Outcomes Estimation Tools Training Webinar Series

Michelle Perez, PhD
Water Initiative Director

Aysha Tapp Ross
Water & Soil Health Scientist

Jen Tillman
Research Scientist

Featuring: Prioritize Target Measure Application (PTMApp)

November 1, 2023
Noon to 1:30 pm eastern

American Farmland Trust

Agenda

- Welcome, Poll (5 min)
- PTMApp Presentation (35 min)
- PTMApp Demonstration (30 min)
- Q&A (20 min)

Michelle

Zoom Webinar Reminders

- Use Q&A Box - last 20 minutes (Vote up!)
- Use Zoom Direct Message feature to Jen if having technical difficulties
- Email with resources to follow each webinar
- Recordings posted on the webinar series site the following Monday
- **Evaluation survey in the Chat Box**
  - **Complete to be entered to win a $25 gift card!!**

Michelle

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Time for 3 polls!

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Tools in 2023 Trainings*

May 3: Webinar Launch & PCOC (recording)

June 7: Model My Watershed (recording)

July 12: Nutrient Tracking Tool (NTT) (recording)

August 2: NRCS Cover Crop Economics Tool (economic) (recording)

September 6: FieldPrint Platform (recording)

October 4: EPA PLET (water quality) (recording)

November 1: PTMApp Web Tool (water quality)

December 6: AFT Retrospective-Soil Health Economics (R-SHEC) Tool (economic)

Tools in 2024 Trainings*

January 10: SIPES Method/SIDMA Tool (social)

February 7: Fast-GHG (climate)

March 6: Cool Farm Tool (climate)

April 3: TBD

May 1: COMET-Farm & COMET-Planner (climate)

June 5: CAST Tool (water quality)

July 3: TBD

*Subject to change

Michelle

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Prioritize Target Measure Application (PTMApp)

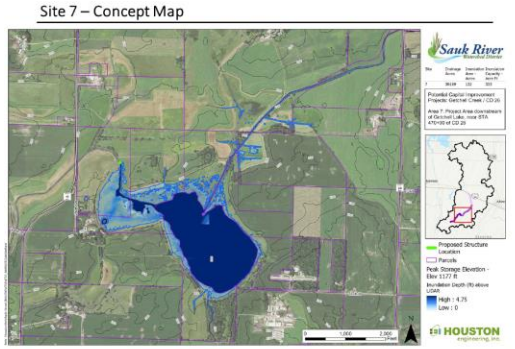
Drew Kessler | Houston Engineering Inc.

Udai Singh| Minnesota Board of Water and Soil Resources

Speaker Intro

Other Areas of Work

- Climate-Smart Farmer-Led Projects
- GHG modeling
- Large wetland and river restorations
- Regional and national water quality studies



Education

PhD in Water Resources Science, University of Minnesota

MS in Geospatial Information, University of Nebraska-Lincoln

BS in Natural Resource Management, North Dakota State University

Professional Experience

HEI: 2014-Present

Total Experience: 18 Years

Away from work

- Spouse, 4 kids, two dogs, and a cat
- Enjoy spending time at the cabin, sporting events, and fishing

BOARD OF WATER AND SOIL RESOURCES

https://ptmapp.bwsr.state.mn.us/

https://bwsr.state.mn.us/ptmapp-learning-center

Udai Singh
Email: udai.singh@state.mn.us
MN Board of Water and Soil Resources (BWSR)
Modeling and Outcomes Coordinator

Introduction

Engineering, Science, and Technology firm

250 employees

Upper-Midwest offices with a national reach

Presentation Focus

- Tool history, use, and methods
- Use by local practitioners
- Show example applications
- Respond to attendee survey responses!!!!
- Brief overview of steps to adapt to new geographies

Snapshot

Snap Shot of Features	Prioritize, Target, and Measure Application (PTMApp)
Scale & level of specificity	**Field level** to **HUC 8** watershed level
Outcomes	**Water quality, loss reductions:** sediment losses (tons & ton/ac), total nitrogen (lbs & lb/ac) losses, total phosphorus losses (lbs & lb/ac)
Conservation practices	**Currently:** 21 different practices based upon NRCSA design standards Nutrient Management Plan, Prescribed grazing, Forage/Biomass Plannting, Reduced Till, Cover Crops, No Till Perennial Crops, lake and Wetland Shoreline Restoration, Grassed waterway, Grade Stabilization, Critical Area Planting, Multi-Stage Ditch, Infiltration Trench, Denitrifying Bioreactor, Riparian Buffer, Filtration Strip, Wetland Restoration, Water and Sediment Control Basin, Drainage Water Management, Farm Pond

Snapshot

Snap Shot of Features	Prioritize, Target, and Measure Application (PTMApp)
Land uses & production systems	**All land uses** (cropland, grazing, pasture, forest) **Production systems**: Focused primarily on row crop and pasture lands. Currently being adapted to Agroforestry.
States & territories	**Available everywhere, but needs work for adaptation** Currently deployed in MN, ND, IA, WI, MB and O'ahu
How much time, data, & skills needed to generate an outcome estimate	1) Inputs need moderate GIS expertise and time 2) Running the tool, novice level GIS expertise 3) Using the outputs, moderate level of GIS expertise and Water Quality understanding
Special note	Meant to make water quality modeling more broadly available through GIS

Purpose: Strengths and Limitations

Strengths

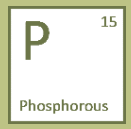
- Publicly available and supported
- User defined results at multiple scales
- Supports planning and implementation
- Demonstrated to support portions of federal 9-step plans

Limitations

- Largely an empirical tool
- Doesn’t speciate nutrients
- Moderate level GIS expertise needed to prep input
- Still needs adaptation guidance in many US regions

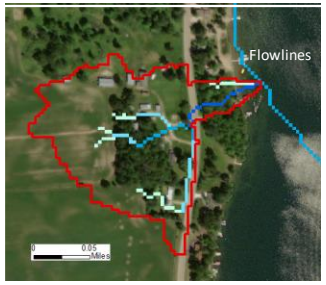
What led to PTMApp development?

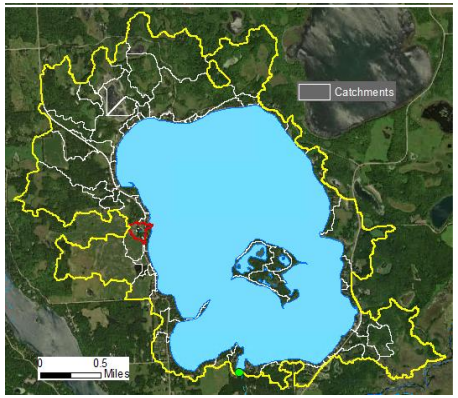
- Shifting expectations of "what's good enough"
  - **Environmental outcomes** vs. **widgets**:

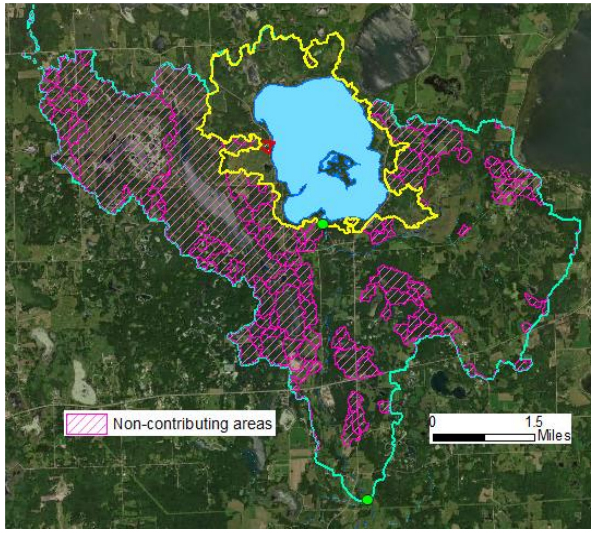
Sediment	Phosphorus	Storage	Land Management or Protection
			
9,322 tons/year reduction (*at catchment*)	**1,562 lbs/year reduction** (*at catchment*)	**16,000 acre-feet**	**17,075 acres**
Focused around rivers: • White Earth River • Marsh Creek • Middle Wild Rice River • Upper South Branch Wild Rice River	Focused around rivers: • White Earth River • Marsh Creek • Middle Wild Rice River • Upper South Branch Wild Rice River	Focused around the transition zone (Dark Green, Fig. 1-8): • Wild Rice River above Mahnomen • Wild Rice River above Twin Valley	Focused around the transition zone (Dark Green, Fig. 1-8): • Soil Health • Grassland • Forest • Wetland • Habitat

