



April 6, 2026

Peter Nelson
District Manager
Pennington SWCD
Peter.Nelson@Pennington.mnswcd.org

Re: Comments on the Red Lake River Comprehensive Watershed Management Plan

Dear Red Lake River Planning Group,

Thank you for the work that went into developing this updated watershed plan. It's clear that a lot of thought and collaboration went into identifying priorities and practical solutions. We appreciate the plan's emphasis on voluntary conservation and its recognition of agriculture as an important part of the watershed's economy and landscape.

We're especially glad to see mention of the **Minnesota Agricultural Water Quality Certification Program** and the **AgBMP Loan Program**. These programs are key tools for helping producers implement practices that protect water quality while keeping farms productive. We also appreciate the plan's strong focus on **soil health**, with ambitious goals for implementing practices that improve soil function, reduce erosion, and enhance water storage. Highlighting these priorities reinforces the value of partnerships between local, state, and federal efforts.

MDA also conducts groundwater and surface water monitoring in this watershed, and more details are available in our [annual monitoring report](#). The MDA sampled four wells in 2024, and aminopyralid, clothianidin, clopyralid, and metolachlor ESA were each detected in only one well, and all detections were <0.1% of the human health drinking water reference value. The MDA also samples the Red Lake River at Fischer from May through August each year. Forty-four pesticide compounds were detected in 2024, and two pesticides, clothianidin and imidacloprid, were detected above an aquatic life reference value in one and three samples, respectively.

Thank you again for developing a plan that reflects both resource protection and support for agriculture. We appreciate the opportunity to review and provide input.

Sincerely,

Reid Christianson

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Northwest Regional Operations
2115 Birchmont Beach Road NE
Bemidji, MN 56601

April 13, 2026

Red Lake River Planning Group
c/o Peter Nelson
Pennington County SWCD
201 Sherwood St.
Thief River Falls, MN 56701

RE: Review and Comments on the Draft Red Lake River Comprehensive Watershed Management Plan

Dear Red Lake River Planning Group,

Thank you for the opportunity to contribute to the draft update of the Red Lake River Comprehensive Watershed Management Plan (CWMP), a crucial document that helps protect and improve the health of the Red Lake River and the citizens of Minnesota. This letter serves to inform you of comments received during the draft plan update, new information, and potential projects that we believe should be incorporated into the final plan.

In the past 5 years, the Red Lake River CWMP planning group has made significant strides toward creating healthy watersheds that protect and improve the Red Lake River and the health of Minnesota citizens. The priorities established in the first planning effort (i.e., water quality, habitat, and reduced flood damage) have all been instrumental. They should remain a priority in the updated plan. The DNR is committed to providing the necessary information to protect and improve resource conditions and opportunities within the Red Lake River Watershed alongside the Red Lake River planning group, and we will continue to assist in implementing this updated plan.

DNR did provide a letter in June 2024 regarding the update to the mid-plan review that was not provided to Peter in a timely manner, so it was not included in the Appendices in this draft plan. Since it was missed, I have attached it to this letter for your review, including the DNR comments in that letter for the draft plan.

DNR has completed an Evaluation of Hydrologic Change (EHC) for the Red Lake River, which can also be included in the updated plan. This can be in precipitation and discharge graphics or the complete plan, which should be included as an appendix. I have attached the EHC report for the Red Lake River, along with a “placement” design that can be used as a quick review of the Red Lake River watershed, its climate, and key resources.

DNR Fisheries provided comments on the draft plan, and I have attached those to the letter in their form received from DNR Fisheries. Please review their comments and provide a response to them to Stephanie Klamm and Matt Skoog.

DNR looks forward to reviewing the final plan and to continuing to foster good working relationships with the Red Lake Watershed CWMP advisory and planning group.

If you have any questions about these comments, please do not hesitate to contact Area Hydrologist Stephanie Klamm at 651-587-5448 or stephanie.klamm@state.mn.us.

Sincerely,

A handwritten signature in blue ink that reads "Nathan Kestner". The signature is fluid and cursive, with a long horizontal stroke extending from the end of the name.

Nathan Kestner
NW Regional Manager | Division of Ecological and Water Resources

cc: Stephanie Klamm (DNR), Ben Bergey (DNR), Barbara Weisman (DNR), Matt Fischer (BWSR)



Northwest Regional Operations
2115 Birchmont Beach Road NE
Bemidji, MN 56601

June 11, 2024

Red Lake River Planning Group
c/o Peter Nelson
Pennington County SWCD
201 Sherwood St.
Thief River Falls, MN 56701

RE: Review of Red Lake River Comprehensive Watershed Management Plan, 5-year amendment update

Dear Red Lake River Planning Group,

Thank you for the opportunity to contribute to the amendment of the Red Lake River Comprehensive Watershed Management Plan (CWMP), a crucial document that plays a significant role in protecting and improving the health of the Red Lake River and the citizens of Minnesota. This letter serves to inform you of new information, concerns, and potential projects that we believe should be incorporated into the amended plan.

In the past 5 years, the Red Lake River CWMP planning group has made significant strides in creating healthy watersheds that protect and improve the health of the Red Lake River and the citizens of Minnesota. The priorities established in the first planning effort (i.e., water quality, habitat, reduced flood damages) have all been instrumental. They should continue to be a priority in the updated plan. The DNR is committed to providing the necessary information to protect and improve resource conditions and opportunities within the Red Lake River Watershed alongside the Red Lake River planning group, and we will continue to assist in implementing this updated plan.

As you know, this plan was part of a pilot project, and there were minimal guidelines on how the plan should look. However, the Red Lake River Planning Group has done an admirable job in navigating these challenges. With the more recent plans, there is a well-laid-out guideline that helps streamline the process and the plan writing; I would recommend that the Red Lake River plan follow the guidelines set by BWSR and streamline the plan to be more consistent with recent CWMP plans. This will remove a lot of redundancy from the older plan.

Another item would be to scale down the project list to projects that can be done in the 5-to-10-year timeline of the plan. There are a lot of numbers associated with Best Management Practices (BMPs) for the three planning regions, but it's difficult to determine if the numbers are truly meaningful. It would be nice to quantify the acre accomplishments to show what was accomplished (i.e., there are x acres and will be benefitting y% of those acres).

Is there a way to quantify all land management practices that lead to resource concerns (agriculture, mining, urban development) and identify which BMPs would provide the "best bank for the buck" on water quality and protection? If agriculture is the dominant land use type and is also where we can make the most positive gain for water quality, then there is a need to identify and quantify what practices are most beneficial (i.e., cover crops, WASCOBs, side water inlets).

Items that could be added to the plan include a vision statement and an emerging concerns section. DNR has completed an Evaluation of Hydrologic Change (EHC) for the Red Lake River that can be provided to include as part of the updated plan. This can be in precipitation and discharge graphics or the complete plan, which should be included as an appendix. At the time of the writing of the CMP, the WRAPs report was incomplete; please update this section to reflect the current status of the WRAPs process.

A reference should be made to Habitat Goals (e.g., the MN Wildlife Action Plan) and the MN Prairie Conservation Plan. The MN Wildlife Action Plan was completed in 2015 and is a 10-year plan that focuses on wildlife, species of greatest conservation need (SGCN), climate and climate adaptations, and how MN DNR and other agencies can ensure Minnesota wildlife's long-term health and viability.

Items that DNR sees as being important but not in the plan or not easy to find would be lateral and floodplain connectivity along with longitudinal connectivity throughout the watershed. It is mentioned throughout the plan, but no specific locations are noted. Are there plans for culvert and fish passage inventories, stream channel stability, and erosion inventories throughout the watershed? If culvert inventories have been completed, could DNR have that information to put into the statewide culvert database?

Any information on the FERC relicensing or information on the Red Lake River (Thief River Falls) dam itself or information on the other dams in the watersheds (i.e., Black River/Schirrick Dam and the Rock Dam) and the possibility for fish passage projects. Lake sturgeon and other fisheries concerns should be addressed in this plan.

The plan does not mention wetland restorations or restorable wetlands. There are GIS layers that show restorable wetlands within the Red Lake River. This important practice can help reduce overland flooding, enhance groundwater recharge, and provide habitat. Wetland restorations should be added as a habitat goal in the plan.

Add in stewardship forestry plans or anything related to forestry habitat or conservation of riparian corridors. It would be nice to establish wider buffers with mature forests on the main stem of the Red Lake River. However, a concern would be the establishment of tree species. The emerald ash borer is making its way north, and a large population of the riparian corridor along the Red Lake River and other tributaries. Riparian habitats may need to be modified to a more sustainable and adaptive tree species. The plan may want to look at climate-resilient and pest-resilient trees. Minnesota Forest Resources Council and MN DNR Forestry Division may be able to help out with tree species for riparian corridors that are resilient to the challenges our tree species may face in the future.

Remove projects not within the Red Lake River Watershed proper (i.e., Four-legged Lake and Pine Lake) as they are in the Clearwater River Watershed.

DNR looks forward to reviewing the updated plan and providing more constructive comments during the formal review process.

If you have any questions about these comments, please do not hesitate to contact Area Hydrologist Stephanie Klamm at 651-587-5448 or stephanie.klamm@state.mn.us.

Sincerely,



Theresa Ebbenga
Northwest Regional Director

ec: Stephanie Klamm (DNR), Nathan Kestner (DNR), Barbara Weisman (DNR), Matt Fischer (BWSR)

Section	Page	Comment
Water Resources	19	Phosphorus is not listed as a primary pollutant of concern even though it is listed as a high priority issue later in the plan (p29)
Land Use, Land Protection and habitat	23	Little discussion on the fisheries resources in the watershed. Lake Sturgeon is a focal species in the lower watershed up to the TRF dam. The Red Lake River provides high quality habitat for Lake Sturgeon and a number of other lotic fish species such as Channel Catfish, Non-game species such as Fresh Water Drum, Etc. Beach ridge areas provide high quality spawning habitat for lithophilic spawners such as Walleye and Lake Sturgeon. Flood plain (oxbow) habitat is important spawning and nursery habitat for a number of species
Issue Statements	30	Altered hydrology statement does not directly address ditching and tiling effects
Issue Statements	30	There is not an aquatic habitat issue. Loss of longitudinal (briefly discussed in land and water narrative pgs. 16 & 21)/lateral connectivity and degraded aquatic habitat such as siltation in Red Lake River Reservoir, altered channel morphology. I think that the nutrient loading and sediment input issues are covered sufficiently in other issue statements.
Red Lake Rive Short Term Measurable Goals	36	Altered hydrology is not improved by improving/repairing drainage capacity and outlets. Ditching and tiling are the root causes of the altered hydrology. Activities such as natural channel design of streams and wetland restorations would be more applicable for addressing altered hydrology
Flooding	43-44	How is this 4000 acre feet of storage going to be added? Can examples beyond “agricultural and storage conservation practices” be provided? Ungated storage such as wetland restoration or other land conservation practices that retain water on the landscape longer (in good areas to do so), especially in the middle and upper watershed, would help restore altered hydrology. Adding impoundments may further alter hydrology rather than return to a “more natural flow regime” depending on the operational details. Correctly operated impoundments can help to restore altered hydrology. Additionally, although improved conveyance in the lower part of the watershed does help to address flooding issues, it does nothing to address the altered hydrology issue. Ideal

Stream Bank Stabilization	55	Reducing channel incision can also have the additional benefit of maintain lateral connectivity for aquatic organisms and energy pathways (if an aquatic habitat issue were to be added).
Stream Bank Stabilization	56	Under long-term goal, could also add improved aquatic habitat
Stream Bank Stabilization	56	I would like to see preference given to natural materials such as toe woods and bank plantings as opposed to rip-rap (where feasible)- Riparian management (p58-59) gets at the importance of riparian vegetation for stream bank stabilization.
Riparian Management	58	Maybe specify terrestrial and aquatic habitat in long-term goal
Drainage management	61-62	Improved ditch capacity does not address altered hydrology although it does help to address some of the issues created by altered hydrology such as nutrient and sediment loading (as pointed out in this section).
Land protection	64	This section best addresses the issue of altered hydrology. None of the activities address the causes of altered hydrology, they just address the symptoms. Could add this to the stacking benefits box
Data collection and Monitoring	80	Culvert inventories. Why is there not any mention of addressing any potential issues with longitudinal connectivity including culverts? This is why I think it could be important to add an aquatic habitat section similar to riparian management section. Many of the issues are covered in other sections, but this is one issue that is not addressed anywhere in the plan other than data collection. Another issue that could included in the issues and activities sections (if there is a desire from the plan implementors) in addressing altered stream geomorphology (e.g. channel straightening, incision, loss of lateral connectivity, etc.)

Red Lake River Watershed Hydrology & Stream Stability

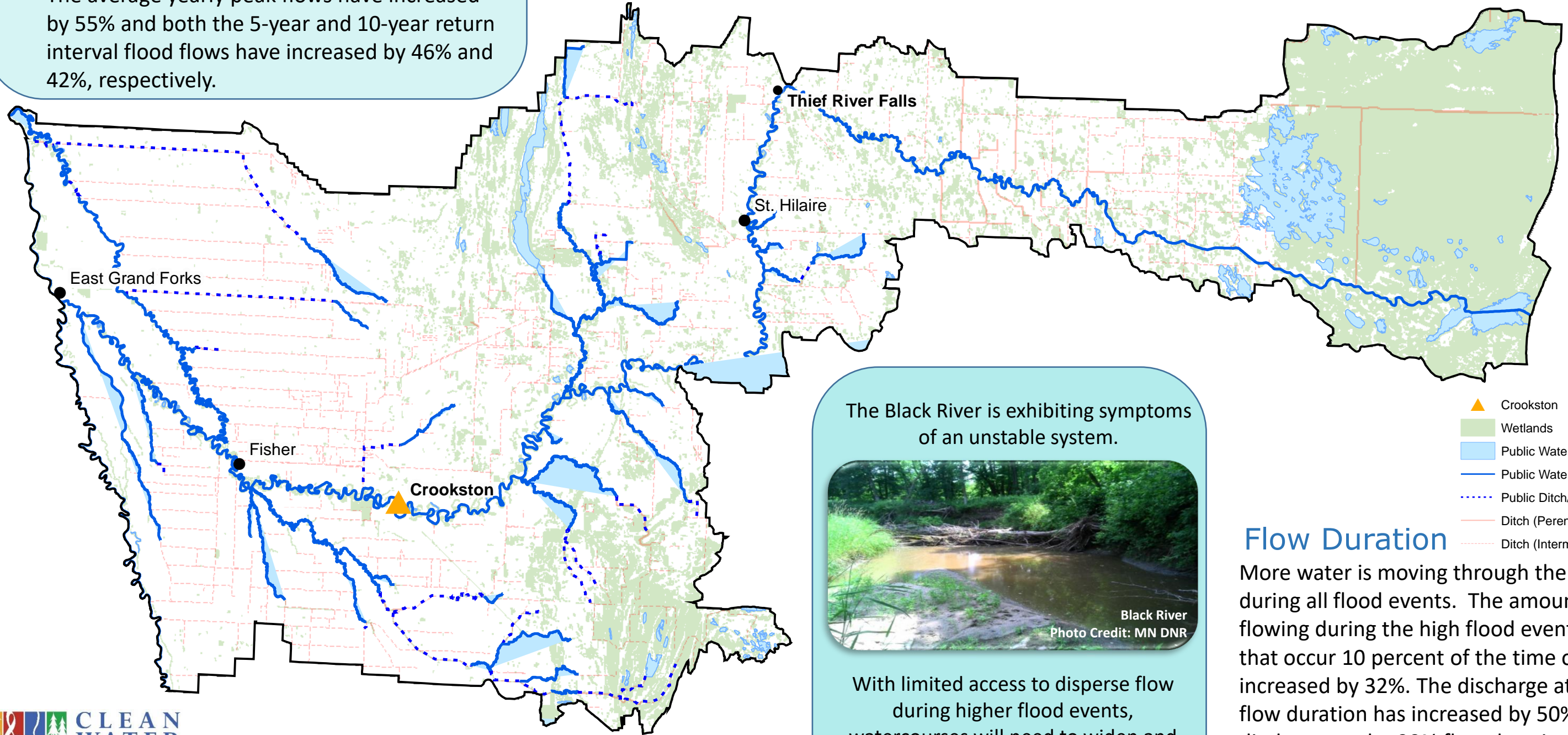
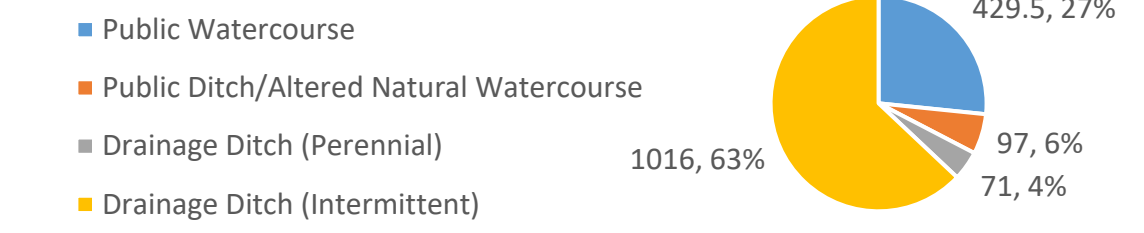
Staff Contact: Stephanie Klamm (Area Hydrologist)
 651-587-5448, stephanie.klamm@state.mn.us
 This poster is part of a series summarizing watershed conditions and providing protection and restoration options for local efforts.

- The Red Lake River has one long-term stream gage site located at Crookston with a period of record from 1902 to present.
- A hydrologic change point identified in 1997 showed precipitation and runoff increased throughout the year compared to pre-1997.
- Precipitation has increased by 2.6 inches since the hydrologic change point in 1997.
- The average yearly peak flows have increased by 55% and both the 5-year and 10-year return interval flood flows have increased by 46% and 42%, respectively.

In-channel Erosion

Higher flows are occurring more often in the watershed, potentially increasing in-channel erosion and reshaping stream channels. In the Red Lake River, the volume of water moving through the channel at bankfull flows (1.5-year return interval) has increased by 71% compared to the pre-change point of 1997.

Stream or Ditch Channel (Length in Miles)



The Black River is exhibiting symptoms of an unstable system.

Black River
Photo Credit: MN DNR

With limited access to disperse flow during higher flood events, watercourses will need to widen and possibly deepen more. This will result in channel erosion.

Flow Duration

More water is moving through the channel during all flood events. The amount of water flowing during the high flood events, those that occur 10 percent of the time or less, has increased by 32%. The discharge at the 50% flow duration has increased by 50% and the discharge at the 90% flow duration has increased by 84%.

Watershed Highlights: Red Lake River

The Red Lake River provides a diverse fishery including channel catfish, walleye, northern pike and lake sturgeon.



Channel catfish and lake sturgeon are beginning to reestablish to streams through the removal of dams. Removing or modifying dams and providing quality habitat helps these and other fish populations thrive.

