BUFFALO-RED RIVER WATERSHED: ONE WATERSHED, ONE PLAN
Joint Advisory Committee/Planning Team November 1st Meeting Materials

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Draft Participation Plan: p. 2 - 17
Draft Land & Water Resources Narrative: p. 18 – 64
Draft Issues Table: p. 65

***Please reference page numbers highlighted in red***
# Agenda

## BUFFALO-RED RIVER WATERSHED: ONE WATERSHED, ONE PLAN

Joint Advisory Committee/Planning Team Meeting

### MEETING INFORMATION

**Date:** November 1, 2018  
**Location:** Buffalo-Red River Watershed District  
1303 4th Ave NE  
Barnesville, MN 56514

**Time:** 9 AM - Noon

**Invitees / Attendees:**  
- Planning Team  
- Advisory Committee  
- Policy Committee (optional)

**Facilitator:** Houston Engineering, Inc.

Buffalo-Red River Watershed District

### PREPARATION FOR MEETING

**Read:**  
- Revised BRRW Issues Table  
- Revised BRRW 1W1P Participation Plan  
- Draft BRRW Land and Water Resources Narrative

### AGENDA ITEMS

<table>
<thead>
<tr>
<th>AGENDA ITEMS</th>
<th>ACTION</th>
<th>TIME ALLOTTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Welcome and Introductions</td>
<td>--</td>
<td>15 min.</td>
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</table>
| 3. Overview of Participation Plan and Meeting Schedule as Proposed  
  - **Meeting Goal:** Confirm Meeting Schedule with Advisory Committee | Decide | 20 min. |
| 4. Land and Water Resource Narrative  
  - **Meeting Goal:** Introduce to Advisory Committee. Set date and format to provide comments. | Introduce/Discuss | 20 min. |
| 5. Draft BRRW Issues Table  
  - **Meeting Goal:** Introduce to Advisory Committee and Review changes to format and content | Introduce/Discuss | 60 min. |
| 6. Public Kickoff Meeting  
  - **Meeting Goal:** Determine logistics of kickoff meeting and format for public to engage on issues to prioritize | Introduce and Decide | 45 min. |
| 7. Meeting Recap  
  - **Meeting Goal:** Discuss Action Items and Next Steps | Discuss | 5 min. |
Buffalo – Red River One Watershed, One Plan Participation Plan
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<th>Acronym</th>
<th>Description</th>
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<tr>
<td>1W1P</td>
<td>One Watershed, One Plan</td>
</tr>
<tr>
<td>BWSR</td>
<td>Board of Water and Soil Resources</td>
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<td>BRRW</td>
<td>Buffalo - Red River Watershed</td>
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<tr>
<td>COE</td>
<td>Corps of Engineers</td>
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<tr>
<td>DNR</td>
<td>Department of Natural Resources</td>
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<td>MDA</td>
<td>Minnesota Department of Agriculture</td>
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<td>MDH</td>
<td>Minnesota Department of Health</td>
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<td>MPCA</td>
<td>Minnesota Pollution Control Agency</td>
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<td>NRCS</td>
<td>Natural Resource Conservation Service</td>
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<tr>
<td>SWCD</td>
<td>Soil &amp; Water Conservation District</td>
</tr>
<tr>
<td>TNC</td>
<td>The Nature Conservancy</td>
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<td>WD</td>
<td>Watershed District</td>
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</table>
1 BACKGROUND

The Counties of Becker, Clay, Otter Tail and Wilkin (Counties), by and through their respective County Board of Commissioners, and the Becker, Clay, West Otter Tail and Wilkin Soil and Water Conservation Districts (SWCDs), by and through their respective SWCD Board of Supervisors, and the Buffalo – Red River Watershed District (WD), by and through its respective Board of Managers were selected in the 2017 planning year by the Minnesota Board of Water and Soil Resources (BWSR), to complete a One Watershed One Plan (1W1P). Collectively, the parties are called the “Buffalo – Red River LGUs” (hereafter referred to as the “LGUs”). The LGUs recognized the importance of partnerships to plan and implement protection and restoration efforts for the Buffalo - Red River Watershed. The Buffalo - Red River Watershed 1W1P planning area is shown in Figure 1.

The LGUs are responsible for preparing a Comprehensive Watershed Management Plan (Plan) under the 1W1P effort. The members of the LGUs share an interest in and the statutory authority to prepare, adopt, and assure implementation of a Plan for the Buffalo - Red River Watershed.

This document describes the participation process for developing the Plan.
Figure 1. Buffalo - Red River Watershed 1W1P Location.
2 AUDIENCE & ROLES

One of the Guiding Principles of 1W1P is that the process “must involve a broad range of Stakeholders to ensure an integrated approach to watershed management.” A Stakeholder is defined as a party (person or group) who holds a vested interest in the outcome of the planning process. The primary outcome resulting from the Plan will be a targeted implementation plan, focused on the implementation of specific management practices, structural best management practices, capital improvement projects, educational and outreach programs, monitoring activities, and regulatory controls. A variety of Stakeholders may be directly or indirectly affected.

Participants in the planning process are comprised of several potential target audiences or groups and collectively represent the Stakeholders. The groups and their respective planning roles are described in the following sections.

2.1 Policy Committee

The primary role of the Policy Committee is to collectively develop and adopt, as local government units, a coordinated watershed management plan pertaining to the area within the Buffalo - Red River Watershed. Bylaws have been adopted to guide the decision-making process, leadership, and direction of process for the Policy Committee. Expectations are that the Policy Committee will review and approve a draft of the plan outline, review and approve information about the priority resources, concerns and issues affecting the plan area, and review and approve the Plan. An additional expectation is that members of the Policy Committee will engage in constructive discussion and debate about issues addressed by the Plan and provide consensus direction on plan development matters, to the Planning Team. The Policy Committee will also review and approve membership on the Advisory Committee. Meeting commitments for the Policy Committee are expected to be every other month. The Policy Committee has additional obligations as described by The Memorandum of Agreement executed by the LGUs.

