change your likelihood of participating in the program?”

We received 196 responses to this question, with 68 people responding “Yes” and 128 responding “No”. Though more respondents indicated they would still participate in the 1W1P program even with a more stringent climate change requirement, about a third felt differently, and many respondents provided written comments voicing concern about such a requirement.

In response to this question, some people showed hesitation to the idea of a requirement to address climate change in CWMPs due to predicted political pushback. Others showed a general hesitation to support a perceived relinquishing of local control and input in the CWMP planning process.

“A more stringent requirement would be met with resistance from the policy committees. It would be a possible deal breaker for some LGUs. A 1W1P is supposed to belong to the participants in the plan not handed down by decree at a state level. If the state is calling the shots, then the whole system does not work. The whole point was to get input from the actual people in the watershed that are familiar with the problems and challenges of that watershed.”

"BWSR is not a regulatory agency and such their policies are not based on "stick" strategies but a more carrot strategy. We would participate in the program because it is what is best for the resources and the need is there today to protect for tomorrow."

Other responses throughout the survey (not just in response to this question about a requirement) made it clear that they did not believe in climate change.

"climate change has been ongoing since the end of the last ice age. cause and effect are unknown, other than the polar caps are decreasing, and gradient temperatures are increasing. the cause can be debated forever with various theories. man had not settled in north america [sic] when the ice began to disappear so burning fossil fuels as the leading cause leads me to be highly suspect."

"I don't believe in the climate-change hoax. An obvious example of leftist alarmism and false assertions. Which are wasting our tax money and ultimately weakening the nation beyond repair."

Other respondents to this question were in support of the idea of a requirement and fell on the other end of the climate change spectrum.

"As a staff level water planner I recognize the importance of climate change in water planning efforts. Stronger language would be appreciated."

"I feel like this may open up more opportunities to incorporate climate change mitigation strategies into the plan".

Some respondents mentioned that climate denialism in the planning process was a challenge, particularly in the policy committee.

A major hurdle has been developing climate change strategy, and even simple language reference, in CWMPs due to resistance from decision-making authorities. Some County Commissioners are opposed to use of a "politically polarizing" term such as climate change. Even if the science is sound, the term is viewed as divisive."

Consultant accounts agreed with this challenge. One consultant talked about the challenge of reading a room to know whether or not incorporating climate change or climate resilience into a plan is feasible, and that the geographic area being conservative or not is not necessarily a

good indicator of receptiveness. For instance, this consultant had two separate conservative, highly agricultural watersheds as clients. In one watershed, the consultant would have been “thrown out” if climate change was discussed too much, while the other watershed was very willing to talk about and incorporate climate change into their CWMP.

Different attitudes towards climate change and climate resilience are also evident from the CWMP analysis. This is apparent in the disparity between mentions of climate change and explicit incorporation of it into goals and action items. Some plans also hinted at climate denialism with language like “This plan recognizes the potential implications of climate change by encouraging the use of updated design standards for water resource infrastructure, based on National Oceanic and Atmospheric Administration (NOAA) Atlas 14”^{xxxv} being the only mention of climate change in the document.

The polarization and politicization of climate change is further exacerbated by a lack of public engagement throughout the planning process. Planning efforts are driven by consultants and planning partners, but input from the public is critical in shaping the content of CWMPs. Public engagement can be an educational tool to inform members of the public and gain momentum for specific plan goals. However, a lack of climate-motivated public engagement during the planning process is a barrier to effectively planning for resilient watersheds. It is clear that public perceptions of climate change are powerful during the planning process and would benefit from greater public engagement, as expressed in the following quotes from the survey:

“Local stakeholders would need to be invested in prioritizing climate change efforts before any risk assessment or further action would take place without challenges/substantial challenges.”

“It seems like no matter what we do there will be some opposition to the discussion of climate change. Does it really exist. That’s what we encountered during our assessment of our plan by the public.”

Financial and Staffing Constraints

Financial and staffing constraints were cited by both survey respondents and interviewees as significant and related barriers to climate resilience strategies being incorporated into CWMPs. These constraints can be generally categorized as a lack of implementation funding, and general understaffing of entities involved in the planning process.

Although the 1W1P program provides significant funding for the CWMP planning process, there are fewer available funds for the implementation of priorities and projects as identified in

resulting CWMPs. This tension was highlighted by survey respondents, who identified financial constraints in implementing priority actions as a main concern. Moreover, many survey respondents also noted that climate resilience actions are seen as additional and therefore even more cost prohibitive.

“The watershed planning process is too expensive as it is. Adding this element as a separate element would just add to that overhead cost. This information can be inferred from available data when watershed protection projects are completed”

Along with a lack of implementation funding, both survey respondents and consultants expressed a difficulty with staffing at local agencies and entities involved in the planning process. Many are chronically underfunded and therefore understaffed, and this was seen as a barrier to both the planning and implementation of climate resilience strategies.

“A challenge would be staff having the time and talent to create monitoring protocols and procedures to track something that has not historically been tracked at the local governmental unit (LGU) level before”

Although grants and funding streams exist to help support local agencies and entities, survey respondents and interviewees explained that it is difficult to access those funds without staff available to apply for them in the first place.

Lack of Technical Resources

It is apparent from the survey and interviews that planning partners and consultants perceive a lack of technical resources. Common themes within this category include people not knowing what resources are available or what successful climate resilience looks like, which is expressed in the following quotes from the survey:

“Lack of down scaled climate projections for the particular watershed and surrounding area.”

“It is not sufficient to say things are getting warmer and wetter and make informed decisions regarding watershed management. We need real empirical measures that will inform better actions. The state has been derelict in its responsibility to provide this technical guidance and funding needed to make this happen.”

“...The trends of more precipitation at a higher intensity and more extreme temperatures were understood at the time of the planning but there wasn't [sic] much reference to hard data other than the Atlas-14.”

Consultants echoed similar sentiments. One consultant stated that having better technical guidance available would be beneficial to the consulting process, as watersheds rely on the expertise of consultants because planning partnerships “really recognize that they don’t know what they’re doing and that the consultants were hired for a reason.” This consultant also said that “when there is room to address climate change, we don’t have really good predictive tools to evaluate what those changes might be.”

Lack of access to predictive tools is also borne out in the CWMP analysis. NOAA Atlas 14, which is mentioned in the third quote above, was discussed in 74% of available CWMPs as a tool to update design standards for water infrastructure. The NOAA Atlas 14 database analyzes historic rainfall and can provide planners with estimates for depth, duration, frequency, and location that can be expected for different storm events. These estimates are based on 30 to 40 years of historical data and assume climate is stationary when making probabilistic assumptions. NOAA Atlas 14 uses a probability distribution to inform infrastructure design and is heavily relied upon by planners for designing water management infrastructure – such as culverts and bridges – but it is not predictive.^{xxxvi} The data is also 20 to 30 years out-of-date in most of the country, as the project has not had a steady funding stream. The last time NOAA Atlas 14 data was updated for Minnesota was about a decade ago.^{xxxvii} It is common knowledge in the planning community that NOAA Atlas 14 is not ideal for planning because it is not future-looking. The predictive models that currently exist are not granular enough for individual watersheds, but there are some in development for Minnesota.