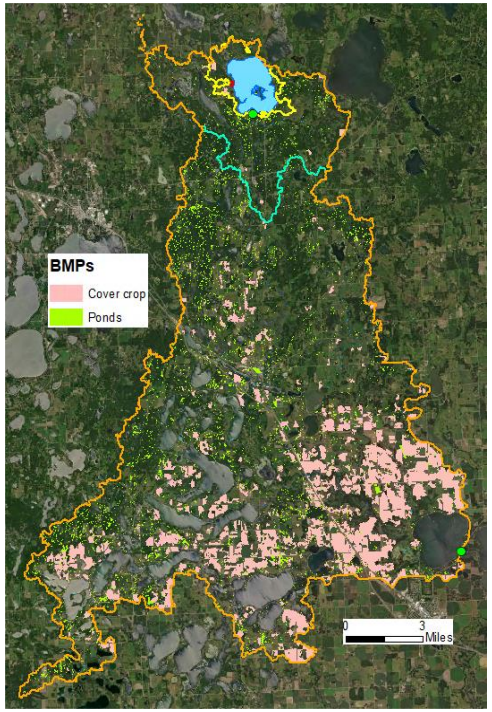
Innovative Technology Solution Sought

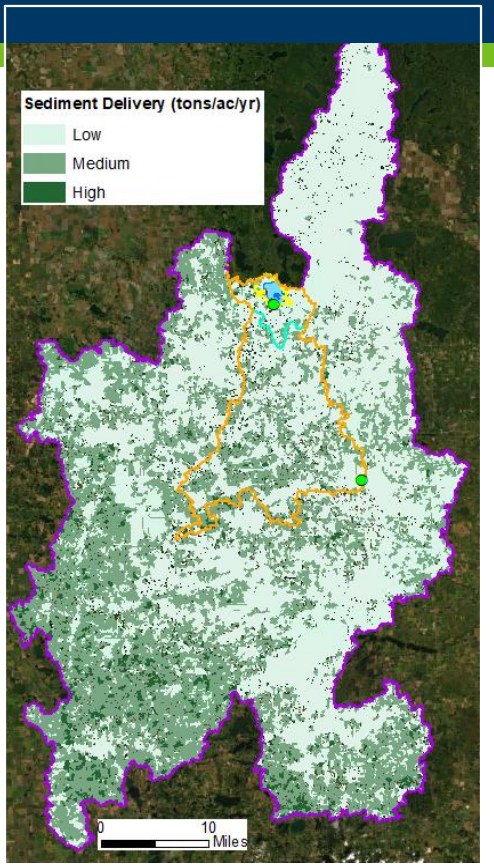
Needed to be scalable to meet project needs











Catchment (~40 ac)
Sediment load = 5.5 tons/yr
TP load = 2.8 lbs/yr

Lakeshed (~3,600 ac)
Sediment load = 0.02 tons
TP Load = 0.37 lbs
Majority of load deposited in lake:
373 tons of sediment
270 lbs of TP

HUC 12 (~17,000 ac)
Sediment load = 568 tons
TP load = 2,189

Some load may be contained locally and not make it downstream

HUC 10 (~132,000 ac)
Sediment load = 2,597 tons
Sediment reduction goal (20%) = 519 tons

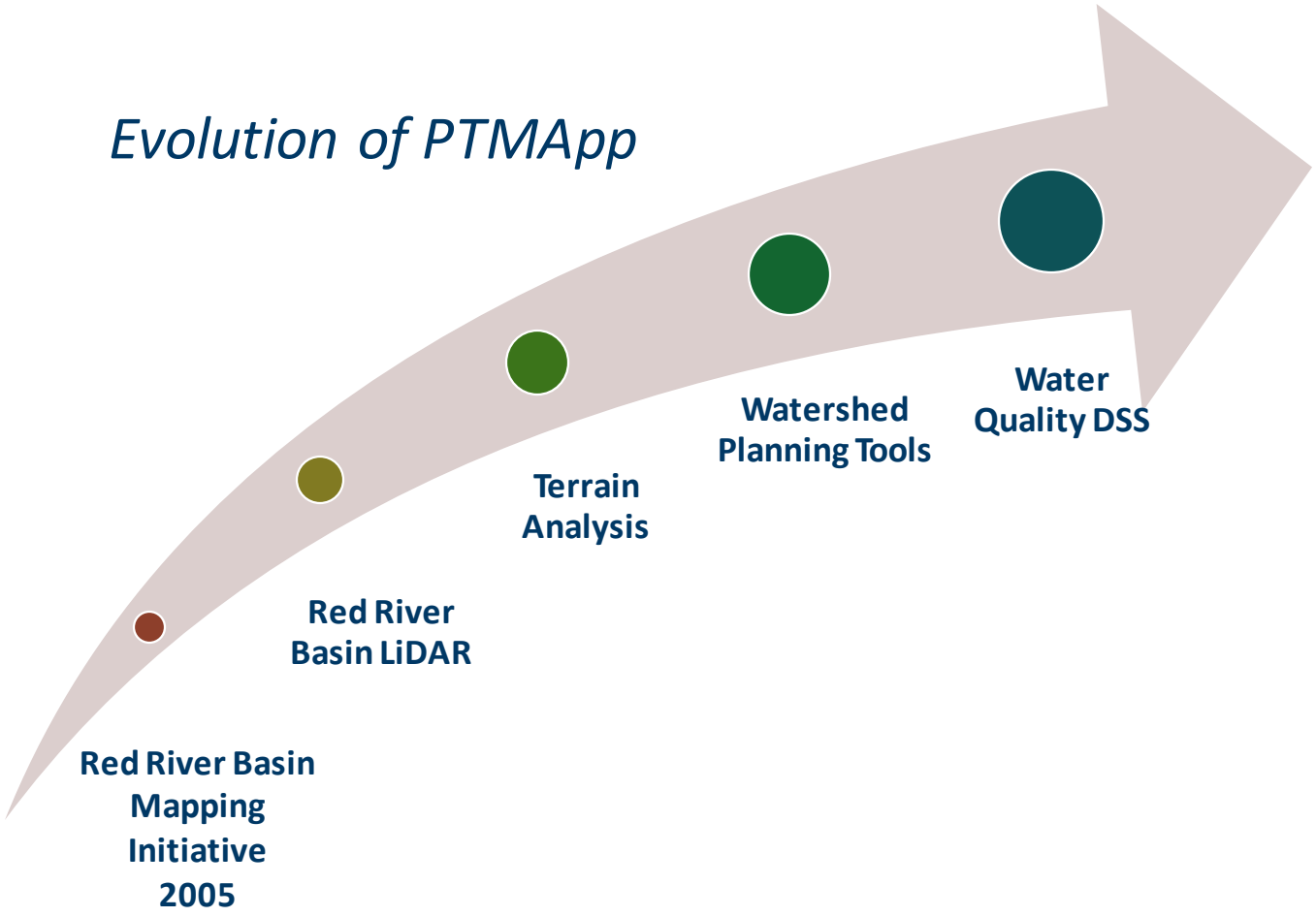
TP load = 4,475 lbs
TP reduction goal (20%) = 895 lbs

HUC 8 (~1.1 mi ac)
Sediment load = 52,201 tons
TP load = 34,245 lbs

Target catchments with high sediment delivery

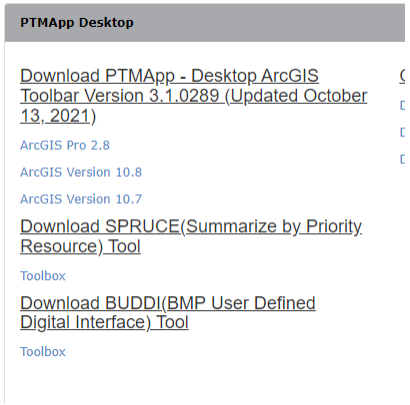
History of development?