2.2 Advisory Committee

Membership on the Advisory Committee may consist of members from the Planning Team, other local government staff, the state’s main water agencies and/or plan review agencies, the general public, trade organizations, nonprofit organizations, and special interest groups. Leaders within the local community are valued members of the Advisory Committee. Membership to the Advisory Committee is reviewed and approved by the Policy Committee.

The purpose of an Advisory Committee is to make recommendations on the Plan and the targeted implementation schedule to the Policy Committee, including identification of priority resources, concerns,
and issues affecting the plan area. Expectations are that members of the Advisory Committee will communicate Plan related activities to their respective organizations. Advisory Committee members are expected to communicate practical concerns during the plan development process and to assist the Policy Committee in ensuring a credible Plan development process. Meeting commitments for Advisory Committee members are expected to be every other month or when subject matter expertise is warranted.

Each state or federal agency or organization participating on the Advisory Committee shall designate one lead representative and one designated alternate. An agency’s or organization’s guidance, input, and decisions shall be communicated through the lead representative or designated alternative. The lead agency or organization representative is expected to coordinate information flow and communication within their agency or organization.

2.3 Planning Team

The Planning Team is comprised of and local SWCD and Watershed District staff for the purposes of logistical and day-to-day decision-making in the planning process. The Planning Team includes the consultant and BWSR Board Conservationist who are also responsible for assembling the draft and final Plan. Members of the Planning Team are responsible for providing information needed for the planning process, reviewing and accepting draft plan related information, and assisting in Plan development. Identifying priority resources, concerns, and issues for their specific county is also the responsibility of the Planning Team. Meeting expectations for the Planning Team are monthly and as needed to maintain pace of progress for plan development.

2.4 General Public

Various public meetings and hearings will be completed as part of the Plan development process. The general public is expected to be an important Stakeholder group. Input from the public meetings will be used to ensure a complete list of priority issues is developed. The role of the general public is expected to include identifying issues affecting resources. The public will be engaged to rank concerns establishing a “public priority” rank. An additional role for the general public is expected to include review of and discussion about the targeted implementation schedule and ability to achieve the measurable goals.

3 INTENT FOR STAKEHOLDER INVOLVEMENT

The principal intent of involving stakeholders during the planning process is to build acceptance of the Plan and the recommended solutions described by the targeted implementation schedule. Acceptance is critical because the LGUs is focused on actively utilizing their Plan to implement projects and programs
within the Buffalo – Red River Watershed. Successful implementation will depend highly on the degree to which the Stakeholders believe their concerns, issues, or expectations are addressed within the Plan.

The LGUs intend for the Stakeholder involvement process to be active, genuine, and credible. To that end, the Stakeholder groups will be involved early in the planning process and will remain engaged through plan completion. Input provided by Stakeholders is intended to help ensure the comprehensiveness of the Plan and validate the implementation priorities of the LGUs and Stakeholders.

4 TOOLS FOR STAKEHOLDER INVOLVEMENT

The LGUs expect to use several tools to involve Stakeholders. These tools include:

- Informing the stakeholders of status and progress by posting information on a website, including document drafts as they become available;
- Convening meetings and workshops with Stakeholders at key milestones to discuss relevant content and obtain input; and
- Use of existing “standing” committees within each county, including local water plan advisory committees. These committees tend to include broad representation.

BWSR has developed guidance for agency comments for the 1W1P planning process that is applicable to all stakeholder groups participating in plan development (See table below for BWSR guidance on providing comments). This guidance is available at [http://www.bwsr.state.mn.us/planning/1W1P/Best_Practices_for_Agency_Comments_on_Water_Plans.pdf](http://www.bwsr.state.mn.us/planning/1W1P/Best_Practices_for_Agency_Comments_on_Water_Plans.pdf)
There are many methods for conveying information and communicating messages. This Stakeholder Participation Plan will utilize a variety of tools as appropriate and beneficial for sharing progress and soliciting input. Information about the planning process can be obtained from the Buffalo – Red River Watershed 1W1P website at http://www.brrwd.org/project-post/one-watershed-one-plan/.

5 CONDUCT

The conduct of members of the various Stakeholder Groups —how the committees function and affect the process—will be based on the overall intent of building acceptance of the Plan through a credible yet timely process. Where appropriate, the LGUs will strive to achieve consensus on Plan related matters. However, because of the diversity of issues and range of resources, full agreement between or among all Stakeholders is not realistic or expected. Within the Policy Committee, bylaws specify voting (Article V). The ultimate responsibility for the content of the Plan rests with the Policy Committee. Participants are expected to act in a professional, constructive, and contributory manner. Members failing to act in good faith during the planning process can be removed from the Advisory Committee by consensus of the Policy Committee.
6  STAKEHOLDER LIST

6.1  Policy Committee Members
The Policy Committee Members, their affiliation, and contact information are listed in Table 1.

Table 1. Policy Committee Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Role</th>
<th>Address</th>
<th>City/State/Zip</th>
<th>Phone</th>
<th>e-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lyle Hovland</td>
<td>Wilkin County</td>
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<tr>
<td>Barry Nelson</td>
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<td>Wayne Johnson</td>
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<tr>
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<tr>
<td>Frank Gross</td>
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<tr>
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<td>701-238-8121</td>
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<td>John Lindquist</td>
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<tr>
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<td>218-863-7785</td>
<td><a href="mailto:jasjos@loretel.net">jasjos@loretel.net</a></td>
</tr>
<tr>
<td>Travis Schaver</td>
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<td>Alternate</td>
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<td>Lake Park, MN 56554-9662</td>
<td>218-238-5077</td>
<td><a href="mailto:travisschaver@yahoo.com">travisschaver@yahoo.com</a></td>
</tr>
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<td>Peter Fjestad</td>
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<td>218-731-4630</td>
<td><a href="mailto:pfjestad@prtel.com">pfjestad@prtel.com</a></td>
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</table>
6.2 Advisory Committee Members

The Advisory Committee Members, their affiliation, and contact information are listed in Table 2. The Advisory Committee is comprised of technical representatives from local, federal and state agencies, non-governmental organizations, industry and citizens who reside in the watershed. Members of the Policy Committee and Planning Team can participate in the Advisory Committee process.