In addition to a lack of data, there appears to be a disconnect between what members of the planning partnerships see as sufficient addressment of the impacts of climate change in their CWMPs versus how well the CWMP’s goals and actions would actually address climate change and incorporate climate resilience. The survey and interviews indicate that this disconnect is possibly due to lack of information and knowledge about how precipitation patterns will change water management in Minnesota, and a lack of best practices and tools for implementing climate change resilience.

The size of watershed planning boundaries may be limiting some of the available technical resources of planners. Some survey respondents mentioned that the watersheds were too small or granular to effectively model or find useful resources for, while others, like the quoted

response below, felt that the watershed planning boundaries are too large and complex to plan. This problem is likely contextual by watershed.

“The issue here is you are asking for if this work could be done at the HUC 8 scale. For our 1W1P the answer is no; we have 27 units of government, not including 40(?) ish communities. So I am answering these questions through the lens of breaking down into smaller sub-units like HUC 12 scale.”

Classifying Climate Change as an Emerging Issue

Over half of the CWMPs classified climate change as an emerging issue. One consultant also revealed that their CWMP template explicitly classifies climate change in this way. Furthermore, in the 1W1P Plan Content Requirements, climate change is given as an example of an emerging issue.^{xxxviii} This means that planning partners are primed to think of climate change and climate resilience as lower priority items from the beginning of the process. The consultants have power derived from expertise to influence the planning partners and the planning process, and BWSR’s words also carry authoritative weight, which may be why over half of the plans talk about climate change this way.

Classifying climate change as an emerging issue is a barrier to adequately addressing it. Emerging issues do not prompt the creation of related action items and goals. When climate change is classified as an emerging issue, it is talked about as something that *could* happen or something that is novel. The Mississippi River Headwaters Watershed CWMP offers this industry accepted definition of “emerging issues”:

“Emerging issues are problems, risks, or opportunities that affect priority resources and could be addressed in future Plan implementation. Emerging issues have typically been novel and have not had a recognizable impact to priority resources, or the issue effect has not been identified until increased intensification, resulting in negative impacts to priority resources” ^{xxxix}

Applying this definition to climate change and associated impacts is problematic because it kicks the can down the road by putting planning partners in the mindset that climate change is an issue that is not currently impacting Minnesota and does not need to be addressed now.

Watershed planners seem to simultaneously think climate change is an important issue facing their watersheds (Figure 5), but that the broader public in their watersheds are less concerned about it (Figure 6). Therefore, classifying climate change as an emerging issue in many CWMPs could be partially due to real or perceived backlash from constituents in the watershed. While planners are concerned about the impacts of climate change in their respective watersheds,

they have many additional priorities. Many CWMPs were more concerned with water quality/runoff pollution than they were with climate change and climate resilience. Other priorities include drinking water quality, invasive species, soil health, and lack of information.

"main priority is to try to get a handle on existing conditions - future conditions impacted by climate change is a secondary priority."

Lack of Collaboration

Survey results revealed that respondents think there needs to be better collaboration within and between agencies. Some respondents voiced that, depending on who they talked to at BWSR, they heard different things about funding, implementation, what is expected from planning partners, etc.

"According to BWSR staff working with the 1W1P local process, [there are] stipulations [that] clean water fund dollars have [prohibited] the implementation of many projects that address climate change"

Therefore, survey respondents felt that the agency needs to create a more united front regarding what they want from the planning partnerships and CWMPs.

In addition to the lack of collaboration between BWSR staff being a barrier, survey respondents specifically identified a lack of collaboration between state agencies as a barrier. Respondents felt overwhelmed by the varying available strategies and conflicted about what to incorporate in their plans.

"Conflicting approaches to climate resilience strategies. (ex. Deferred mature harvest/carbon credits vs. working forests/DNR approach) (NRCS [Natural Resources Conservation Service] regional seed requirements vs. planting seeds from regions that have climates more akin to predicted future climates)."

"Many of the actions would have to be implemented by organizations that are not part of the plan or part of implementing the plan. MNDOT, MNDNR Forestry, etc... these entities likely have the most impact locally when it comes to climate change adaptations. They may have been part of the development of the plan, but they are not part of implementation."

The paralysis regarding what to incorporate into CWMPs poses a threat for planning partnerships to develop robust plans. Additionally, the lack of collaboration between state agencies poses a threat to successfully implementing climate resilience measures.

Survey responses did not reveal concerns about the relationships between planning partnerships, BWSR, and consultants. Therefore, we used interviews with consultants in order to fill in this knowledge gap and better understand these dynamics.

Interviews with various consultants revealed a lack of consistency with and understanding of the relationship between consultants, BWSR, and planning partners. One consultant highlighted that they have worked with board conservationists who were accessible, provided input, and were “partners at every step of the way”, while other board conservationists told the consultant “not to talk with BWSR folks unless it was at the same meeting as the steering committee or technical committee and they got approval”. This consultant also said they thought BWSR treated consultants as “part players” and is missing out on opportunities by viewing consultants this way, because they have a lot of knowledge and ideas, and would welcome opportunities to collaborate with BWSR.

One consultant also stated that there is a discrepancy between what happens when planning partners begin the CWMP process and expectations from BWSR about the functionality of those groups. They offered an example where a planning partnership could not agree on what to do, but the consultant was working to create relationships. As the consultant started to bring balance to the planning partnership and create a substantial cohesion between individuals, BWSR heard about the dysfunction and, from the consultant’s perspective, worked outside the relationships the consultant had developed, which hampered the consultant from doing their job. The consultant wishes that BWSR had collaborated with them to understand what was going on and develop solutions, including developing criteria or assessments of the planning partner’s cohesiveness to function as a team, as there is currently nothing like this.

The experience-informed views of consultants are at odds with how BWSR views consultant-BWSR and consultant-planning partner relationships. Because the governments of the planning partners hire the consultants, BWSR leadership does not feel they can call consultants, but are happy to talk with consultants if consultants call them. BWSR also thinks they risk being perceived as overstepping their boundaries if they start “telling consultants what to do”. It is also BWSR’s position that they want “the local governments to do a better job of ‘taking charge’ of the process and guiding the consultants”, but our interviews revealed that consultants are heavily leaned on by planning partners because they have expertise the

planning partners do not have, and because the planning partners do not have the information they need, as revealed by the survey.

These varying forms of collaboration required to complete CWMPs create a complex web of dynamics. Each individually serves as a barrier to successful CWMP incorporation of climate change and resilience. Collectively they create an overwhelmingly difficult landscape to navigate.

To read other relevant survey responses, please see Appendix D.

Recommendations

The recommendations we are making for the 1W1P program with regards to climate resilience come from our CWMP analysis, survey, and interview findings. These are not presented in order of importance.

