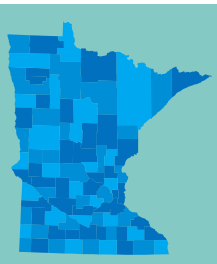
Nutrient Reduction Strategy

June 2025

Appendix 7-2: Supplemental Visualization Tools and Applications for Tracking Nutrients

MINNESOTA POLLUTION CONTROL AGENCY



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Background

Many partners develop and support web-based tools to track various measures and metrics that are critical for tracking long term success of the MN NRS. Significant progress has been made in developing user friendly trackers and this work will continue to expand in the future. Within Chapter 7 of the MN NRS, a number of these existing trackers are listed, described and examples provided. This Appendices provides additional context and visual representations of these trackers. Due to the dynamic nature of these tracking tools, it should be noted that the trackers shown in this appendix will be modified and changed over time and represent that state of these applications at the time of publication of this document.

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Appendix 7-2: Supplemental Visualization Tools and Applications for Tracking Nutrients

MPCA Healthier Watersheds Applications

The Healthier Watersheds suite of web tools (Figure 7-2.1) were some of the first applications deployed that supported reporting for Clean Water Accountability Act and help inform both the MN Watershed Approach and tracking for the NRS. These tools focus on the Status of WRAPS, TMDLs, wastewater treatment plant progress, BMP implemented by watershed, and spending for implementation progress. These applications are being continually update and are important tools in helping support the NRS. Chapter 6 of the NRS details the importance of the WRAPS and TMDL applications for tracking progress on the MN Water Management Framework.

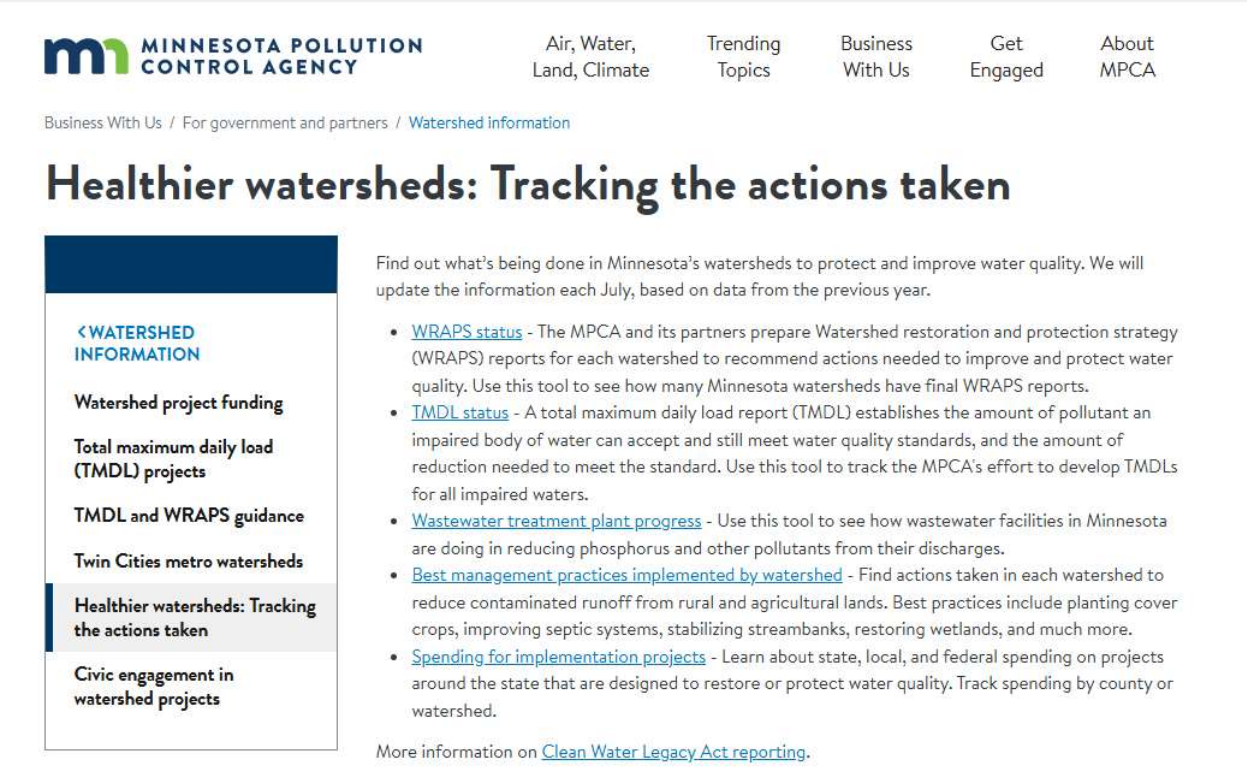


Figure 7-2.1: MPCA Healthier Watersheds Website

Healthier Watersheds- WRAPS Status

The WRAPS status tracker includes not only the status of initial WRAPS and WRAPS Updates (Figure 7-2.2), but also includes status of Stressor Identification (SID) reports (Figure 7-2.3), as well as the status of Intensive Watershed Monitoring (IWM) across the state (Figure 7-2.4x).