Table 2. Advisory Committee Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Address</th>
<th>City/State/Zip</th>
<th>Phone</th>
<th>E-mail</th>
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<tbody>
<tr>
<td>Annette Drewes</td>
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<td>Bemidji, MN 56601</td>
<td>218-308-2468</td>
<td><a href="mailto:annette.drewes@state.mn.us">annette.drewes@state.mn.us</a></td>
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<tr>
<td>Michael Sharp</td>
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<td>714 Lake Ave Suite 220</td>
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<td>218-846-8103</td>
<td><a href="mailto:michael.sharp@state.mn.us">michael.sharp@state.mn.us</a></td>
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<tr>
<td>Ryan Lemickson</td>
<td>MDA</td>
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<td></td>
<td>320-634-7350</td>
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<tr>
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<td></td>
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<tr>
<td>Shawn May</td>
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<td>Chad Raitz</td>
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<td>218-739-2291</td>
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<tr>
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<td>218-847-9393 ext. 112</td>
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</tr>
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<td><a href="mailto:rodger.hemphill@state.mn.us">rodger.hemphill@state.mn.us</a></td>
</tr>
<tr>
<td>Name</td>
<td>Affiliation</td>
<td>Address</td>
<td>Phone</td>
<td>Email</td>
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<tr>
<td>Nicholas Brown</td>
<td>DNR</td>
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<td><a href="mailto:Nicholas.Brown@state.mn.us">Nicholas.Brown@state.mn.us</a></td>
<td></td>
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</tr>
<tr>
<td>Lynn Foss</td>
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<td>1615 30th Ave S, Moorhead, MN 56560</td>
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<tr>
<td>Tony Nelson</td>
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</tr>
<tr>
<td>Brian Winter</td>
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<td>218-498-2679</td>
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<td></td>
</tr>
<tr>
<td>Jay Nord</td>
<td>MN Wheat Growers/Citizen</td>
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<tr>
<td>Gerald Nordick</td>
<td>Citizen</td>
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<td>Wayne Brendemuhl</td>
<td>Citizen</td>
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<td>John Evert</td>
<td>Citizen</td>
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<td>Chuck Anderson</td>
<td>Citizen</td>
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<tr>
<td>Charles Piekarski</td>
<td>Citizen</td>
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<td>James Grier</td>
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<tr>
<td>Jill Wilkey</td>
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</tr>
<tr>
<td>Phil Doll</td>
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<td>218-846-7360</td>
<td><a href="mailto:Phil.doll@mn.nacdnet.net">Phil.doll@mn.nacdnet.net</a></td>
<td></td>
</tr>
<tr>
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<tr>
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<td></td>
</tr>
<tr>
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The Planning Team Members, their affiliation, and contact information are listed in Table 3.

Table 3. Planning Team Members.

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7 SCHEDULE

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<td>PC</td>
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<td>AC</td>
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<td><em>Meeting times subject to change due to holidays, road, and other potential conflicts.</em></td>
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Notes: "Introduce, Discuss, Decide" primarily relates to PT meetings, and is intended to set planning process pace. AC and PC members will review and approve developed material as available.

Schedule is intended to document planning pace of progress and anticipated scheduled meetings. However, meeting dates and meeting committees may change to meet planning process needs.
Buffalo – Red River One Watershed, One Plan
Land and Water Resources Narrative
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1. INTRODUCTION

The Buffalo-Red River Watershed (BRRW) One Watershed, One Plan (1W1P) area, located in northwest Minnesota, comprises an area of 1,785 square miles and mirrors the jurisdictional boundary of the Buffalo-Red River Watershed District. All or parts of two major (8-digit Hydrologic Unit Code, or HUC) watersheds (the Buffalo River, the Upper Red River) and one minor (10-digit HUC) watershed (the Otter Tail River downstream from Orwell Dam) are located within the legal boundary of the BRRW. Other watersheds bordering the BRRW are the Wild Rice River (north), Elm-Marsh River (northwest), upper Otter Tail River (east) and the Bois de Sioux (south). The western boundary is the Red River (Figure 1).

Figure 1: Watersheds within the BRRW 1W1P boundary and neighboring watersheds.
The BRRW 1W1P planning area is based on the legal boundary of the Buffalo-Red River Watershed District (BRRWD). The BRRWD and partner Local Governmental Units (LGUs) involved with water resource management, including the development of the BRRW 1W1P, determined to use this boundary as it has recently been updated to better match with the hydrology of the watershed. The BRRW plan area is comprised of nine distinct planning regions based on the planning regions established by the BRRWD (Figure 1). These planning regions account for regional variation within the plan area to allow for tailored management and planning at a more refined scale.

The 2016 Buffalo-Red River Watershed District Revised Comprehensive Management Plan forms the basis of this Land and Water Resources Narrative unless otherwise cited in-text.