Calcareous Fens ●

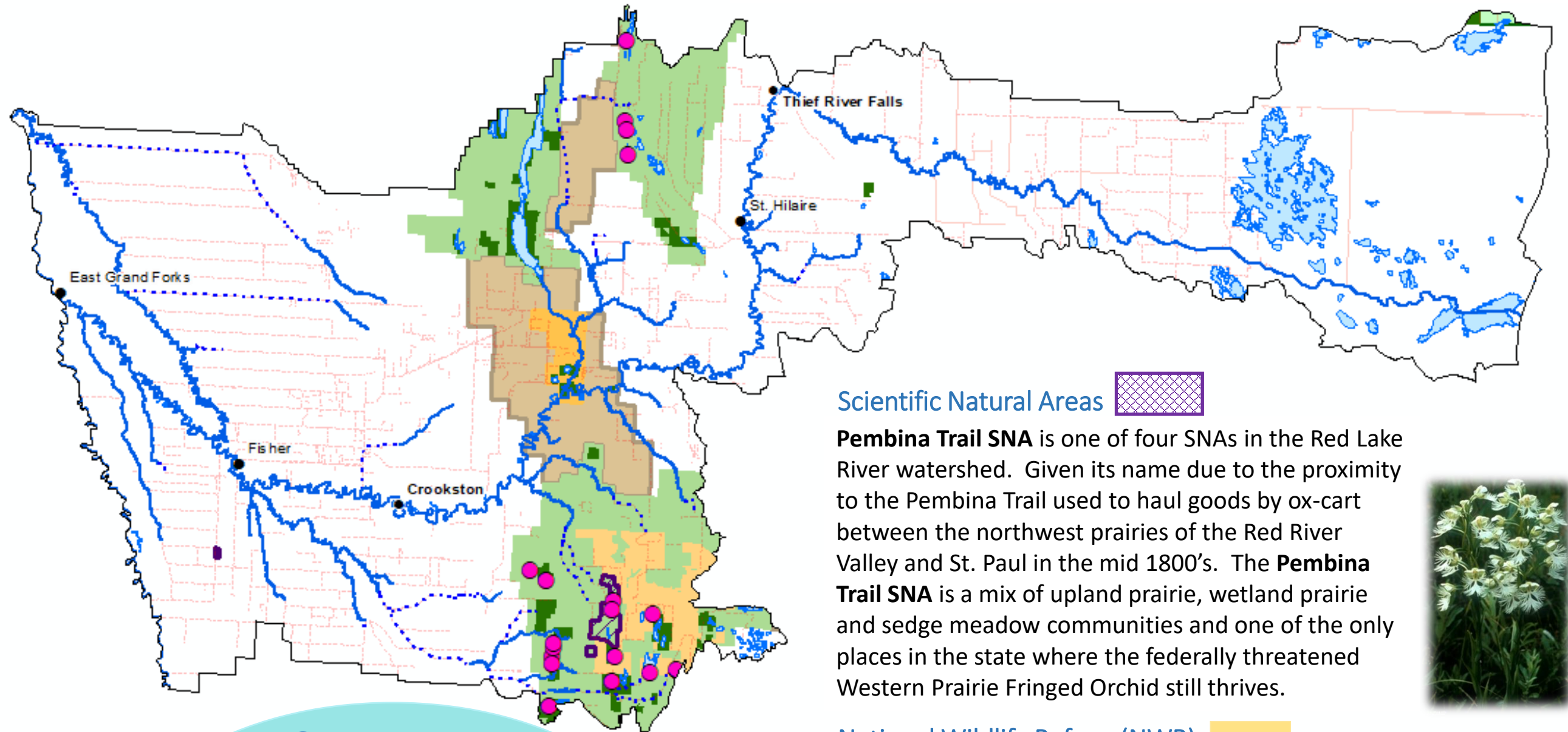
Calcareous fens are rare and distinctive peat-accumulating wetlands. These fens depend on a constant supply of upwelling groundwater rich in calcium and other minerals. Fens are highly susceptible to disturbance and are state protected.

Prairie Corridor ■

Prairie Core Area ■

Prairie Strategic Habitat Complex ■

Core areas function as a habitat base for wildlife species that need large areas of grassland/wetland habitat. Corridors function as dispersal corridors that allow an exchange of species and genetics between wildlife populations. Strategic habitat complexes function as habitat “stepping” stones for mobile wildlife species within the corridors.



Concerns

- Access to floodplains
- Water quality impairments from increased flows impacting streambanks
- Erosion, flooding and fish movement issues caused by improperly sized or poorly positioned culverts
- Changes in flow regime and impacts to fish communities
- Poor aquatic habitat

Scientific Natural Areas ■

Pembina Trail SNA is one of four SNAs in the Red Lake River watershed. Given its name due to the proximity to the Pembina Trail used to haul goods by ox-cart between the northwest prairies of the Red River Valley and St. Paul in the mid 1800's. The **Pembina Trail SNA** is a mix of upland prairie, wetland prairie and sedge meadow communities and one of the only places in the state where the federally threatened Western Prairie Fringed Orchid still thrives.



National Wildlife Refuge (NWR) ■

Glacial Ridge NWR is the largest prairie and wetland restoration in U.S. history. This 24,000-acre habitat complex is a mix of prairie pothole wetlands, upland prairie and savannas. This refuge is home to the federally threatened Western Prairie Fringed Orchid and a variety of birds including Prairie Chickens, Sandhill Cranes and Upland Sandpipers.

Wildlife Management Areas (WMA) ■

WMAs provide outdoor recreation and are established to protect those lands and waters that have the potential for wildlife production, public hunting, fishing, and other compatible recreational uses.

April 14, 2026

Peter Nelson
District Manager, Pennington SWCD
201 Sherwood Ave S.
Thief River Falls, MN 56701

RE: Response to submittal of draft Red Lake River Comprehensive Watershed Management Plan Amendment 60-day review

Dear Red Lake River Planning Group,

Thank you for the opportunity to provide comments regarding the draft Red Lake River Comprehensive Watershed Management Plan Amendment developed under the Board of Water and Soil Resources (BWSR) One Watershed One Plan (1W1P) program as prescribed under Minnesota Statutes Section 103B.101, Subdivision 14. We appreciate the partners' continued willingness to participate in the development and implementation of a multi-jurisdictional, watershed-based plan.

As a comprehensive watershed management plan, this is an all-inclusive plan to address surface and groundwater, water quality and quantity, habitat, and land use per the 1W1P Plan Content Requirements adopted by the BWSR on August 24, 2023. Implementation actions in the plan consider a broad range of tools and programs necessary to achieve the goals of the plan. BWSR has the following comments on the plan:

Assessment of the inclusion of BWSR's initial priority issues submitted May 31, 2024:

- BWSR submitted initial comments for priority issues to include in the plan amendment. After review of the draft plan, we commend the group for discussing all the submitted priorities during the amendment process and incorporating them into the plan.

Items for consideration that may provide additional benefit:

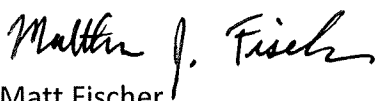
- Consider taking the time before final plan submittal to make the document compliant with federal requirements for accessibility of web content. From my understanding, these requirements go into effect for local governments on April 26, 2027. Making the plan compliant now will prevent the need for changes in the near future.
- The "Success Since Previous Plan" and "Planning Regions" sections at the beginning of Section 3 seem out of place in the Priority Issues section. We suggest moving them to the end of Section 2 and leaving the issues section (Section 3) all about issues.
- Unstable River and Stream Channels is listed as a priority issue addressed by the Upland Erosion & Nutrients goal. This goal relates to upland erosion as estimated with the PTMApp and there is a separate

goal for Streambank Stabilization, therefore the Unstable River and Stream Channels should not be listed here.

- Under the long-term goal for Upland Erosion & Nutrients it says “TSS – 24,378 tons/year”. It is unclear how this number was derived. Please add an explanation. It is recommended that this long-term goal be based off the loading capacities and allocations from the Red Lake River and Grand Marais Creek TMDLs.
- The flooding goal should present some information that identifies where flooding occurs and where there are frequent flood damages. Flood prone areas should be mapped if possible. This is a challenging and complicated subject, but the narrative could be improved to better tie together flooding, flood damages, peak flow reduction, and water storage.
- We recommend using length as the goal/metric for Streambank Stabilization (9,300 linear feet) and showing the estimated sediment reduction as a stacked benefit.
- The priority area identified for the Riparian Management goal is the Red Lake River corridor (Figure 4.8). We encourage the planning group to consider adding the Red River corridor as a priority and assessing if there are any secondary priorities that should be included. Also, we encourage the addition of a reference to easements and the Red River Riparian Habitat program in the opening narrative for this goal.
- Figure 5.1 has the management zones from the previous plan presented. The footnote does indicate that they are no longer in use with this amendment but it might still be confusing. We recommend remaking this map without the management areas.
- The Red River Watershed Management Board has received federal funding for 10-year floodplain mapping. We recommend including this as an action under the Data Collection and Monitoring implementation table.
- Section 7 includes an 8-step process for creating Water Management Districts. Water Management Districts have already been created. We recommend replacing this with a section on how to establish a project in a Water Management District (recommended language included in editorial comments).
- Everything besides the WD Rules could be removed from Appendix D. Water Management Districts are included in another appendix and the SWCD Statute Table of Chapters isn’t referenced at all in the plan.
- Include the DNR response letter in Appendix “E”. The title page for the appendix says Appendix L so that needs to be updated to Appendix E.
- Appendix F isn’t currently referenced in the plan. Add a reference in the Flooding goal.
- Appendix G should be cleaned up. It all was applicable when this information was amended to the existing plan but isn’t anymore. Section 1 includes references to the existing plan which are now confusing because those references no longer exist in the amended plan. We recommend to remove the information in Section 1 and only include the individual Water Management District information.

The work of the Red Lake River planning group provides a great example of the type of collaborative effort needed to develop and implement a comprehensive watershed management plan through the 1W1P program. The state’s main water management agencies have committed to the 1W1P approach, and we look forward to continuing to work with you as this amended plan is implemented. If you have any questions about this letter, please feel free to contact Matt Fischer at 218-766-6496

Sincerely,



Matt Fischer
BWSR Board Conservationist

Evaluation of Hydrologic Change (EHC) Technical Summary Red Lake River Watershed

Hydrologic Unit Code: 09020303
DNR Major Watershed ID: 63

July 2023



Preferred Citation

Minnesota Department of Natural Resources. 2023. *Evaluation of Hydrologic Change (EHC) Technical Summary: Red Lake River Watershed*.

Contact

For more information about this summary, contact the [DNR Area Hydrologist](#) for the area that includes this watershed.

Credits

Prepared by the Minnesota Department of Natural Resources (DNR), Ecological and Water Resources Division, with funding from the Clean Water Fund established by Minnesota's Clean Water, Land and Legacy Amendment. Chief author: Jason Carlson. Major contributors: Ryan Bjerke, Kim Boland, Ben Kiefer, Stephanie Klamm, Andrew Lindlof, Ruth MacDonald, Dan O'Shea, Dan Reinartz, Barbara Weisman, Katie Wigen.

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Introduction

Overview

Why is understanding hydrologic change essential for managing watershed health?

Hydrologic change, or *alteration*, is a complex and dynamic concept affecting multiple water management aspects and watershed health. It is defined as “significant changes in the magnitude, duration, timing, frequency or rate-of-change of natural stream flows” (American Rivers 2017). Minnesota has experienced widespread changes in hydrology, often expressed as higher stream flow (Minnesota DNR 2020). These changes are known to affect stream channel stability, aquatic habitats, and water quality, and can also impact adjacent infrastructure and agricultural lands.

Who is this summary for?

The intended audience for this summary is water resource professionals and others with a general understanding of watershed hydrology and hydrologic alteration. Many of them manage water resources or advise other water resource managers. Understanding how specific hydrologic conditions have changed can help water resource managers set suitable water management goals. It can also help them select management strategies that address known or potential impacts and meet local and regional priorities.

What is included in this summary?

This summary provides an overview of changes in hydrologic conditions in the Red Lake River Watershed (**Figure 1**). The summary is based on a set of peer-reviewed tools and analyses selected by the Minnesota Department of Natural Resources (DNR) and developed into a standardized assessment called the *Evaluation of Hydrologic Change (EHC)*.

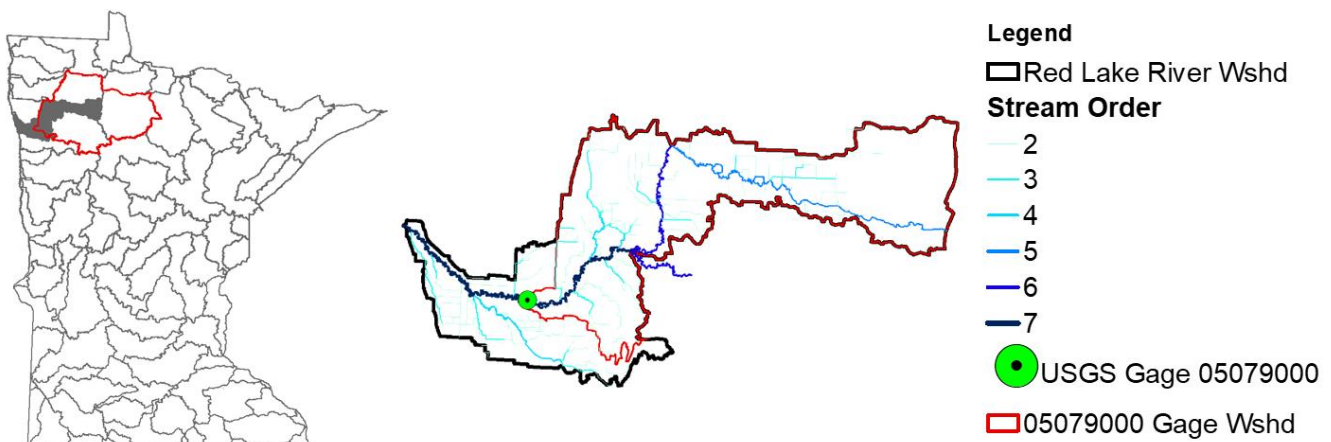


Figure 1. Red Lake River Watershed map showing stream order (Horton 1945), streamflow gage location, and contributing watershed area

The EHC uses historical streamflow, precipitation, and other records over a period of at least 30 years to characterize hydrology in the watershed. Daily, monthly and annual data are assessed and compared before and after an identified point of greatest hydrologic change.

In 2020, the DNR completed an EHC analysis for all major watersheds in Minnesota that had streamflow gages with the necessary data. This summary presents a subset of the full suite of EHC analyses for this watershed and puts the results in context with the hydrologic changes identified for the other watersheds assessed.

This summary specifically includes the following:

- The key hydrologic changes identified for this watershed
- An overview of critical concepts in the EHC and the data used to assess hydrologic change
- A review of the multiple tests used to identify the point of greatest hydrologic change
- An assessment of hydrologic data compared to other watersheds regionally and statewide
- A comparison of selected hydrologic metrics before and after the identified change point for each gage assessed, and associated levels of concern about watershed impacts
- An assessment of the influence of hydrologic drivers on discharge in this watershed

Where to find more information

[DNR Area Hydrologists](#) and other staff can help identify other analyses within the EHC beyond the scope of this summary. They can also provide other available information to further characterize the watershed's hydrology, and additional context and analysis to help interpret this information for different applications.

More information about the EHC is available on the DNR website. The website provides access to EHC Technical Summaries for all watersheds assessed in 2020 and a statewide map and list of the U.S. Geological Survey (USGS) gages analyzed in those watersheds.

Key Hydrologic Changes

Identified below are selected key hydrologic change dynamics from the EHC analysis for this watershed. Additional results are provided in **Table 1** and specifics about each metric are described in the EHC Summary Table and Metrics section. Additional context and analysis can be provided by [DNR Area Hydrologists](#) and other staff.

Hydrologic Conditions Changed in 1997

The EHC identified 1997 as the point of greatest hydrologic change within the watershed. The year 1997 is also consistent with the change points identified in several other watersheds in northwest Minnesota and the Red River Basin.

Increased Precipitation and Discharge

The Red Lake River Watershed receives 2.6 inches more precipitation per year when compared to the pre-change point period of record going back to the 1902. Comparing the same time periods, 1.3 inches of additional precipitation left the system as discharge. All flow metrics (low, moderate and high) increased, indicating a shift in hydrologic dynamics that will likely impact stream stability and aquatic habitat. When comparing historical to the recent time period, the average daily amount of water flowing through the channel increased by 40%.

Increased Flood Flows and Low Flows

More water is moving through the channel during all flood events, small and large. The average yearly peak flows have increased by 55%, and both the 5-year and the 10-year return interval flood flows have increased by 46% and 42%, respectively. The amount of water flowing during the largest floods, those that only occur 10% of the time or less, has increased by 32%. The channel is also sustaining these large volumes for a longer period of time, compared to the earlier record. The discharge at the 50% flow duration has increased by 50% and the discharge at the 90% flow duration has increased by 84%.

Channel Forming Flows

Bankfull flows, critical for moving sediment and shaping stream channels, typically range between the 1.1 and 1.8-year return interval flood flows. For the EHC analysis, the 1.5-year return interval flow is used as a surrogate measure and has increased 71% compared to the pre-change point. The pre-change bankfull flow (5088 cfs) occurs 2.25% more frequently in the post-change point period. Larger and longer sustained bankfull flows can have impacts to stream channels through increased erosion, scour and deposition in the channel.

Hydrologic Impacts from Dam Operations

The EHC results using data from the Red Lake River at Crookston (05079000) are likely impacted by the operation of the old Crookston dam located 0.25 miles below the gage location. There are several metrics highlighted in the EHC, particularly those calculated using instantaneous and daily discharge values, which may reflect dam operation influences rather than upstream conditions. Conclusions drawn from the gage must consider these potential impacts before being used to guide watershed management decisions.

Limitations to Using the Results of this Analysis

As noted earlier, [DNR Area Hydrologists](#) and other staff can provide additional information to help watershed managers interpret EHC results, including addressing or accounting for the limitations below.

- **Scale:** The major watershed scale of the analyses in this summary may not capture the range of specific landscape factors that influence localized hydrologic conditions. Hydrologic and hydraulic modeling at differing scales may be more appropriate in informing water management strategies in some circumstances.
- **Related data and information:** EHC results add context to other watershed health information such as water quality, stream stability, biologic community composition, groundwater use, and lake hydrology.
- **Gage location and period of record:** The maps and figures represent observed data from one or more gages in the watershed (**Figure 1**). The EHC was conducted on USGS gages within Minnesota that met the minimum standard of 30 years of continuous discharge records. When putting the results into context, it is important to consider the time frame of the data and the spatial extent of the area draining to the gage(s). Regardless, watershed-averaged precipitation figures in the EHC are based on the entire HUC-8 major watershed and might differ from figures for the gage watershed.
- **Snapshot in time:** The findings in this summary represent the data available at the time of analysis (2020). Change points and other indices of hydrologic change might differ if re-evaluated using additional years of data as they become available. Any identified trends or forecasts characterizing future conditions are based on the best available data and may differ from the results in this summary.

Critical Concepts in the Evaluation of Hydrologic Change

The EHC focuses on the four critical concepts below to assess hydrologic changes in the watershed and their impact on watershed health.

1. Change Point: Identifying when conditions changed

The *change point* is a key indicator of hydrologic alteration that separates the historical record into two periods of greatest hydrologic difference. The EHC applies multiple lines of evidence from 17 tests to identify the *water-year* (October through September) that represents this point and then compares conditions before and after. The term change point is synonymous with *breakpoint* and *point of non-stationarity*.

2. Percent Change: Quantifying increases and decreases

The EHC focuses on a subset of 21 metrics selected to reduce redundancies among the 150-plus metrics analyzed (Gao et al. 2009). For these 21 metrics (see **Table 1**), the EHC computes the percent change before and after the change point.

3. The Range of Variability Approach (RVA)

The *RVA* computes changes in the frequency and distribution of hydrologic data and represents the percent change in the rate of occurrence of a metric within the *interquartile range* (Richter et al. 1998). The rate of occurrence within the central range is calculated for the period before the identified change point and is then compared to the rate in the period after. Four of the 21 metrics in **Table 1** cannot be assessed by the *RVA* and two others (90% flow duration and 10% flow duration) use the daily rate of occurrence above or below the pre-change period value to determine *RVA* values.

4. Impact Concerns: Assessing levels of concern about the impact of changes

The final critical concept is the idea of framing water management efforts around how much change to the *flow regime* a watershed can endure before both the biological and the physical systems become degraded (Arthington et al. 2006; Richter 2009). Reviews of state regulatory programs and peer-reviewed literature show that both support using thresholds of 10% and 20% changes in flow to separate three distinct *impact concern* categories. The EHC uses these thresholds to identify three categories or levels of impact concern (neutral, moderate, and major) and adds a fourth category of extreme concern based on EHC findings from across Minnesota.

EHC Summary Table and Metrics

The EHC applies the critical concepts described above to produce a summary table (**Table 1**) showing the percent increase or decrease for each of the 21 key metrics, the range of variability, and associated levels of concern about watershed impacts. The Red Lake River at Crookston results (**Table 1**) may be influenced by dam operations.