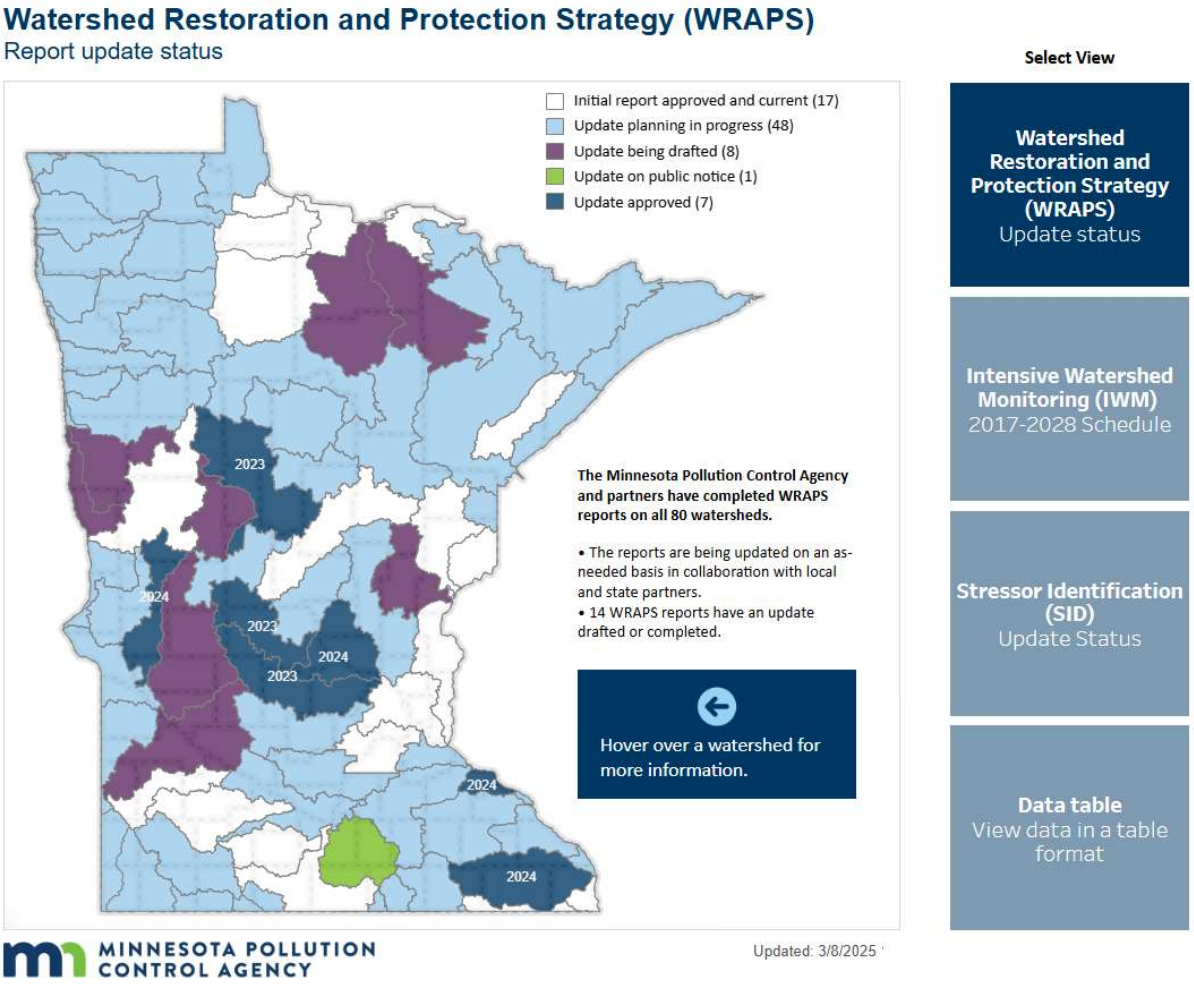


Figure 7-2.2: MPCA WRAPS Status Tracker

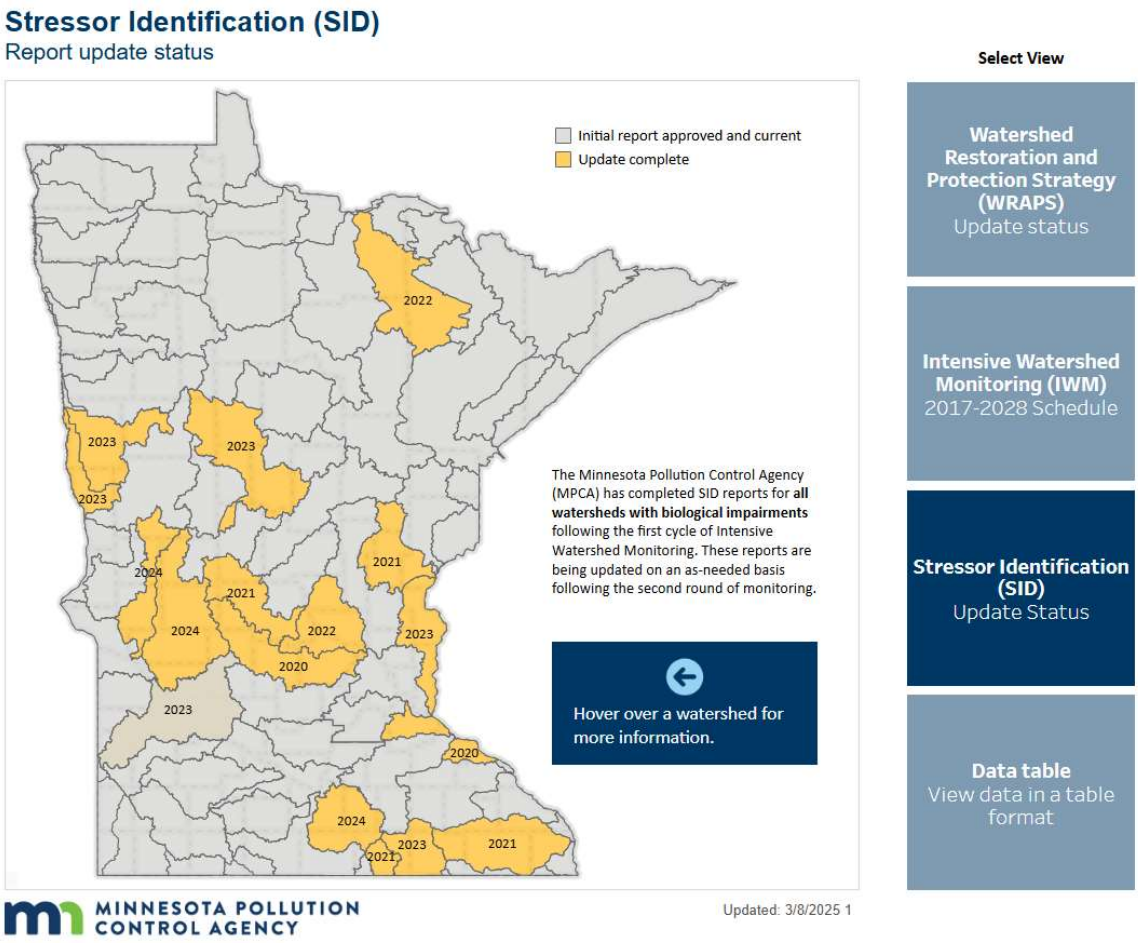


Figure 7-2.3: MPCA Stressor Identification (SID) Status Tracker

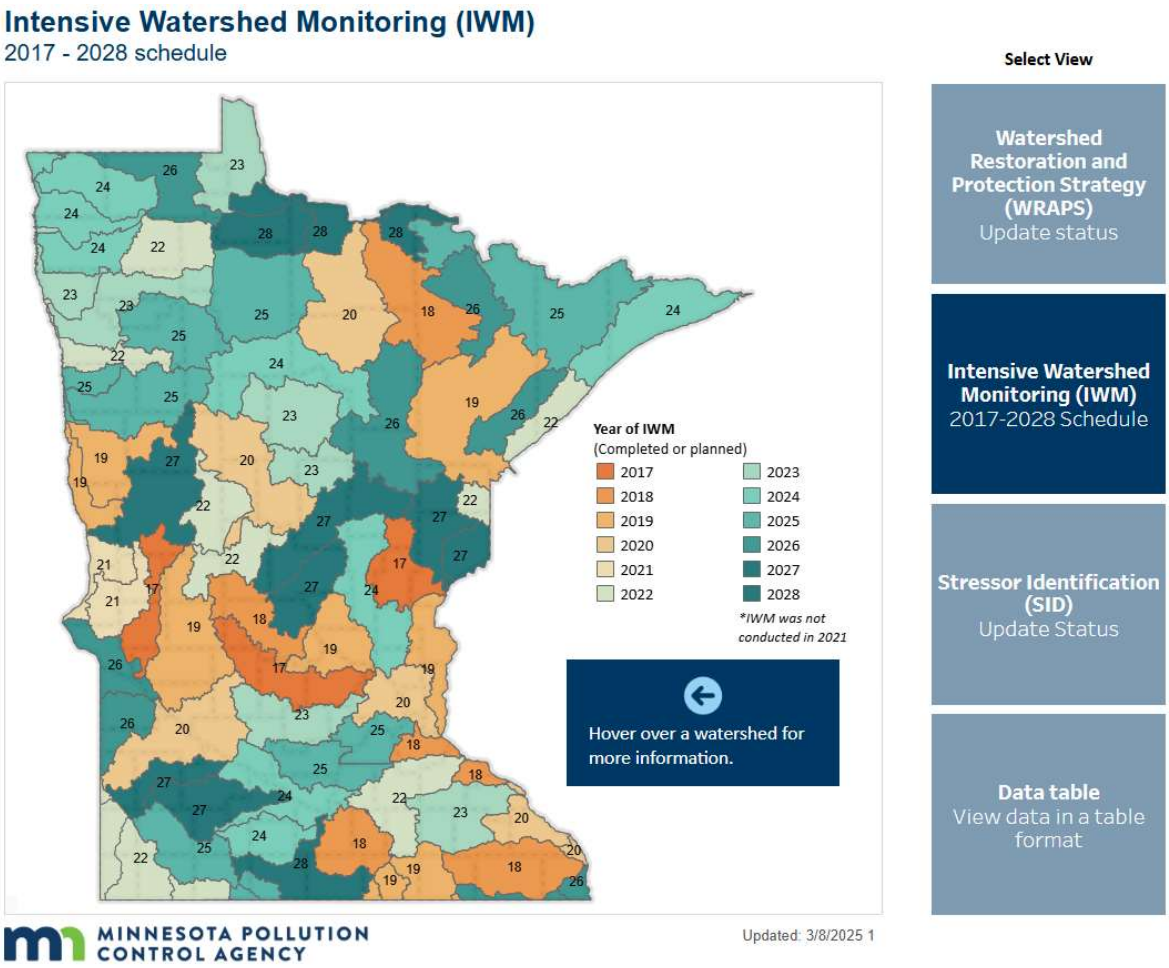


Figure 7-2.4: MPCA Intensive Watershed Monitoring (IWM) Status Tracker

Healthier Watersheds – Total Maximum Daily Load (TMDL) Status

The TMDL tracker allows the user search for the status of a TMDL either statewide or by major watershed (Figure 7-2.5), query and export TMDL load allocation data, and view and query waters in Minnesota delisted from the impaired waters list (Figure 7-2.6).