Do Not Require Climate Resilience

The survey asked respondents about the possibility that CWMPs created under the 1W1P program would be required to incorporate climate resiliency in some capacity. Ultimately, we are not recommending that such a requirement become a part of 1W1P. Survey responses and interviews highlighted the politically charged nature of climate change discussions throughout the state, and a sense that BWSR's role in the drafting process should not be expanded, so as to ensure CWMPs are a product of local stakeholders. Our survey results also showed that a requirement to explicitly address climate change and/or climate resilience could result in approximately a third of current 1W1P participants withdrawing from the program, either because of attitudes towards climate change or because of feelings about expanding government oversight into local issues. Furthermore, it is likely not necessary to include this requirement in order for watersheds to address climate resilience.

An example of this can be found in the Cedar-Wapsipinicon CWMP. This CWMP uses predictive precipitation modeling and has priorities, goals, and action items that address flooding and other impacts of climate change without explicitly mentioning climate change or resilience. Therefore, we chose our recommendations based on what could help achieve incorporation of climate resilience into future CWMPs without using alienating and politically fraught language. If, for whatever reason, climate resilience does become a requirement in the

future, we recommend that BWSR provide funding and technical assistance to support meeting that requirement, so that implementation of associated action items are more feasible.

Shift from Prioritization Framework to Risk Framework

Shift towards a framework of resilience and risk, instead of relying on prioritization as the guiding framework for 1W1P. The 1W1P program currently guides planning partnerships to prioritize resources and implement strategies based on that prioritization. According to guiding principles, “BWSR’s vision for *One Watershed, One Plan* is to align local water planning on major watershed boundaries with state strategies towards prioritized, targeted and measurable implementation plans”.^{xi} A consultant we interviewed emphasized that prioritization is the basis of the whole act passed by the legislature.

First and foremost, shifting the planning framework and language towards risk creates better alignment with resilience, which emphasizes the capacity of a water system to sustain a desired set of conditions in the face of disturbance and ongoing climatic changes. If proper attention is not given to most at-risk water resources within the watershed, CWMPs may prevent the water system as a whole from sustaining the desired set of conditions. A shift to risk assessment would allow BWSR to promote climate change resilience through 1W1P without explicitly mandating its incorporation into plans.

Our survey results also revealed that climate change was not a priority for many planning partnerships and that other issues were of higher priority. This was explicitly stated by survey respondents and highlights that the framework of prioritization often left behind climate change and resilience during the planning process. Therefore, continuing to require planning partnerships to use a prioritization framework in the 1W1P process will only reinforce the oft-used justification that other priorities take precedence over climate change.

In addition to the exclusion of climate change impacts as priorities in plans, a consultant interview illuminated the fact that the values of some partners in the planning process do not align with the current 1W1P framework of prioritization. This consultant told a story about a tribal member who voiced that the local tribe did not see how one resource could be more important than another because they are all equally important. After the consultant shifted the prioritization exercise to a risk assessment exercise, the tribal member felt more comfortable with the approach of the planning partnership. The consultant believes that this led to a more robust plan that properly considered climate change and resilience. A shift to risk would be beneficial because it would allow CWMPs to consider what resources, water bodies, wetlands,

and people are most at risk. This prevents partnerships from continuing to focus and spend money on preferred resources or the resources that have the most public support.

Risk also allows plans to consider equity, which is not an explicit consideration in the 1W1P guidance but should be considered any time climate resilience is considered, because equity and climate resilience go hand in hand. Certain communities, often less resourced and vulnerable, face disproportionate effects to their homes and lives due to climate change and its impacts. If planning partnerships do not consider this in their CWMPs, watershed management could further exacerbate these inequities. Therefore, a shift from prioritization to risk could help planning partnerships properly consider the communities and parts of the watershed that are most at risk to harmful climate change impacts. Even if planning partnerships deny climate change poses a threat to the watershed, and specifically certain communities, a risk assessment framework still likely positions them to create plans that meaningfully consider climate resilience and equity.

Moving away from a prioritization framework and leveraging the language of risk instead of priorities may help climate change to be more prevalent in plans without specifically requiring planning partnerships to consider it. The language of risk also aligns with research on resilience. Additionally, this language is more acceptable to Minnesota's tribal communities. Focusing on priorities has the potential to lead to alienation of these tribes, who are important partners in the 1W1P process and have valuable knowledge. Lastly, the language of risks, instead of priorities, could result in stronger plans that include measurable goals and actions that address climate change and resilience. While an overall shift to a risk framework is important, each watershed is unique. Some have most of their resources in a degraded state and require restoration at a mass scale. These watersheds could also benefit from a risk framework by focusing their efforts on more heavily degraded resources in areas that most greatly impact vulnerable populations. Allocating resources in this way would be in line with resilience and equity.

Resilience planning at the watershed scale is still a new practice and there is little evidence of its efficacy. Therefore, BWSR has an opportunity to set a precedent by shifting to a risk framework.

If a complete overhaul of the 1W1P program to move from prioritization to risk is unfeasible due to political barriers or money, it might be valuable to instead provide planning partnerships with the risk framework as a supplemental way of thinking about plan development and addressing their watersheds' resources. This could still provide an

opportunity for CWMPs to be more climate resilient and equitable without jumping through hoops to change the foundation of 1W1P.

Improve Consultant Relationships

Our analysis makes it clear that consultants play a significant role in the creation of CWMPs, yet their role as a liaison between BWSR staff and planning partners is underutilized. In order to extract the most benefit from consultant guidance on plan content, it is important that BWSR deliberately works with consultants to strengthen their relationships with each other and more clearly identify the roles that each party plays in relation to one another within the 1W1P program.

Primarily, BWSR should establish a standardized understanding of the relationship between BWSR, consultants, and planning partners in the 1W1P process. A lack of clarity surrounding these relationships during the planning process resulted in varying levels of participation and influence from consultants, and even led to a hampering of a consultant's ability to do their job effectively in one instance. Identifying a clear understanding of the roles that each organization plays during the planning process, and how they should work together, will make the overall process more effective and will avoid further discrepancies in the future. These roles should be communicated clearly with consultants and planning partners from the beginning to shift the atmosphere from siloed roles to a collaborative process.

BWSR should also prioritize open lines of communication between consultants and BWSR staff. As identified in consultant interviews, when and how to utilize avenues of communication are unclear for consultants and BWSR staff. By developing a formal understanding of communication practices between the two groups, consultants will be better able to share with BWSR their input, findings, and experiences from plan writing experiences rather than either party being perceived as overstepping boundaries. Similarly, BWSR can communicate openly about their goals for the program and how they envision CWMPs evolving to address climate resilience more adequately. Establishing a sense of mutual collaboration between BWSR and consultants will bridge the gap between consultant input on plans and BWSR goals for watersheds, allowing for a better administration of the 1W1P program.