Hydrologic Group	Metric	Magnitude Change (%)	Magnitude Impact	RVA Change (%)	RVA Impact
Annual Values	Annual Precipitation	11	Moderate	-32	Major
	Annual Discharge	40	Major	1	Neutral
	Annual Peak Discharge	55	Extreme	-5	Neutral
	Annual Runoff Ratios	22	Major	12	Moderate
Low Flows	7-Day Minimum	11	Moderate	4	Neutral
	August Median Base Flow	33	Major	-4	Neutral
	90% Flow Duration	84	Extreme	-88	Extreme
Moderate Flows	May Median Flow	70	Extreme	39	Major
	50% Flow Duration	50	Major	n/a	n/a
	1.5 Year Return Interval Flows	71	Extreme	n/a	n/a
	Annual Baseflow	38	Major	-6	Neutral
High Flows	10% Flow Duration	32	Major	50	Major
	5 Year Return Interval Flows	46	Major	n/a	n/a
	10 Year Return Interval Flows	42	Major	n/a	n/a
	3-Day Maximum	60	Extreme	-13	Moderate
Flow Timing	Julian Day Max Flow	9	Neutral	-22	Major
	Julian Day Min Flow	-3	Neutral	30	Major
Flashiness	High Pulse Count	25	Major	65	Extreme
	Low Pulse Count	-33	Major	83	Extreme
	Number of Reversals	-12	Moderate	13	Moderate
	Rise Rate	-30	Major	39	Major

Impact Concern Legend						
>50 Extreme	20 to 50 Major	10 to 20 Moderate	10 to -10 Neutral	-10 to -20 Moderate	-20 to -50 Major	< -50 Extreme

Table 1. EHC summary table for the Red Lake River at Crookston (05079000) (1997 Change Point)

The EHC metrics characterize each component of the flow regime (magnitude, frequency, duration, timing, and rate of change). These components directly or indirectly influence the ecological integrity of stream and river systems by altering the water quality, energy flow, physical habitats, and biotic interactions (Karr 1991; Poff et al. 1997).

Because of the strong connections between streamflow and the physical and chemical characteristics of streams, streamflow is considered a *master variable* that limits the distribution and abundance of aquatic and riparian species. Bunn and Arthington (2002) framed the influence of the flow regime on the biological community with four principles: (1) flow is a major determinant of physical habitat in streams, (2) aquatic species survival strategies are a direct response to the natural flow regime, (3) aquatic connectivity is essential for maintaining viable populations, and (4) altering flow regimes promotes invasion success.

The 21 metrics in **Table 1** are organized into six hydrologic groups representing fundamental components of hydrologic alteration. Changes in the metrics may impact channel stability, streambank erosion, water quality, infrastructure and land use near rivers and streams, and the health of biological communities. The six groups of metrics are described below.

Annual Value metrics

The Annual Values hydrologic group includes key components of the *water balance* (see **Table 5**). It looks at the inputs of precipitation and the outputs of river discharge. It also characterizes the peak flows for each year and assesses the relationship between precipitation and discharge, expressed as *annual runoff ratios*.

Low Flow metrics

The Low Flows group includes three metrics that characterize conditions of limited water availability. The *7-day minimum* identifies the lowest flows sustained over any seven-day period each year. The *August median base flow* is a period of baseflows that are usually lowest during the regular growing season. The *90% flow duration* looks at flows that are exceeded 90% of the time, analogous to the *Q10* flow. RVA values for this metric are assessed based on the daily occurrence of flows under the 90% flow duration value computed for the period before the identified change point.

Moderate Flow metrics

The Moderate Flows group looks at *May median flow*, an important metric as spring snowmelt may increase flows in heavy snow years or be absent in light snow years. The *50% flow duration* looks at average flows that occur at least 50% of the time. The *1.5-year return flow* occurs at roughly that frequency (every 1.5 years) within each period. It is often a reasonable surrogate for *bankfull flow* or the flow rate correlated with a water level that begins to spill out of the channel onto its floodplain. These flows are known to move the most sediment over time and shape the stream channel itself. They are computed using *annual peak discharge* values. The last flow metric is the *annual average baseflow*.

High Flow metrics

The High Flows group points to concerns about flooding and related damage to roads and other infrastructure. The first metric is the *10% flow duration* value, or discharge, exceeded 10% of the time. The second and third are return interval flows based on annual peak discharges. The *5-year return interval* and *10-year return interval* flows are often identified as key regulatory flows for impacts on riparian areas during floods. The last high flow metric is the *3-day maximum* flow sustained throughout each year.

Flow Timing metrics

The Flow Timing group is represented by two metrics, the *Julian maximum* and *Julian minimum* flow days. The Julian flow day is a numerical representation of the day of the year in which each type of flow occurs. The Julian

maximum often occurs during the spring in snowmelt-dominated systems and may occur later in the year in precipitation-dominated systems. Julian minimum values indicate the lowest flow point of each year and help characterize when the least amount of habitat is available for biological communities that rely on the system's water.

Flashiness metrics

The final group, Flashiness, characterizes how discharge dynamics have changed over time. It quantifies the number of annual flows that exceed the 75th percentile flows (*high pulse count*) and go below the 25th percentile flow value (*low pulse count*). The *number of reversals* quantifies how often daily flow values reverse from increasing to decreasing day to day, or vice versa. Finally, the *rise rate* calculates the average increase in discharge during every period of increasing flow from day to day for each period. Increases in this metric may be due to storm intensity or land alterations that move water off the landscape faster.

Hydrologic Data for Assessing Long-Term Conditions

The continuous collection of hydrologic data is critical for assessing changes in watershed conditions. The precipitation and discharge datasets presented in **Figures 2 to 4** show the variability in annual water-year values (blue line) and the 30-year running average (red line) for this watershed. A change in the slope of the red line indicates a shift in the long-term average. The 25th and 75th percentile values (dashed grey lines) define the centralized or interquartile range.

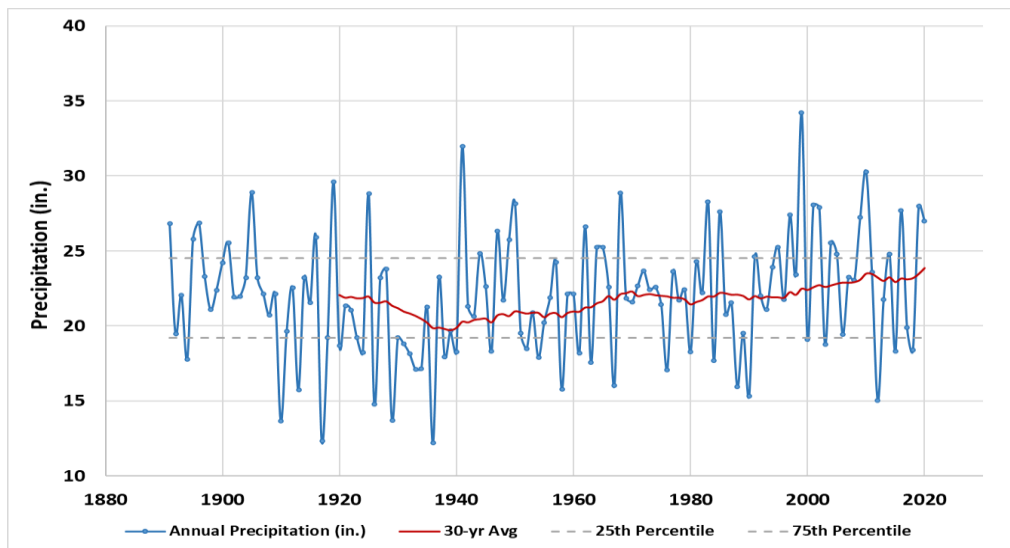


Figure 2. Averaged precipitation for the Red Lake River Watershed (Minnesota Climatology Office 2020)

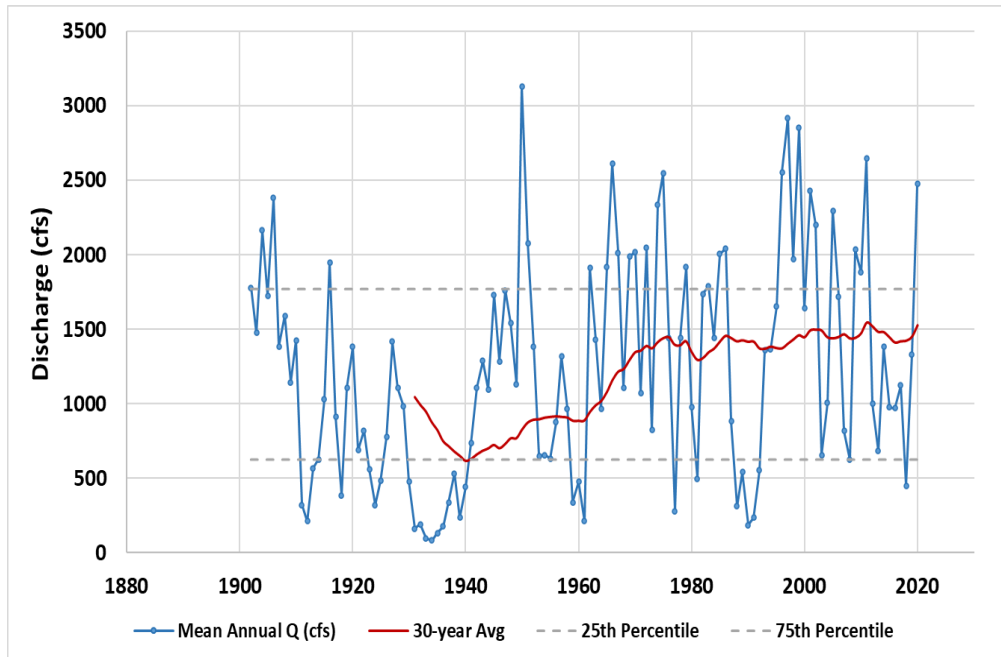


Figure 3. Annual mean discharge for the Red Lake River at Crookston (05079000) (USGS 2020)

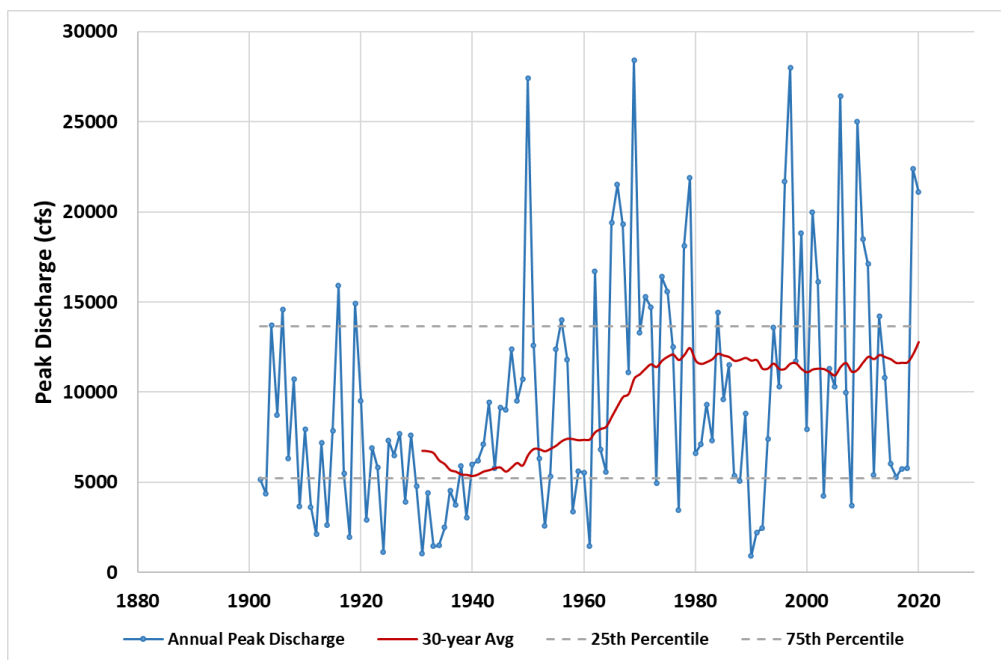


Figure 4. Annual peak discharge for the Red Lake River at Crookston (05079000) (USGS 2020)

Figure 5 shows the discharge dataset using a *raster hydrograph* in which each color-coded cell represents a specific daily discharge value (Koehler 2004). This helps us visualize the timing and duration of high flows (dark blue values) and general changes in flow magnitude (color shifts). It also helps point out periods of missing data.

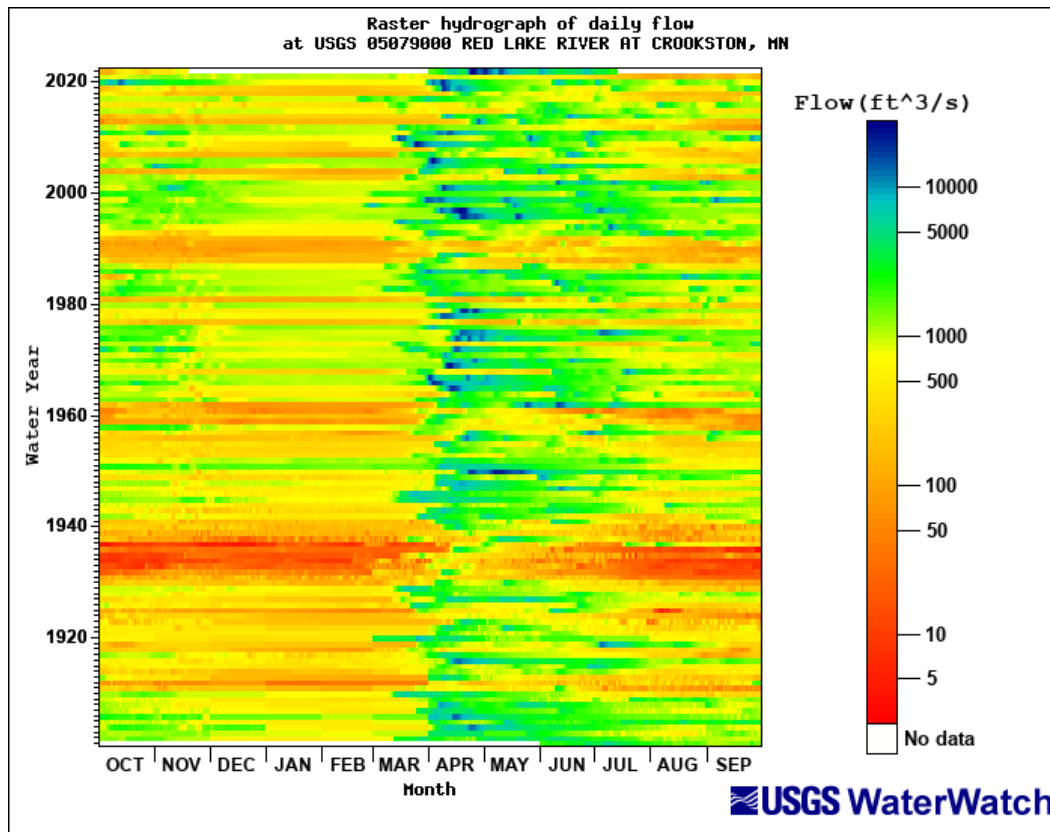


Figure 5. Raster hydrograph for the Red Lake River at Crookston (05079000)

Double Mass Curve and Covariance F-Test

What does it tell us?

The *double mass curve* assesses the relationship between runoff and precipitation over time and identifies the year that separates the two most significantly different periods in the record (**Figure 7**). The analysis quantifies the portion of the prior three year's precipitation that is expressed as current-year discharge, representing the rate of water movement and storage in the watershed and is known as *effective precipitation* (Searcy and Hardison 1960).

How it works

The method plots two cumulative datasets against each other. The first is a computed runoff record derived from the average relationship between annual discharge and effective precipitation. The second is the measured runoff from the gage (Searcy and Hardison 1960). In this way, the analysis removes the variability of precipitation carried across multiple years and allows statistical assessment of the precipitation-runoff relationship using the *covariance F-test*. The highest F-score value in the test often identifies the change point year for the test, but hydrologists may also consider secondary peaks.

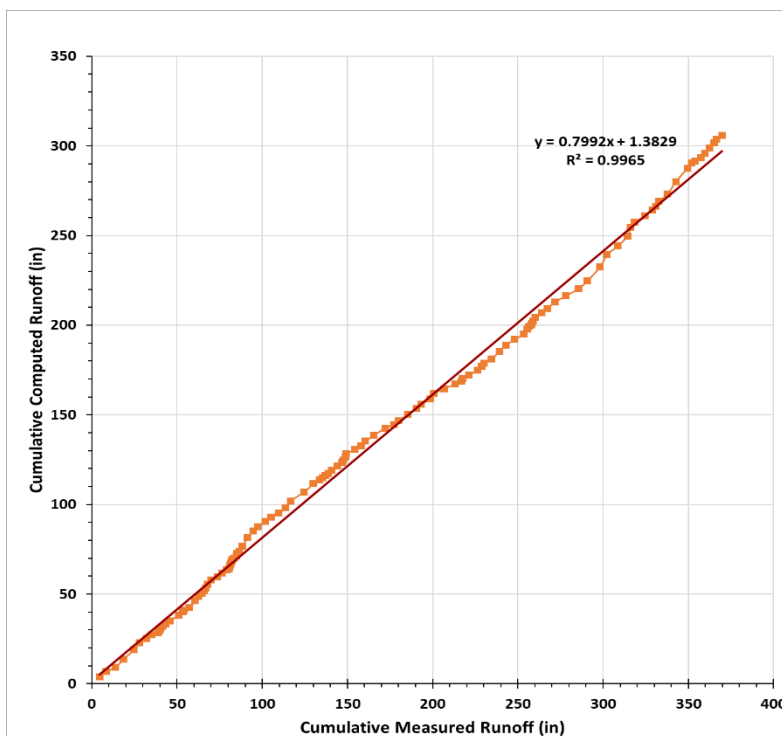


Figure 7. Double mass curve for the Red Lake River at Crookston (05079000)

When visual breaks in the double mass curve are not apparent, an *Analysis of Variance (ANOVA)* statistical test for significance helps determine whether the precipitation-runoff relationship has changed. The ANOVA splits the record into two periods and compares the variance between each period to the variance within each period. The higher this ratio, called the F-ratio, the more likely the datasets reflect a significant change. Higher F-scores (those above the “Fmin” or 5% value) indicate greater (95%) certainty that the segments of the record, separated by the assessed year, represent a statistically significant difference in variance between the two datasets. The tool does this for each year in the record and compares their respective segments (**Figure 8**).

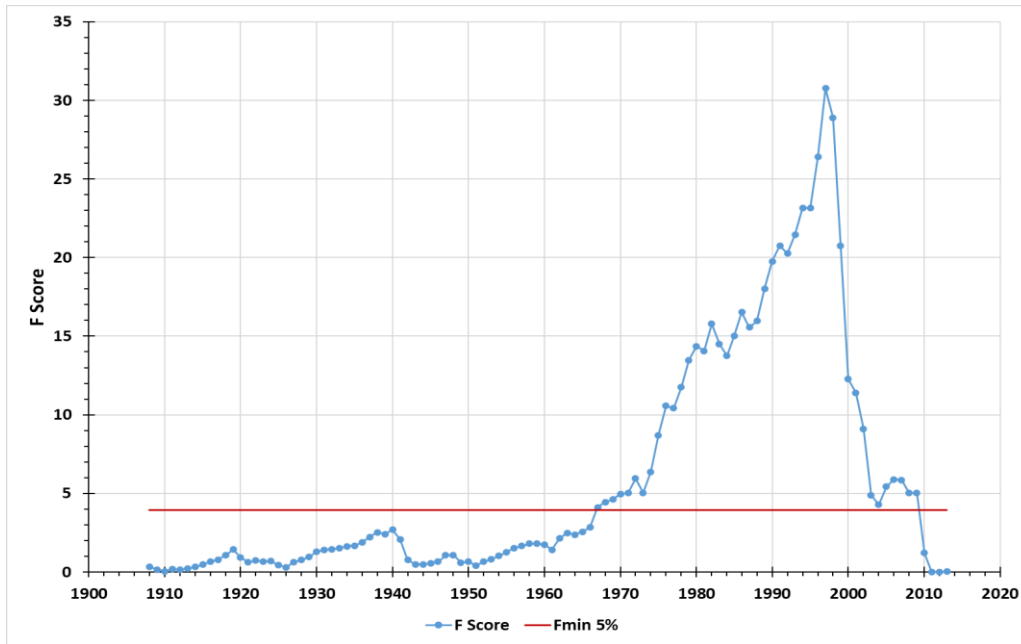


Figure 8. Double mass F-Test results for the Red Lake River at Crookston (05079000)

Cumulative Departure Analysis with Hurst Coefficient

What does it tell us?