2. ECOREGIONS

The BRRW transects three ecosystems, including the Lake Agassiz Plain, the North Central Hardwood forests, and the Northern Lakes and Forests (Figure 2). The majority of the BRRWD is located in the Lake Agassiz Plain with a lesser area of North Central Hardwood forests. Less than 1% of the BRRWD is located in the Northern Lakes and Forests ecoregion.
3. GEOLOGY, SOILS AND TOPOGRAPHY

The geology of the Red River Basin and the BRRW, as a microcosm, consists of glacial lake deposits, lake shore deposits, till and a small amount of ice-contact deposits overlying the bedrock. Bedrock in the east part of the basin consists of Precambrian, undifferentiated igneous, and metamorphic rock. Bedrock in the west part of the basin consists of a small band of Cretaceous, fine-grained sandstone and shell. Clay and silt lake deposits dominate the Lake Agassiz plain bordering the Red River of the North. A transition zone between the lake plain and the glacial moraine areas is formed by lake shore deposits, delta sand, and gravel (Figure 3).
Figure 3: Quaternary Geology of the BRRW.
3.1 TOPOGRAPHY

The BRRW can be characterized by three physiographic regions extending from the west boundary to the east boundary: the glacial lake bed deposits, the beach ridge area, and the glacial moraine. Over twelve thousand years ago, much of the BRRW was covered by Glacial Lake Agassiz. Lake Agassiz was formed by an accumulation of melt waters from the last receding glacier. The western portions of Clay and Wilkin Counties are located on this lake bed. The lake bed is characterized by flat, extremely level deposits of lake sediments reaching up to 80 feet in thickness. The beach ridge area is located along the boundary of old Glacial Lake Agassiz. The level of Lake Agassiz fluctuated through the centuries, with the fluctuations leaving their mark on the land in the form of beaches. The beach ridge physiographic region of the BRRW follows a north-south corridor approximately eight miles wide through the center of the BRRW and is located on the east boundary of the lake plain. The glacial moraine area is located east of the beach ridge physiographic region. The landscape of this region was formed by the soil, rocks and debris deposited by the glaciers. The glacial moraine area can be characterized as rolling prairie, with scattered areas of sharply rolling hills interspersed with lakes, ponds, wetlands, and bogs. All in all, elevation across the BRRW slopes from east to west, and ultimately drains to the Red River of the North. Figure 4 depicts the general relief of the BRRW.
Figure 4: BRRW Topography.
3.2 Soils

Like the three physiographic regions, there are three distinctive soil groupings in the BRRW. The soils in the west tend to be clays of low permeability, with poor internal drainage, though very fertile for agriculture. The soils near and within the beach ridge area of the BRRW tend to be clay loams and sandy loams mixed with sands and gravels and include some moderately steep slopes. The soils of the moraine area are mostly clays and silts, and those areas of more irregular topography tend to have a loamy texture and be dark to moderately dark colored and poorly to well-drained. The glacial moraine upland area has nearly level to steep slopes and many wet areas and pocketed depressions. Figure 5 shows soil associations found within the BRRW.
Figure 5: Soil Associations within the BRRW.
4. CLIMATE AND PRECIPITATION

The BRRW is located near the center of the North American continent. It has a continental climate, characterized by cold weather and reduced amounts of precipitation. The movement of cold, polar air masses into the area during the winter months result in very cold, dry weather. During the spring and summer, warm moist air from the Gulf of Mexico tends to dominate weather patterns. National Weather Service stations are located at the Cities of Campbell, Fergus Falls, Detroit Lakes, Ada, and Fargo, North Dakota. All of these weather stations are near to, but outside, the BRRW. Historic weather data indicates extreme variations in temperature and moderate precipitation. Based on historical information (1971-2000) for the Detroit Lakes station, the normal mean monthly temperatures vary from 6°F to 69°F, with a normal mean annual temperature of 41°F. Temperatures have ranged from an extreme low of -53°F to an extreme high of 107°F. The growing season lasts about 121 days, with approximately 2,508 growing degree days during the year. Average annual precipitation for the BRRW is 26.36 inches. Approximately 69% of the precipitation occurs during the five-month growing season, which is May through September. Snowfall depth averages 45.3 inches per year.

5. LAND USE AND LAND COVER

Land use within the BRRW is mostly for agriculture, which has largely replaced the expansive prairies that existed prior to European settlement (Figure 6). Most of the agricultural activity occurs in the western and central portions of the BRRW (Figure 7). Areas in the eastern portion of the BRRW are mostly forested, with scattered lakes and wetland areas. Riparian zones along the Buffalo, Otter Tail, and Red Rivers also exist. Municipalities are scattered in the BRRW. The largest of these municipal areas is the City of Moorhead. Development pressure is moderate to intensive as farmland, timberland, and lakeshore is parceled out for residential and seasonal development.
Figure 6: Pre-settlement Vegetation in the BRRW.
Figure 7: BRRW Land Use.

Legend

- □ 1wp Boundary
- □ Planning Regions
- 2017 Cropland Data Layer:
  - □ All other Land Uses (<1%)
- Land Use:
  - Soybeans (31%)
  - Corn (21%)
  - Spring Wheat (9%)
  - Herbaceous Wetlands (9%)
  - Deciduous Forest (6.5%)
  - Sugarbeets (5%)
  - Developed/Open Space (4.5%)
  - Grass/Pasture (3%)
  - Open Water (3%)
  - Alfalfa (3%)
  - Woody Wetlands (1.5%)
  - Other Hay/Non Alfalfa (1%)
  - Developed/Low Intensity (1%)

Data Source: USDA NASS 2017 Cropland Data Layer
6. SURFACE WATERS

6.1 HYDROLOGIC POSITION

Generally, catchments in the BRRW can be considered headwater catchments due to relatively small acreage of upstream contributing drainage. The Otter Tail River flows in a westerly direction through the Orwell Dam at the southeastern extent of the BRRW and continues west and north to the confluence with the Bois des Sioux River at Wahpeton-Breckenridge. The Red River of the North originates from the confluence of these two rivers and flows north. The South Branch of the Buffalo River originates in the Southern Planning Region and joins the Buffalo River at the north end of the Central Planning Region. The Buffalo River originates from Tamarack Lake in the Lakes Planning Region and flows 139 miles in a westerly direction to its confluence with the Red River near Georgetown, MN at the northwest corner of the BRRW. Contributing drainage from the BRRW comprises some of the most upstream portions of the Red River Basin, which flows to Lake Winnipeg, then the Nelson River, before reaching Hudson Bay in Manitoba, Canada.
6.2 STREAMS