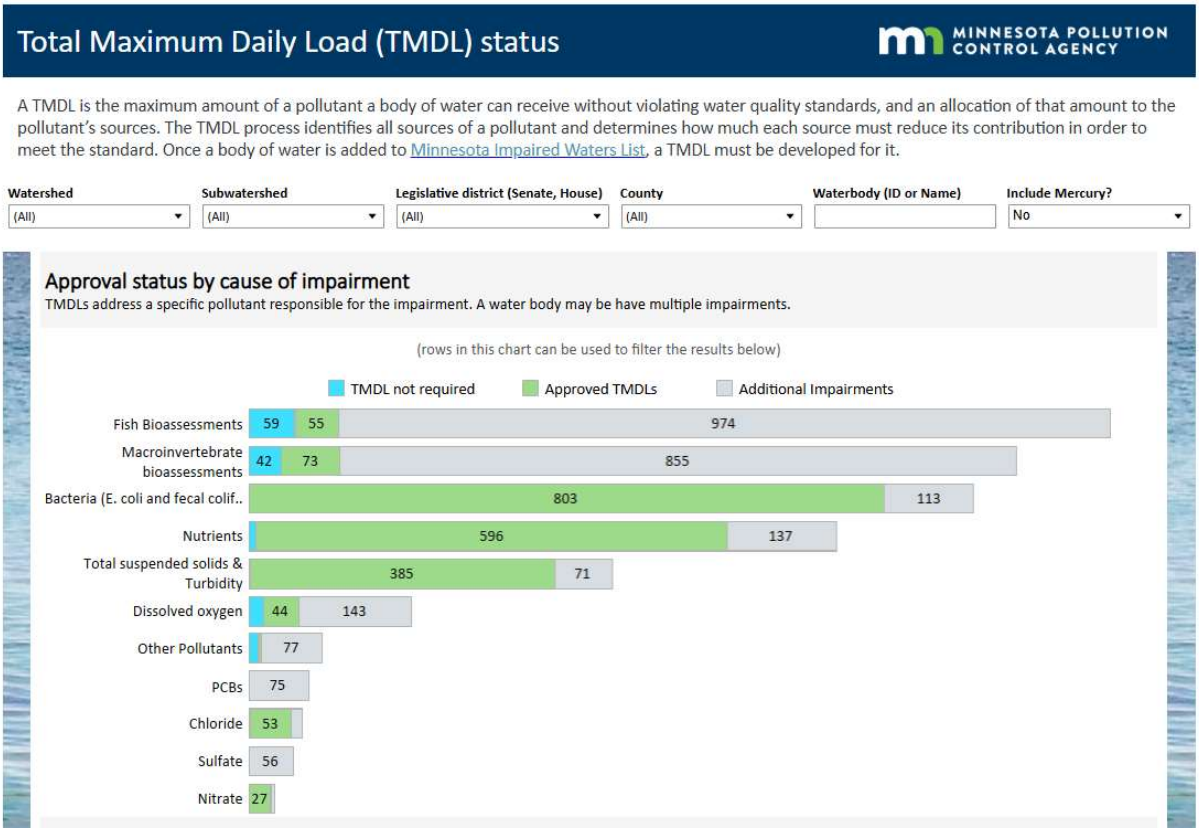


Figure 7-2.5: MPCA TMDL Status Tracker

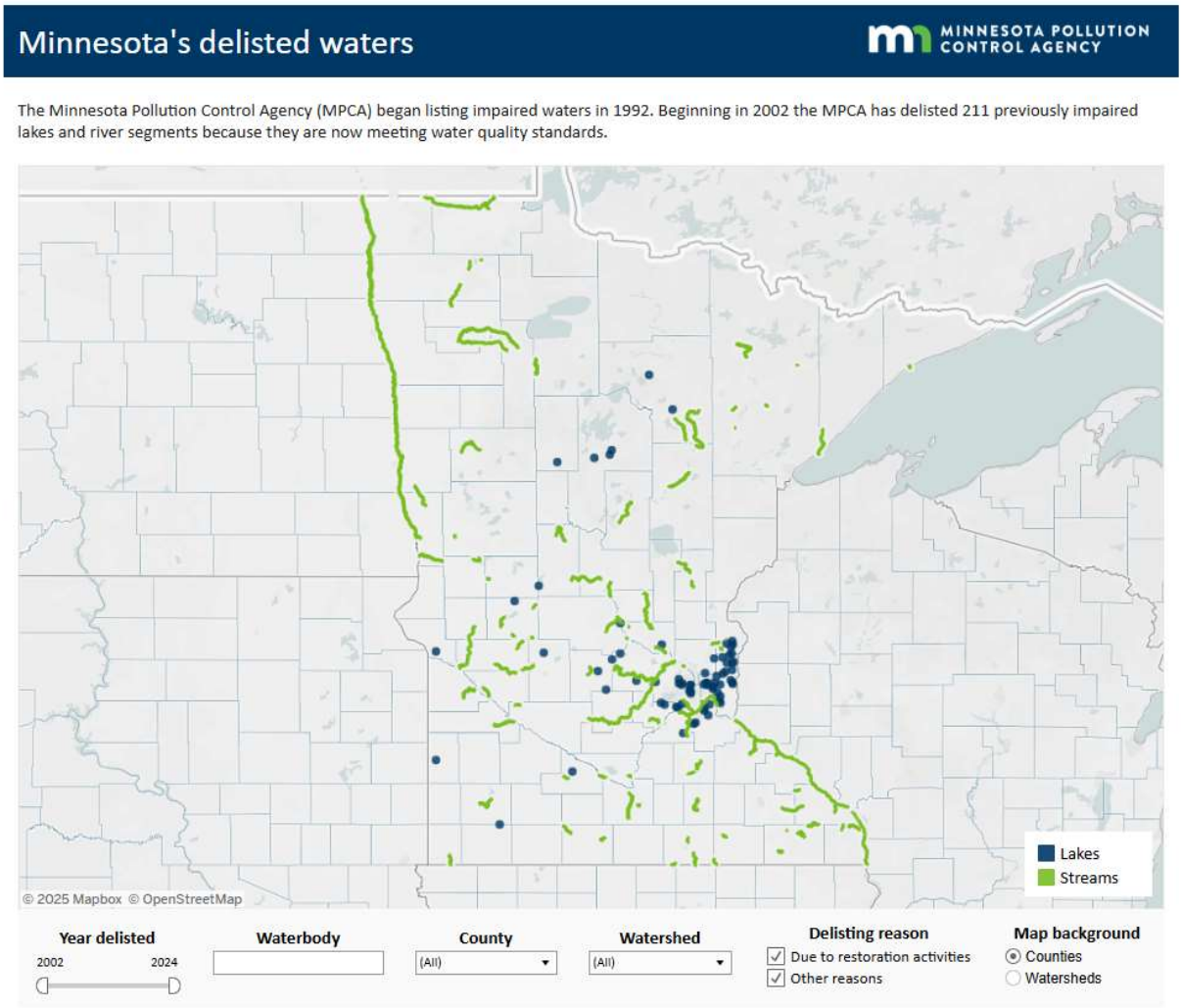


Figure 7-2.6: MPCA Minnesota Delisted Waters Tracker

Healthier Watersheds – Wastewater

The Wastewater Treatment Plant Progress application (Figure 7-2.7) within the Healthier Watersheds site is very germane to NRS Tracking and tracks nitrogen and phosphorus reduction progress, as well as TSS and CBOD. This application is important in tracking one of the key metrics of success regarding mitigating point source nutrient loads and impacts to major rivers. Additionally, MPCA has developed an interactive map (Figure 7-2.8) that provides information on wastewater effluent flow and nutrient concentration and loads by facility.

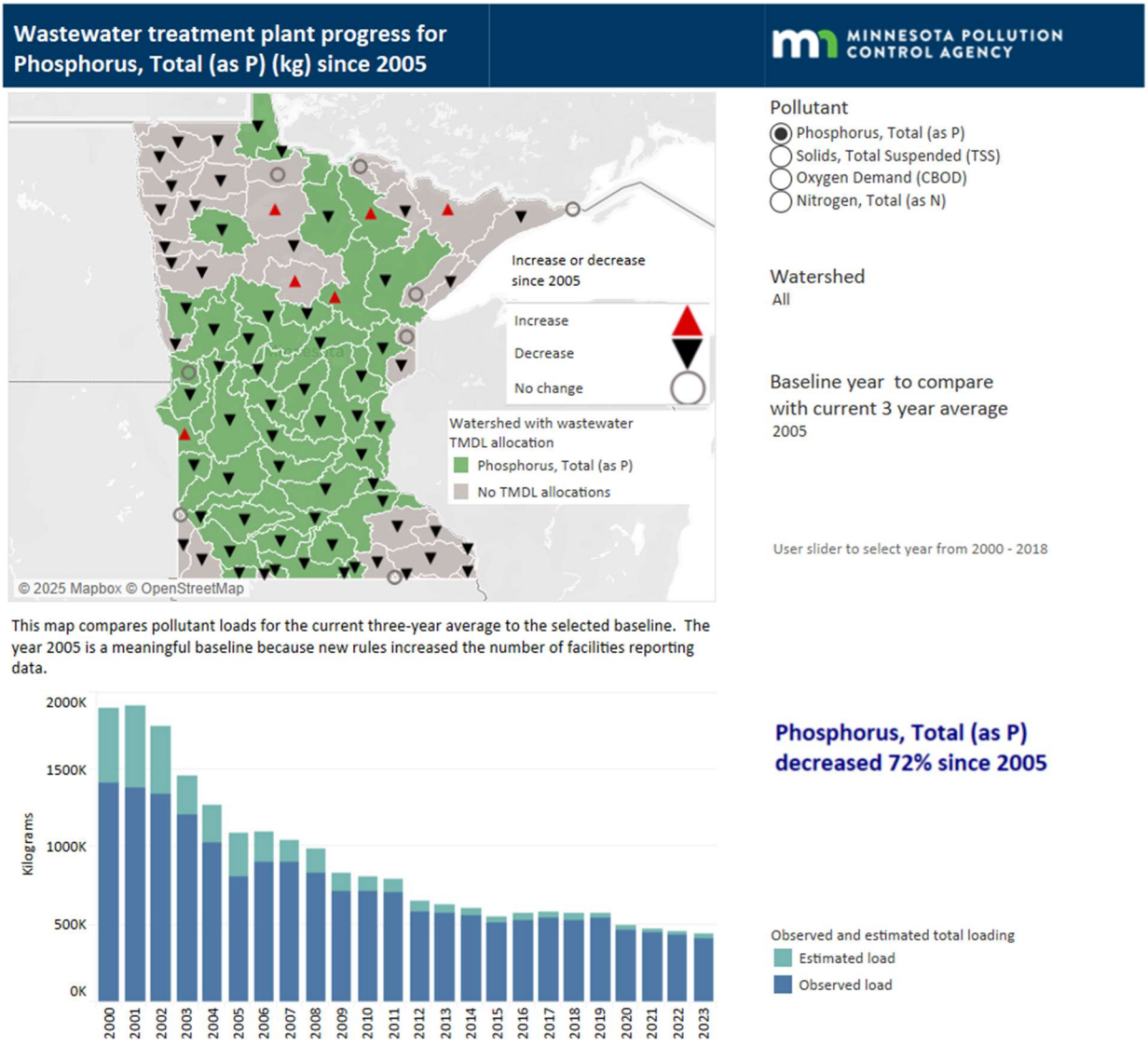


Figure 7-2.7: MPCA Wastewater Treatment Plant Progress Application

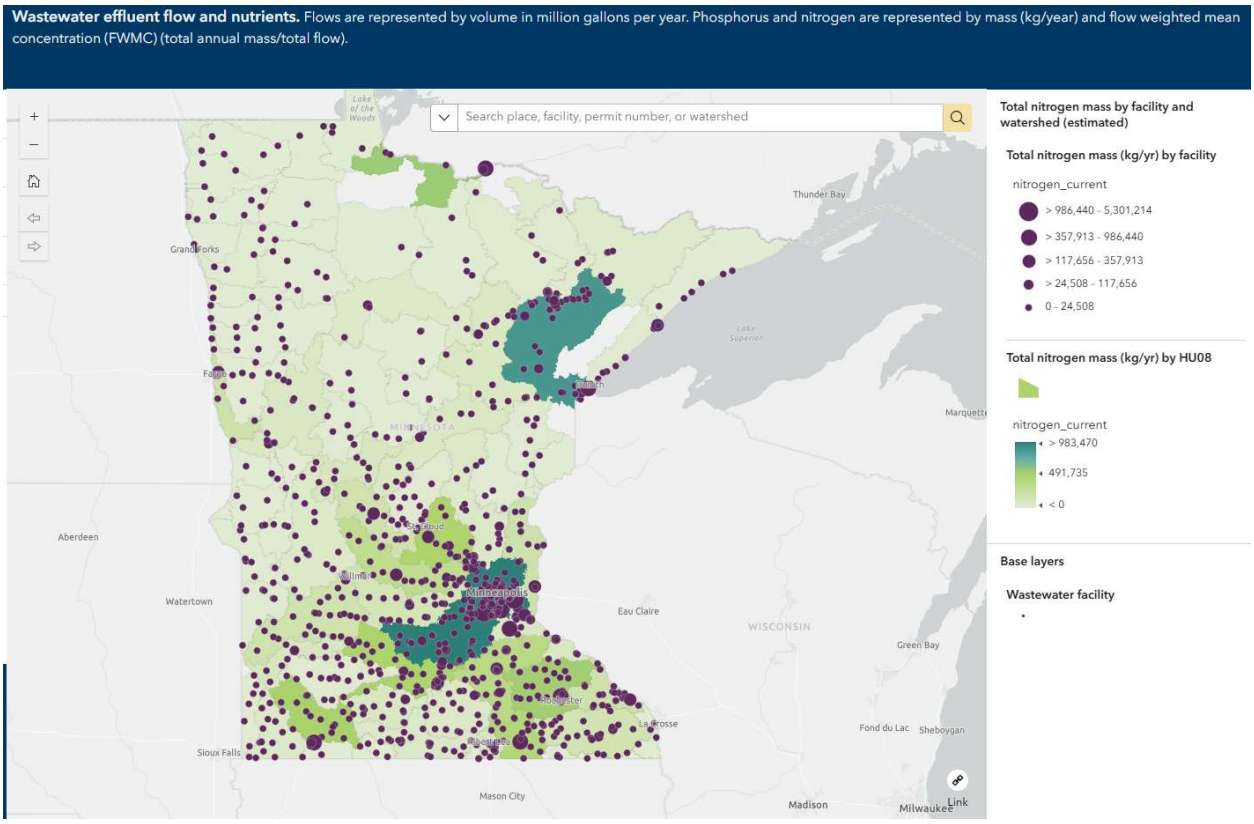
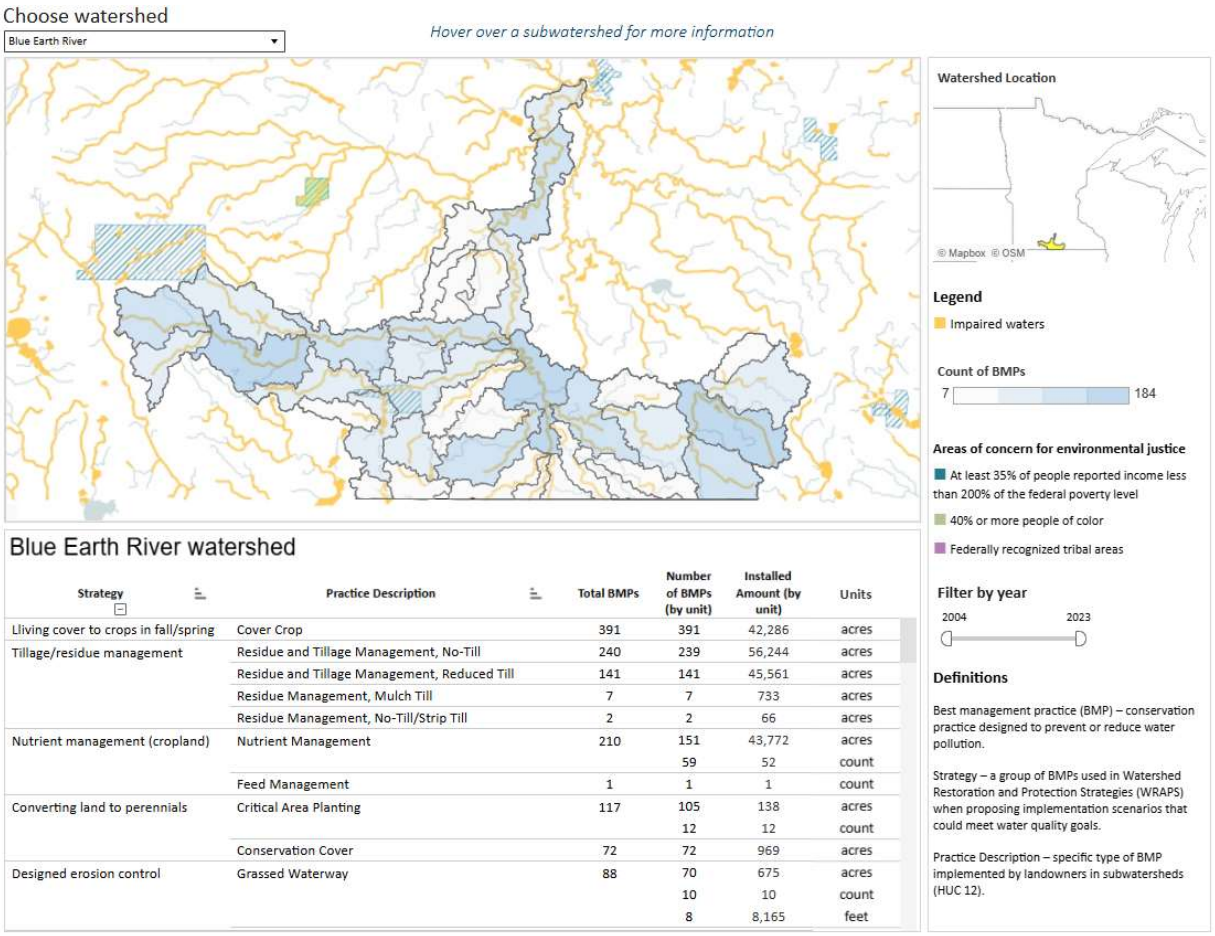