Comparing annual precipitation and discharge values to the mean values for their periods of record helps us identify trends and visualize how the two datasets track with each other. Sloping lines over long periods indicate that conditions are above or below the average for the site. Clear changes in the direction of the slope of the lines indicate shifting of hydrologic conditions. The location where the slopes change is considered a potential change point. Simultaneous changes in both precipitation and discharge indicate climate as the likely influence. In contrast, if they react at different times, other factors are more likely to be key drivers.

How it works

The *cumulative departure* analysis in **Figure 9** compares annual precipitation and discharge values to the mean value over the period of record for each dataset. Differences from the mean value for each year are then accumulated and graphed to identify segments of the record that are consistently above average (positive slope) or consistently below average (negative slope). The analysis also generates the *Hurst coefficient* which ranges from zero to one. Values between 0.5 and 1.0 indicate increasing *hydrologic persistence* or a tendency for high values to follow high values and low values to follow low values.

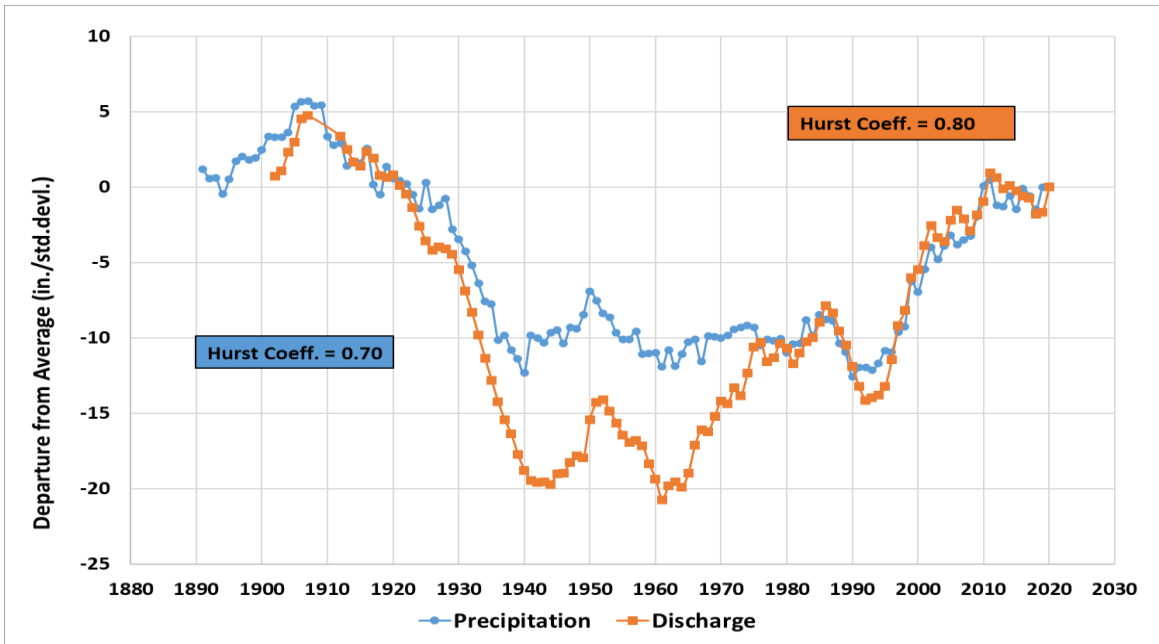


Figure 9. Cumulative departure from the historical mean for the Red Lake River at Crookston (05079000)

Change Point Analysis

What does it tell us?

Table 2 shows the year(s) identified by each of the 17 change point tests used to inform the selection of the overall change point for the watershed. Analyzing the individual change point tests and their results gives additional context into how and when hydrology in the watershed has changed.

How it works

The overall change point for the watershed is selected by reviewing the results of the 17 tests, identifying separate change points for the precipitation, discharge, and annual peak discharge datasets, and comparing them to the double mass curve results. Several other factors are also considered, including the length of the datasets, the timing and length of any gaps in the record, when (which year) the change point splits the record, and the change points identified for similar watersheds in the same hydrologic region.

The change point year selected for this watershed was 1997, as it shows a change in the data during this time frame. This is one of three gage stations with over 100 years of flow data in Minnesota. Water years are from 1902 to current (data was used up to 2020).

Data Category	Change Point Test	Change Point Year
Precipitation	Hurst Precipitation	1997
	DNR Hydrologic Assess. Tool (ED)	none
Discharge	Hurst Discharge	1965
	DNR Hydrologic Assess. Tool (ED)	1963
Precipitation/Runoff Relationship	Double Mass Curve	1997
Annual Peak Discharge	Cramer-Von-Mises (CPM)	1944
	Kolmogorov-Smirnov (CPM)	1944
	LePage (CPM)	1964
	Energy Divisive Method (ED)	1945
	Lombard Wilcoxon	1943
	Pettitt	1944
	Mann-Whitney (CPM)	1964, 1979, 1993
	Bayesian	none
	Lombard Mood	1959
	Mood (CPM)	None
	Smooth Lombard Wilcoxon	1938-1946
	Smooth Lombard Mood	none

Table 2. EHC change point analysis for the Red Lake River Watershed

Statewide Change Point Comparison

The completion of individual EHC assessments for 65 gage sites in 47 watersheds enabled the DNR to compare this watershed’s change point to the change points selected for other watersheds in the same hydrologic region (generally in the same major river basin) and statewide (**Figure 10**). Change points statewide ranged from 1940 to 2001, with most occurring in the 1980s and early 1990s (**Figure 11**). A past assessment of 36 Minnesota USGS gages, which looked at seven hydrologic metrics over 5, 10, and 25-year periods, similarly showed pronounced changes occurring in the mid-1980s and 1990s (Novotny and Stefan 2007).

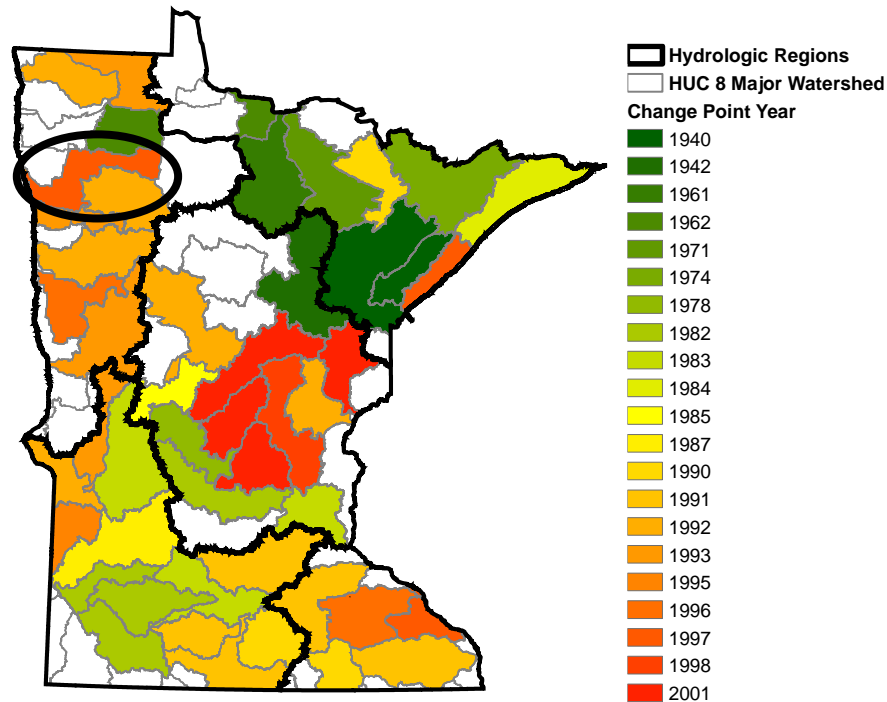


Figure 10. EHC hydrologic change points for 47 Minnesota watersheds (this watershed circled)

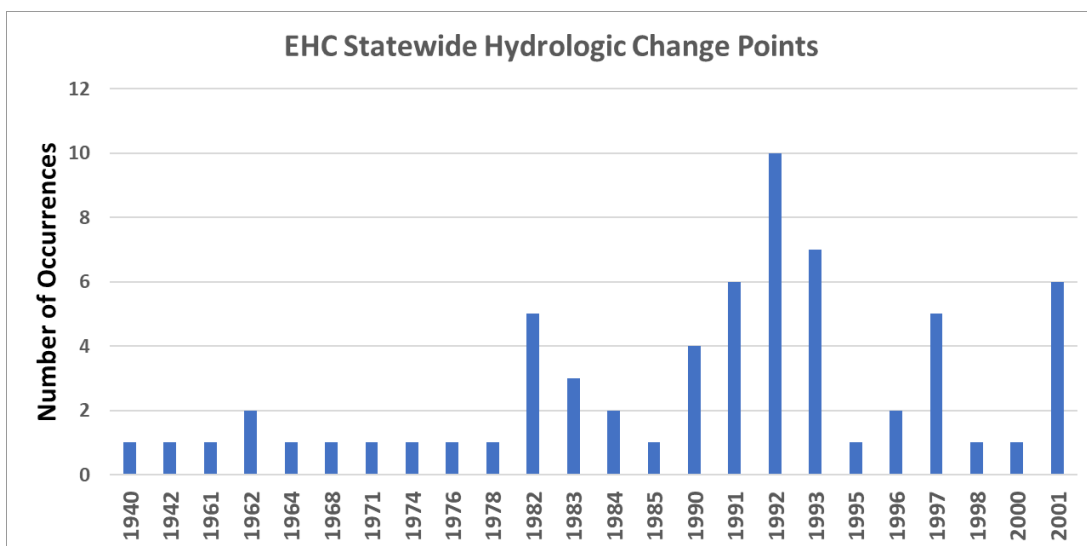


Figure 11. Frequency of EHC change point occurrences in 47 assessed watersheds in Minnesota

Observed Hydrologic Change

Hydrologic change is driven by complex sets of physical conditions that influence the movement and storage of water within the watershed. Evaluating hydrologic change is complicated by diverse interactions between water and the environment. Conclusions drawn from observed change are often influenced by factors such as the length of records of hydrologic data and the types of data being recorded.

The EHC looks at two main components of hydrology, precipitation and stream discharge. It assesses available long-term datasets, compares values before and after the identified change point for the watershed, and compares the results at three different spatial scales: watershed, hydrologic region, and state.

The results of the watershed analysis are compared to the results for similar watersheds in the same hydrologic region (generally in the same major river basin) and statewide. The statewide comparison shows diversity across different hydrologic landscapes and helps us interpret the watershed-scale results in a wider context.

Annual Precipitation

What does it tell us?

Changes in precipitation can drastically change stream flows for a given year and beyond. Erosion and transport of sediment to the stream are driven by factors such as the timing, intensity, and duration of precipitation events. Watershed-specific characteristics such as soil types, topography, and water storage capacity determine how and when precipitation is expressed as discharge.

How it works

Watershed-averaged precipitation is derived from a statewide spatially gridded dataset calculated back to 1890 using a combination of high-density rainfall readings from a statewide citizen monitoring program and other continuously collected rainfall data from gages across the state (Minnesota Climatology Office 2020). **Figure 12** shows watershed-averaged annual precipitation for this watershed. **Figures 13 and 14** compare the change in annual precipitation for this watershed to the other watersheds assessed in the EHC.

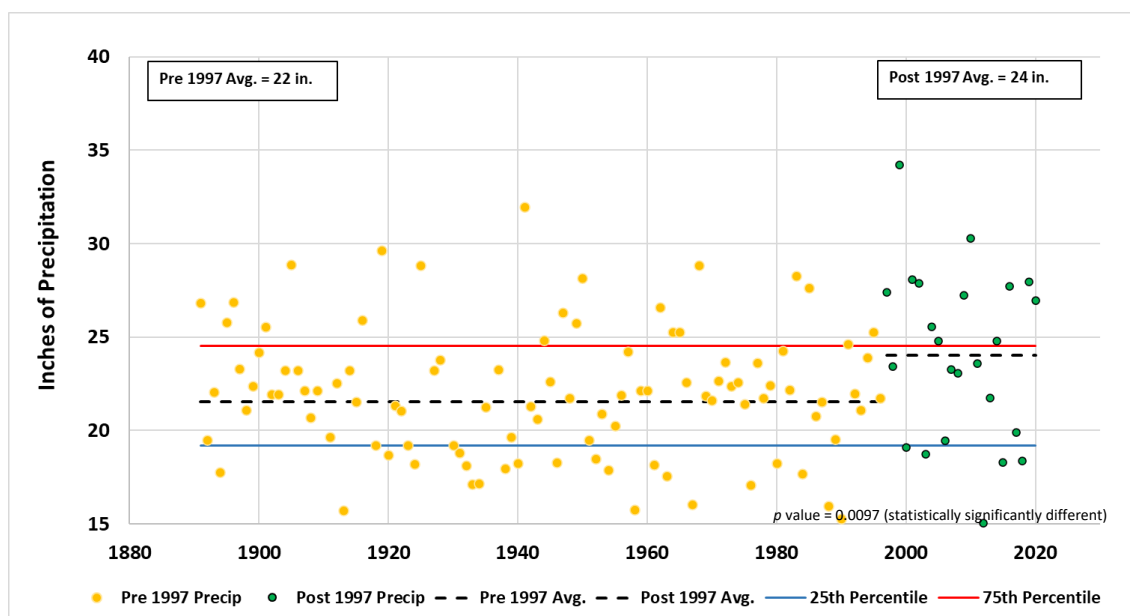


Figure 12. Averaged annual precipitation for the Red Lake River Watershed

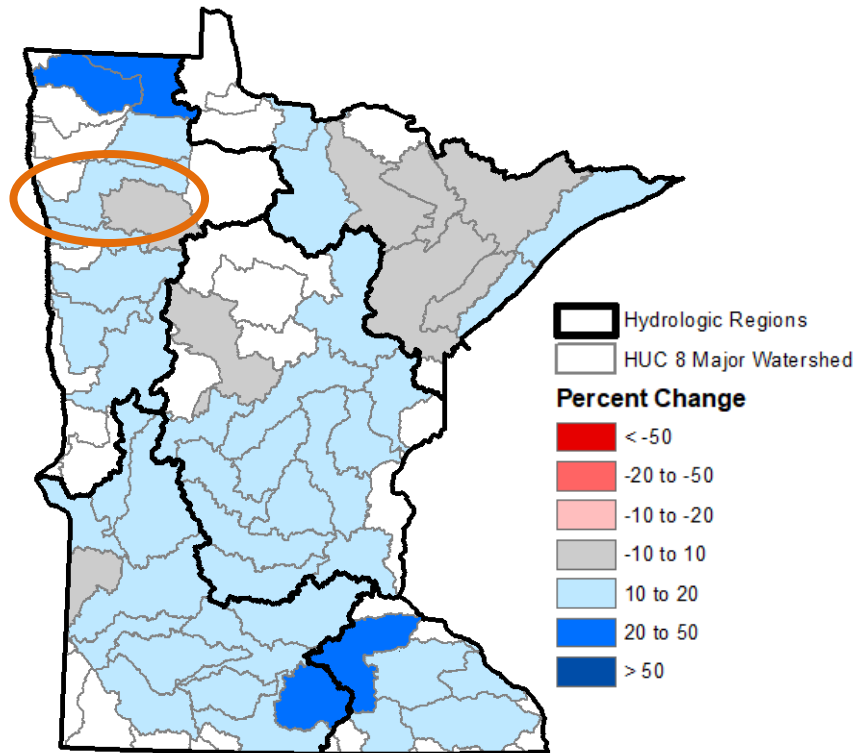


Figure 13. Change in annual precipitation by watershed, for assessed watersheds (this watershed circled)

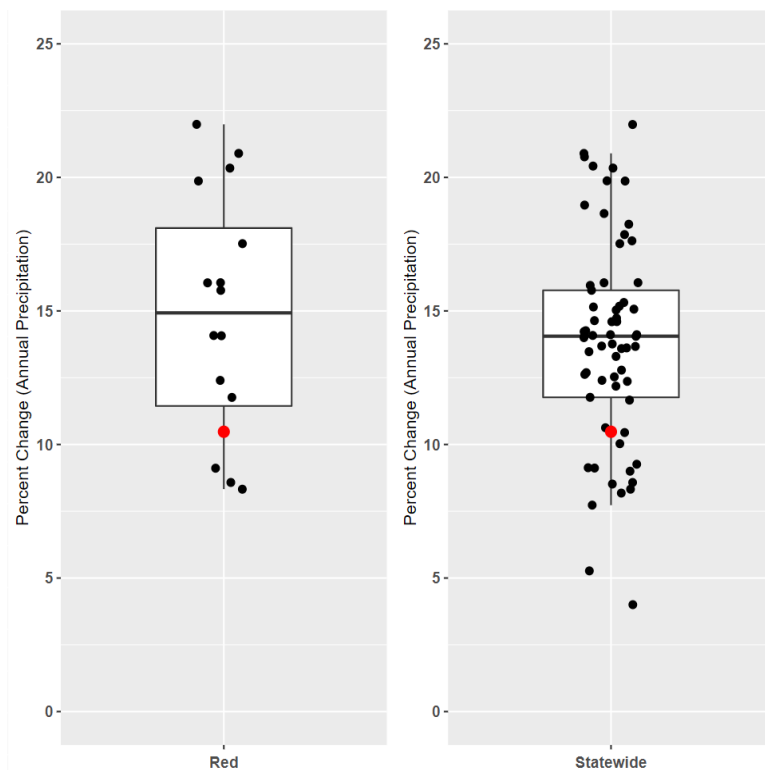


Figure 14. Change in annual precipitation: box plots comparing the Red Lake River Watershed (red dot) to other assessed watersheds (black dots) in the same hydrologic region and statewide

Wetness Analysis

What does it tell us?

Both the *Palmer Hydrologic Drought Index (PHDI)* and the *Standardized Precipitation Index (SPI)* characterize a watershed’s moisture conditions over time. **Figures 15 and 16** illustrate the length and intensity of wet and dry periods. **Tables 3 and 4** go further by quantifying the degree of change in specific moisture categories and by assessing changes in monthly values. Significant increases in “very wet” or “extremely wet” conditions indicate a higher potential for flooding, erosion, and pollutant transport. Likewise, changes in dry conditions indicate alteration to periods of low flow and possible periods of pollutant concentration.

How it works

The PHDI incorporates multiple climactic variables and assesses water availability on a long-term scale (Palmer 1965). The SPI is calculated using precipitation data alone and helps detect shorter-term changes in conditions (Keyantash et al. 2018).

While the long-term graph represents annual drought index values throughout the period of record, the percent change table for each index is based on monthly *moisture regime* values. The rate of occurrence for each moisture regime category (**Tables 3 and 4**) is calculated before and after the watershed’s change point.