Finally, it would be beneficial for consultant-BWSR relationship development to be prioritized earlier on in the watershed planning process. BWSR should communicate a set of baseline expectations to consultants at the beginning of the planning process in order to ensure plan consistency. For example, in conversation with a 1W1P consultant, it was shared that

consultants often recommend that watersheds address climate change in the "Emerging Issues" section of their plans after "[getting] a pulse from the group" on the topic of climate change. However, addressing climate change as an emerging issue should not be encouraged because climate change is much more than an emerging issue, as expressed in the Barriers section above. It is a relevant and pressing issue and should be addressed as such. Therefore, BWSR should proactively set clear expectations for consultants in order to avoid the persistence of this common practice. If consultants are properly informed of BWSR's expectations and goals for watershed plans, then consultants can be proactive about the ways in which they guide their watersheds in incorporating climate change measures.

Leverage Regional BWSR Staff Involved in 1W1P

Our analysis determined that BWSR regional staff (such as Clean Water Specialists and Board Conservationists) are frequently influential experts during the creation of CWMPs, and BWSR should provide training and education opportunities for these staff members, so they can stay up to date with likely climatic changes in their respective regions, and corresponding strategies for natural resource management.

Survey respondents cited local/state/federal government agencies as their most frequent and reliable sources of information about climate change and associated impacts, and in particular, Clean Water Specialists and Board Conservationists. Ensuring that Board Conservationists and Clean Water Specialists have opportunities to continue learning about the impacts of climate change on their respective regions has the added benefit of promoting climate resilience through a more dynamic and interpersonal vector. Many people involved with the planning process, from committee members to consultants and BWSR staff, expressed the high volume of resources, documentation, and guidance that can feel burdensome. Having BWSR staff available to help guide the planning process through less rigid means may help alleviate some of that burden.

Conduct a Climate and Equity Audit

As climate resilience and equity are inextricably linked, BWSR should take steps to improve equitable outcomes through the 1W1P planning and implementation process. This concern was not explicitly discussed at any point in survey responses or interviews. However, the fact that equity was not present in our finding shows that it is not being prioritized and should be addressed by BWSR. The impacts of watershed-scale planning can be directly tied to human health outcomes, the integrity of the built environment within the watershed, and economic

prosperity of residents, all of which can be inequitably exacerbated based on existing disparities and vulnerabilities.

Moreover, climate change is expected to disproportionately impact previously marginalized communities, who will likely bear the brunt of the burden from issues such as loss of access to safe drinking water, relative flood risk, and failing infrastructure.

Equity audits are an increasingly available and accepted tool for organizations to systematically identify the ways that their programs, products, or initiatives center inclusivity and equity.

Equity audits can be undertaken internally, or with the help of an external guide (such as a consultant). Examples of questions that an equity audit might ask include:

- Do groups and individuals involved in various stages of the 1W1P process reflect the demographics of their respective watersheds? If not, how could 1W1P shift its planning and/or committee structure to facilitate more impactful representation?
- Are non-tribal entities familiar with both proper and respectful partnership expectations with tribal nations? How can tribal concerns be centered and uplifted?
- How could watersheds better use available demographic data to assess relative risk throughout their watershed, and plan implementation accordingly?

Increase Funding

Implementation of effective climate resilience measures will require financial resources. Surveys and interviews revealed that a lack of knowledge about and access to financial resources is a substantial barrier to climate resilience. We have a few recommendations for ways to make this financial burden more manageable if an explicit budget increase to the 1W1P program is not feasible; however, our recommendations in this area are by no means comprehensive of potential ways to approach this barrier.

An important resource for watersheds as they plan would be a list of grants or other funding sources that could be used for climate resilience measures. These funding sources could be state and local funding sources such as the Minnesota Pollution Control Agency's recent "Planning Grants for Stormwater, Wastewater, and Community Resilience". They could also come from the federal government's U.S Climate Resilience Toolkit, or they could come from private businesses or foundations like the Climate Resilience Fund. We think it would be beneficial to distribute these funding sources to the watershed, and it may be worth hiring someone to compile a more exhaustive list of potential funding sources.

Another way to facilitate increased funding for watersheds to work with would be by providing grant-writing resources to SWCDs and watershed districts. Alongside not knowing where to procure funding, we identified that watershed planning staff may not have the time or expertise to apply for funding grants. Advice and grant-writing resources could be provided to planning partnerships, or a grant-writing expert could be contracted to train the partnerships in person.

Finally, we recommend that funding from BWSR be allocated specifically towards resilience measures, though they do not need to necessarily be called climate change resilience measures. There is a gap between what is planned for and what can actually be implemented, and without money earmarked for resilience it is easy for those action items to be sidelined. Ideally, existing funding could be allocated towards resilience alongside new funding sources. There was also some confusion amongst survey respondents about BWSR priorities and what funding could be used for, so clarifying that some money is meant for resilience in particular could be helpful.

Provide Technical Resources

Through the survey and interviews, we identified several opportunities for BWSR to support Technical Service Area staff, watershed planning teams, and consultants with technical resources that would promote incorporation of climate resilience measures into CWMPs. These opportunities include development of resilience tools, utilization of predictive modeling, and guidance for best practices.

Predictive Modeling

NOAA Atlas 14 is used in 74% of the currently published CWMPs. It is a retrospective tool, not a predictive one, meaning it is good for building infrastructure in a world where precipitation patterns are not changing. Since Minnesota's precipitation patterns are changing – a fact the majority of CWMPs acknowledge – relying solely on Atlas 14 to inform built water infrastructure needs puts watersheds at risk for detrimental flooding and frequent renovations and repairs – all of which will result in increased expenditures. To help watersheds protect their infrastructure and their assets by creating CWMPs that are more forward looking, BWSR should:

- Recommend that watershed management teams use Atlas 14 as a *base* for designing infrastructure but stipulate that watershed management teams also need to consider predictions for Minnesota's changing precipitation patterns.
- Identify and promote predictive tools to complement Atlas 14. Minnesota-specific models and guidance are being developed by the University of Minnesota, and

consultants have mentioned others. More work needs to be done in this area to give planning partners BMPs for this issue, especially at the watershed level.

- Moore, Trisha L., John S. Gulliver, Latham Stack, and Michael H. Simpson. 2016. Stormwater management and climate change: vulnerability and capacity for adaptation in urban and suburban contexts. *Climate Change*. Volume 138, Issue 3-4, pages 491-504.
- Noe et al. 2022. Equipping Municipalities with Climate Change Data to Inform Stormwater Management.
- HSPF-SAM (mentioned by several consultants).

Best Management Practices

From the survey, we identified confusion among the planning partnerships about what incorporating climate resilience into the CWMPs looks like. Survey respondents said they needed more guidance about the types of goals and actions that would result in effective incorporation of climate resilience.

The interviews with consultants also revealed that BMPs are helpful for their process of collaborating with and guiding the planning partnerships, because BMPs give consultants concrete, actionable materials to pull from.

Given these insights, BWSR should develop BMPs for watersheds that would promote climate resilience. These should be planning partnership and consultant facing.