Figure 7-2.8: Wastewater Effluent Flow and Nutrients Application

Healthier Watersheds – Best Management Practices Implemented by Watershed

The Best Management Practices Implemented by Watershed tracker (Figure 7-2.9) enables the user to quantify the number and type of best management practices that have been implemented with state and federal government programs since 2004. The user queries data by major watershed and is provide with an interactive map and a summary table that can be further queried by minor watershed to obtain more specific detailed information.



Blue Earth River watershed

Strategy	Practice Description	Total BMPs	Number of BMPs (by unit)	Installed Amount (by unit)	Units
Living cover to crops in fall/spring	Cover Crop	391	391	42,286	acres
Tillage/residue management	Residue and Tillage Management, No-Till	240	239	56,244	acres
	Residue and Tillage Management, Reduced Till	141	141	45,561	acres
	Residue Management, Mulch Till	7	7	733	acres
	Residue Management, No-Till/Strip Till	2	2	66	acres
Nutrient management (cropland)	Nutrient Management	210	151	43,772	acres
			59	52	count
	Feed Management	1	1	1	count
Converting land to perennials	Critical Area Planting	117	105	138	acres
			12	12	count
	Conservation Cover	72	72	969	acres
Designed erosion control	Grassed Waterway	88	70	675	acres
			10	10	count
			8	8,165	feet

Figure 7-2.9: MPCA Healthier Watersheds Application – BMP Implemented by Watershed

Healthier Watersheds – Spending for Implementation Projects

The Spending for Implementation Projects tracker (Figure 7-2.10) allows the user to see the distribution of federal and state grant and loans funds invested in practice and actions to reduce pollution impacts since 2004. The user can look at statewide amounts or query by major watershed or county.

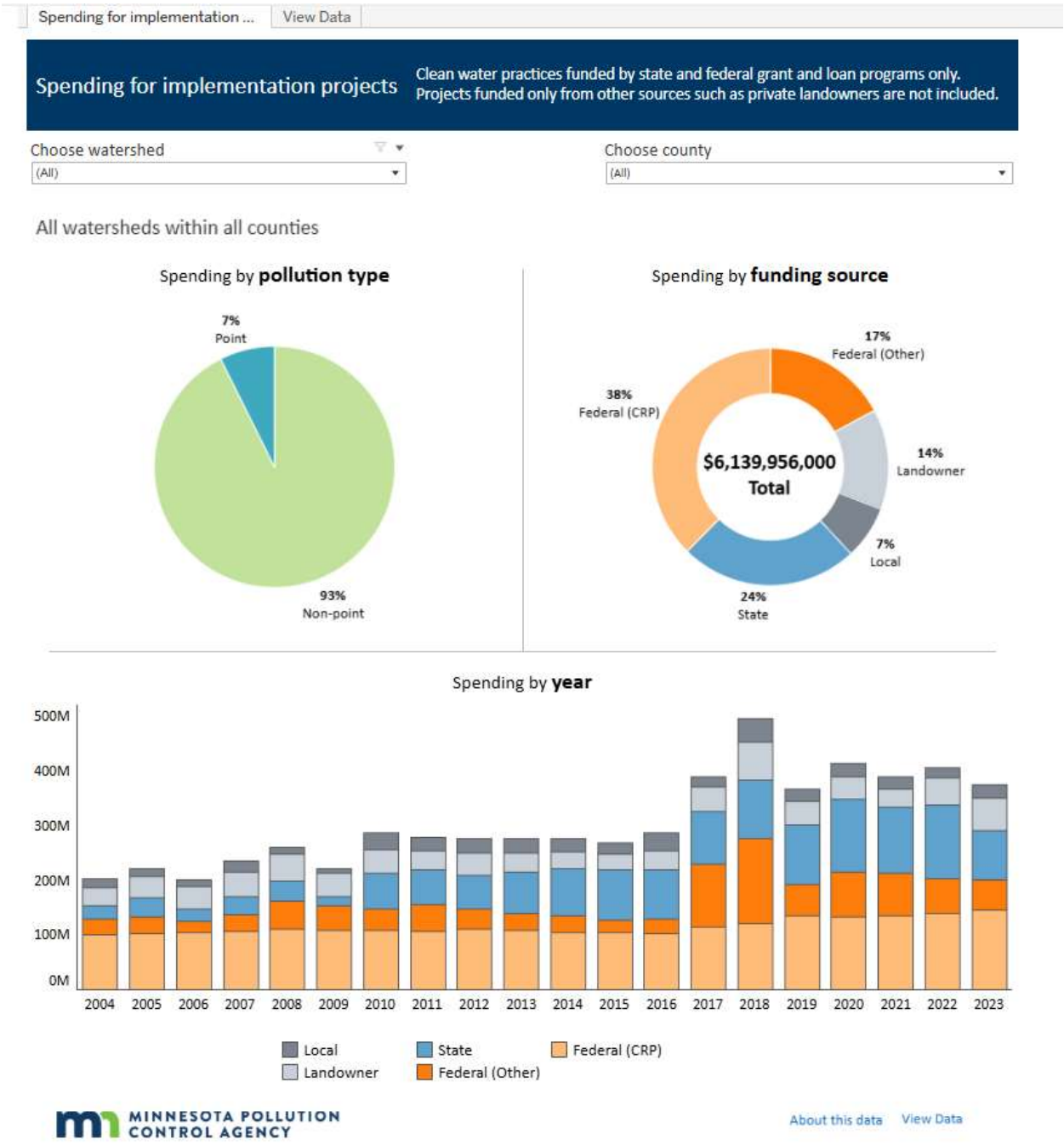


Figure 7-2.10: MPCA Spending for Implementation Projects Tracker

MPCA Watershed Pollutant Load Monitoring Network (WPLMN)

The Watershed Pollutant Load Monitoring Network (WPLMN) is a long-term program designed to measure and compare pollutant load information from Minnesota's rivers and streams and track water quality trends. This program utilizes state and federal agencies, universities, and local partners to collect water quality and flow data to calculate pollutant loads. Pollutant loads are calculated for total phosphorus, dissolved orthophosphate, nitrate plus nitrite nitrogen, total Kjeldahl nitrogen, as well as total suspended solids. The web application (Figure 7-2.11) displays average, annual, and daily values for each of these parameters. Monitoring sites span three scales: basin (HUC 4), major watershed (HUC 8) , and sub-watershed (HUC 10/12).