The two branches of the Buffalo River traversing and draining the BRRW are the South Branch of the Buffalo River and the Buffalo River (Figure 9). The South Branch of the Buffalo River receives runoff from several important tributaries including Deerhorn Creek, Stony Creek, Hay Creek, and Whisky Creek. The watercourses consist of an intermingling of natural streams and public and private drainage systems. Most of the land traversed by the South Branch of the Buffalo River is characterized by low relief and is in agricultural production. The South Branch of the Buffalo River generally flows north to the Buffalo River. The Buffalo River flows generally to the west toward Lake Park and Hawley to the confluence with the South Branch of the Buffalo River, near Glyndon. The Buffalo River then flows in a northwesterly direction to the confluence with the Red River at Georgetown. Wolverine Creek is a relatively large area on the
western boundary of the BRRW and in the western portion of the BRRW, which flows directly to the Red River of the North, upstream from the Fargo-Moorhead Metropolitan Area (FMMA). The lower reach of the Otter Tail River flows generally west from Orwell Reservoir to its confluence with the Bois de Sioux River at the headwaters of the Red River. The Red River runs northerly and is the western boundary of the BRRW.

6.2.1 Water Quality

All streams within the BRRW are classified and assessed by the State of Minnesota (specifically the MPCA) relative to their desired uses and water quality (Figure 9). These uses include: aquatic consumption, aquatic recreation, and aquatic life. The protection of these uses is typically ensured by establishing water quality standards. These standards are generally numeric or narrative (i.e., describe a desired condition). Streams failing to attain the water quality standards and support their desired beneficial uses are considered “impaired”. There are several streams within the BRRW that have been identified as being impaired by the MPCA. These are identified in Figure 10. The main stressor for riverine impairments is turbidity and excessive sediment. \textit{E. coli} is also a prominent stressor for aquatic recreation impairments.
Figure 9: 2018 Assessed Waterbodies and MDNR Lakes of Phosphorus Sensitivity Significance in the BRRW.
Figure 10: 2018 Proposed Impaired Waterbodies in the BRRW.
6.2.2 Water Quantity

Flood damage is one of the primary issues associated with surface waters in the Red River Valley area and the BRRW. Flooding causes a significant financial burden, particularly for the agricultural sector. Flooding is most severe in the western portion of the BRRW. Flooding results in financial damages as well as social and emotional damages that are more difficult to quantify. In general, the lake plain area is prone to flooding due to the flat landscape and channels that have relatively low capacities. The water from the portion of the watershed contributing to the lake plain area of the BRRW tends to release its runoff faster than the lake plain channels can carry it away. More recently, the BRRW has seen an increase in landlocked basin flooding in the beach ridge and morainal areas. Figure 11 shows the Federal Emergency Management Area (FEMA) 100 and 500-year floodplains.
Figure 11: FEMA Floodplains in the BRRW.
6.3 Lakes

There are numerous lakes within the northeastern portion of the BRRW, at the headwaters of the Buffalo River, as well as in the general eastern portion (Figure 9). All of the lakes are essentially in Becker, Clay, and Otter Tail counties. The largest lake is Tamarac Lake, at 1,504 acres.

6.3.1 Water Quality

Similar to streams, lakes within the BRRW are also classified and assessed by the State of Minnesota (specifically the MPCA) relative to their desired uses and water quality (Figure 9). Additionally, the MDNR developed criteria to identify phosphorus sensitivity for lakes by predicting how much water clarity would be reduced with additional phosphorus loading to the lakes. A phosphorus sensitivity index was formulated to prioritize lakes relative to the MPCA’s objective to protect high quality, unimpaired lakes at the greatest risk of becoming impaired (Figure 9).

Lake water quality is important to the residents of the BRRW. Area lakes are used for recreational opportunities, such as waterfowl hunting, fishing, and swimming. Many of these lakes also have homes located along their shores, since they are a desirable place to recreate. Quality of lake water is, thus, important to the economic progress of the areas in the BRRW where many lakes are concentrated.

Increased demands on these water bodies, however, can lead to increased risk of water quality degradation. While there are varying degrees of reduced water quality, impacts can already be seen on some of the lakes in the BRRW. There are seventeen lakes with nutrient impairments in the BRRW (Figure 10).

6.4 Wetlands

Wetlands are common in the glacial moraine (Supraglacial Drift Complex) physiographic region, as well as in low areas between the beach ridges (Figure 12). These wetlands are either lacustrine, palustrine, or riverine types. At the present time, wetlands are virtually nonexistent in the lake plain (Lacustrine) physiographic region.
Figure 12: Wetlands in the BRRW.
6.5 PUBLIC DRAINAGE SYSTEMS

There are numerous public and private drainage systems in the BRRW, specifically constructed since the early 1900’s to provide agricultural drainage (Figure 13). The BRRWD has legal jurisdiction over all these ditch systems (except those in Otter Tail County), with the authority to approve proposed improvements to be made to the ditches. Most of these drainage systems are located in the lake plain geomorphic region, since this area is flat, has poorly drained soils, and lacks a natural drainage network. Without the drainage network, water would stagnate in the fields and drown crops. The ditch networks have improved the connection between areas that would otherwise not be hydrologically connected.
Figure 13: Public Ditch Systems in the BRRW.
6.6 Altered Hydrology

Altered hydrology is a term often referenced as a stressor for aquatic life impairments. Altered hydrology is commonly thought to be characterized by increases in peak discharge and runoff volume for a range of precipitation events, as compared to some historic or benchmark condition. Numerous studies have suggested that this hydrologic alteration is a result of some combination of climatic variation, land use/land cover changes, or other landscape scale changes. Aquatic habitat loss, increased streambank erosion and bank failure, and increased sediment levels are some of the suggested consequences of altered hydrology. Individually and collectively these are believed to lead to the impairment of aquatic life, exhibited by lower ecological diversity (Erickson, 2017).