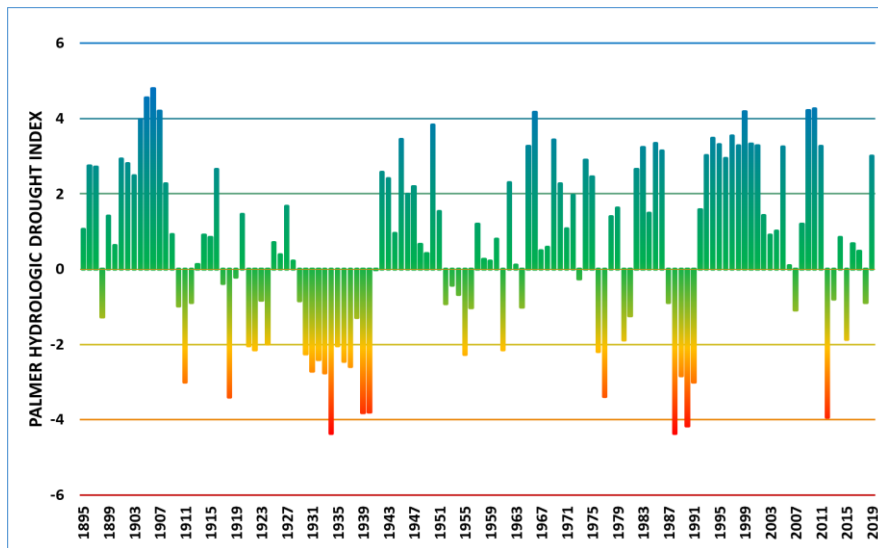


Figure 15. Palmer Hydrologic Drought Index (PHDI) annual values for Red Lake River Watershed

PHDI VALUES	PERCENT CHANGE
Extremely Wet	124
Very Wet	107
Moderate to Normal	-52
Severe Drought	-29
Extreme Drought	-62

Table 3. Palmer Hydrologic Drought Index (PHDI) percent change in monthly occurrence for Red Lake River Watershed

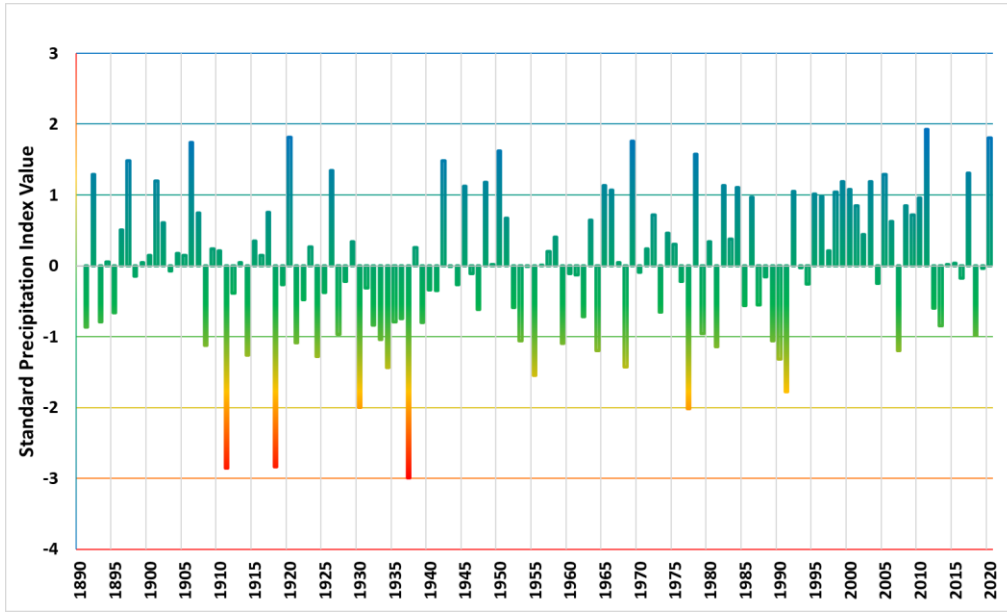


Figure 16. Standard Precipitation Index (SPI) annual values for Red Lake River Watershed

SPI VALUES	PERCENT CHANGE
Extremely wet	58
Very wet	-1
Moderately wet	49
Moderately dry	-18
Severely dry	-19
Extremely dry	-49

Table 4. Standardized Precipitation Index (SPI) percent change in monthly occurrence for Red Lake River Watershed

U.S. Army Corps of Engineers Climate Hydrology Assessment Tool (CHAT)

What does it tell us?

The *Climate Hydrology Assessment Tool (CHAT)* identifies changes in runoff that can lead to future instability in the watershed, suggesting the need for watershed planners to consider strategies to minimize potential impacts. The tool uses watershed-specific hydrologic modeling to quantify potential changes in streamflow. Historically modeled data from 1951 to 2005 show past trends in *maximum average annual monthly streamflow* and modeled future data from 2006 to 2099 show future trends (Figure 17).

How it works

Developed by the U.S. Army Corps of Engineers, this tool uses climate model outputs for temperature and precipitation from 32 global climate models to generate an *annual-maximum mean monthly stream flow*. This is

done using a distributed precipitation-runoff model in tandem with a river network routing model that is fed the inputs from the climate models (U.S. Army Corps of Engineers 2022). Combining the two different future climate scenarios ensures that a robust range of potential climate outcomes are represented as the outputs are spatially aggregated to this watershed’s boundaries.

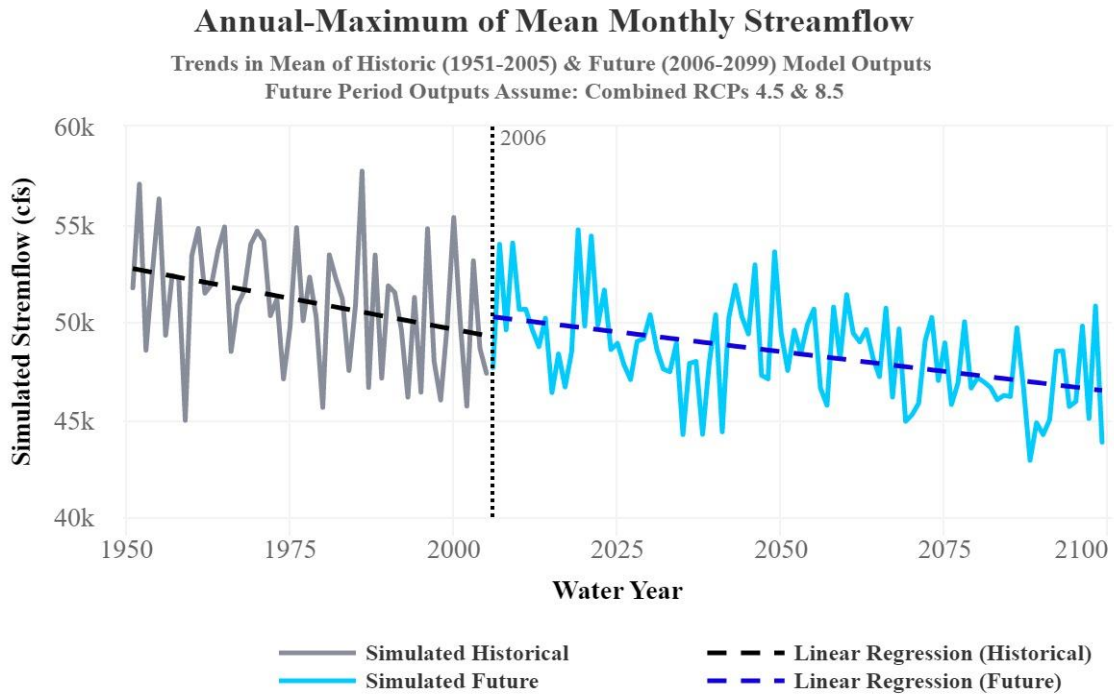


Figure 17. Annual maximum average monthly streamflow forecasted by the Climate Hydrology Assessment Tool (CHAT), for the Red Lake River Watershed

Annual Runoff

What does it tell us?

The volume of water discharged annually in a watershed is a metric that characterizes hydrologic conditions over time. When compared with precipitation volumes, it can help us understand how watershed dynamics impact the relationship between the two variables. Significant increases in runoff likely mean higher flows throughout the year, whether through increased baseflow or more intense storms. Additional analyses, including annual peak discharge evaluations and *baseflow separation*, can help us better understand these dynamics and guide management efforts to address specific challenges.

How it works

Annual average runoff is measured at the gage site by continuously recording the water level, which is used as a variable in an equation known as a *rating curve*. The rating curve correlates a given water level with the volume of water passing the gage over a given period, measured in cubic feet per second (cfs). Changes in the relationship between the two variables are regularly measured and temporary adjustments to the discharge record reflect the measured departure from the rating curve. **Figure 18** shows the *mean annual discharge* for this watershed. **Figures 19 and 20** compare the change in annual discharge for this watershed to the other watersheds assessed in the EHC.

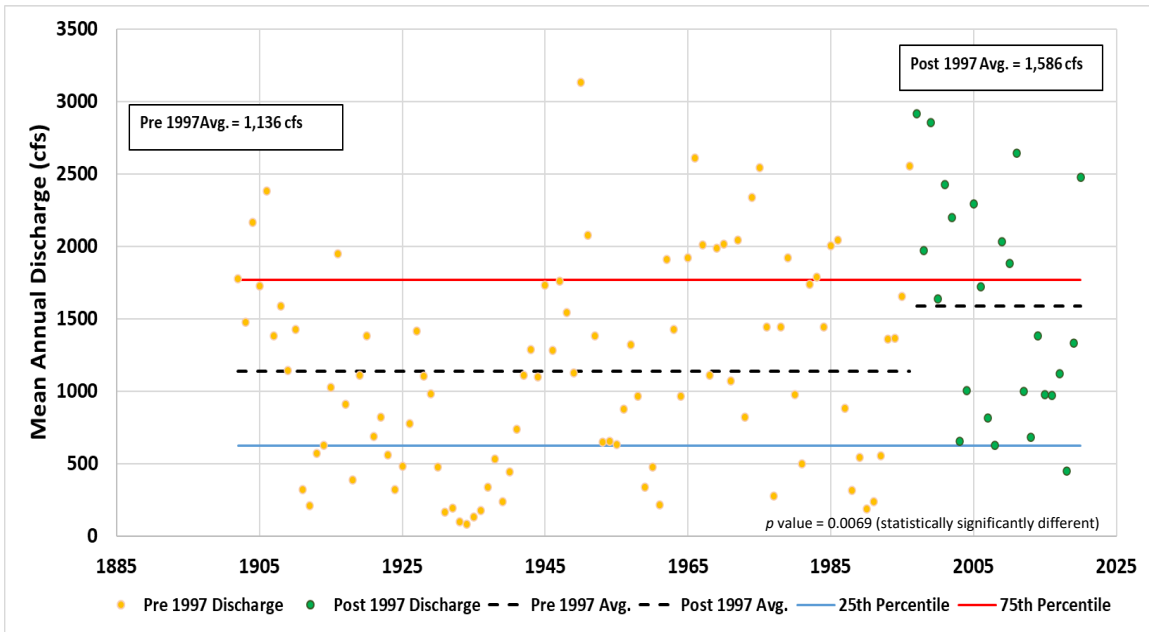


Figure 18. Mean annual discharge for the Red Lake River at Crookston (05079000)

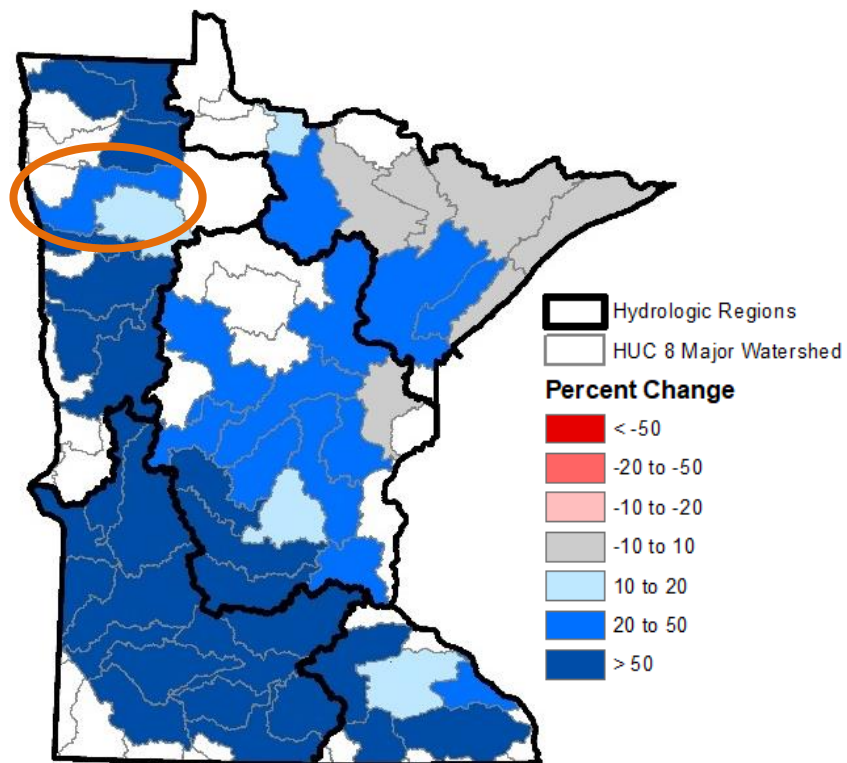


Figure 19. Change in mean annual discharge by watershed, for assessed watersheds (this watershed circled)

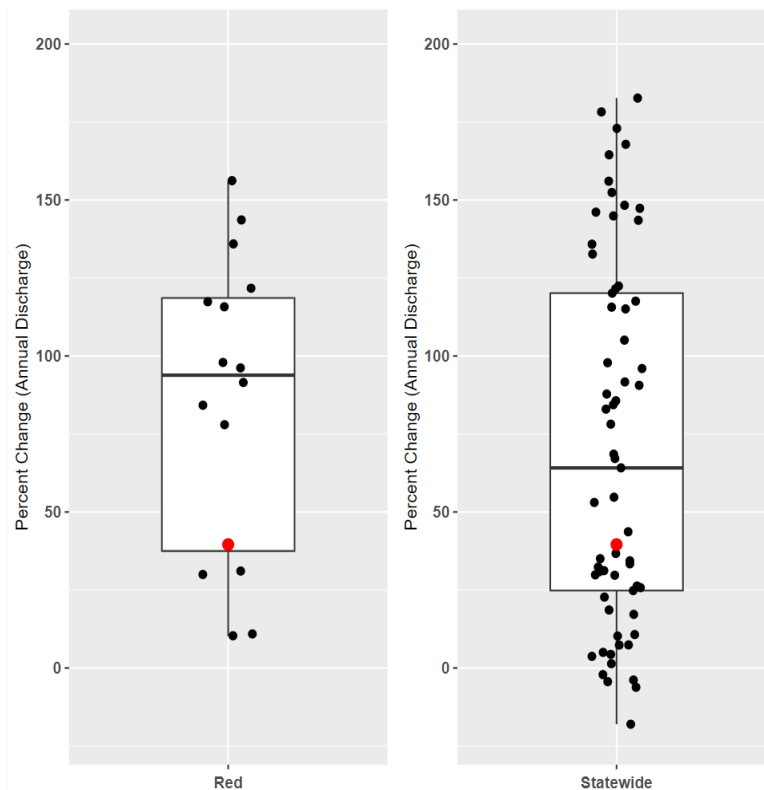


Figure 20. Change in mean annual discharge: box plots comparing the Red Lake River at Crookston (05079000) (red dot) to other assessed sites (black dots) in the same hydrologic region and statewide

Annual Peak Discharge

What does it tell us?

Increases in annual peak discharge values are one of the most significant concerns for stream channel stability, impacts on infrastructure, and impacts on biological communities. Changes in the magnitude and duration of peak discharges indicate shifts in the precipitation-discharge relationship. Increased peak discharges, typically caused by changes in storm intensity, land use, or both, can point to a need to prioritize peak flow reduction strategies.

How it works

Both *flood frequency analysis* and the Non-Stationarity Detection Tool use annual peak discharges by water-year. **Figure 21** shows the annual peak discharge for this watershed. **Figures 22 and 23** compare the change in annual peak discharge for this watershed to the other watersheds assessed in the EHC.

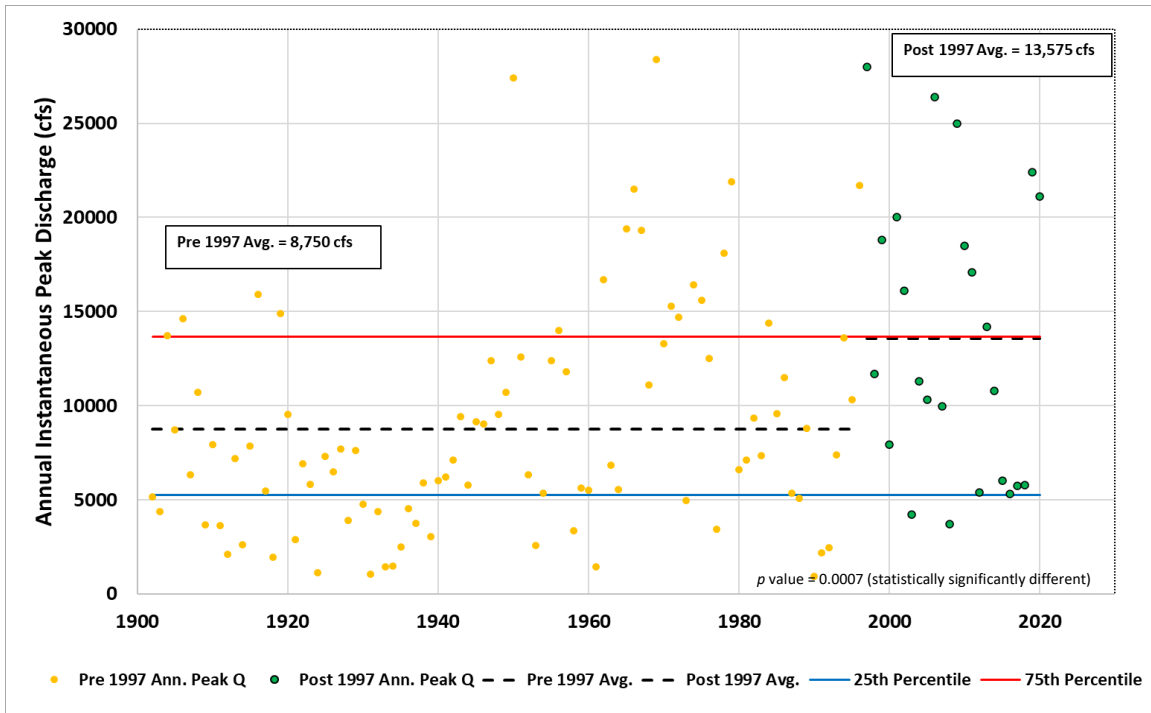


Figure 21. Annual peak discharge for the Red Lake River at Crookston (05079000)

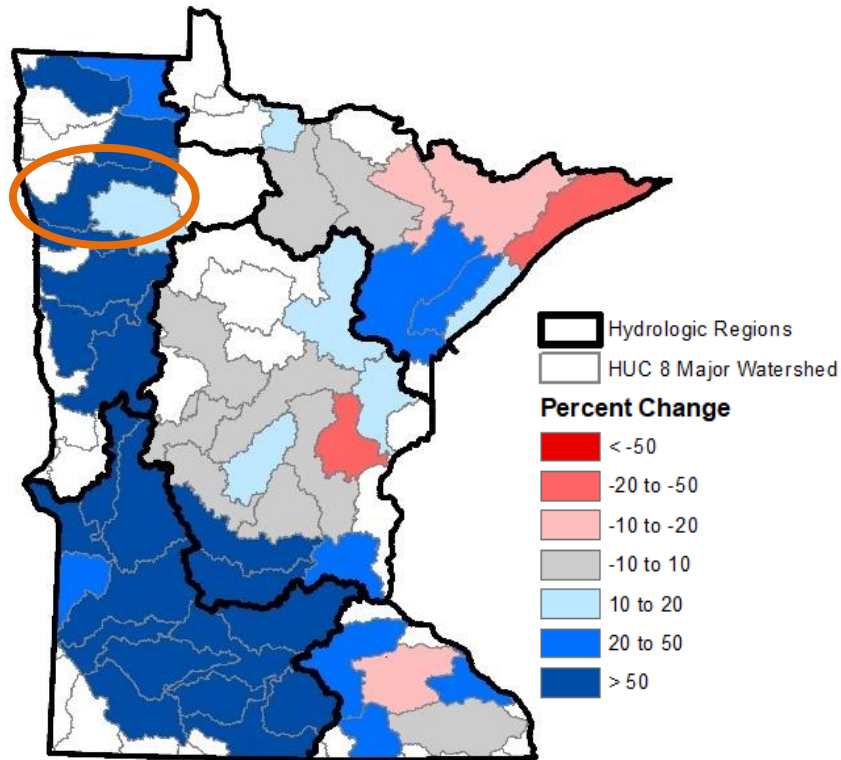


Figure 22. Change in annual peak discharge percent change by watershed, for assessed watersheds (this watershed circled)

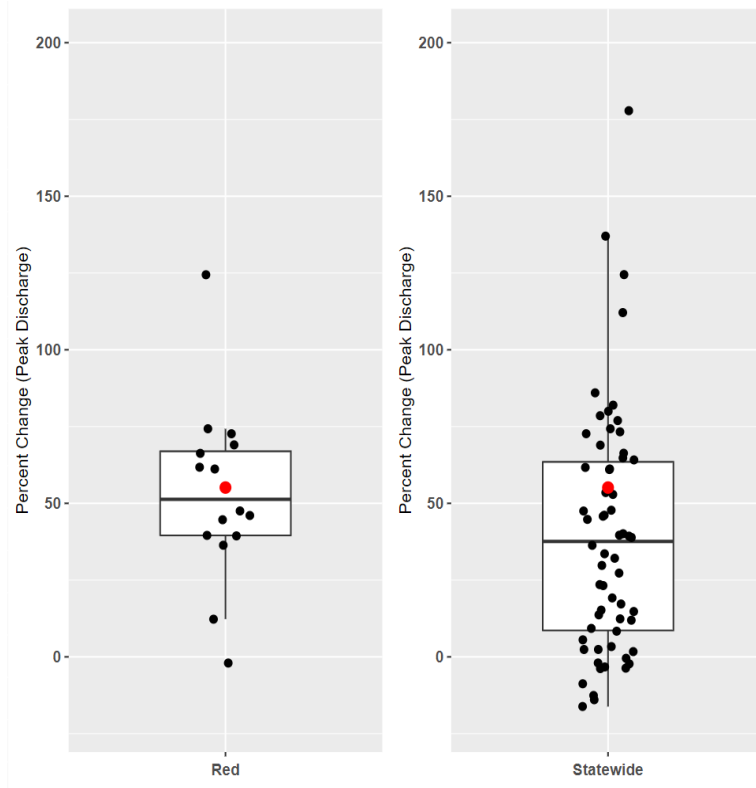


Figure 23. Change in annual peak discharge: box plots comparing the Red Lake River at Crookston (05079000) (red dot) to other assessed sites (black dots) in the same hydrologic region and statewide

Flow Duration Curve

What does it tell us?