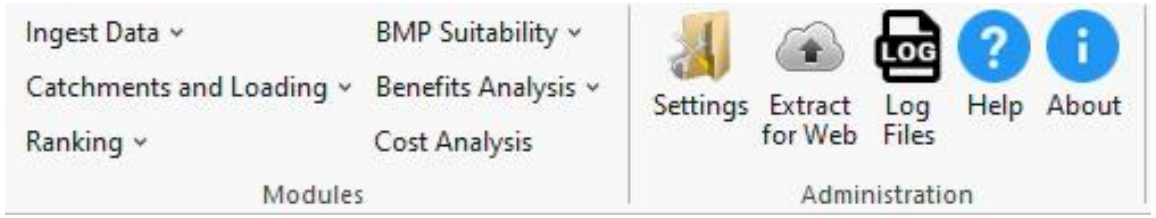
- ArcGIS-based toolbar add-in
- Option for Web App
- Free to public
- Vetted by peers



Solution: PTMApp

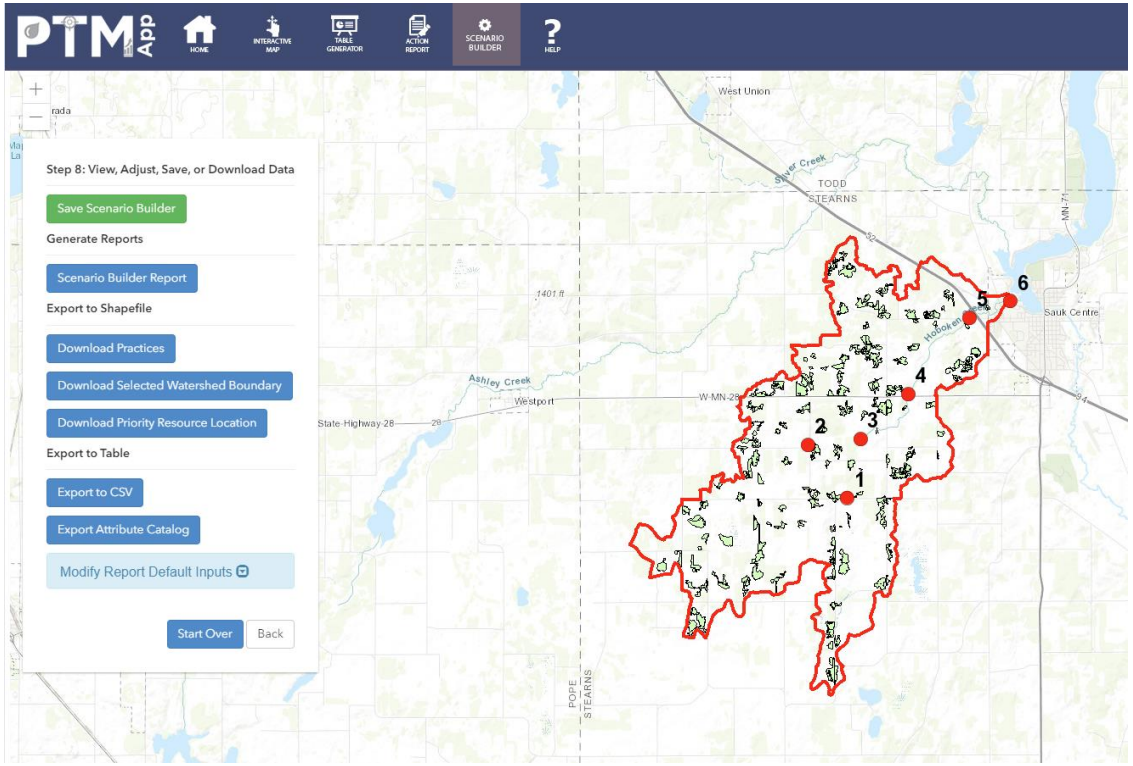
Desktop





https://ptmapp.bwsr.state.mn.us/User/PTMAppDesktop

Web



Tool Overview

	Dataset	PTMApp Name	Description	Format
1	Plan Boundary			
		bound_1w1p	Project boundary; naming convention for boundary of 1W1P planning area	polygon
2	SSURGO			
		ssurgo_cpi	SSURGO - Crop productivity index	raster
		ssurgo_hs	SSURGO - Hydraulic rating	raster
		ssurgo_hsg	SSURGO – Hydrologic group	raster
		ssurgo_dtgw	SSURGO - Depth to groundwater	raster
3	Curve Number			
		curve_num	Curve number raster	raster
4	Elevation Products			
		raw_dem	Non-conditioned digital elevation model	raster
		fdr_total	Flow direction raster from fill all	raster
		fac_total	Flow accumulation from fill all	raster
		hyd_dem	Hydrologically-conditioned digital elevation model	raster
		us_tt	Upstream travel time in hours	raster
		ds_tt	Downstream travel time in hours	raster
5	RUSLE Inputs			
		rusle_kw	RUSLE - Soil erodibility factor	raster
		rusle_r	RUSLE - Rainfall-runoff erosivity factor	raster
		rusle_c	RUSLE - Cover management factor	raster
		rusle_p	RUSLE - Support practice factor	raster
		rusle_m	RUSLE - m-weight factor	raster
6	Travel Time			
		tt_grid	Cell to cell travel time in seconds	raster
7	Priority Locations			
		p_res_pts	Point locations of priority resources and/or plan regions, with water quality goals in attributes	point

- Input generation most significant (human-time) part of running the tool

- Requires:
  - Locating data
    - Difficult for large watersheds with many stakeholders
  - Formatting for use in tool

Tool Overview

Delivery Potential (D)

Peak Discharge, ft./sec..

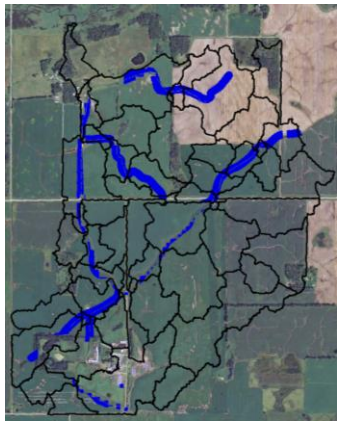
High

Low

Treatment Potential (T)

Design Standard Velocity

0.05 ft./sec.



Reduction Ratio (R = T/D)