Though no definitive benchmark or scientific consensus on metrics exists, the MPCA and MDNR qualitatively assess altered hydrology by whether or not a watercourse has been altered. Altered in this sense means channelized, ditched, or impounded. These alterations often reduce habitat complexity for aquatic life. The MPCA, in collaboration with MNGeo, developed a suite of Geographic Information Systems (GIS) methods for identifying altered hydrology statewide. Figure 14 shows the results of this Minnesota Statewide Altered Watercourse Project.

In the BRRW, 52.3% (1,176 miles) of watercourses are altered, 0.4% (9 miles) are impounded, 27% (603 miles) are natural, and 20.3% (458 miles) have no definable channel. Most of the altered watercourses are the result of ditching in the lake plain and in the Otter Tail, Southern, and Upper Red Planning Regions. Significant amounts of altered watercourses are found in the upper reaches of the Mainstem Planning Region as well.
Figure 14: Altered and Natural Watercourses in the BRRW.
7. GROUNDWATER

The BRRW is located within the Western and Central Minnesota Groundwater Provinces. The Western province is comprised of clayey glacial drift overlying Cretaceous and Precambrian bedrock, which contain limited extents of sand and sandstone aquifers. The Central province contains sand aquifers in generally thick sandy and clayey glacial drift overlying Cretaceous and Precambrian bedrock. Aquifers are located primarily in the beach ridge and lake plain areas (Figure 15). The major surficial aquifers are the Buffalo, Trojan, Wahpeton Buried Valley, and Pelican. The Buffalo aquifer is the most used aquifer system in the BRRW. There is also a system of deep aquifers in the BRRW, collectively known as the Cretaceous aquifer. The flow of these aquifer systems trends generally to the west and the Red River.
Figure 15: Groundwater Provinces and Major Aquifers in the BRRW.

7.1 SURFACE-GROUNDWATER INTERACTIONS

A groundwater sensitivity study for shallow aquifers in the area was produced by the DNR, based upon the water table depths and soil textures (Figure 16). The beach ridge area has the highest sensitivity to pollution, followed by the glacial moraine area, and then the lake plain area. An exception to this is the area around the Buffalo aquifer, which is the principal source of groundwater supply for Moorhead, MN. Most of the moraine and beach ridge areas as well as the Buffalo aquifer in the BRRW are underlain by active near-surface groundwater systems. Most of the water in these systems is less than 50 years old.
and interacts with processes occurring on the surface, including precipitation, runoff, evapotranspiration, interaction with lakes, rivers, and wetlands, and infiltration through the unsaturated zone. Inactive near-surface groundwater systems are found in the lake plain and scattered throughout the beach ridges and morainal areas. These systems may receive annual recharge, but water moves laterally, discharging into ditches, rivers, and streams. Though close to the surface, water in these systems is hundreds to thousands of years old.
Figure 16: Groundwater Sensitivity in the BRRW.
7.2 WATER QUALITY

The Minnesota Department of Health (MDH) is the state agency tasked with the protection and regulation of ground and surface public drinking water supplies. To that end, in the Buffalo River watershed, the MDH is in the process of developing a Groundwater Restoration and Protection Strategies Report (GRAPs). Similar to the MPCA WRAPs, the GRAPs aims to integrate groundwater protection and restoration strategies into local water management planning. The Buffalo River watershed GRAPs is anticipated at the end of 2018.

Generally, groundwater quality in the BRRW is good. The main contaminant risks are arsenic, bacteria, and nitrates. Figure 17 depicts arsenic concentrations in drinking water wells throughout the BRRW. Arsenic is a naturally occurring element that is detrimental to human health. Many wells across the watershed contain arsenic concentrations above the EPA standard of 10 micrograms per liter (ug/L).

![Figure 17: Arsenic Concentrations by wells in the BRRW.](image)

Nitrate is another contaminant that poses a risk to human health, especially infants. Nitrate levels are typically well below the 10 mg/L EPA standard. Occurrence of the wells coincides with areas of low to moderate pollution sensitivity of near surface materials. Wells that exceed the standard are primarily in the eastern extents of the
BRRW, where pollution sensitivity is higher due to sandier soils and faster infiltration rates of surface water. Figure 18 depicts nitrate concentrations of drinking water wells and coincidence with pollution sensitivity of near surface materials.

Figure 18: Nitrate Concentrations by wells in the BRRW.

7.3 WATER QUANTITY

To be completed as information is provided.

8. WATER USE – SURFACE AND GROUNDWATER

Surface water and groundwater in the BRRW is used for municipal, industrial, and rural domestic water supplies. With the exception of Moorhead, public water supply systems in the BRRW are supplied from groundwater sources. The City of Moorhead also uses groundwater as a source for drinking water, but the largest source is from the Red River.

Wellhead protection is a way to prevent drinking water from becoming polluted by managing potential sources of contamination in the area that supplies water to a public well. The wellhead protection plan is
a separate document from the source water assessment, and it is developed by the water system and its wellhead protection planning team. All groundwater-based community and nontransient noncommunity public water systems should have begun the wellhead protection planning process by 2006.

For communities with drinking water from surface water sources, a Source Water Management Area is often established. The City of Moorhead has completed a source water assessment that delineated three assessment areas. For emergency response (to address acute health issues) an inner source management area was defined to allow advance notice to the water plant operator for preparation of possible shutdown of the intake. For contaminants that are cumulative in their impact on drinking water users (chronic health issues), an outer source management area was delineated as an area that can be realistically managed so that positive results can be expected. The entire watershed is the remaining area that is managed for specifically identified source water concerns. For surface intakes, susceptibility is always high; for groundwater systems susceptibility can be high, medium or low depending on the protection that may exist due to soils and geology.