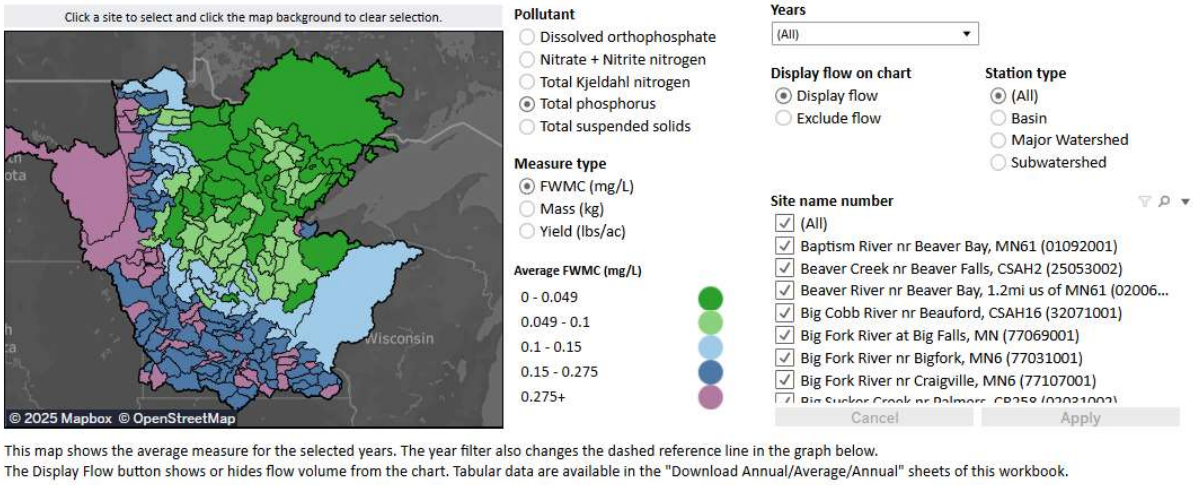


Figure 7-2.11: MPCA WPLMN Web Application – Average Total Phosphorus Flow Waited Mean Concentration (mg/l)

MPCA Long Term Stream Nutrient Concentration Trends

MPCA has also recently deployed (2024) a long-term stream trends application (Figure 7-2.12) that looks at river nutrient concentrations trends. River nutrient trends analyses conducted over long periods of time provide an understanding of the combined outcomes of land use changes, management practices, and other key factors affecting water quality. Improvements made on the land can sometimes take decades or more before changes are observed in ambient river water quality. This application shows flow adjusted and non-flow adjusted trends in nitrogen (nitrite plus nitrate), total phosphorus, and TSS.

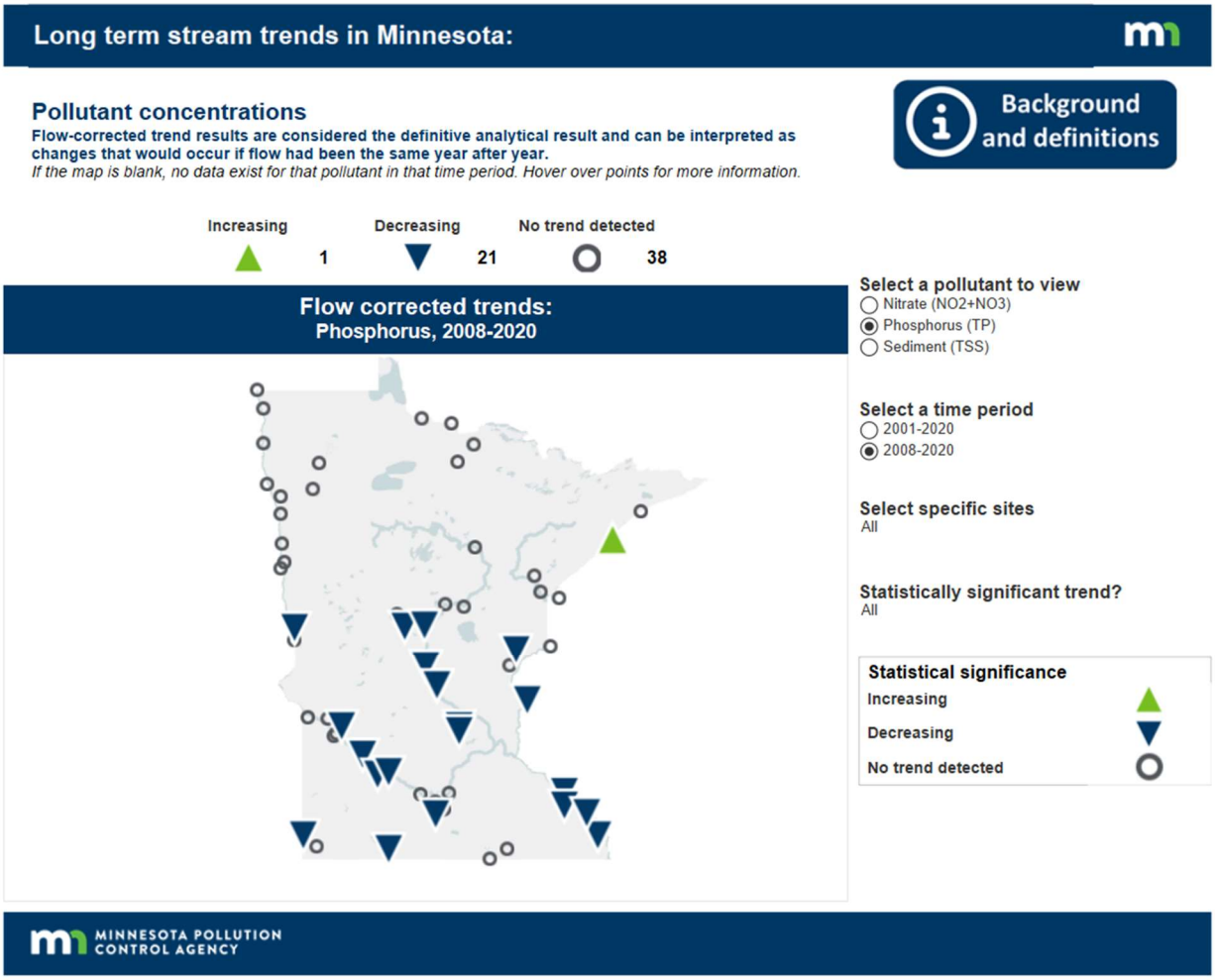


Figure 7-2.12: MPCA Long Term Stream Trends in MN Application – Flow Correct Phosphorus Trends (2008-2020)

Metropolitan Council Water Quality Monitoring and Tracking

The Metropolitan Council Environmental Services Department (Met Council) is responsible for tracking water quality in larger river systems, lakes, streams, and waste water treatment within their jurisdictional boundaries. The Met Council provides access to numerous datasets and reports that are accessible on their website and coordinates with MPCA, DNR, and MDH on water quality monitoring efforts. Data can be accessed by the public through Met Council's Environmental Information Management System (EIMS) portal website. The Met Council is in the process of developing dashboards to visualize some of their data and has produced fact sheets and reports such as the example in Figure 7-2.13 below.

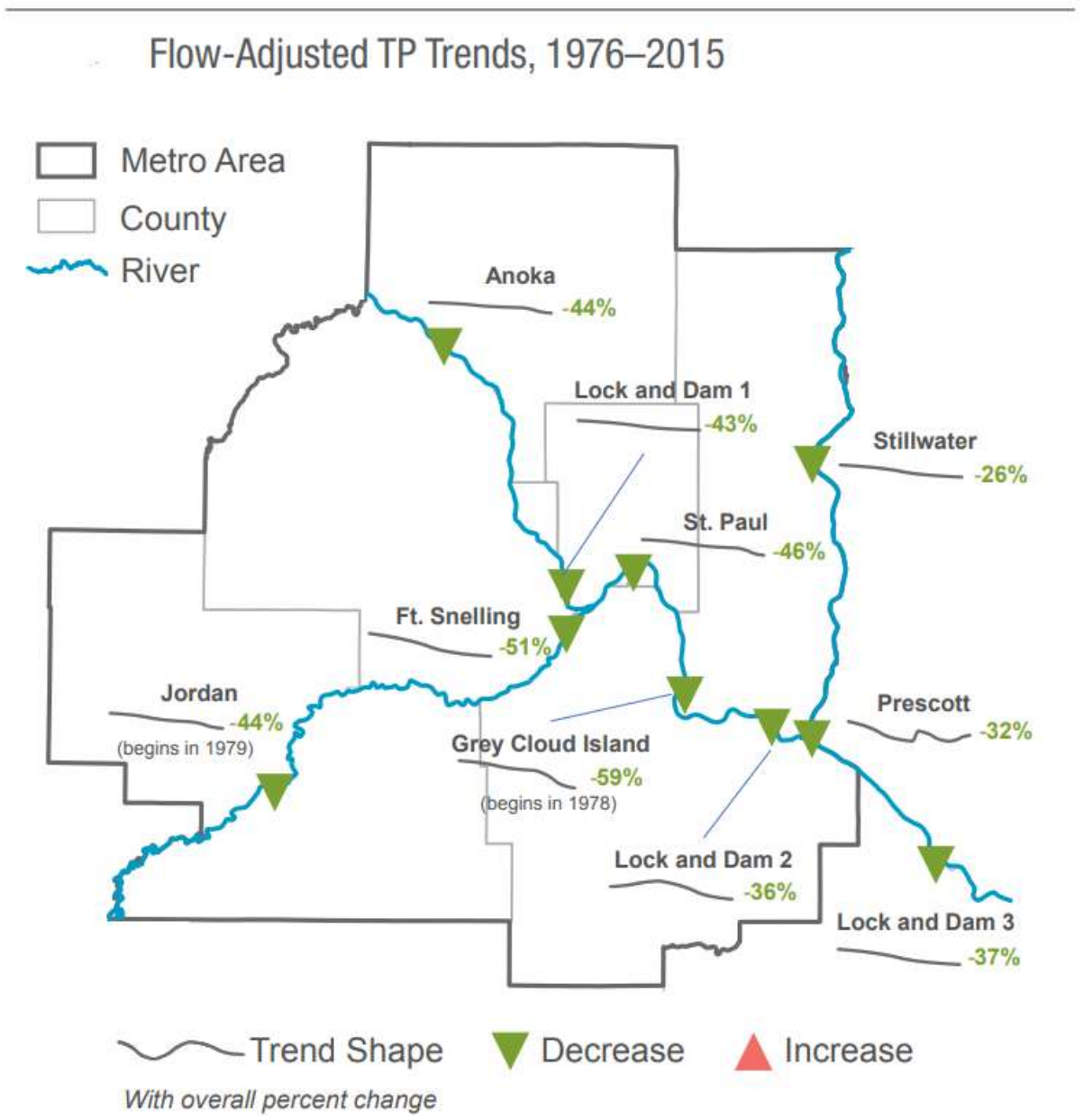


Figure 7-2.13: Met Council Environmental Services River Trend Report Fact Sheet Example Visualization. This 2015 River Report and other fact sheets can be found at www.metrocouncil.org/rivers.