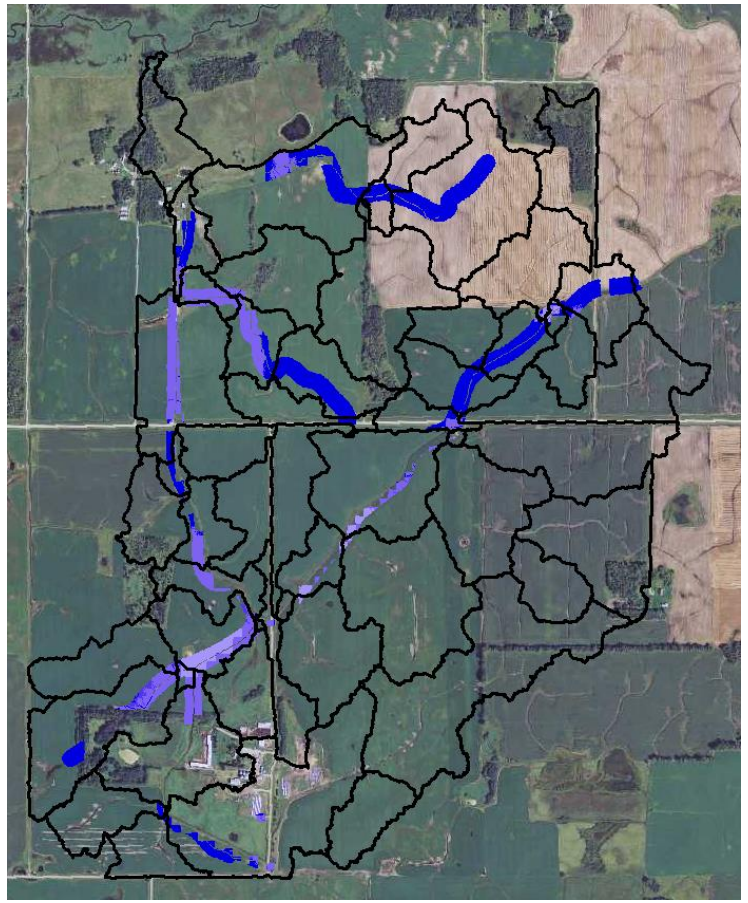
R, %

< 53%

53 – 75%

75 – 90%

> 90 %

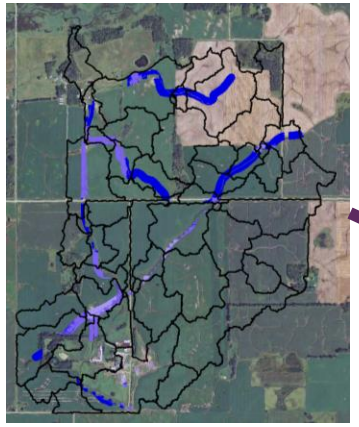


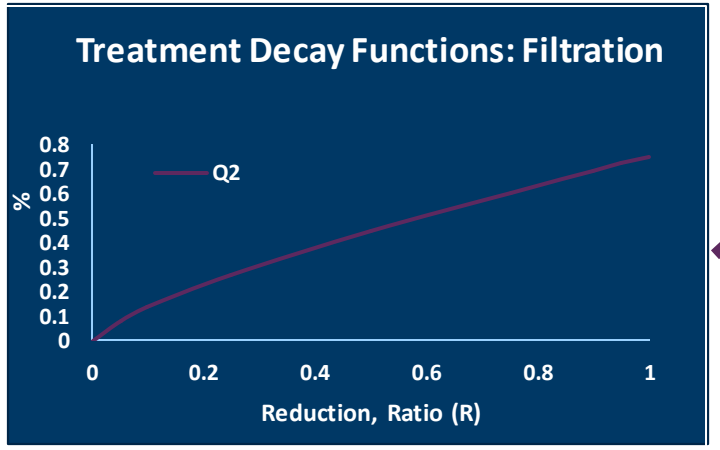
Tool Overview

Reduction Ratio

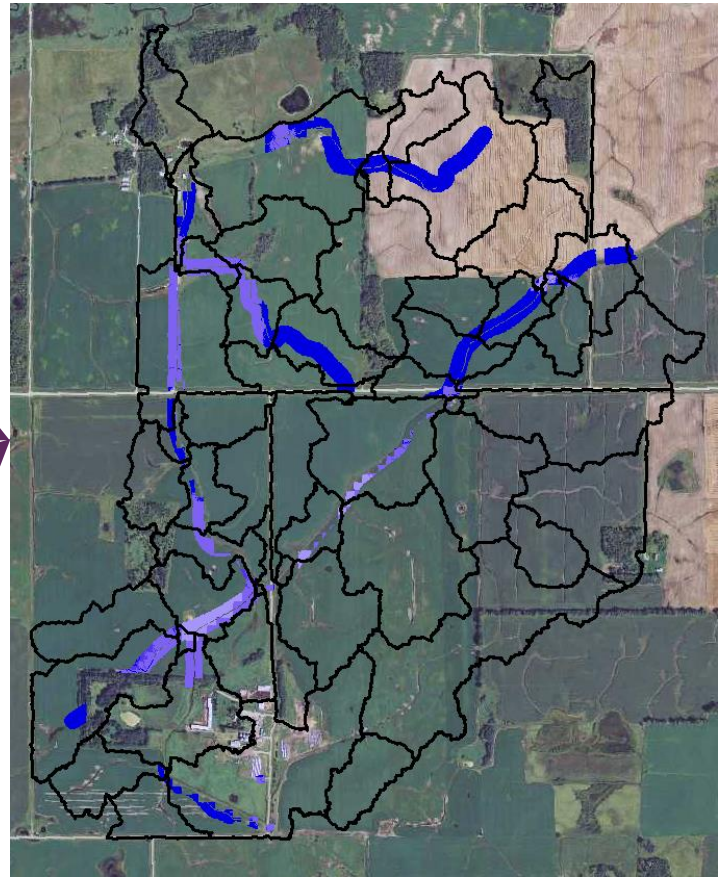
R, %

- < 53%
- 53 – 75%
- 75 – 90%
- > 90 %





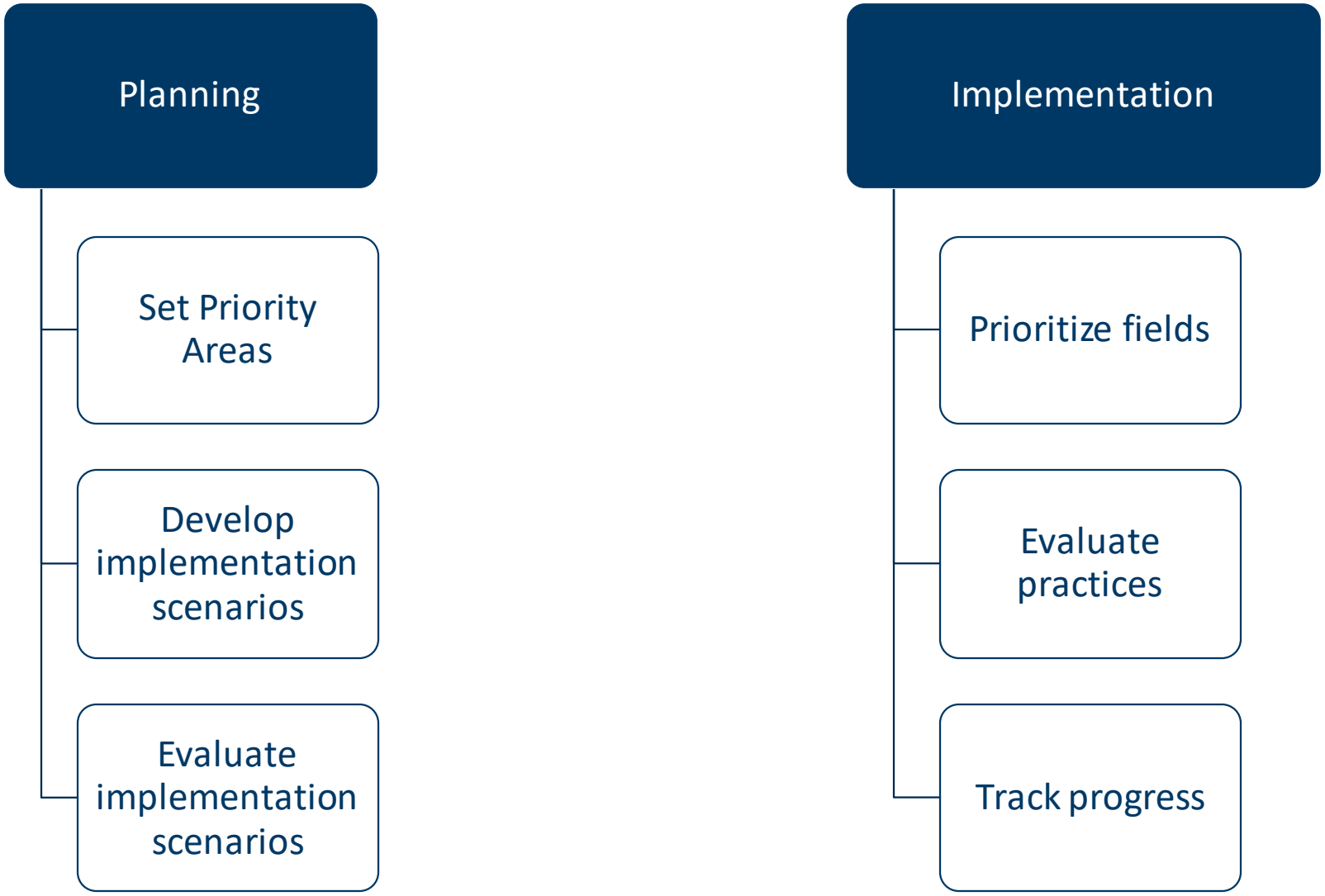
% Sediment Reduction



Sediment Reduction, %

- <46%
- 47% - 60%
- 61% - 70%
- > 70%

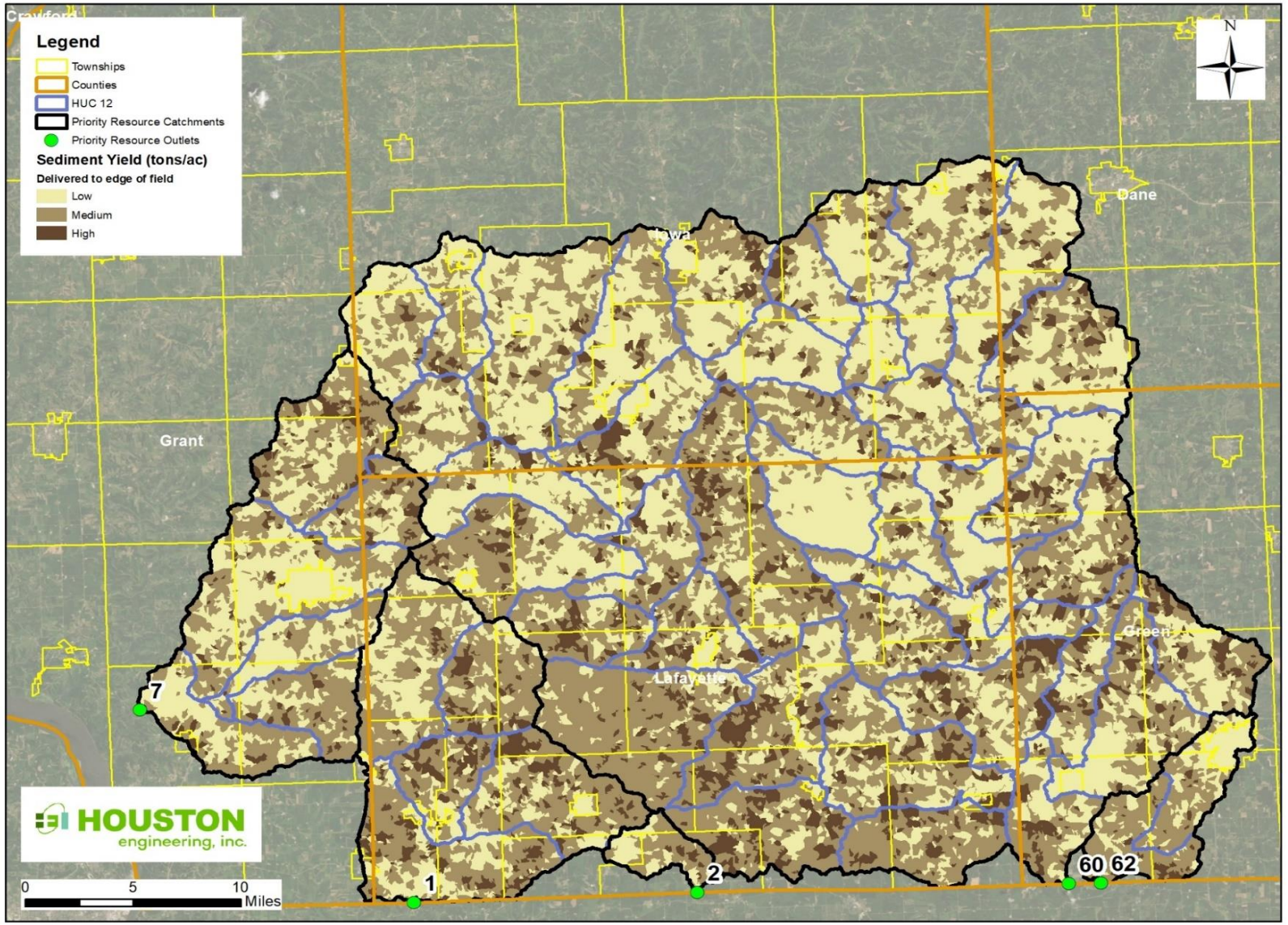
PTMApp use in planning and implementation



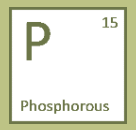
Set Priority Areas: Source assessments

Source assessments completed for:

- **Sediment**
- **Phosphorous**
- **Nitrogen**



Track progress towards goals

Sediment	Phosphorus	Storage	Land Management or Protection
			
9,322 tons/year reduction (*at catchment*)	**1,562 lbs/year reduction** (*at catchment*)	**16,000 acre-feet**	**17,075 acres**
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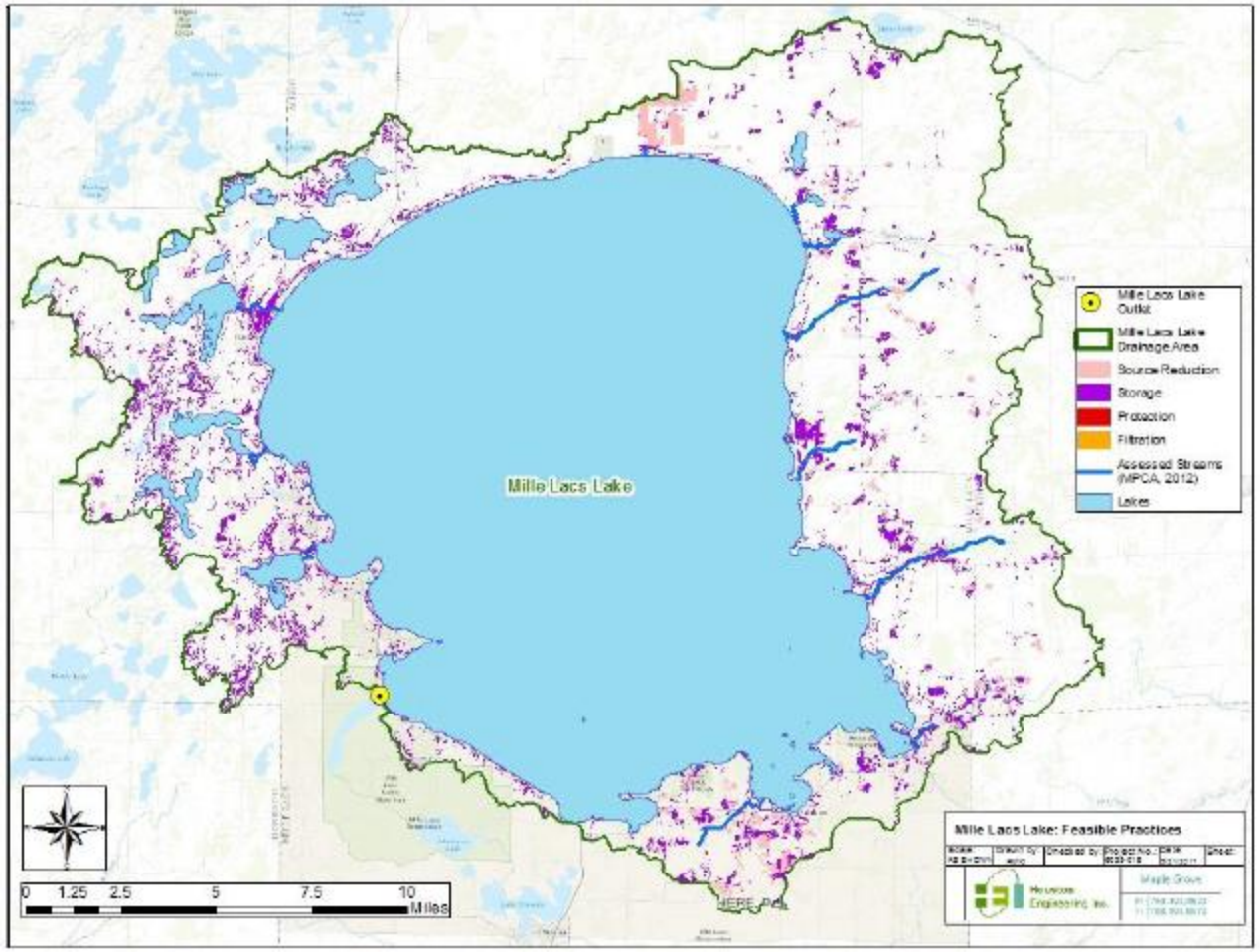
Develop Implementation Scenarios: Priority Locations



Water Quality Protection Goal

Current Water Quality Status:

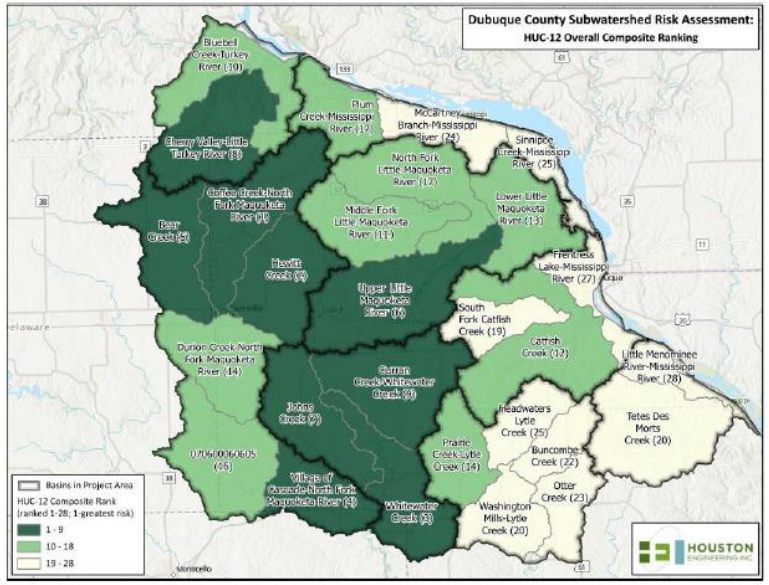
- ✓ Meets eutrophication numeric standard
- ✓ Current Estimated Annual TP Load: 9,785 lb/yr