There are many agricultural users within the BRRW that draw water for irrigation purposes. The majority of this irrigation water is from groundwater sources. There are a few instances where some of the major streams in the BRRW, such as the Mainstem and South Branch of the Buffalo River, are used for irrigation. Water users that draw more than 10,000 gallons per day or 1 million gallons per year must obtain a permit from the MDNR. Water use sources, wellhead protection areas, and drinking water supply management areas are shown in Figure 19.
Figure 19: Ground and Surface Water Supply Uses in the BRRW.
9. STORMWATER AND POINT SOURCE MANAGEMENT

The National Pollutant Discharge Elimination System (NPDES) program is a nation-wide federal regulatory program stemming from the Clean Water Act. In Minnesota, this program is implemented by the MPCA. The NPDES program addresses point source discharges, including stormwater and related pollution, from various sources. The first phase of stormwater NPDES program (Phase I) focused on controlling pollution from industrial activities and included construction activities disturbing more than 5 acres and municipal separate storm sewer systems (MS4s) with populations greater than 100,000. NPDES permit sites are shown in Figure 20.

The second phase (Phase II) of this program, preliminarily initiated by the MPCA in 2003, was formalized in 2006. It built on Phase I by lowering the threshold for requiring stormwater permits for construction and municipal activities. The basis of the program is for permittees to complete a Storm Water Pollution Prevention Program (SWPPP). In all cases, BMPs are to be identified and implemented in order to minimize stormwater runoff impacts to receiving waters. The cities of Dilworth and Moorhead as well as Clay County are affected by this program. The BRRWD is also required to develop an SWPPP as it was identified in 2014 as an MS4 due to legal drainage flowing through the City of Moorhead. MS4s in the BRRW are shown in Figure 20.
Figure 20: NPDES Sites and MS4s in the BRRW.
10. WATER-BASED RECREATION AREAS

Water-based recreation and tourism are important in the BRRW. The lakes area in the east provides opportunities for boating and fishing. Lake home development has grown considerably. Many recreational opportunities exist for hunting waterfowl in one of the many USFWS Waterfowl Production Areas (WPAs). Fishing opportunities exist in the lakes and the Otter Tail and Red Rivers for gamefish species. As designated state water trails, the Red River and Otter Tail River are also popular canoeing destinations. Figure 21 depicts opportunities for water-based recreation in the BRRW.
Figure 21: Water-based Recreation Areas in the BRRW.
11. FISH AND WILDLIFE HABITAT

Though land use in the BRRW is predominately agricultural, extents of prime fish and wildlife habitat can be found (Figure 22). The majority of the areas with biological significance, based on Minnesota County Biological Survey (MCBS) information, are located in the central portion of the BRRW in the beach ridge geomorphic region due to the prairies, forests, and grasslands located there. There are a number of state-owned Wildlife Management Areas (WMAs) and federally controlled Waterfowl Production Areas (WPAs) located throughout the BRRW. The BRRW also includes the Hamden Slough and Tamarac National Wildlife Refuges (NWR).

11.1 RARE AND ENDANGERED SPECIES

Rare natural features (plants and animals) are scattered about the BRRW, but mostly focused in the key habitat areas previously discussed, and along water features (lakes, streams, and wetlands), and the riparian areas around these water features.
Figure 22: Fish and Wildlife Habitat in the BRRW.
12. SOCIOECONOMICS

12.1 POPULATION AND TRENDS

Population in the BRRW is concentrated primarily in the urban areas. The largest urban area is the City of Moorhead. The most recent population value (2010) for Moorhead is 38,065, which is up from 32,177 in 2000. In addition, population within rural areas has experienced a general decline since the 1960’s, due to changes in farming practices and the difficulty of finding employment in small towns. Other areas of increasing growth within the BRRW are in the eastern region around the lakes. This is probably due to the increasing popularity of the lakes for vacation and retirement homes. Population increases are expected in the BRRW with most of future growth occurring in urban areas.

12.2 ECONOMY AND TRENDS

Agriculture, and its related economic activities, provides the primary force behind the economy of the BRRW. The farms throughout the District tend to be very large, concentrating on cash crops rather than on livestock production. Principal crops grown in the BRRW include small grain, soybeans, sunflowers, sugar beets, corn, and potatoes.

Stands of forest exist in the eastern portion of the BRRW. The White Earth State Forest is located partly within the BRRW. An active harvest of timber for the pulp wood industry exists, and sawmills are operated on an all-season basis.

Processing and manufacturing industries are generally located in the BRRW's primary urban center - Moorhead. Moorhead's urban economy is dependent upon agriculture, for many of the businesses are concerned with either processing agricultural products or in selling equipment, seeds, and fertilizers to the farmers. Other industries in Moorhead include wholesale and retail trade, insurance and banking, construction, transportation, and communications, government, public utilities, health facilities, and education.

The education industry is especially important to Moorhead and the BRRW. Young people from all over the area are attracted by Minnesota State University - Moorhead, Concordia College, and the Moorhead Area Vocational Technical Institute. The economic effect of these institutions is noticeable.