Resilience Roadmap

BWSR should develop a road map for creating a resilient watershed. This could include characteristics of a watershed that are resilient and examples for how to achieve these characteristics for various kinds of watersheds. A Resilience Road Map could incorporate:

- The language of addressing risks instead of creating priorities.
- Guidance for incorporating predictive modeling.
- Best Management Practices.

Promote Climate Resilience Outside of BWSR

Lobby for other agencies and mechanisms to create stricter climate resilience metrics and strategies.

This recommendation allows BWSR to take advantage of the diffuse nature of water governance in Minnesota, as no single agency has sole authority over how water is governed in the state. State-level agencies involved in water management include: BWSR, Department of Agriculture, Department of Natural Resources, and Department of Health. BWSR can lean on the fact that their agency and the 1W1P program are not the only mechanisms in which climate resilience strategies can be required.

The Minnesota Subcabinet on Climate Change, established by Governor Tim Walz in 2019, is an example of an already established mechanism that focuses on helping Minnesota increase resiliency.^{xli} The Subcabinet is composed of leaders from various state agencies and departments. They work closely with the Governor's Advisory Council on Climate Change, a board of citizens to advise the Subcabinet. They currently have a Climate Change Action Framework in the works,^{xlii} of which one of its main goals is creating resilient communities. This framework has potential to make the 1W1P program and resultant plans more climate resilient.

This recommendation would help maintain good relationships between BWSR and planning partnerships. The survey results and interviews with consultants highlighted the polarizing and divisive nature of the term climate change. Therefore, it is critical to sidestep a 1W1P climate change requirement by seeking to accomplish other climate resilient strategies (i.e., water storage). By having the planning partnerships meet other requirements, their CWMPs can be more climate resilient while also protecting the 1W1P program from receiving backlash or losing participants.

The Clean Water Council's push for incorporating water storage goals into the 1W1P process is evidence that this recommendation can be successful. The 2006 Clean Water Legacy Act created this council to advise the Legislature and the Governor on the administration and implementation of the act.^{xliii} They were active in the development of a policy that required plans within the 1W1P program to establish water storage goals, expressed in acre-feet. Though it is a climate resilient strategy within 1W1P, BWSR did not push for its incorporation into the program.

BWSR can play a role in encouraging similar climate resilient metrics to be required by other agencies. There is a lot of active discussion about climate resilience across the state in various agencies, departments, and government levels and bodies. Taking advantage of this provides an opportunity for 1W1P to become stronger in creating climate resilient CWMPs, but successfully putting their thumb on other scales will require better collaboration within and among agencies. The survey confirmed that respondents hear different things from different

people within BWSR. They also hear different things between agencies. This results in confusion and weakens the ability for planning partnerships to consider incorporating climate change and resilience strategies into their CWMPs.

Improve Public Engagement

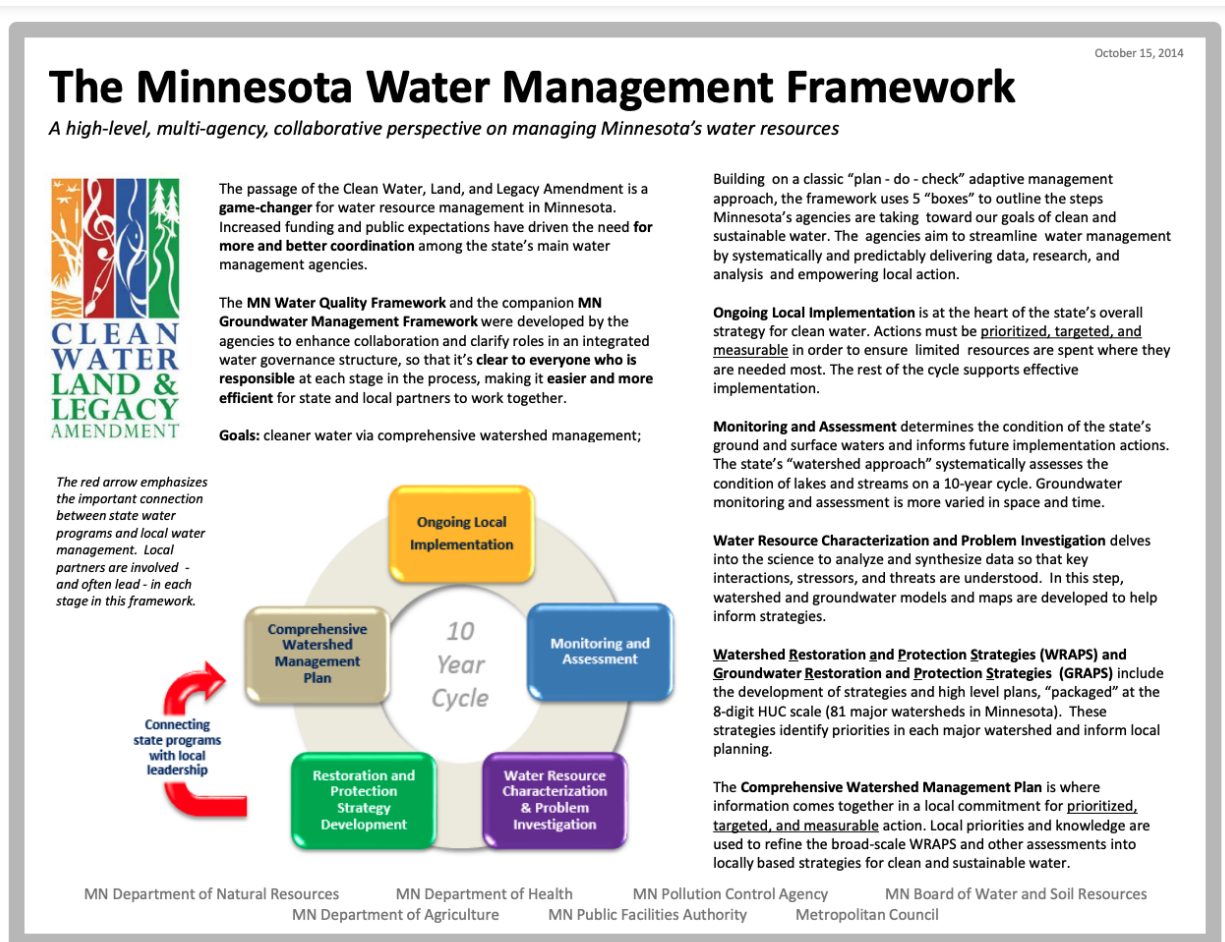
Public relations and engagement are critical to the implementation of many CWMPs. On private land, watershed managers rely on landowners agreeing to participate in voluntary practices. As mentioned previously, buy-in from members of the public is a barrier to climate resilience efforts. However, this problem is not limited to climate resilience, and is something that BWSR is aware of and has been thinking about. Though we have identified this as a problem that should be addressed, it is larger than the scope of our project and should be solved holistically by BWSR and potentially other state agencies.

Conclusion

These recommendations, individually or collectively, will strengthen the 1W1P program. Climate resilience is important for watersheds to address, especially as Minnesota feels more effects from climate change. BWSR can use these recommendations to ensure that Minnesota is prepared for the future and water resources are protected.