DNR Watershed Health Assessment Framework (WHAF) Application

The Watershed Health Assessment Framework (WHAF) application was developed by the MN DNR to provide easy access to state supported GIS layers and the ability for users to discover the health of the watershed they are interested in. The WHAF is a structured, science-based approach to help resource professionals and citizens work together and grow our common understanding of Minnesota's complex natural resource systems that interact within a watershed boundary. The WHAF brings together current data and scientific analysis to generate information about Minnesota's watersheds. These products are delivered in a transparent and repeatable framework to foster robust conversations and innovative approaches for improving the health of Minnesota's watersheds and communities. Information

supported by the WHAF application area important for decision making support for not only the NRS, but also for WRAPS Updates and local CWMPs.

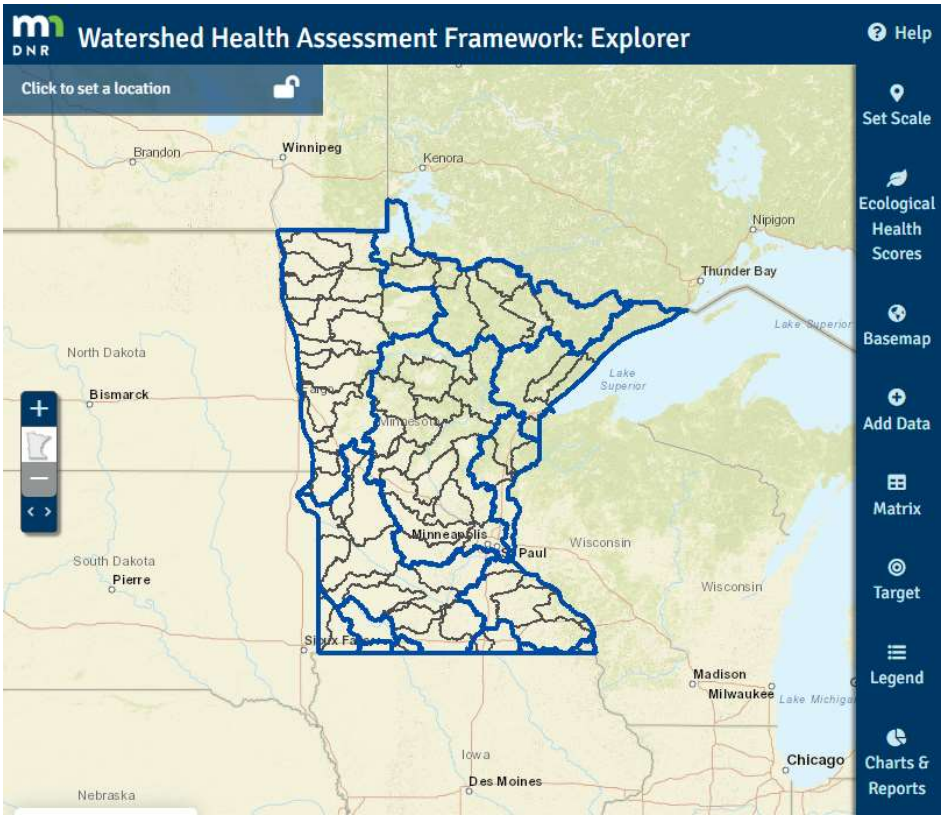


Figure 7-2.14: Watershed Health Assessment Framework Interface

The data and reports for the WHAF can be accessed through a user friendly, web-based interface called the WHAF Explorer (see figure 7-2.14). Within the WHAF Explorer, you can download reports on the watershed-based report cards that provides and overview of the health of the watershed based on hydrology, geomorphology, biology, connectivity, and water quality (see Figure 7-2.15). In addition, the WHAF for lakes tool was recently deployed that helps track the health of individual lakes in Minnesota.

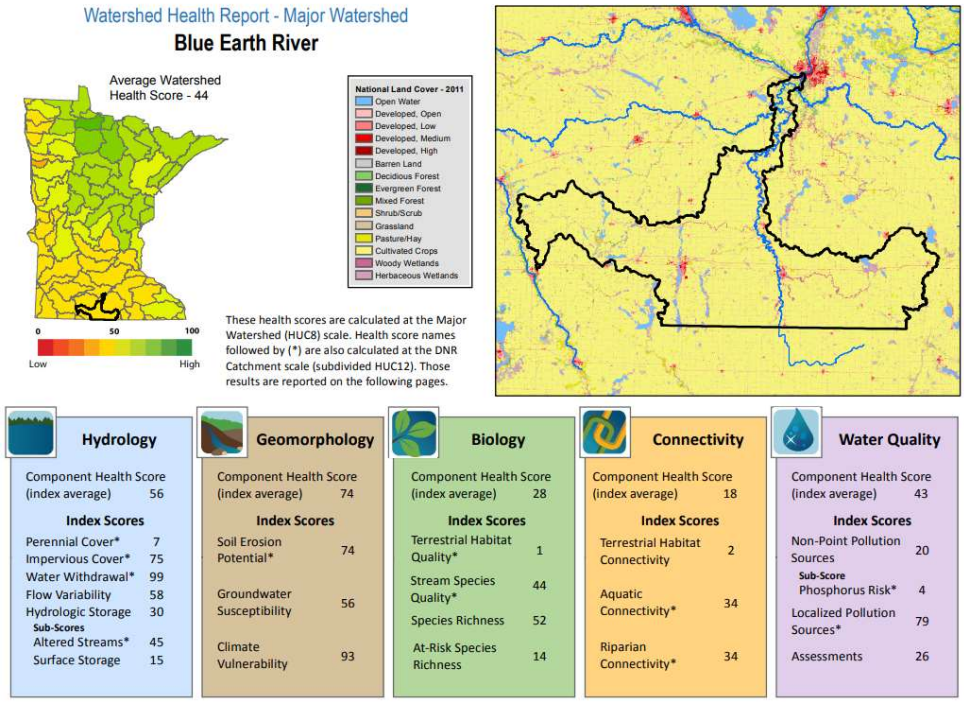


Figure 7-2.15: Watershed Health Assessment Framework Major Watershed Health Report

State and Local tracking systems at the major watershed or CWMP level

Throughout the CWMP development process, many local governments have developed their own tracking systems to coordinate the management of plans, grants and contracts, landowner agreements, project financials, and environmental outcomes. Local needs to be proactive in showing results to the public and technological advancements are drivers in the advancement of this work.

Tracking Tools Under Development

MPCA BMP Effects Estimation Tools (BEET)

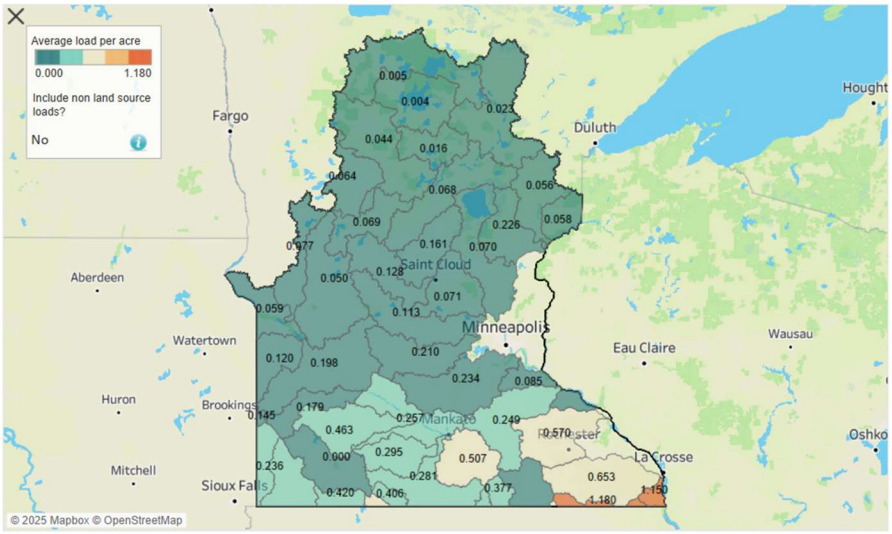
The MPCA developed the Watershed Pollutant Load Reduction Calculator (WPLRCT) on-line application in 2020 to help support the NRS, WRAPS Updates, and CWMPs by providing a simple, easy to use interface for determine the impacts of from conservation practices on nutrients and sediment at a watershed scale. This tool utilized modeling outputs from the Hydrologic Simulation Program Fortran (HSPF) model and nutrient reduction efficiencies derived from current research and from supporting documentation from the 2014 NRS. This application allowed the users to develop watershed-based scenarios for pollution reduction impacts as well as look at the impacts of single BMPs on major and minor watershed scales. The MPCA is modernizing this tool for the NRS revision process to include new functionality that better supports the needs of watershed planners who utilize the too. The updated suite of tools is called the BMP Effects Estimation Tool (BEET) Tracker and Planner applications. The BEET Planner (Figure 7-2.16) directly replaces the WPLRCT, but also includes the major basin wide scale for running scenarios on the same scale at the NRS. This application provides estimates for a wide range of agricultural and non-agricultural non-point source practices connected to the NRS.

BMP effects estimator tool (BEET)

Select inputs

Scale	Drainage area	Pollutant	Pollutant delivery point
Watershed / Basin	to the Gulf of Mexico	Phosphorus (lbs/ac/yr)	State Line

Estimated Phosphorus (lbs/ac/yr) load delivered to the State Line



This map shows the estimated annual pollutant load per acre delivered from the selected drainage area to the **State Line**. Click on the map to assign selected BMPs only to the selected area (use ctrl+click to select multiple HUC 8 watersheds). This load will be reduced as new BMPs are added.