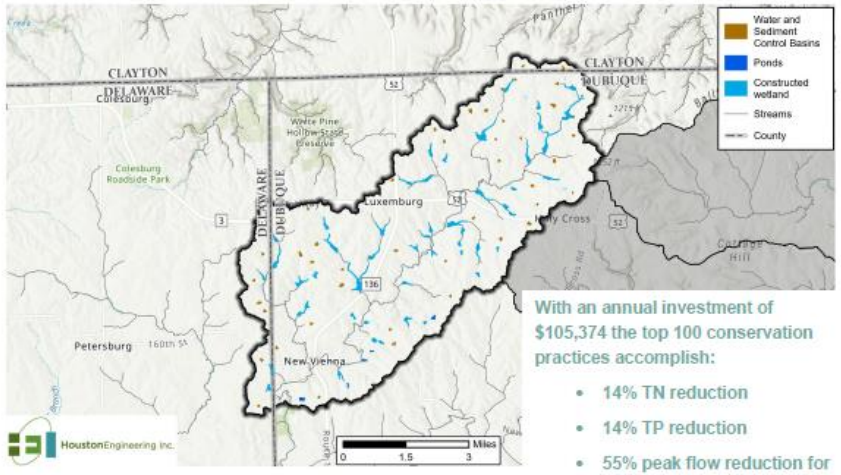
Total Phosphorus Protection Goals :

- ☐ Current 10-year average TP Concentration 29.4 ug/l
- ☐ Concentration Goal: 24.7 ug/L
- ☐ TP Annual Load Reduction Goal: 11.6%
- ☐ TP Annual Load Goal: 8,650 lb/yr

Treatment Group Type	Structural vs. Non-Structural	Number in Mille Lacs Lake Drainage Area
Storage	Structural	2461
Filtration	Structural	308
Protection	Structural	135
Source Reduction	Non-Structural	503

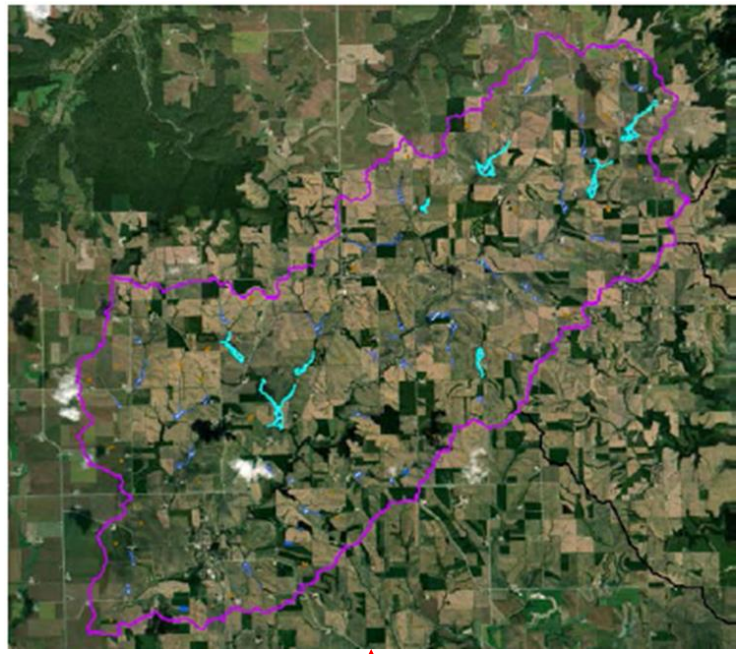
Prioritize Fields: WQ and Hydrology in Dubuque County





With an annual investment of $105,374 the top 100 conservation practices accomplish:

- 14% TN reduction
- 14% TP reduction
- 55% peak flow reduction for the 10-yr, 24-hr event



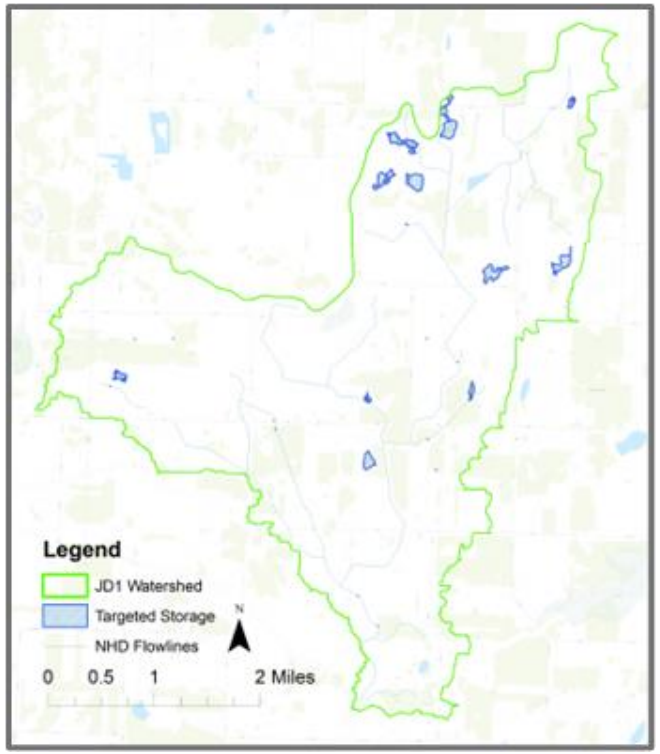
Benefits of the Top 100 Multi-benefit Conservation Practices

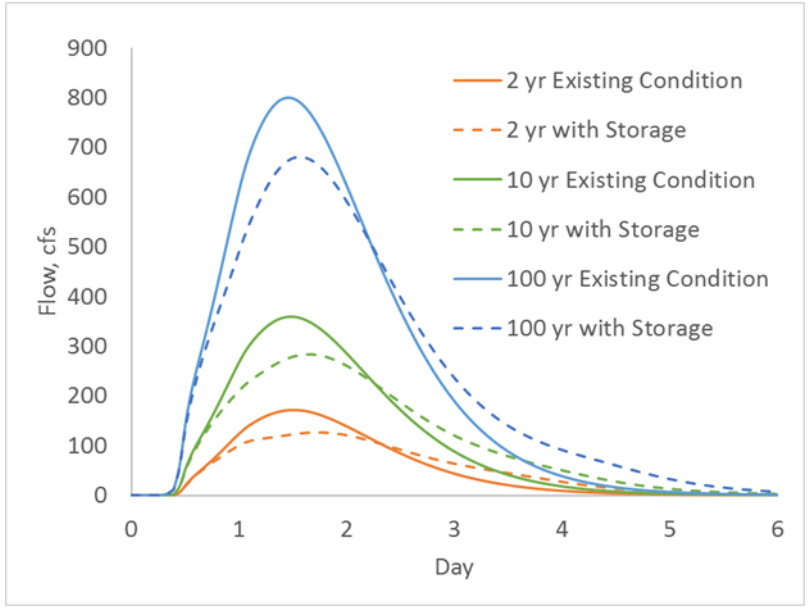
Implementation of the top 100 multi-benefit conservation practices in the Headwaters of the North Fork Maquoketa Watershed will accrue sediment, total nitrogen, total phosphorus, and percent flow reduction benefits and make progress toward stated County resource goals, as summarized in the table below.