Appendices

Appendix A: Minnesota's Water Management Framework



Appendix B: Sample Survey Form

One Watershed, One Plan and Climate Change Resilience

Thank you for taking the time to help us with this project. We are conducting this survey as a part of our capstone project at the University of Minnesota Humphrey School of Public Affairs. Our aim is to help identify opportunities to address the impacts of climate change in Minnesota.

We are interested in understanding the extent to which comprehensive watershed management plans (CWMPs or “plans”) created through BWSR’s One Watershed One Plan (1W1P) program are referencing and/or incorporating climate change and associated impacts. In Minnesota, the effects of climate change vary across the state, but in broad terms are marked by increased precipitation, warmer winter low temperatures, and an increase in extreme weather events.

We greatly appreciate your participation in this survey. Your input will help support our educational experience and will provide valuable information for consideration by BWSR. BWSR is aware of this project, but this survey is solely the responsibility of this student team and is separate from any other BWSR initiatives.

This survey contains 17 questions in 4 sections and will take you approximately 15 minutes to complete. For this survey, please consider the **most recent** CWMP drafting process you participated in. The results will help us understand how participants and authors of CWMPs think about climate change resilience in relation to their watershed. The results of our analysis will be provided to BWSR for review and consideration for the 1W1P program.

Your participation in this survey is entirely voluntary, and your personal information will be kept private should you choose to participate.

Section 1. CWMP Draft Process

With the following questions we aim to gain an understanding of your experience during the CWMP planning process. Please reflect on the process of drafting your watershed’s plan and how decisions were made about which content to include or prioritize in the plan.

During the planning process, do you feel like you had the information you needed about likely climate related changes in your watershed over the coming decades?

- ☐ No
- ☐ Yes
- ☐ Please elaborate (optional)

Do you think that the impacts of climate change (such as extreme weather or flooding) should have been addressed more or less in your CWMP?

- ☐ Climate change should have been addressed **more**
- ☐ Climate change should have been addressed **less**
- ☐ Climate change was addressed as much as it should have been

Section 2. Addressing climate change through CWMPs

In this section we aim to understand options for successfully increasing climate change resilience through watershed planning. For example, one measure may be including goals and actions specifically geared toward preparing for increased and more extreme precipitation. Some examples of these goals are: increasing water storage, protecting and restoring forests, and encouraging regenerative agriculture.

How feasible do you think it would be for your watershed to implement the following climate resilience strategies?

	Not at all feasible	Feasible but with substantial challenges	Feasible with some challenges	Feasible with minimal challenges	Feasible with no challenges

Incorporation of a climate change risk assessment during the CWMP planning process

☐☐☐☐☐

Formal stakeholder engagement during the planning process that generates feedback specifically about impacts of climate change

☐☐☐☐☐

Monitoring and reporting of climate resilience measures (e.g. creating a reporting and tracking system for farmland flooding, monitoring water storage, or mapping land use to measure reforestation and wetland restoration goals)

☐☐☐☐☐

Please elaborate on any comments on the feasibility for the above strategies (optional).

Considering all potential strategies discussed, what barriers or challenges would your watershed face when attempting to incorporate climate resilience strategies in your CWMP? Check all that apply.

- ☐ Lack of interest amongst participating entities
- ☐ Other priorities are more important

- ☐ Public opinion about/acceptance of climate change
- ☐ Financial constraints in implementing strategies
- ☐ Unfamiliarity with climate change impacts to natural resources
- ☐ Unfamiliarity with climate resilience strategies
- ☐ Lack of access to climate trend data
- ☐ Lack of expertise in incorporating climate projections into implementation scenarios
- ☐ Other _____

What resources would your planning group need in order to adopt climate change resilience strategies in your CWMP?

BWSR policy currently states: "Planning partnerships are strongly encouraged to consider the potential for more extreme weather events and their implications for the water and land resources of the watershed in the analysis and prioritization of issues..." If BWSR policy included a more stringent requirement about addressing climate change/extreme weather events, would it change your likelihood of participating in the program?

- ☐ No
- ☐ Yes
- ☐ Please elaborate (optional)

Section 3. Perspective of contributors

With the following questions we aim to gain an understanding of your perspective, as an author/contributor to a CWMP, on incorporating climate change resilience during the planning process. In this context we are referring to climate change resilience as the ability of the watershed to effectively and quickly recover from damage associated with climate change.

How important do **you personally** think the impacts of climate change are to the health of your watershed?

	Not at all important	Slightly important	Moderately important	Important	Very important
	☐	☐	☐	☐	☐

How comfortable do **you personally** feel describing the following to other members of your planning team:

	Not at all comfortable	Somewhat comfortabl e	Mostly comfortable	Comfortabl e	Very comfortable
Impacts of climate change on your watershed	☐	☐	☐	☐	☐
Strategies to deal with the impacts of climate change on your watershed	☐	☐	☐	☐	☐

In your opinion, how important do **the people in your watershed** think the impacts of climate change are to the health of your watershed?

	Not at all important	Slightly important	Moderately important	Important	Very important

☐
☐
☐
☐
☐

During the planning process, did you feel like you could **productively** talk with other contributors about climate change, and associated impacts on your watershed?

- ☐ No
- ☐ Yes
- ☐ Why or why not (optional)

Do you feel like the following in your watershed’s CWMP will adequately address the potential impacts of climate change?

	Does not address climate change	Somewhat addresses climate change	Mostly addresses climate change	Adequately addresses climate change	More than adequately addresses climate change
Priorities	☐	☐	☐	☐	☐
Actions	☐	☐	☐	☐	☐

Please provide details about why priorities or actions in your watershed's CWMP will or will not address climate change (optional).

What sources of information are you most likely to use to learn about the impacts of climate change on your watershed (check all that apply)?

- ☐ Local, state, or federal government resources
- ☐ Academic publications
- ☐ University extension services
- ☐ Other water resource professionals
- ☐ News media - print, radio, TV
- ☐ Social media
- ☐ Word of mouth - friends, family, neighbors
- ☐ Other _____

Section 4. Other

Please add any additional information you would like to provide here.

Would you be comfortable with someone from our team contacting you to conduct a short follow-up interview?

- ☐ No
- ☐ Yes

Please provide your name. This will only be used for interview contact and will be separated from your survey responses to ensure anonymity.

What is the best way to contact you if you're interested in a follow-up interview?

- ☐ Email _____

☐ Phone _____

☐ Not applicable

Would you like to receive an email copy of our final product, informed in part by this survey?

☐ No

☐ Yes

Appendix C: Interview Consent Script and Example Questions

Verbal Consent (to be read verbatim at the beginning of each interview)

Purpose of Study

We are a group of graduate students conducting interviews as part of our capstone project at the University of Minnesota Humphrey School of Public Affairs. Our project centers around understanding the extent to which comprehensive watershed management plans created through the One Watershed, One Plan program are referencing and/or incorporating climate change and associated impacts.