12.3 LAND OWNERSHIP AND TRENDS

Land ownership in the BRRW follows land use and is approximately 94% private, with the largest landholdings in agriculture (Figure 23). Notable landowners include R.D. Offutt Company, FSD Partnership and The Nature Conservancy. Public lands comprise approximately 5% of the BRRW, with the US Fish and Wildlife Service holding significant tracts in WPAs and two wildlife refuges. The state of Minnesota also has a significant land investment in the form of WMAs and forest land. The White Earth Tribe has land (<1%) in the northeastern extent of the BRRW. As agriculture continues to be a primary
economic driver and urban, suburban and lakes country development increases, private ownership will likely continue to be the dominant ownership class in the BRRW.
Figure 23: Land Ownership in the BRRW.
13. ADDITIONAL WATERSHED INFORMATION


Minnesota Pollution Control Agency (MPCA), 2016b. Buffalo River Watershed Restoration and Protection Strategy Report. [https://www.pca.state.mn.us/sites/default/files/wq-ws4-11a.pdf](https://www.pca.state.mn.us/sites/default/files/wq-ws4-11a.pdf)

Minnesota Pollution Control Agency (MPCA), 2016c. Buffalo River Watershed Total Maximum Daily Load Report. [https://www.pca.state.mn.us/sites/default/files/wq-iw5-06e.pdf](https://www.pca.state.mn.us/sites/default/files/wq-iw5-06e.pdf)

Minnesota Pollution Control Agency (MPCA), 2017a. Upper Red River of the North Watershed Total Maximum Daily Load Report. [https://www.pca.state.mn.us/sites/default/files/wq-iw5-09e.pdf](https://www.pca.state.mn.us/sites/default/files/wq-iw5-09e.pdf)

Minnesota Pollution Control Agency (MPCA), 2017b. Upper Red River of the North Watershed Restoration and Protection Strategy Report. [https://www.pca.state.mn.us/sites/default/files/wq-ws4-36a.pdf](https://www.pca.state.mn.us/sites/default/files/wq-ws4-36a.pdf)

<table>
<thead>
<tr>
<th>Issue No.</th>
<th>Issue Statement</th>
<th>Resource Concern</th>
<th>Planning Region Focus</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Instability impairing public drainage system performance, shoreline, and stream and river bank and channel integrity</td>
<td>Water Quality</td>
<td>x</td>
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<td>2</td>
<td>Outdated benefit determination for many agricultural drainage systems</td>
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<td>3</td>
<td>Increased erosion and sedimentation leading to ditch, stream, and lake degradation and decreased water clarity, impacting aquatic life and drinking water supplies</td>
<td>Water Quality</td>
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<td>4</td>
<td>Increased phosphorus loading from natural background, human, wildlife, and livestock sources contribute to decreased water clarity and water quality impairments impacting aquatic life</td>
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<td>5</td>
<td>Increased nitrogen loading from natural background, human, wildlife, and livestock sources contribute to water quality impairments impacting aquatic life and increased nutrients in drinking water supplies</td>
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<tr>
<td>6</td>
<td>Elevated concentrations of bacteria (E. coli) loading from natural background, human, wildlife, and livestock sources contribute to water quality impairments impacting aquatic recreation and drinking water quality</td>
<td>Water Quality</td>
<td>x</td>
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<td>7</td>
<td>Reduced concentrations of dissolved oxygen reduce aquatic species health and diversity, impacting aquatic life</td>
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<td>8</td>
<td>Increased surface runoff contributes to flood conditions which has economic, environmental, social, and health safety implications</td>
<td>Water Quality</td>
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<td>9</td>
<td>Loss of natural storage, lack of stream connectivity, channelization and ditching, land use changes, and tillage contributing to increased stream flow, erosion, and sedimentation and is a stressor on aquatic life</td>
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<td>10</td>
<td>Vulnerability of wetlands to indirect impacts such as altered hydrology, increased pollutant loadings, and reclamation from development</td>
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<td>11</td>
<td>Lack of in-stream habitat as a primary stressor on impaired surface waters</td>
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<td>12</td>
<td>Degradation and fragmentation of terrestrial habitats, like CRP, and the impacts on species richness and diversity as well as water quality</td>
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<td>13</td>
<td>Aquatic invasive species (AIS) impacts on habitat, recreation, and economic development</td>
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<td>14</td>
<td>Terrestrial invasive species impacts on areas with high quality vegetation</td>
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<td>15</td>
<td>Groundwater is at risk of being depleted because of overuse and loss of recharge due to pressures from agriculture, development, and industry</td>
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<td>16</td>
<td>The increased frequency of extreme weather events that exacerbate flooding, agricultural, commercial, and residential damages and hinder the operational capacity of entities involved in water resource management</td>
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<td>17</td>
<td>The increased probability of prolonged drought and its impact on agricultural, aquatic and terrestrial habitat, surface and groundwater supplies</td>
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<td>18</td>
<td>Lack of public awareness and understanding of water issues like drainage, erosion, fertilizer use, prescription and non-prescription drug disposal, and household hazardous waste disposal</td>
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<td>19</td>
<td>Lack of a sustainable and coordinated approach to the planning and management of groundwater resources</td>
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<td>20</td>
<td>Lack of a coordinated approach to flood management and planning in accordance with Flood Damage Reduction principles</td>
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<td>21</td>
<td>Lack of a coordinated approach to administering LID statutory obligations</td>
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<td>22</td>
<td>Lack of comprehensive monitoring and data collection including surface and groundwater quality, flow and stage monitoring, water quality monitoring, and digital elevation data</td>
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<td>23</td>
<td>Decreased soil health and its impact on agricultural productivity, water quality and water-holding capacity</td>
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<td>24</td>
<td>Lack of emphasis on wild rice habitat enhancement, protection, and restoration for cultural, economic, and wildlife benefit</td>
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<td>x</td>
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<tr>
<td>25</td>
<td>Lack of suitable recreational access to lakes, rivers, and streams</td>
<td>Water Quality</td>
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</table>

**Issues for discussion:** Inclusion of the two issues as part of the 1w1p. Considerations include whether these are local or state issues and the range of options as well as resources available to make measurable progress towards addressing these issues.

- Elevated concentrations of mercury and PCB levels in fish contribute to aquatic consumption impairments and reduce aquatic species health and diversity.
- Elevated concentrations of arsenic contribute to aquatic consumption impairments and impacts safe drinking water.