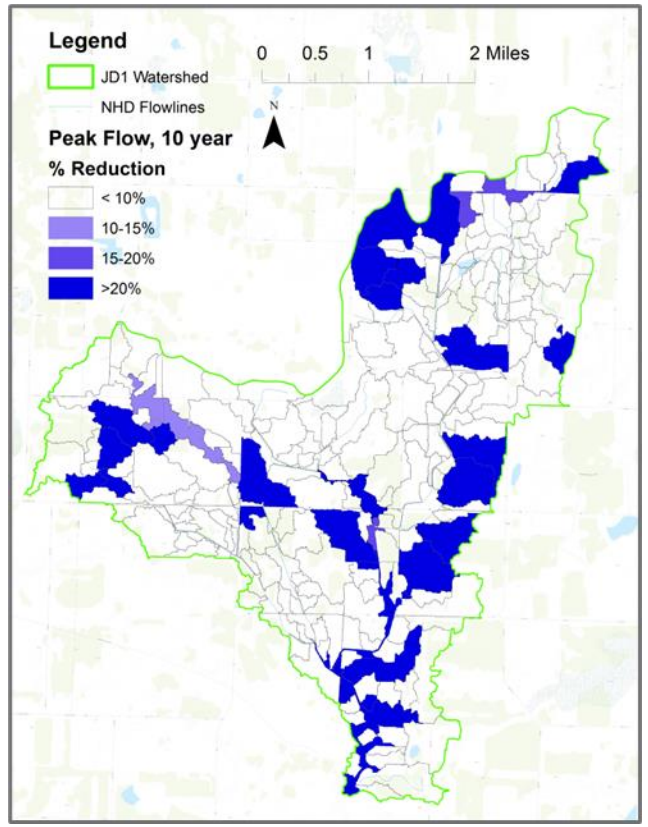
	Total Nitrogen		Total Phosphorus		Sediment		Peak Discharge	
	Mass (lbs./yr.)	Percentage (%)	Mass (lbs./yr.)	Percentage (%)	Mass (tons/yr.)	Percentage (%)	Rate (cfs)	Percentage (%)
Existing Load	410,302	41	38,959	16	140,587	--	2,406	15
Goal	168,224		6,233		--		361	
Total Progress of Top 100 Practices	58,281	14	5,451	14	49,430	NA	1,322	55

* No INRS goal for sediment. Percentage reduction shown is from existing conditions.

New Innovations: Hydrology





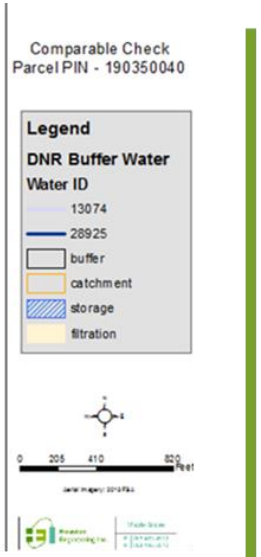


	Peak Flow, cfs			Volume, ac-ft		
	Existing	With Storage	% Reduction	Existing	With Storage	% Reduction
2 yr	172	126	27%	611	611	0%
10 yr	360	76	21%	1,281	1,281	0%
100 yr	800	681	15%	2,849	2,849	0%

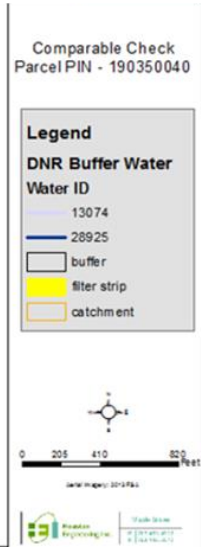
Evaluate Practices

Buffer		
Practice Type	Water ID	Sediment Reduction, tons/year
Vegetative Buffer*	13074	2.24
Vegetative Buffer*	28295	4.13

* Benefits provided by the buffer without other conservation practices in place

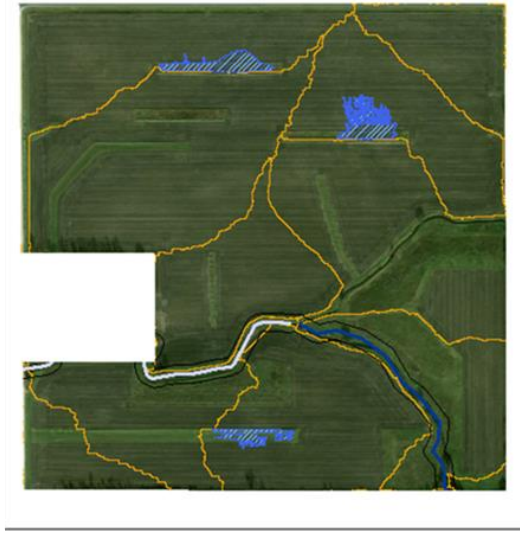


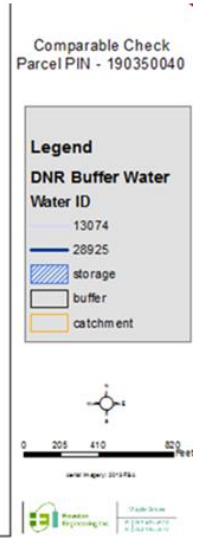
Proposed Alternative Practices		
Practice Type	HEI ID	Sediment Reduction tons/year
storage	13074	15.0



Existing Alternative Practices		
Practice Type	Water ID	Sediment Reduction, tons/year
filtration	13074	37.51
filtration	28925	10.72
storage	13074	16.56

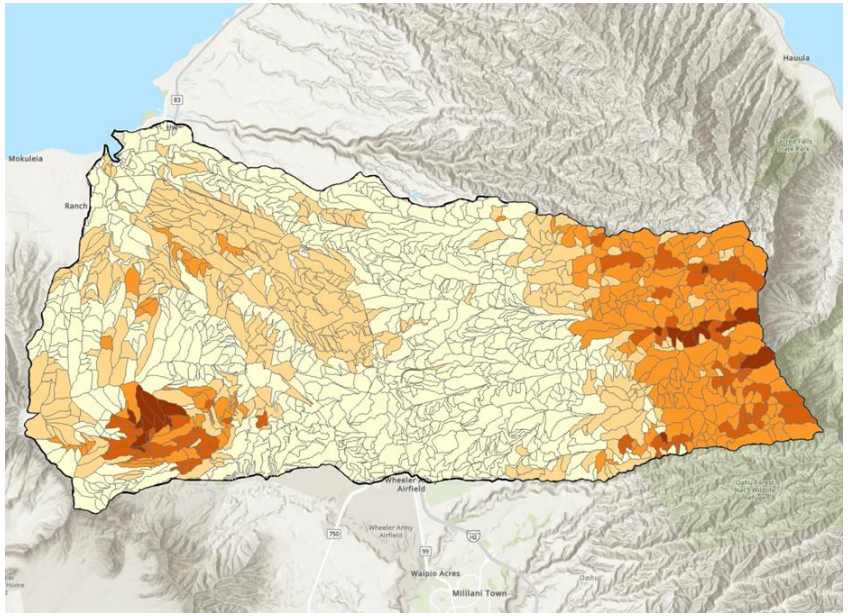
* Document width of existing buffer if applicable





Survey Questions: Producer Friendly & Outside of MN

Photo Credit not available



Survey Questions: 9-element watershed-based plans

WHISKEY CREEK WATERSHED
SECTION 319 NINE ELEMENT PLAN

HOUSTON ENGINEERING INC.