The *flow duration curve* is a graphical representation of how frequently discharges of a given magnitude are equaled or exceeded over a specific period. The analysis is unique in that it shows changes over the entire flow regime rather than for a specific flow range. A curve with a steeper slope after the change point indicates an increasing occurrence of higher flows and more variability in flows, while a flattening slope indicates an increase in moderate to low flows. Steeper slopes are commonly interpreted to imply more direct runoff while flatter slopes suggest increases in surface or groundwater storage (Searcy 1959).

How it works

The metrics for the flow duration analysis identify changes in high flows (10%), low flows (90%), and average flows (50%). A duration curve is created for the period before the identified change point and compared to a curve based on the period after the change point. RVA values are calculated for the high and low flow metrics by using the daily rate of occurrence above the 10% exceedance flow and below the 90% exceedance flow. The 50% exceedance value is equal to the median flow value for the period being analyzed. **Figure 24** shows flow duration curves for the periods before and after the change point as well as for the entire length of the record. **Figures 25 through 28** compare the change in 10%, 50%, and 90% flow duration exceedances for this watershed to the other watersheds assessed in the EHC.

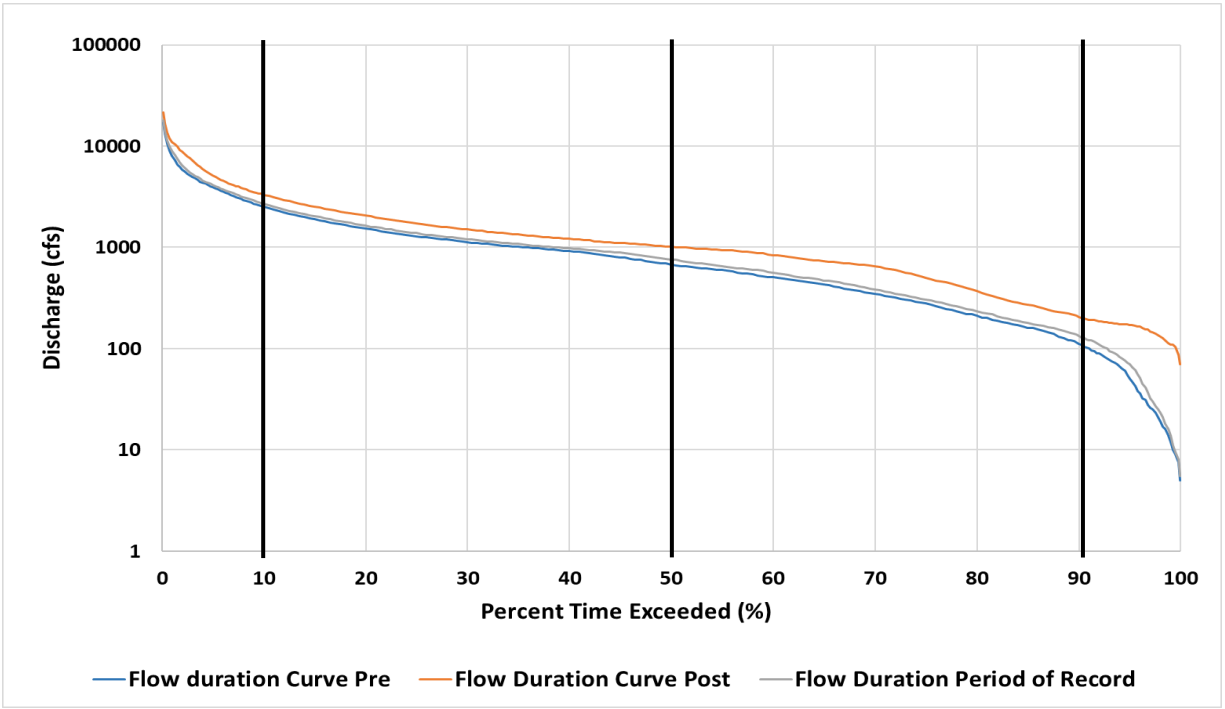
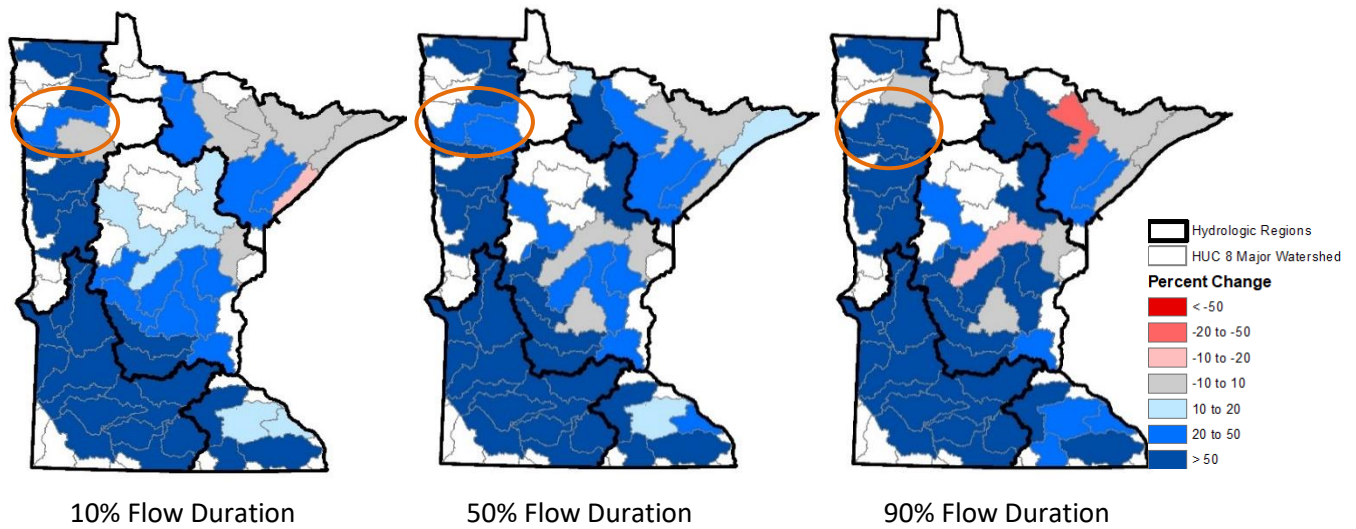


Figure 24. Flow duration curves for the Red Lake River at Crookston (05079000)



10% Flow Duration

50% Flow Duration

90% Flow Duration

Figure 25. Change in flow duration exceedance (10%, 50%, 90%) by watershed, for assessed watersheds (this watershed circled)

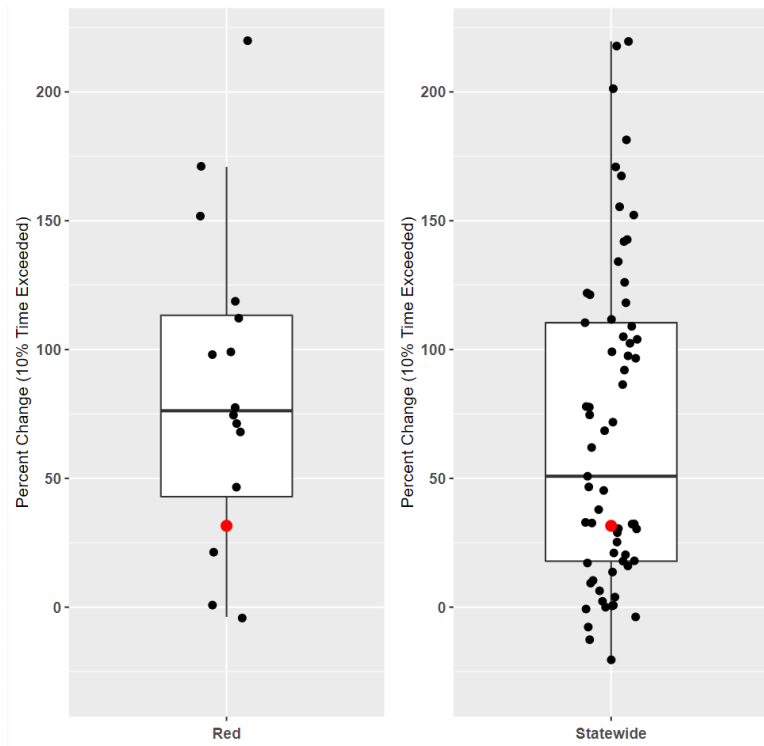


Figure 26. Change in 10% flow duration exceedance: box plots comparing the Red Lake River at Crookston (05079000) (red dot) to other assessed sites (black dots) in the same hydrologic region and statewide

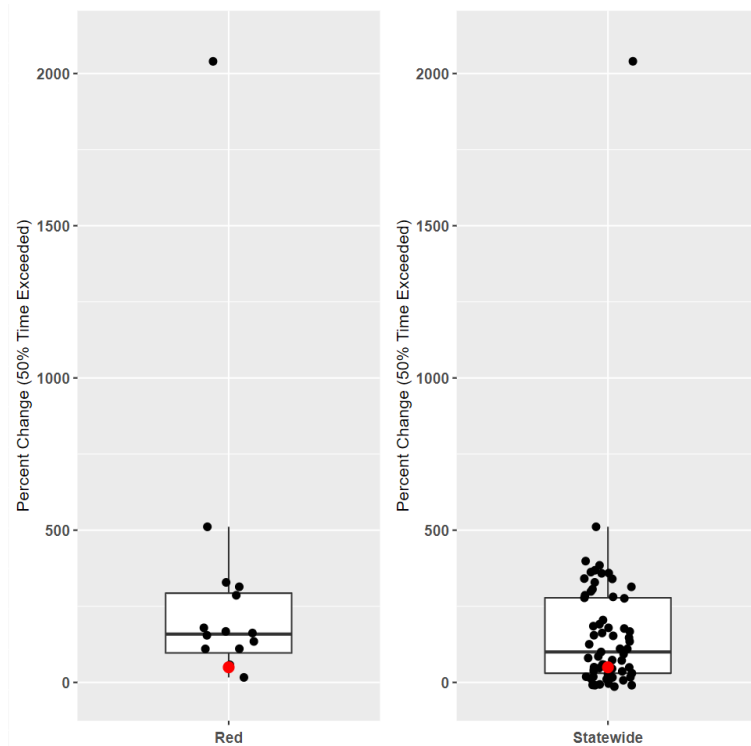


Figure 27. Change in 50% flow duration exceedance: box plots comparing the Red Lake River at Crookston (05079000) (red dot) to other assessed sites (black dots) in the same hydrologic region and statewide

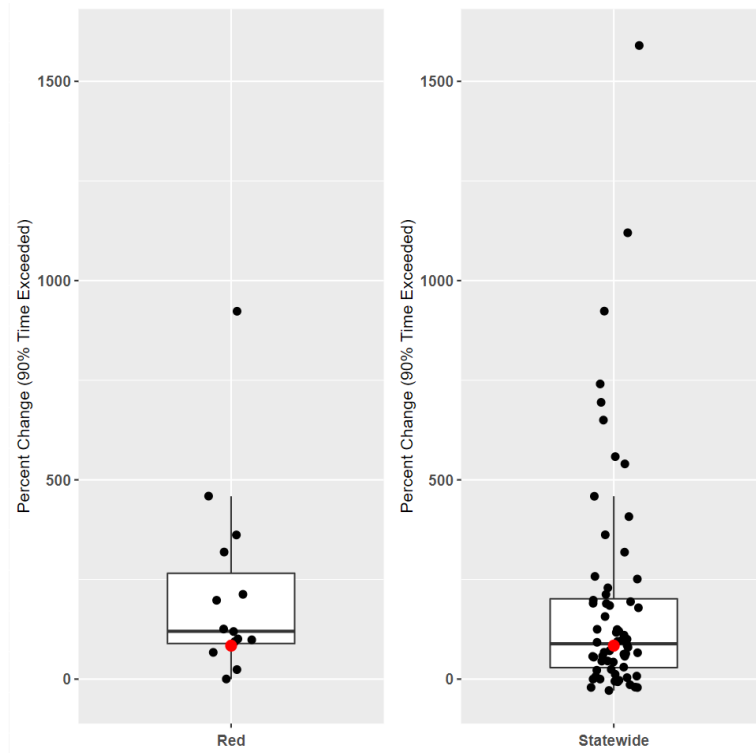


Figure 28. Change in 90% flow duration exceedance: box plots comparing the Red Lake River at Crookston (05079000) (red dot) to other assessed sites (black dots) in the same hydrologic region and statewide

Hydrologic Dynamics

Annual Runoff Ratios

What does it tell us?

Dramatic changes in runoff ratios are a key indicator of altered hydrology. These shifts can be caused by short-term changes in storage, shallow groundwater contributions, and even storm intensity. Understanding the difference in the volume of water leaving the watershed compared to what the watershed is receiving through precipitation provides a general understanding of how water moves through the landscape.

How it works

The *annual runoff ratio* analysis compares annual discharge to annual precipitation volumes normalized in inches over the watershed. Changes in water storage and loss of water through evaporation and transpiration all impact the percentage of precipitation that makes its way out of the watershed. **Figure 29** shows the annual runoff ratios for this watershed. **Figures 30 and 31** compare the change in annual runoff ratios for this watershed to the other watersheds assessed in the EHC.

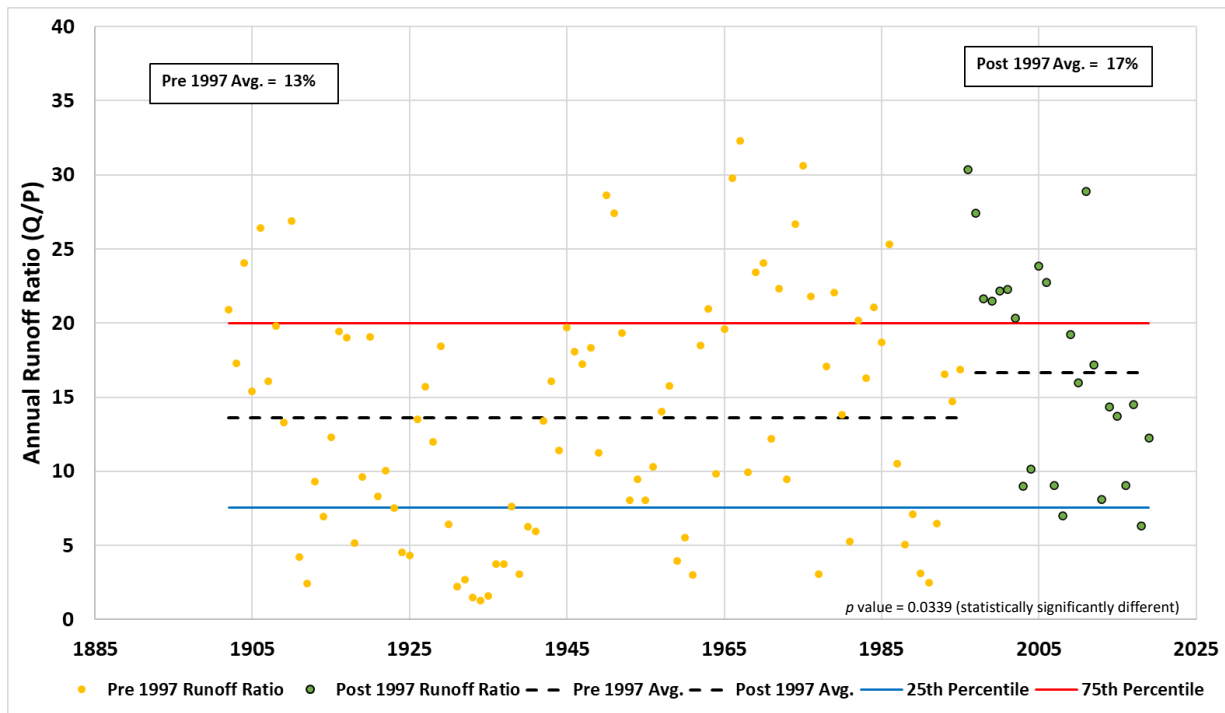


Figure 29. Annual runoff ratios for the Red Lake River at Crookston (05079000)

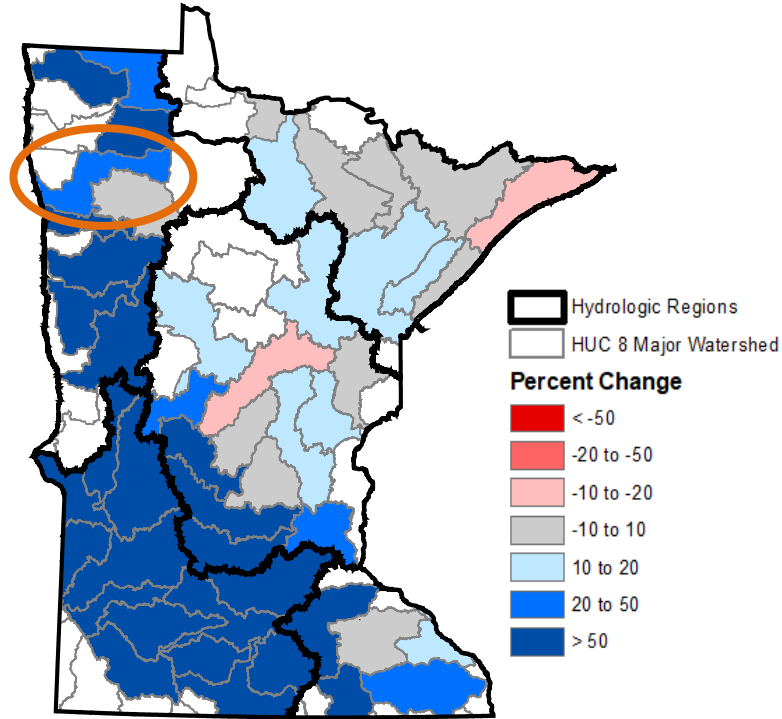


Figure 30. Change in the annual runoff ratio by watershed, for assessed watersheds (this watershed circled)

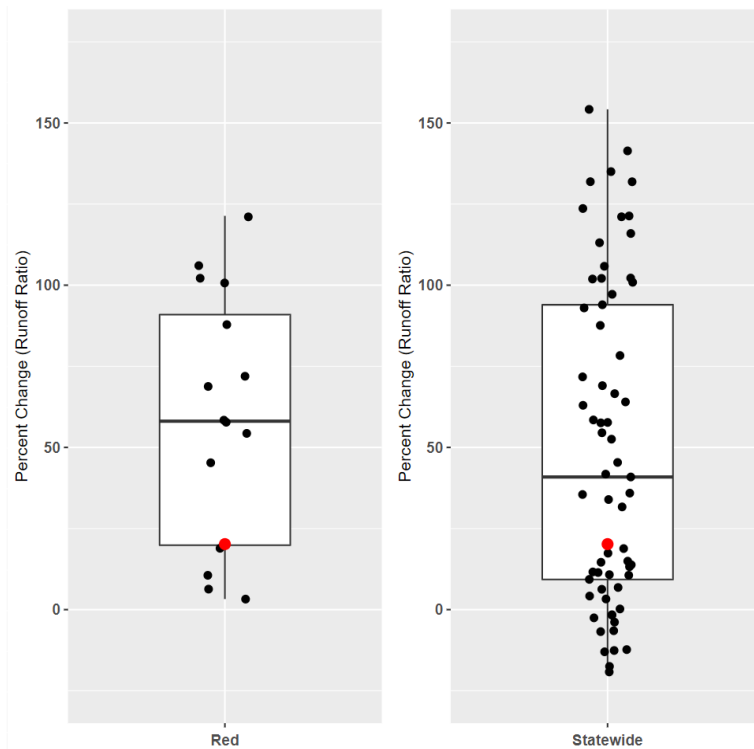


Figure 31. Change in the annual runoff ratio: box plots comparing the Red Lake River at Crookston (05079000) (red dot) to other assessed sites (black dots) in the same hydrologic region and statewide

Annual Baseflow

What does it tell us?