Procedures

Given your consent, we would like to ask you questions for no more than an hour about your experiences working with watersheds in the 1W1P drafting processes and the role you play in the process, especially as it relates to addressing climate change and associated impacts.

If there is anything that we do not ask but you think is relevant, please feel free to bring it up.

Confidentiality

This interview is confidential. This means that we will not reveal your identity to anyone. We will make an audio recording of the interview, which we will take contact notes from prior to destroying the original recording to protect your anonymity. Notes will not include any identifying information. Notes will be kept on a secure server and the research team will be the only people able to access them. Your responses are completely confidential

Your name and person will not be included in the final report.

Do you consent to being recorded for note-taking purposes?

Voluntary Nature of Participation

You are free to decline participation in the project, in part or whole. If you begin participating, you are free to discontinue participation at any time. Your decision, if you do so, to decline or discontinue taking part in the project will not result in any negative consequence(s) from the researchers or the University of Minnesota. Your participation is entirely voluntary.

Questions

Do you have any questions about the study or the research team? Please feel free to pose them now. We are happy to answer anything to the best of our abilities.

Contacts

Please know that you can ask questions now or at any time during the interview process, and if questions arise afterwards you are encouraged to contact one of us.

Example questions

Background about their role in the process and the work they do and how they interact with their clients (in general and on the specific issue of climate change)

What is your role in the consulting process and your role in drafting CWMPs?

What influence, if any, do you have over the content included in CWMPs (e.g., climate change, resilience, etc.)?

Do you make suggestions to your clients about what should and shouldn't be included? Please give some examples. Is one of these things climate change and/or resilience?

Is there much back and forth iteration during the drafting process between your company and the watershed committees?

Experiences with 1W1P plan in relation to climate change resilience

What are their perspectives/observations about climate change in the 1W1P process?

How much do watersheds rely on your technical expertise to help them write these plans?

- If they do rely on you: What barriers are there to you providing information about climate change and resilience in the watersheds you work with?
- If they don't rely on you: What is your role?

Can you push for incorporation of climate change? Have you previously? What have been the reactions of other 1W1P authors/contributors?

What is the spectrum of climate change opinions across watersheds you've worked with?

What is your organizational perspective on climate resilience?

What is the relationship between you and BWSR?

- Would more interaction with BWSR be beneficial to the process of drafting the CWMPs?

Appendix D: Additional Selected Quotes From Survey Responses

The following quotes were taken directly from survey responses. They do not represent every comment made in the survey. Rather, we have selected particularly important or enlightening quotes that have been categorized by apparent themes from the survey. We incorporated many quotes into our main text, but these were quotes that did not make it into the final report but are still relevant to understanding the perspective of respondents who are doing the groundwork to draft CWMPs within their planning partnerships.

Technical Resource Needs

- "Had enough for general planning purposes but did not have specifics like H&H models for actual numbers and how increased rainfall may impact the watershed."
- "watershed storage was the most challenging metric to determine for our watershed and will be difficult to track due to needing experienced modelers to run HSPF."
- "Extra tools and info to sell and incorporate strategies and best management practices to help reduce climate change impacts could be helpful"
- "Continued and expanded modeling though programs like PTMapp of climate change effects such as extreme rainfall events. Modeling or prediction models of the effects of [temperature] changes on soils and soil structure."
- "Some topics necessary for adoption would be to gain an understanding of what climate change resilience is, its success in past efforts, direction to implement, expectations and community commitment."

Funding and/or Staffing

- "Monitoring, reporting, and tracking farmland flooding seems like a big undertaking, one that I don't think our organization could handle on our own."
- "The most significant challenge with restoring critical wetland acres in our prairie pothole region is funding for easements. A majority of the best, most critical wetlands to handle climate changes are pattern tiled and very productive farmland when dry. To even have a conversation about setting aside these acres is strictly a financial matter in my opinion."
- "This effort would really have to come from the consultants who have the experts working on models and projections. Staff at the local planning level are too focused on the 10-year vision. Policy requirements don't necessarily do anything to change the real reason that it's not being addressed."
- "Climate change is important but I am concerned about the reporting requirements that may follow"

- "Implementation is the most difficult part of any initiative. It's easy to plan. It's completely another to bring it to the ground. Over the years there are lots of great resource plans with highly variable success. Unless serious economics are brought to bear, to get buy-in with sustained activity, success will be less than hoped"

Public Relations Needs

- "Open minds and examples of recent close to home climate change incidents and how they will be affecting natural resources and production results."
- "Elected officials and local stakeholders interested or engaged in climate change resilience efforts."
- "Volunteer conservation isn't as simple as call a landowner and let them know we have money to implement conservation activities. It's more psychological in nature. We as SWCD's for example have to find the common goal with that landowner in order to become better conservation sales people. One of the barriers to selling good conservation practices is state restrictions. Being required to do something within a program doesn't help us sell conservation. In many cases it can actually have the opposite effect."
- "It is my feeling that people in this area of the state feel somewhat insulated from the most dire consequences of climate change. In my 75 years of living in Minnesota as a sportsman, citizen concerned with natural resources, and manager of the Pelican River Watershed District, I have witnessed climate change. Despite my personal concern, I feel impotent to control climate change in a major way."

Collaboration Within and Between Government Agencies

- "1W1P focus is on water quality. BWSR didn't even want to include any flooding items (climate change related or not) unless there was a water quality angle..."
- "I think the group could look into each counties Multi-Hazard Mitigation Plans...things like flooding, tornadoes, hail, windstorms, winter storms, drought, wildfire, landslides, dam failure, and extreme heat/cold. Maybe look at hazard risk assessment and vulnerability analysis and review of existing hazard risk prioritization."
- "There are other agencies that could be more effective in this arena than BWSR of the watershed districts. the US Corps of Engineers would be a major evaluator in this endeavor."
- "The 1W1P s while seeming to be a good idea from the outside have a tendency to promote conflict between the LGU's because of how the money can be divided and sorted by a majority of the members vote. This will always leave the members with the

least political pull/population base out in the cold. It promotes a system of inequality among the LGU and is not a good solution.”

Geographic and Temporal Scope is Limiting

- “climate change should be looked at more than 40 years, not a year to year trend. 100 or 200 years should be considered when talking about climate change.”
- “All water in the Lower Minnesota River Watershed is sourced beyond the boundaries of the Watershed District. The District therefore has little authority to address changes needed in upstream areas to reduce impacts of climate change, specifically sediment transport and flow management.”
- “Our planning scope seems too short-termed, and we focused more on issues within the 10-year timeframe. It's hard to plan for something when it's a vision for the future, or a speculation about life 100 years from now.”
- “State sponsored and developed modeling [would be important]. This would be a good project for the state to work on and then communicate down to locals. Strategies and expectations should be realistic. CWMP's already have hundreds of pages of implementation efforts for surface water, groundwater, flood mitigation, soil health, point and non point activities and dozens of partners. If we're intentional about having climate resiliency added into our water plans, it needs to compliment other activities that are being worked on.”