Enter acres of new BMPs

Best Mangement Practice (BMP)	Maximum available acres	Load reduced (lbs/ac/yr)	Reduction from new BMPs	Acres treated by new BMPs
Alternative Tile Intakes	3,603,928	0.23	0.0	0
Bioreactors to treat tile water	6,691,506	Null		0
Conservation Cover Perennials	1,952,718	0.29	0.0	0
Conservation Crop Rotation	14,023,325	0.1	0.0	0
Contour Buffer Strips	4,739,212	0.24	0.0	0
Contour Stripcropping	8,350,952	0.16	0.0	0
Controlled tile drainage (drainage water mgmt.)	6,691,508	0.02	0.0	0
Cover Crops after early harvest crops	6,718	0.08	0.0	0
Cover Crops with corn and soybeans	11,576,463	0.1	0.0	0
Drainage Side Inlet Improvements	6,626,870	0.18	0.0	0
Feedlot Manure/Runoff Storage	26,332	0.65	0.0	0
Feedlot Runoff Reduction/Treatment	27,860	0.55	0.0	0
Filter Strips, 50 ft (Cropland field edge)	4,731,715	0.25	0.0	0
Forestry Erosion Control	8,326	Null		0
Forestry Riparian Management Zones	1,109	0.02	0.0	0
Grassed Waterways	4,726,052	0.17	0.0	0
Livestock Access Control/Fencing (to waters)	56,797	0.07	0.0	0
Manure/Fertilizer Incorporation (no surface spreading)	3,464,780	0.13	0.0	0
Nutrient Management: Improved Rates/Timing	5,333,173	0.03	0.0	0
Nutrient Management: Precision/Variable Rate	5,333,173	0.05	0.0	0
Reduced Tillage (30%+ residue cover)	12,289,018	0.11	0.0	0
Reduced Tillage (no-till)	12,289,018	0.23	0.0	0
Riparian Buffers, 16.5 ft from ditch (replacing crops)	74,551	0.15	0.0	0
Riparian Buffers, 50 ft (Pasture)	23,986	0.05	0.0	0
Riparian Buffers, 50 ft (replacing row crops)	69,873	0.26	0.0	0
Riparian Buffers, 100 ft (replacing row crops)	400,215	0.31	0.0	0
Rotational Grazing - convert from row crop lands	870,004	0.21	0.0	0
Rotational Grazing - convert from traditional pasture	1,973,375	0.07	0.0	0
Saturated Buffer	6,693,729	Null		0
Terrace	2,827,960	0.28	0.0	0
Water and Sediment Control Basin (Cropland)	7,117,264	0.31	0.0	0
Wetland construction to treat tile waters	1,556,800	0.18	0.0	0

Figure 7-2.16: BEET Planner Main Interface

The BEET Tracker (Figure 7-2.17) allows the user to determine the impact of conservation practices that have already been implemented through government programs since the adoption of the original NRS to display and quantify progress that has been made to date.

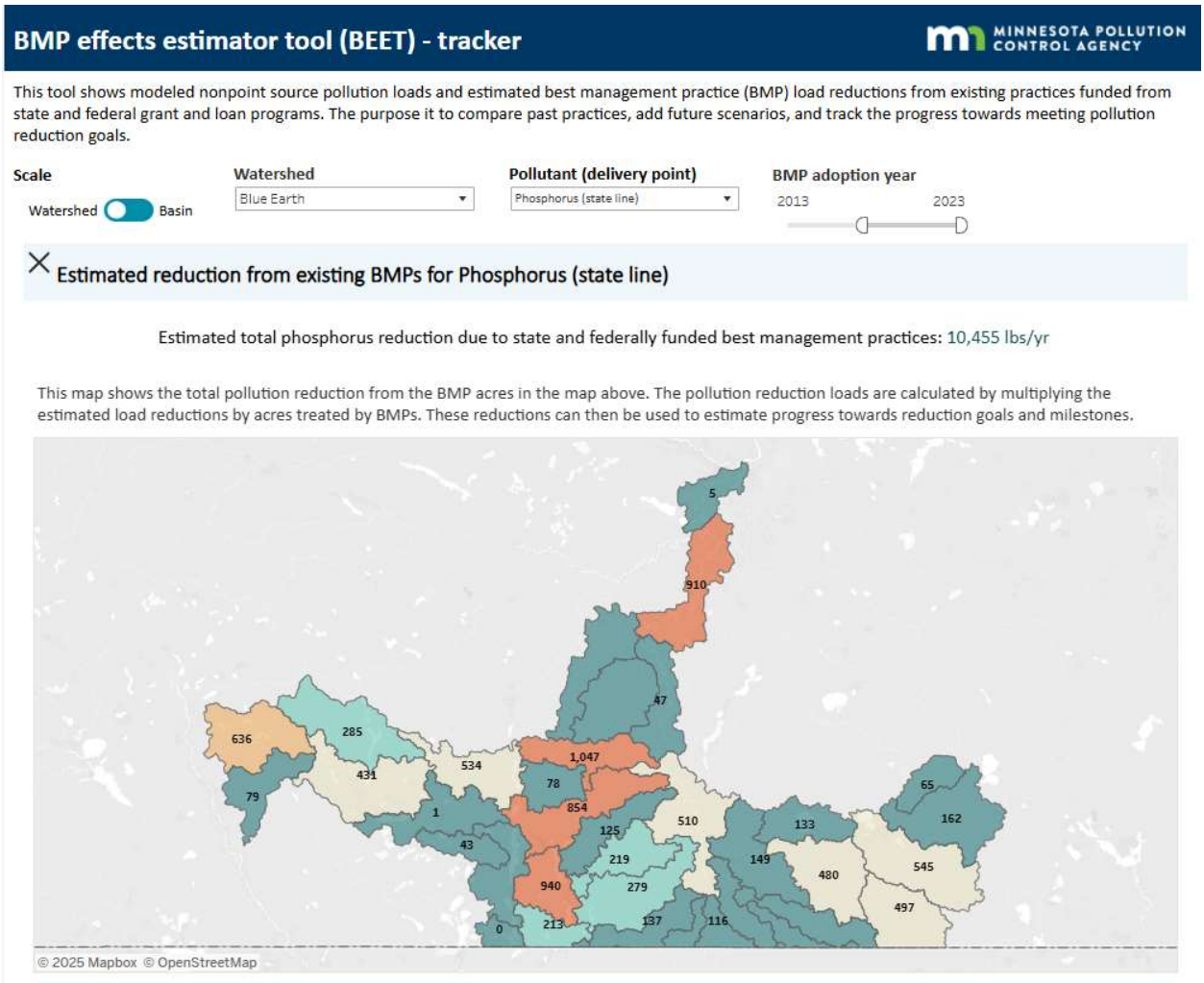


Figure 7-2.17: BEET Tracker Main Interface

In addition, the user can also gauge progress made at various scales that includes non-point source practices calculated reductions, reductions calculated from point sources, user estimates on private adoption that has occurred, and future practice scenarios for reduction nutrients. The application will then estimate the impacts of the scenario toward meeting goals set by the NRS and estimate the need for additional adoption to meet the overall goals at the major basin scale (Figure 7-2.18). This application can also be used to aggregate practices and gauge progress at the major basin scale to meet state line NRS goals, which is connects directly back to the overall tracking needs for the NRS (Figure 7-2.19. Additionally, application can estimate the major watershed outlet progress towards meeting NRS load goals set at that scale (Figure 7-2.20). The BEET applications will critical portals for tracking the success of best management practices adoption and impact for the NRS.

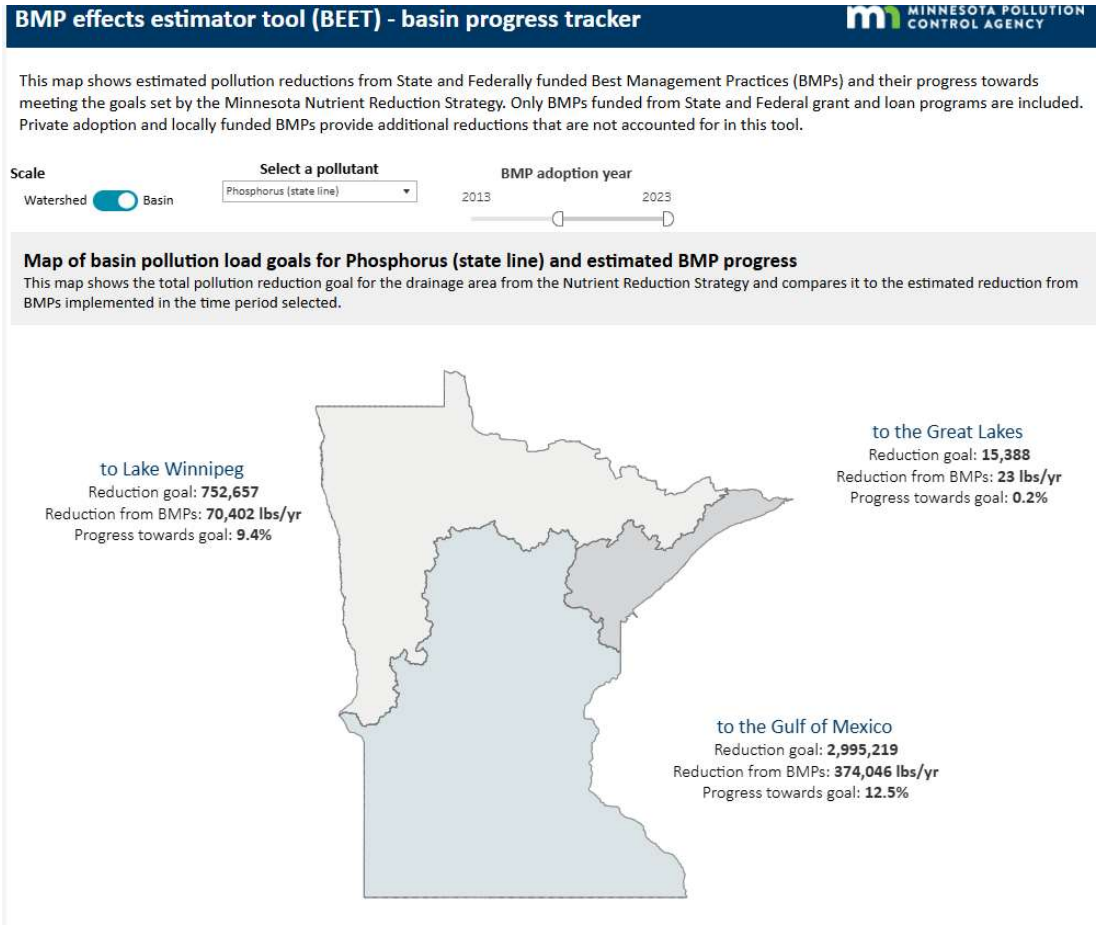


Figure 7-2.18: BEET Tracker – Major Basin Summary of Overall Load Reduction Needs and Goals