Baseflow analysis identifies changes in hydrologic conditions relating to water storage, subsurface groundwater movement, and aquifer recharge. *Baseflow* is the portion of flow within a river or stream that does not come from overland runoff. It is key to maintaining stream channel conditions in times of little to no precipitation. Many organisms rely on baseflow to buffer temperatures in streams to survive and carry out life functions.

Changes in baseflow volumes are often closely tied to land use. Land management practices and changes in vegetative cover can alter surface runoff dynamics and prevent water from moving downward into areas of deeper groundwater storage. The direct removal (appropriation) of groundwater near a stream can also impact the stream's baseflow volume.

How it works

Annual baseflow is calculated using an online hydrograph separation module developed by the University of Purdue called the *Web-based Hydrograph Analysis Tool (WHAT)* (Lim and Engel 2004). The tool separates discharge data into two datasets, one for baseflow and one for surface runoff. **Figure 32** shows the annual baseflow for this watershed. **Figures 33 and 34** compare the change in annual baseflow for this watershed to the other watersheds assessed in the EHC.

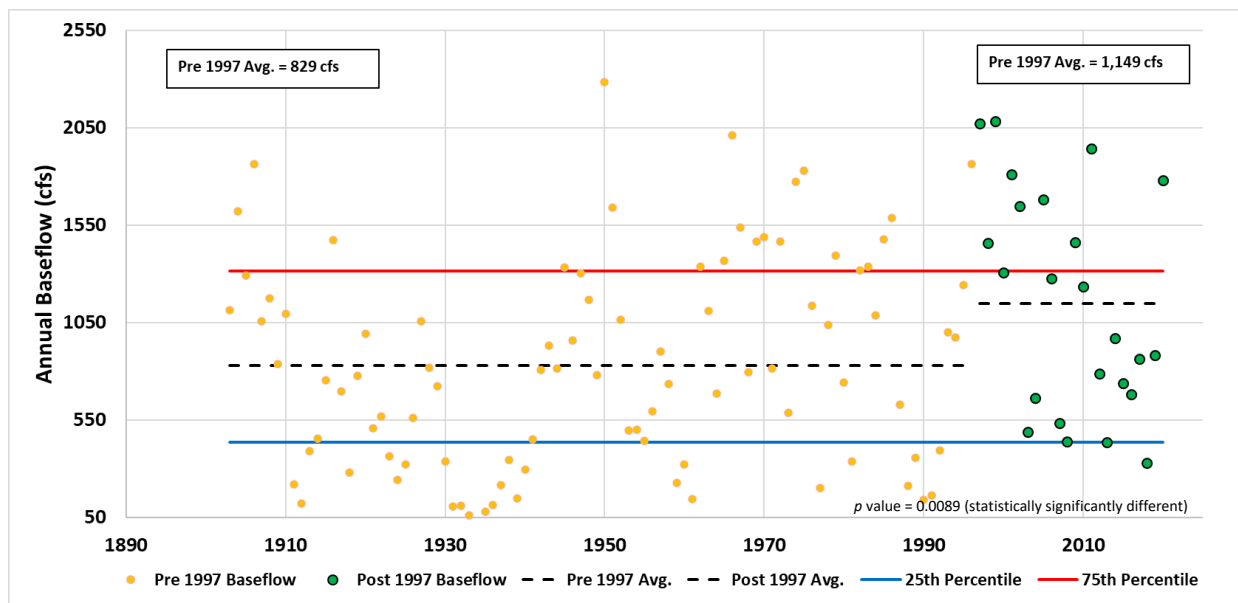


Figure 32. Annual baseflow for the Red Lake River at Crookston (05079000)

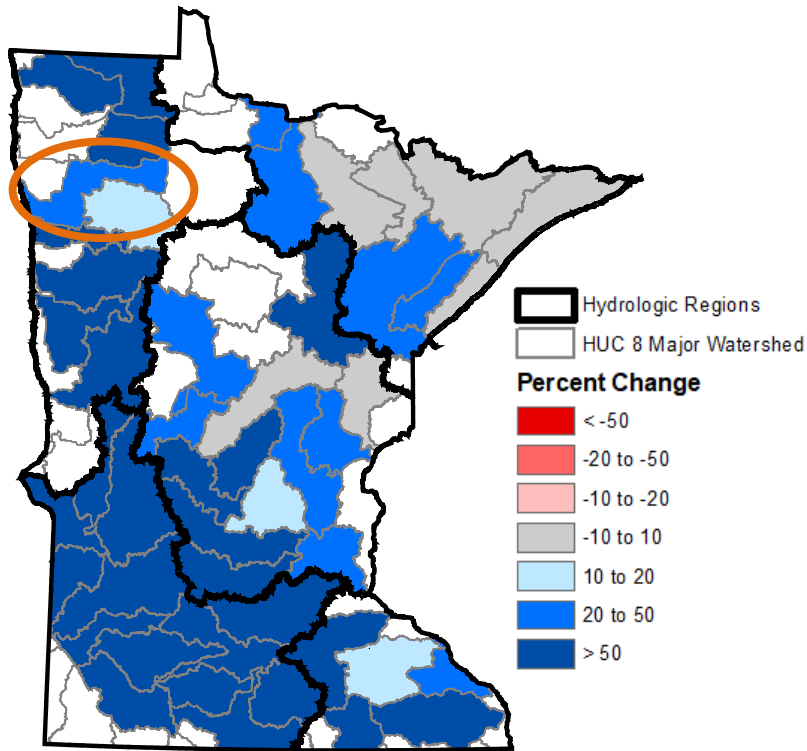


Figure 33. Change in annual baseflow volume by watershed for assessed watersheds (this watershed circled)

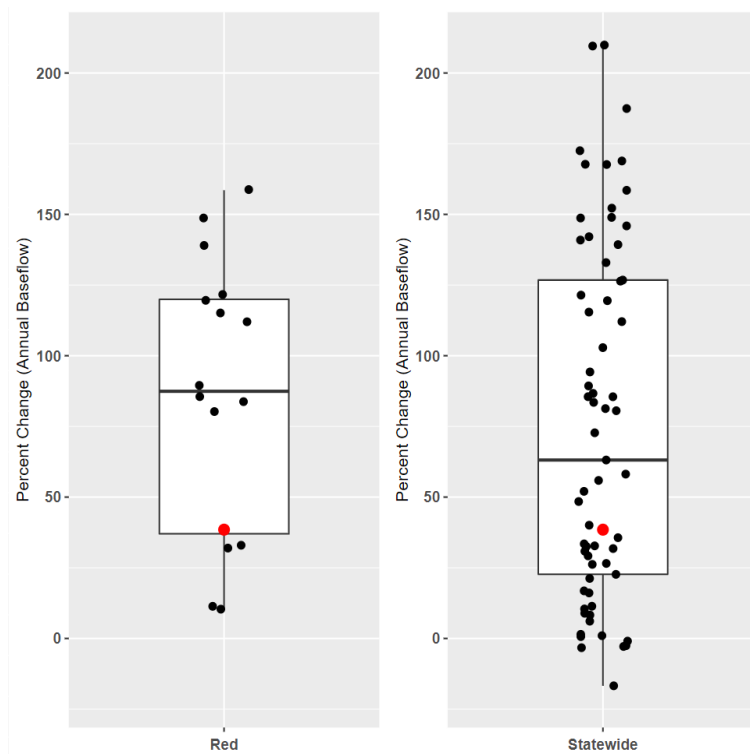


Figure 34. Change in annual baseflow: box plots comparing the Red Lake River at Crookston (05079000) (red dot) to other assessed sites (black dots) in the same hydrologic region and statewide

Water Balance Table

What does it tell us?

The water balance table (**Table 5**) quantifies changes in the relationship between precipitation and discharge. The table compares the volume of water entering and exiting the watershed before and after the change point. Small changes in precipitation (P) or evapotranspiration (ET) can have significant effects on discharge (D). Comparing changes in discharge and precipitation can help determine the capacity of the watershed to store additional water.

How it works

The water balance table is populated by averaging annual volumes of discharge and precipitation before and after the change point. The difference between the discharge and precipitation values for each period is identified as evapotranspiration. Changes in water storage are assumed to be negligible over the span of many years and are not included in the water balance. Each hydrologic component in the budget equation is normalized by converting volume units to inches over the gage watershed to enable direct comparisons.

Change Point = 1997	<u>D</u>ischarge (in.)	ET (in.)	<u>P</u>recip (in.)	Runoff Ratio (<u>D</u>/<u>P</u>)
Pre 1997	2.9	18.5	21.4	0.14
Post 1997	4.2	19.8	23.9	0.17
Change	1.3	1.3	2.6	0.04

Table 5. Water balance (in inches over the watershed) for the Red Lake River at Crookston (05079000)

Hydrologic Drivers

Detecting and characterizing hydrologic change frequently leads to questions about the causes. Understanding the drivers of change is important for developing management strategies. One common approach is the use of mechanistic models. These mimic the physical processes within the watershed and can help untangle the complex relationships between climate, terrain, geology, land use, and other variables.

Applying detailed mechanistic hydrologic models throughout the state is beyond the scope of the EHC, so an alternative approach involving machine-learning data regression modeling is used to make inferences regarding the impacts of hydrologic drivers. The Random Forest regression modeling used in the EHC is such a model and relies on observed or empirical relationships between several datasets. Historical county-level crop data from the U.S. Department of Agriculture (**Figure 35**) (USDA 2020) is one dataset used in this approach to examine the impact of watershed area in row crops.

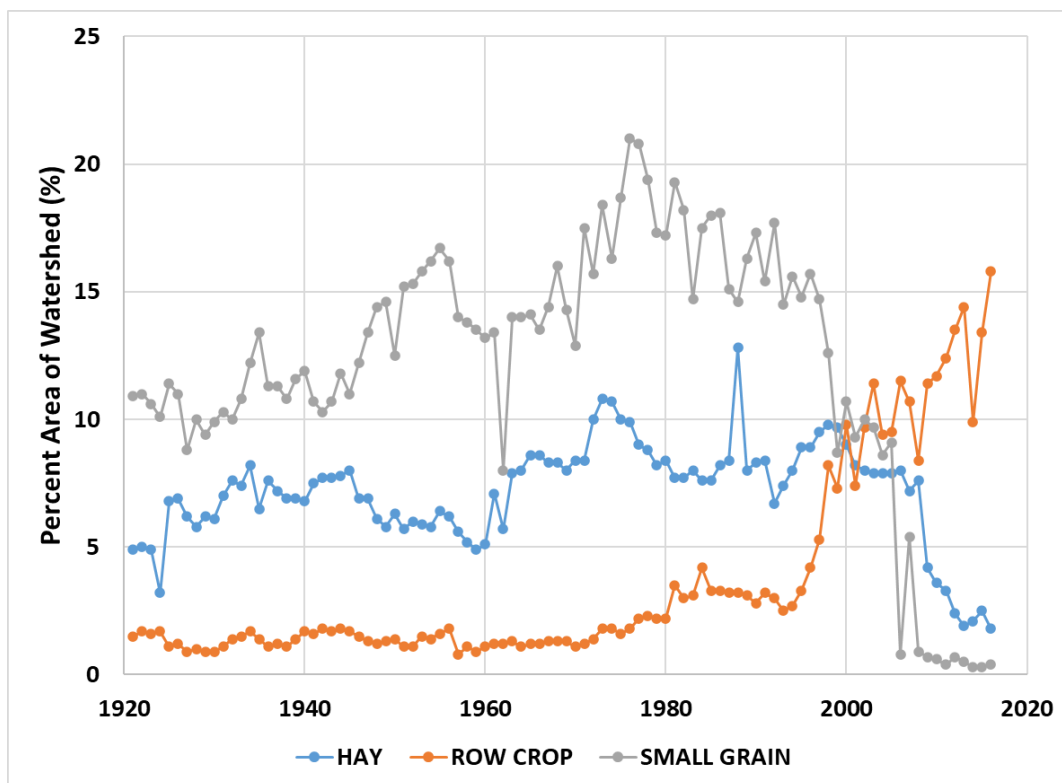


Figure 35. Area-weighted USDA county-reported harvest data for the Red Lake River Watershed

Random Forest Regression

What does it tell us?

Random Forest Regression modeling identifies how key hydrology drivers influence the watershed's discharge record. Outputs from the analysis can identify tipping points where small increases in a given hydrologic driver can create significant increases in yearly discharge. These tipping points or thresholds are critical to understanding how the hydrologic changes characterized in the EHC may be impacting the discharge record.

How it works

Random Forest Regression analysis is a modeling technique that uses a machine-learning algorithm to assess the impact of each variable on a specific output (Breiman 2001). The EHC-assessed variables in **Figure 36** are annual precipitation (Ann Precip), one- and two-years prior precipitation (Ann Precip Lag 1 and Lag 2), temperature (Mean Ann Temp), one- and two-years prior temperature (Mean Ann Temp Lag 1 and Lag 2), and the percent of the watershed area in row crops (% Row Crops Lag 1). The output variable is annual discharge.

The *variable importance* analysis determines the relative importance of each variable to changes in discharge over the period of record. The output is generated by estimating each variable's impact on the mean square error of the model used to relate the variables to the discharge record. This is done by isolating each variable's impact on the *mean annual discharge volume*. Higher values have more influence on discharge. The *partial dependence* analysis plots the three strongest hydrologic drivers in relation to their effect on discharge (Friedman 2001).

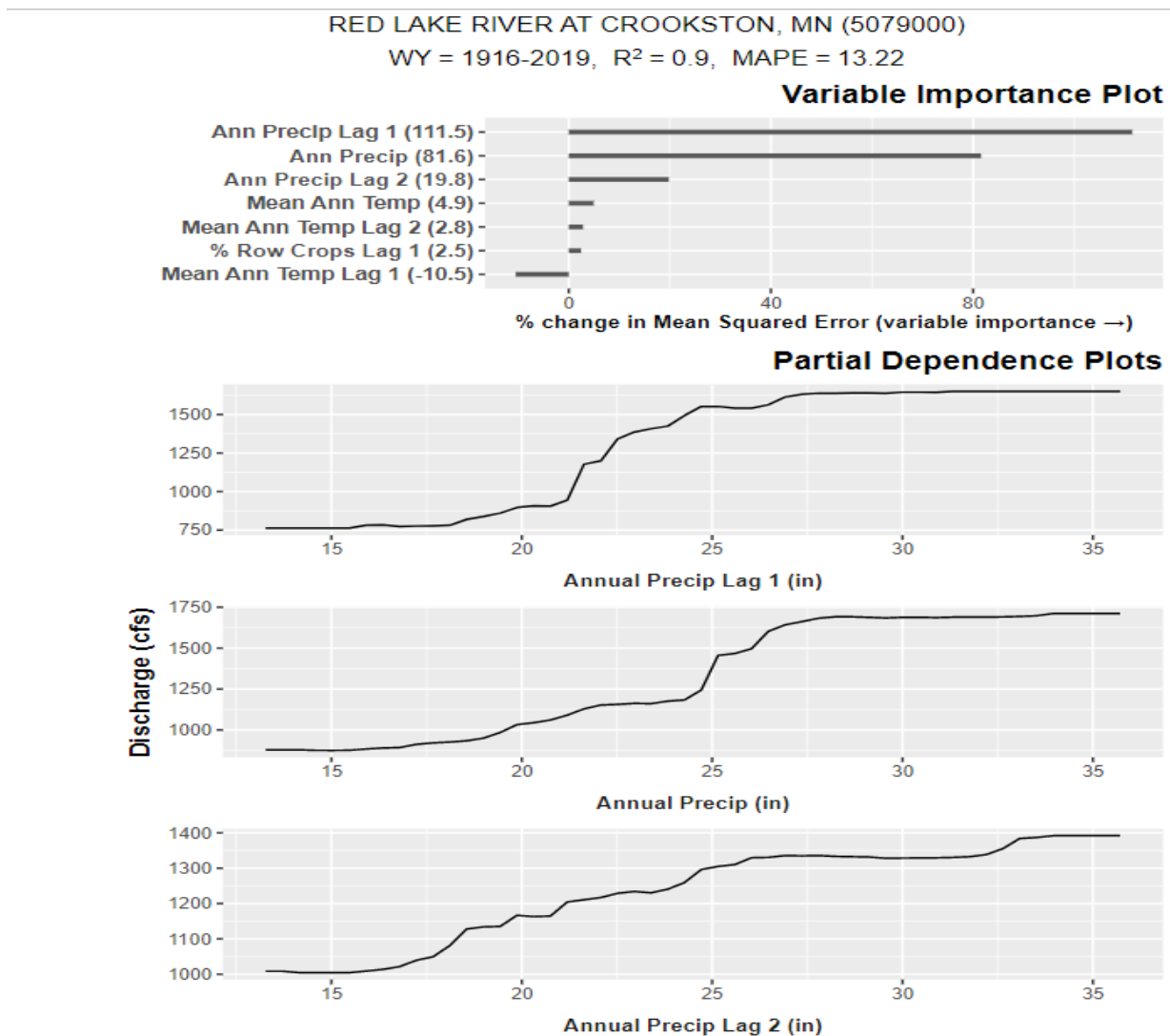


Figure 36. Random Forest Regression variable importance and partial dependence plots for the Red Lake River at Crookston (05079000)

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April 14, 2026

Peter Nelson, Manager
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Thief River Falls, MN 56701
Sent to peter.nelson@pennington.mnswcd.org

Matt Fischer, Board Conservationist
Board of Water and Soil Resources
403 4th St NW, Room 200
Bemidji, MN 56601
Sent to matt.fischer@state.mn.us

Subject: Minnesota Department of Health Comments for the Red Lake River Comprehensive Watershed Management Plan (RLRCWMP)(1W1P) 60-Day Review

The Minnesota Department of Health (MDH) Source Water Protection Unit appreciates the opportunity to review the draft Red Lake River Comprehensive Watershed Management Plan. MDH commends the plan partners for including drinking water as a priority concern. Thank you for the opportunity to participate in the plan's Advisory Committee and for including our considerations.

MDH comments on the draft plan include an assessment of priority concerns addressed from our initial comment letter dated May 31, 2024.

1. Prioritize drinking water protection: Consider groundwater Drinking Water Supply Management Areas (DWSMAs) delineated for Crookston, Red Lake Falls, Saint Hilaire, Country Estates Mobile Home Park, Aeseby Court, and Basswood Court as priority areas for protection activities. The vulnerability of DWSMAs determines the level of risk posed by various land uses and potential sources of contamination.