Climate Change Can Be Addressed Without Being Called Climate Change

- “We are not dealing with Climate Change exactly, we are trying to implement practices that make the landscape more resilient to weather patterns that do not follow the averages we are accustomed to.”
- “Much if not most of the planning had climate change mitigation outcomes, but was not specifically focused on climate change.”
- “With the political divide [between] rural vs. metro MN we can't use the term climate change. If we would, nothing would be addressed. It's fairly acceptable if we call it extreme weather events. I find that with that change we can dance it into the plan.”
- “Our group was encouraged to change the term climate change to 'extreme weather' as climate change seems to trigger conflicting ideas. Extreme weather is something everyone can agree on, and an increase in extreme weather is acknowledged. Planning around climate change is complicated in this area.”
- “Depending on who the audience is - if I bring up the term ‘Climate Change’ I will lose a majority of the crowd. However, if we present it as protecting the productivity of agricultural fields from increased storm events - we will be miles ahead.”

- "Climate change is a politically charged subject. On a local level I don't want to have to argue with elected officials, or private landowners about what climate change means. I want our watershed plans to be a tool that helps me to target our local efforts to address the locally identified priority resource issues by working with private landowners that choose to adopt conservation practices. By doing this I think we will be addressing the impacts of climate change without having to call them out through some formal process."

Climate Change Was Not a Priority

- "Was not a big topic of conversation yet since we were just beginning to form a 1W1P. I expect it will become a larger topic as we decide on projects to tackle."
- "Climate change was not really a priority for our community, elected officials, or staff during the time the planning effort was underway."
- "It was not on my mind nor was it brought to my mind - this is all our concern and we all (including me) need to get engaged!"

Climate Denialism - Survey Respondents

- "As long as the earth has been, climate has been changing. This needs to be recognized first. Is climate change man made? I do not believe so, it has been changing forever. Man has possibly sped climate change up a bit, but we can only recognize that change will happen. Hard to know what things will look like in decades. BMP's should be followed at all times."
- "As a taxpayer, I am angry that my tax dollars are used to support liberal/democrat false assertions in our public schools and universities here in Minnesota. And brainwashing students into believing this nonsense."
- "I don't waste my time interacting with morons; i.e. democrats and liberals"

Climate Denialism - Planning Process

- "There was resistance from some partners to specifically EXCLUDE the term "Climate Change" from the Comprehensive Planning Document"
- "Usually there is good dialogue at the technical committee level, then not accepted at the policy committee level so not in the plan"
- "In my conversation with County and soil and water employees, they feel that the one watershed project was pre-set with goals and they were paid to go through an already pre-determined process. What is happening on Lake Shamineau has no impact on this process and it hardly addressed climate change in this project. Climate change is the cause of Lake Shamineau. No one will address it."

Climate Denialism - General Public

- “The words “climate change” arouse less angst than they used to, but can still be a barrier in heavily agricultural areas. Be careful of jargon. Farmers see the real impacts, but have sometimes resisted the validity and wave of publicity about climate change in the past.”

ⁱ Ackerman + Gruber, *Origin Story*, n.d., n.d., <https://www.nature.org/en-us/magazine/magazine-articles/mississippi-river-photos/>.

ⁱⁱ Ryan R. Noe et al., “Climate Change Projections for Improved Management of Infrastructure, Industry, and Water Resources in Minnesota,” Report, September 15, 2019, <http://conservancy.umn.edu/handle/11299/209130>.

ⁱⁱⁱ US Environmental Protection Agency, “What Climate Change Means for Minnesota” (Environmental Protection Agency, August 2016), <https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-mn.pdf>.

^{iv} US Environmental Protection Agency.

^v Noe et al., “Climate Change Projections for Improved Management of Infrastructure, Industry, and Water Resources in Minnesota.”

^{vi} Adani Azhoni, Simon Jude, and Ian Holman, “Adapting to Climate Change by Water Management Organisations: Enablers and Barriers,” *Journal of Hydrology* 559 (April 1, 2018): 736–48, <https://doi.org/10.1016/j.jhydrol.2018.02.047>.

^{vii} Jane A Leggett, “Climate Change: Defining Adaptation and Resilience, with Implications for Policy,” *Climate Change*, May 11, 2021, 3.

^{viii} Julia Baird and Ryan Plummer, eds., *Water Resilience: Management and Governance in Times of Change* (Cham: Springer International Publishing, 2021), <https://doi.org/10.1007/978-3-030-48110-0>.

^{ix} Reinette Biggs et al., “Toward Principles for Enhancing the Resilience of Ecosystem Services,” *Annual Review of Environment and Resources* 37, no. 1 (2012): 421–48, <https://doi.org/10.1146/annurev-enviro-051211-123836>.

^x Baird and Plummer, *Water Resilience*.

^{xi} Baird and Plummer.

^{xii} Tim Pugmire, “Walz: \$293M Needed to Make Water Infrastructure More Resilient to Climate Change,” *MPR News*, January 10, 2020, <https://www.mprnews.org/story/2020/01/10/walz-293-million-needed-to-make-water-infrastructure-more-resilient-to-climate-change>.

^{xiii} Leggett, “Climate Change: Defining Adaptation and Resilience, with Implications for Policy.”

^{xiv} Baird and Plummer, *Water Resilience*.

^{xv} Baird and Plummer.

^{xvi} Azhoni, Jude, and Holman, “Adapting to Climate Change by Water Management Organisations.”

^{xvii} Dan Shaw and Suzanne Rhees, “Climate Change Trends and Action Plan,” Minnesota Board of Water and Soil Resources, September 2019, https://bwsr.state.mn.us/sites/default/files/2019-09/ClimateChangeTrends%2BActionPlan_Sept2019.pdf.

^{xviii} Shaw and Rhees.

^{xix} Houston Engineering Inc., “Buffalo-Red River Watershed Comprehensive Watershed Management Plan,” October 28, 2020.

^{xx} Houston Engineering Inc., “Wild Rice-Marsh River Watershed One Watershed, One Plan,” n.d.

^{xxi} Houston Engineering Inc.

^{xxii} Emmons and Livier Resources, Inc., “Cannon River Comprehensive Watershed Management Plan,” March 2020.

^{xxiii} RESPEC, “Sauk River Comprehensive Watershed Management Plan,” March 2021.

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- ^{xxiv} Houston Engineering Inc., "Lake of the Woods Watershed Comprehensive Watershed Management Plan 2019-2029," August 2019.
- ^{xxv} Houston Engineering Inc., "Leaf-Wing-Redeye Watershed One Watershed One Plan," n.d.
- ^{xxvi} "Lower St. Croix River Comprehensive Watershed Management Plan," n.d.
- ^{xxvii} Houston Engineering Inc., "Buffalo-Red River Watershed Comprehensive Watershed Management Plan."
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- ^{xl} Board of Water and Soil Resources, "One Watershed, One Plan Guiding Principles," December 18, 2013, <http://bwsr.state.mn.us/sites/default/files/2019-05/1W1P%20Guiding%20Principles%20Policy.pdf>.
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