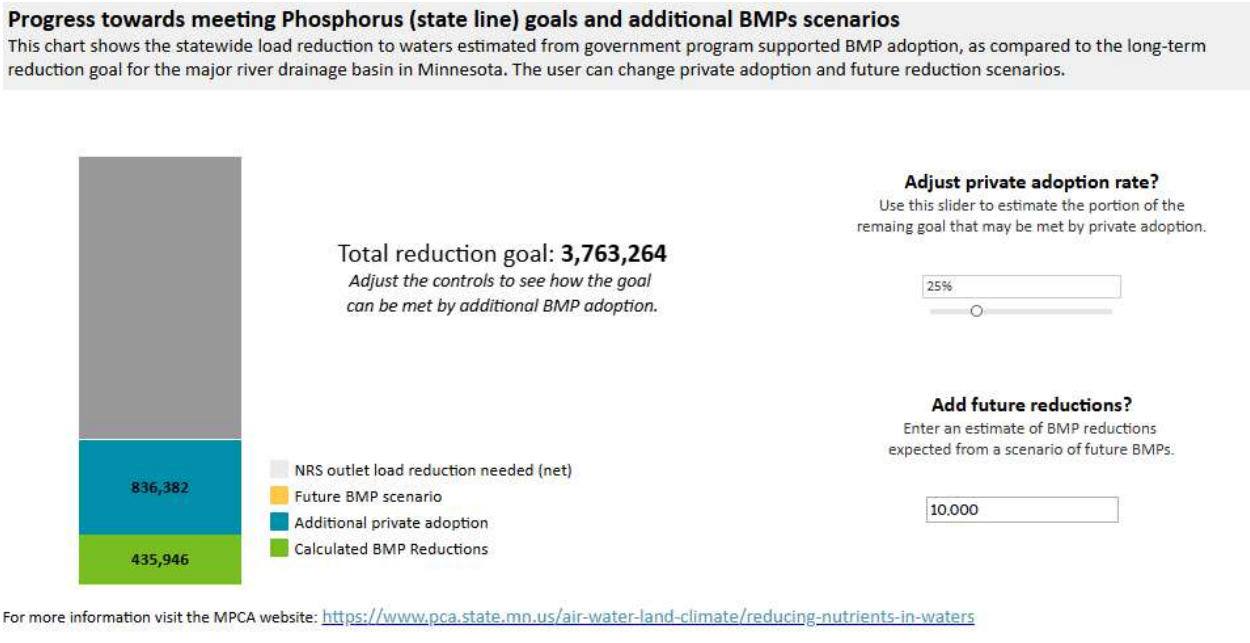


Figure 7-2.19: BEET Tracker – Major Watershed Outlet Reductions to Meet Stateline Goals

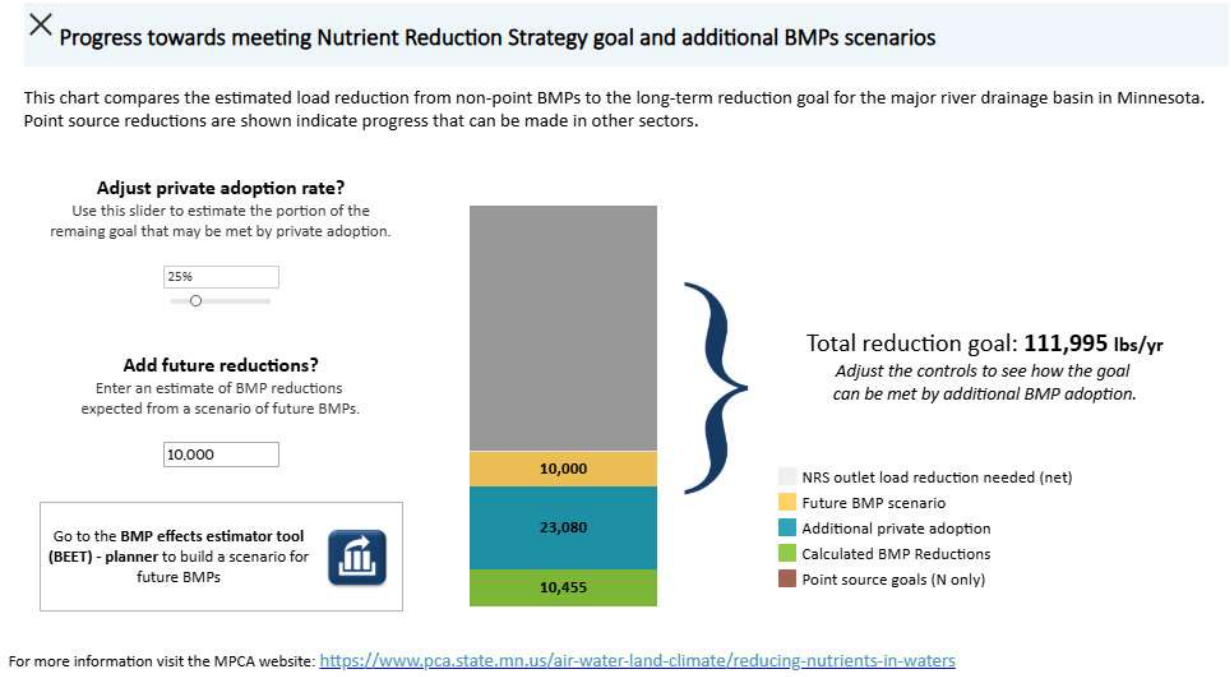


Figure 7-2.20: BEET Tracker - Nutrient Reduction Strategy Goal at Major Basin Scale

BWSR and U of M Daily Erosion Project Dashboard

Soil erosion is a major concern not only for water quality, but for soil health and long-term sustainability. Increased soil erosion also is directly correlated to nutrient loss and transport in agricultural systems. The BWSR and the University of Minnesota have worked with Iowa State University to model average runoff and soil loss (tons/acre/year) through the Daily Erosion Project Application. Figure 7-2.21 summarized long-term soil loss by minor watershed from 2008-2024 and Figure 7-2.22 illustrates an example Daily Erosion Project interactive dashboard that was deployed by the U of M April 2025.

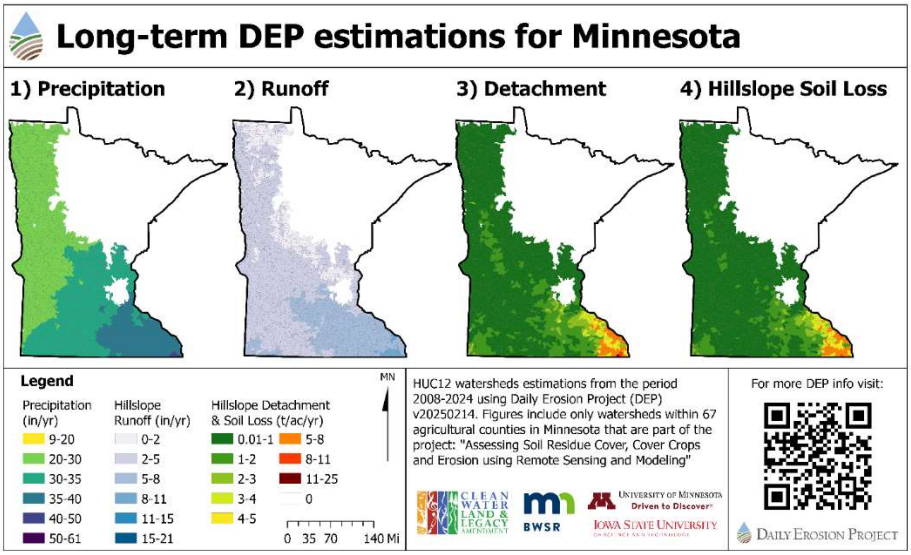


Figure 7-2.21: Long Term Daily Erosion Project Soil Loss Estimations for Minnesota

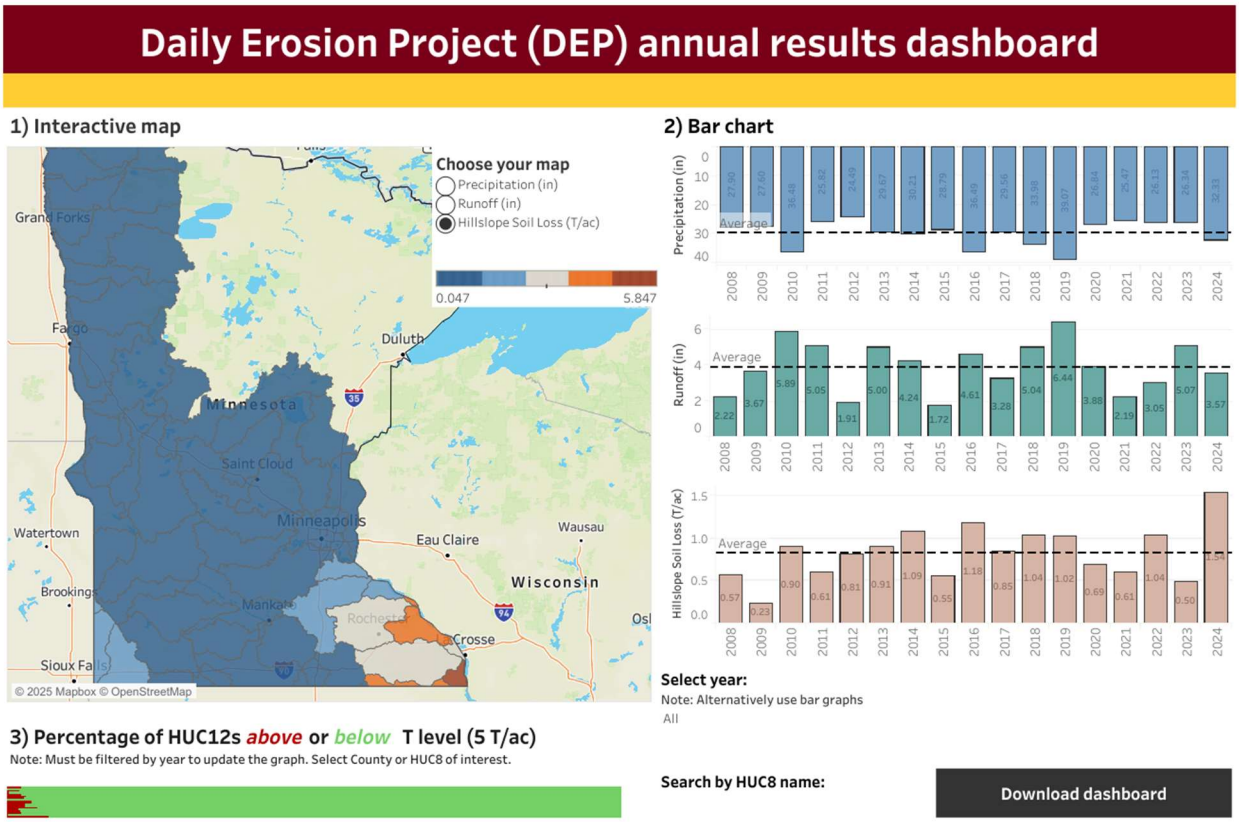


Figure 7-2.22: Daily Erosion Project Annual Results Dashboard