This priority concern was addressed in the following ways:

- a. Identifying DWSMAs in the planning area as targeted protection areas in the Relevant Socio-Economic Information Section of the Land and Water Resources Narrative (page 24).
- b. Including vulnerable groundwater quality as an issue in the Issues section (page 31).
- c. Specifying that DWSMAs are focus areas for the partnership to prioritize protection activities in Measurable Goals (page 47).
- d. Providing a figure of DWSMAs in the planning area to assist partners with targeting activities in Measurable Goals (page 48).
- e. Including DWSMA delineations as information for the partnership to use in the prioritization of activities in Targeted Implementation Schedule (page 72).
- f. Assigning Source Water Protection planning and implementation as a watershed-wide action for the partnership to measure progress in the Targeted Implementation Schedule (page 79).
- g. Providing DWSMA protection as an example of partnership collaboration in Plan Administration and Coordination (page 106).

- h. Identifying MDH’s Source Water Protection Grant Program as a financial resource for projects and practices, capital improvement projects, data collection and monitoring, and outreach in Plan Administration and Coordination (page 117).

- 2. Prioritize sealing abandoned wells: This is a central practice in protecting groundwater quality. When resources are limited, it is important to further evaluate an unsealed well by examining the risk it poses to active Public Water Systems or to an aquifer used by many private wells in an area.

This priority concern was addressed in the following ways:

 - a. Assigning the sealing of five wells per year as a short-term plan goal in Measurable Goals (pages 35 and 46).
 - b. Identifying the sealing of all abandoned and unused wells as a long-term goal in Measurable Goals (page 46).
 - c. Including well sealing as a Focus Area for groundwater protection in Measurable Goals (page 47).
 - d. Referencing the MDH well sealing grant program as a financial resource in Plan Administration and Coordination (page 117).

- 3. Prioritize protection of private wells: Many residents rely on a private well for the water they drink. Local governments can assist with protecting private wells through land use management, making water testing accessible, controlling sources of contamination, and providing best practices information.

This priority concern was addressed in the following ways:

 - a. Including private well water testing kit distribution and the holding of testing clinics as a watershed-wide activity in Targeted Implementation Schedule (page 78).
 - b. Identifying testing clinics as Education and Outreach activities to be prioritized in Plan Implementation Programs (page 82 and 95).

- 4. Prioritize protection of Noncommunity Public Water Systems: Noncommunity public water suppliers provide drinking water to people at their places of work or play. The plan should consider impacts of land use and management activities to drinking water resources used by employees, volunteers and visitors of One-N-Only Store, Snowsled Inn, Maple Lake Resort, Kruse Inn, Falls Cinema, Western Professional Building, Johnson’s Riverside, Northdale Oil, Arctic Cat Sales, Fishers Landing Wayside Rest, Old Crossing Treaty Wayside Park, St. Mary’s Catholic Church, St Paul’s Lutheran Church, Bible Baptist Church, St. Peter’s Church of Gentilly, Black River Lutheran Church, St Pauli’s Lutheran Church, Oak Ridge Lutheran Church, Community Church International, Bethany Lutheran Church, and Eklund Lutheran Church.

This priority concern was addressed in the following way:

Building collaboration with private businesses and civic groups as a partnership activity in Plan Administration and Coordination (page 108).

- 5. Support the development of surface water intake protection plans: The city of Thief River Falls has an approved drinking water protection plan, and the city of East Grand Forks will be updating a drinking water source assessment and initiating protection planning during the early implementation of this RLRCWMP. Both communities rely on managed flow from the Red Lake River. Surface water-based drinking water systems are highly susceptible to potential contamination from a variety of sources and partnerships continue to be essential for effective protection activities.

This priority concern was addressed in the following ways:

- a. Assigning surface water intakes in Thief River Falls and East Grand Forks as targeted protection areas in the Relevant Socio-Economic Information Section of the Land and Water Resources Narrative (page 24).
 - b. Identifying Thief River Falls and East Grand Forks surface water intakes as vulnerable and prioritized for protection in the Issues Section (page 31).
 - c. Including the benefit to Thief River Falls and East Grand Forks in their drinking water protection efforts through the reduction of sediment loading in Measurable Goals (page 37).
 - d. Assigning Source Water Protection planning and implementation as a watershed-wide action for the partnership to measure progress in the Targeted Implementation Schedule (page 79).
6. **Prioritize and promote groundwater conservation and recharge:** The watershed has limited aquifer availability and western portions of the planning area have conditions prone to groundwater loss through flowing wells. Conservation practices that improve groundwater recharge and manage discharge are considerations for planning and projects in the watershed.

This priority concern was addressed in the following ways:

- a. Identifying the loss of recharge as an issue for groundwater supplies to be addressed in the plan in the Issues Section (page 31).
- b. Assigning improved groundwater recharge as a 10-year goal in Measurable Goals (pages 35 and 43).
- c. Including the protection of groundwater recharge areas as an example of stacked benefits in Measurable Goals (page 47).

MDH priority concerns have been adequately addressed in the drafted plan. We look forward to providing continued support and technical assistance with plan implementation. If you have any questions, please contact me at (218) 332-5195 or via email at dan.disrud@state.mn.us.

Sincerely,



Daniel L. Disrud, REHS, NW District Principal Planner
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 - Melinda Neville, MPCA Watershed Grants and Contract Specialist
 - Reid Christianson, MDA Clean Water Technical Assistance Unit Supervisor
 - Catherine Neuschler, Minnesota Environmental Quality Board

April 6, 2026

Peter Nelson, District Manager
Pennington SWCD
201 Sherwood Ave S
Thief River Falls, MN 56701

RE: Notification of formal 60-day comment period for draft Red Lake River Comprehensive Watershed Plan

Dear Peter Nelson:

Thank you for the opportunity to provide comments regarding the draft Red Lake River Comprehensive Watershed Plan (Plan). The Minnesota Pollution Control Agency (MPCA) appreciates the opportunity to work with local partners and other state agencies to protect and improve water resources. The MPCA has the following comments:

1. There are numerous references to an undefined acronym “RLRW”.
2. There are a couple of in-text citations that are missing the correct reference in Appendix I, specifically:
 - a. Page 33 has (MPCA, 2021), as a reference for contaminants of emerging concern regarding antibiotics, disinfectants, antidepressants, DEET, and BPA. However, the source in Appendix I is: “Minnesota Pollution Control Agency (MPCA). (2021). Summary of the Statewide Chloride Management Plan. Retrieved from <https://www.pca.state.mn.us/sites/default/files/wq-s1-94a.pdf>”
 - b. Page 40 has a reference to the Grand Marais Creek Watershed Restoration and Protection Strategy (WRAPS) Report, and I believe the intent is to reference both the Grand Marais Creek WRAPS Report as well as the Red Lake River WRAPS Report.
3. The Upland Erosion & Nutrient long-term goal is “all waters support aquatic life and recreation thresholds for sediment levels. TSS – 24,378 tons/year”. However, according to the total suspended solids (TSS) Total Maximum Daily Load (TMDL) Report for the Grand Marias Creek and Red Lake River watersheds, the long-term goal as stated would not achieve the required load reductions. Frame TSS long-term goals and implementation actions with the loading capacities and allocations from each TMDL. The load reductions can be found in Tables 4-1, 4-2, and 4-3 in the Grand Marais Creek Watershed TMDL and Tables 5-5, 5-7, 5-9, 5-12, 5-14, 5-16, 5-18, 5-20, 5-23, and 5-25 in the Red Lake River Watershed TMDL.
4. Page 69 mentions that the most recent MPCA water quality assessment was completed in 2014. The MPCA completed the most recent Intensive Watershed Monitoring in 2025 for Grand Marais Creek and Red Lake River Watersheds. The following updates will be available prior to the mid-point update: watershed assessment report, the Red Lake River and Grand Marais Creek WRAPS Report, and TMDLs (as applicable).

5. In Appendix B – B5, to clarify the statement regarding the application of TSS standards to tributaries. Water quality standards are set based on conditions that will protect waterbodies themselves and do not directly consider downstream uses or standards. There are many cases in which upstream standards are less stringent than downstream standards. This does not mean that upstream waters may degrade downstream waters (see Minn. R. 7050.0155; <https://www.revisor.mn.gov/rules/7050.0155/>), but the mechanism to protect downstream waters is through TMDLs, permitting, and other water quality management activities. This means that although upstream water meets its applicable standards, reductions in pollutants beyond those standards may be needed to protect downstream waters.

Again, thank you for the opportunity to review and comment on the draft Plan. If the MPCA can be of further assistance, do not hesitate to reach out to me by phone at 218-846-8146 or by email at zachrie.gutknecht@state.mn.us.

Sincerely,



This document has been electronically signed.

Zachrie Gutknecht
Environmental Specialist
Watershed Division

ZG:jdf

cc: Tammy Audette, Red Lake Watershed District
Tanya Hanson, Red Lake SWCD
Nicole Bernd, West Polk SWCD
Rachel Klein, East Polk SWCD
Jacob Snyder, Polk County
Rachel Olm, HEI
Matt Fischer, BWSR
Henry Van Offelen, BWSR
Dan Disrud, MDH
Reid Christianson, MDA
Chad Anderson, MPCA
Molly Costin, MPCA

Red Lake River 1W1P Formal Letter Comments

Section	Page	Org.	Initials	Comment	Plan Change Made (Yes/No)	Comment Response / Action
2	19	DNR	SK	Phosphorus is not listed as a primary pollutant of concern even though it is listed as a high priority issue later in the plan (p29)	Y	Added Phosphorus page 19
2	23	DNR	SK	Little discussion on the fisheries resources in the watershed. Lake Sturgeon is a focal species in the lower watershed up to the TRF dam. The Red Lake River provides high quality habitat for Lake Sturgeon and a number of other lotic fish species such as Channel Catfish, Non-game species such as Fresh Water Drum, Etc. Beach ridge areas provide high quality spawning habitat for lithophilic spawners such as Walleye and Lake Sturgeon. Flood plain (oxbow) habitat is important spawning and nursery habitat for a number of species	Y	Added narrative on fisheries comment
3	30	DNR	SK	Altered hydrology statement does not directly address ditching and tiling effects	N	Altered Hydrology Issue Statement is general and covers (covered under flooding goal) Can have two-stage ditches that address altered hydrology – add to the narrative. Culvert sizing can address altered hydrology as well.
3	30	DNR	SK	There is not an aquatic habitat issue. Loss of longitudinal (briefly discussed in land and water narrative pgs. 16 & 21)/lateral connectivity and degraded aquatic habitat such as siltation in Red Lake River Reservoir, altered channel morphology. I think that the nutrient loading and sediment input issues are covered sufficiently in other issue statements.	Y	Added "Aquatic Management" to the Shoreland and Riparian Management Issues statement.
4	36	DNR	SK	Altered hydrology is not improved by improving/repairing drainage capacity and outlets. Ditching and tiling are the root causes of the altered hydrology. Activities such as natural channel design of streams and wetland restorations would be more applicable for addressing altered hydrology	Y	Added altered hydrology to flooding, add Mitigating altered hydrology by natural channel design

4	43-44	DNR	SK	How is this 4000 acre feet of storage going to be added? Can examples beyond “agricultural and storage conservation practices” be provided? Ungated storage such as wetland restoration or other land conservation practices that retain water on the landscape longer (in good areas to do so), especially in the middle and upper watershed, would help restore altered hydrology. Adding impoundments may further alter hydrology rather than return to a “more natural flow regime” depending on the operational details. Correctly operated impoundments can help to restore altered hydrology. Additionally, although improved conveyance in the lower part of the watershed does help to address flooding issues, it does nothing to address the altered hydrology issue.	N	Specific practices covered in section 5, implementation.
4	55	DNR	SK	Reducing channel incision can also have the additional benefit of maintain lateral connectivity for aquatic organisms and energy pathways (if an aquatic habitat issue were to be added).	Y	Changed Streambank Stabilization Title to Stream Stabilization to allow reference to both streambank and stream channel
4	56	DNR	SK	Under long-term goal, could also add improved aquatic habitat	Y	Changed priority issues addressed “Shoreland and Riparian and Aquatic Management
4	56	DNR	SK	I would like to see preference given to natural materials such as toe woods and bank plantings as opposed to rip-rap (where feasible)-Riparian management (p58-59) gets at the importance of riparian vegetation for stream bank stabilization.	N	Habitat addresses connectivity and improvements. Don’t want to limit specific project materials in this plan.
4	58	DNR	SK	Maybe specify terrestrial and aquatic habitat in long-term goal	Y	Added “terrestrial and aquatic habitat” to long-term goal language.
4	61-62	DNR	SK	Improved ditch capacity does not address altered hydrology although it does help to address some of the issues created by altered hydrology such as nutrient and sediment loading (as pointed out in this section).	Y	Addressed with previous comment
4	64	DNR	SK	This section best addresses the issue of altered hydrology. None of the activities address the causes of altered hydrology, they just address the symptoms. Could add this to the stacking benefits box	N	Planning workgroup agrees there are benefits to altered hydrology but there's not a good way to quantify the benefits.

5	80	DNR	SK	Culvert inventories. Why is there not any mention of addressing any potential issues with longitudinal connectivity including culverts? This is why I think it could be important to add an aquatic habitat section similar to riparian management section. Many of the issues are covered in other sections, but this is one issue that is not addressed anywhere in the plan other than data collection. Another issue that could included in the issues and activities sections (if there is a desire from the plan implementors) in addressing altered stream geomorphology (e.g. channel straightening, incision, loss of lateral connectivity, etc.)	N	Comment will be addressed by changing issue statement to add aquatic habitat to the riparian habitat issue statement.
All		BWSR	MF	Consider taking the time before final plan submittal to make the document compliant with federal requirements for accessibility of web content. From my understanding, these requirements go into effect for local governments on April 26, 2027. Making the plan compliant now will prevent the need for changes in the near future.	Y	Plan will meet Federal requirements for accessibility of web content using Microsoft Word Review tool for accessibility.
3	27	BWSR	MF	The "Success Since Previous Plan" and "Planning Regions" sections at the beginning of Section 3 seem out of place in the Priority Issues section. We suggest moving them to the end of Section 2 and leaving the issues section (Section 3) all about issues.	N	Not addressed.
4	37	BWSR	MF	Unstable River and Stream Channels is listed as a priority issue addressed by the Upland Erosion & Nutrients goal. This goal relates to upland erosion as estimated with the PTMApp and there is a separate goal for Streambank Stabilization, therefore the Unstable River and Stream Channels should not be listed here.	Y	Unstable river and stream channels. Removed unstable river and stream channels from issue box.
4	37	BWSR	MF	Under the long-term goal for Upland Erosion & Nutrients it says "TSS- 24,378 tons/year". It is unclear how this number was derived. Please add an explanation. It is recommended that this long-term goal be based off the loading capacities and allocations from the Red Lake River and Grand Marais Creek TMDLs.	Y	Long-term goal updated to 57,286 tons/year to align with TMDL at East Grand Forks. This will capture the sediment loading and reduction from all watershed sources with the exception of the Grand Marais Creek as no TMDLs calculated.

4	43	BWSR	MF	The flooding goal should present some information that identifies where flooding occurs and where there are frequent flood damages. Flood prone areas should be mapped if possible. This is a challenging and complicated subject, but the narrative could be improved to better tie together flooding, flood damages, peak flow reduction, and water storage.	Y	FEMA Floodplain maps to be included and update narrative to include the mapping of the 10-year floodplain. RLWD staff included map of flooding concerns and FEMA layers.
4	55	BWSR	MF	We recommend using length as the goal/metric for Streambank Stabilization (9,300 linear feet) and showing the estimated sediment reduction as a stacked benefit.	N	Not addressed.
4	59	BWSR	MF	The priority area identified for the riparian management goal is the Red Lake River corridor (Figure 4.8). We encourage the planning group to consider adding the Red River corridor as a priority and assessing if there are any secondary priorities that should be included. Also, we encourage the addition of a reference to easements and the Red River Riparian Habitat program in the opening narrative for this goal.	Y	A mapped corridor of the Black River and Red River of the North and Grand Marais Creek included in the plan.
5	71	BWSR	MF	Figure 5.1 has the management zones from the previous plan presented. The footnote does indicate that they are no longer in use with this amendment but it might still be confusing. We recommend remaking this map without the management areas.	Y	Map updated per comment.
5	80	BWSR	MF	The Red River Watershed Management Board has received federal funding for 10-year floodplain mapping. We recommend including this as an action under the Data Collection and Monitoring implementation table.	Y	Included as action in table. Talked to RLWD and included cost-estimate.
7	112	BWSR	MF	Section 7 includes an 8-step process for creating Water Management Districts. Water Management Districts have already been created. We recommend replacing this with a section on how to establish a project in a Water Management District (recommended language included in editorial comments).	Y	Language updated to clarify WMDs.
Appendix		BWSR	MF	Everything besides the WD Rules could be removed from Appendix D. Water Management Districts are included in another appendix and the SWCD Statute Table of Chapters isn't referenced at all in the plan. Include the DNR response letter in Appendix "E". The title page for the appendix says Appendix L so that needs to be updated to Appendix E.	Y	**Changes done - removed everything except RLWD rules from Appendix D. Added all new agency response letters and updated to Appendix E.
Appendix		BWSR	MF	Appendix F isn't currently referenced in the plan. Add a reference in the Flooding goal.	Y	Reference added to pg. 44 to include Technical Paper No. 11

Appendix		BWSR	MF	Appendix G should be cleaned up. If all was applicable when this information was amended to the existing plan but isn't anymore. Section 1 includes references to the existing plan which are now confusing because those references no longer exist in the amended plan. We recommend to remove the information in Section 1 and only include the individual Water Management District information.	Y	*changes done - removed section 1. updated pg numbers.
Multiple		MPCA	ZG	There are numerous references to an undefined acronym "RLRW".	Y	Defined by RLRW at first mention in the plan.
4	33,40	MPCA	ZG	in Appendix I, specifically: a. Page 33 has (MPCA, 2021), as a reference for contaminants of emerging concern regarding antibiotics, disinfectants, antidepressants, DEET, and BPA. However, the source in Appendix I is: "Minnesota Pollution Control Agency (MPCA). (2021). Summary of the Statewide Chloride Management Plan. Retrieved from https://www.pca.state.mn.us/sites/default/files/wq-s1-94a.pdf " b. Page 40 has a reference to the Grand Marais Creek Watershed Restoration and Protection Strategy (WRAPS) Report, and I believe the intent is to reference both the Grand Marais Creek WRAPS Report as well as the Red Lake River WRAPS Report.	Y	In text citations: Appendix I, pg 33, Address both reference comments
4	37	MPCA	ZG	3. The Upland Erosion & Nutrient long-term goal is "all waters support aquatic life and recreation thresholds for sediment levels. TSS – 24,378 tons/year". However, according to the total suspended solids (TSS) Total Maximum Daily Load (TMDL) Report for the Grand Marais Creek and Red Lake River watersheds, the long-term goal as stated would not achieve the required load reductions. Frame TSS long-term goals and implementation actions with the loading capacities and allocations from each TMDL. The load reductions can be found in Tables 4-1, 4-2, and 4-3 in the Grand Marais Creek Watershed TMDL and Tables 5-5, 5-7, 5-9, 5-12, 5-14, 5-16, 5-18, 5-20, 5-23, and 5-25 in the Red Lake River Watershed TMDL.	Y	Long-term goal updated to 57,286 tons/year to align with TMDL at East Grand Forks. This will capture the sediment loading and reduction from all watershed sources with the exception of the Grand Marais Creek as no TMDLs calculated.
5	69	MPCA	ZG	Page 69 mentions that the most recent MPCA water quality assessment was completed in 2014. The MPCA completed the most recent Intensive Watershed Monitoring in 2025 for Grand Marais Creek and Red Lake River Watersheds. The following updates will be available prior to the mid-point update: watershed assessment report, the Red Lake River and Grand Marais Creek WRAPS Report, and TMDLs (as applicable).	Y	Last sentence updated with information in comment from the MPCA.

Appendix B.		MPCA	ZG	<p>5. In Appendix B – B5, to clarify the statement regarding the application of TSS standards to tributaries. Water quality standards are set based on conditions that will protect waterbodies themselves and do not directly consider downstream uses or standards. There are many cases in which upstream standards are less stringent than downstream standards. This does not mean that upstream waters may degrade downstream waters (see Minn. R. 7050.0155; https://www.revisor.mn.gov/rules/7050.0155/), but the mechanism to protect downstream waters is through TMDLs, permitting, and other water quality management activities. This means that although upstream water meets its applicable standards, reductions in pollutants beyond those standards may be needed to protect downstream waters.</p>	Y
					Done

*changes done - clarified.