Fargo, ND | HEI No. 1915-0247
December 18, 2019

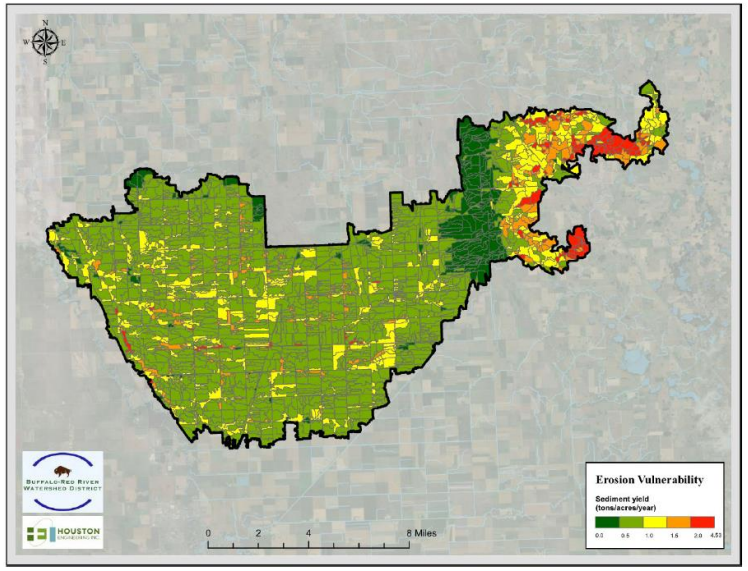


Figure 17: Erosion Vulnerability

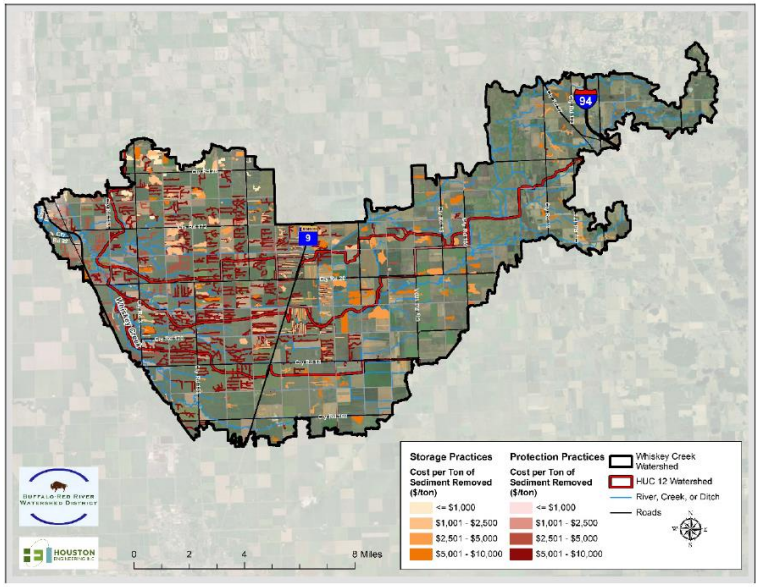


Figure 20: Sediment Reduction Practices

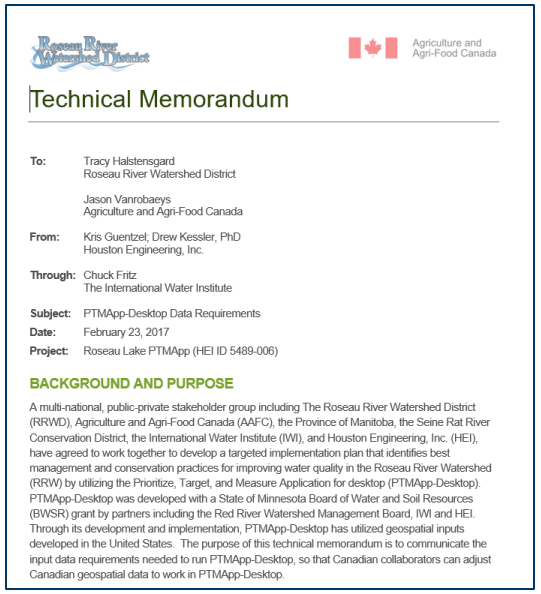
New Geographies: Known Geographies

- **Minnesota (core development location)**
- **North Dakota (widespread use in eastern ND)**
- **Wisconsin**
- **Manitoba**
- **O’ahu**

New Geographies: Primary Steps

1. **Identify input conversions (process already developed)**

2. **Test and validate results**



Roseau River Watershed District

Agriculture and Agri-Food Canada

Technical Memorandum

To: Tracy Halstensgard
Roseau River Watershed District

Jason Vanrobaeys
Agriculture and Agri-Food Canada

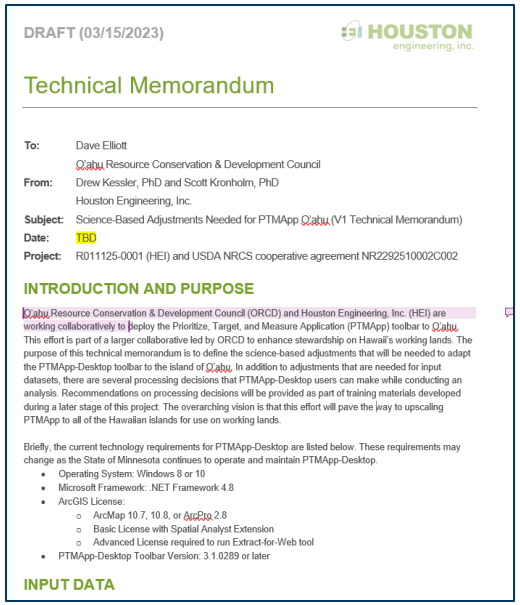
From: Kris Guentzel; Drew Kessler, PhD
Houston Engineering, Inc.

Through: Chuck Fritz
The International Water Institute

Subject: PTMApp-Desktop Data Requirements
Date: February 23, 2017
Project: Roseau Lake PTMApp (HEI ID 5489-006)

BACKGROUND AND PURPOSE

A multi-national, public-private stakeholder group including The Roseau River Watershed District (RRWD), Agriculture and Agri-Food Canada (AAFC), the Province of Manitoba, the Seine Rat River Conservation District, the International Water Institute (IWI), and Houston Engineering, Inc. (HEI), have agreed to work together to develop a targeted implementation plan that identifies best management and conservation practices for improving water quality in the Roseau River Watershed (RRW) by utilizing the Prioritize, Target, and Measure Application for desktop (PTMApp-Desktop). PTMApp-Desktop was developed with a State of Minnesota Board of Water and Soil Resources (BWSR) grant by partners including the Red River Watershed Management Board, IWI and HEI. Through its development and implementation, PTMApp-Desktop has utilized geospatial inputs developed in the United States. The purpose of this technical memorandum is to communicate the input data requirements needed to run PTMApp-Desktop, so that Canadian collaborators can adjust Canadian geospatial data to work in PTMApp-Desktop.



DRAFT (03/15/2023)

HOUSTON engineering, inc.

Technical Memorandum

To: Dave Elliott
Oʻahu Resource Conservation & Development Council
From: Drew Kessler, PhD and Scott Kronholm, PhD
Houston Engineering, Inc.
Subject: Science-Based Adjustments Needed for PTMApp Oʻahu (V1 Technical Memorandum)
Date: TBD
Project: R011125-0001 (HEI) and USDA NRCS cooperative agreement NR2292510002C002

INTRODUCTION AND PURPOSE

Oʻahu Resource Conservation & Development Council (ORCD) and Houston Engineering, Inc. (HEI) are working collaboratively to deploy the Prioritize, Target, and Measure Application (PTMApp) toolbar to Oʻahu. This effort is part of a larger collaborative led by ORCD to enhance stewardship on Hawaii's working lands. The purpose of this technical memorandum is to define the science-based adjustments that will be needed to adapt the PTMApp-Desktop toolbar to the island of Oʻahu. In addition to adjustments that are needed for input datasets, there are several processing decisions that PTMApp-Desktop users can make while conducting an analysis. Recommendations on processing decisions will be provided as part of training materials developed during a later stage of this project. The overarching vision is that this effort will pave the way to upscaling PTMApp to all of the Hawaiian islands for use on working lands.

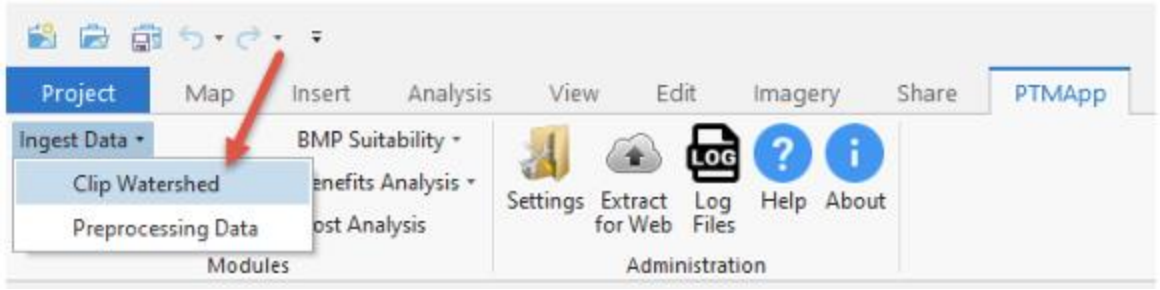
Briefly, the current technology requirements for PTMApp-Desktop are listed below. These requirements may change as the State of Minnesota continues to operate and maintain PTMApp-Desktop.

- Operating System: Windows 8 or 10
- Microsoft Framework: .NET Framework 4.8
- ArcGIS License:
  - ArcMap 10.7, 10.8, or ArcPro 2.8
  - Basic License with Spatial Analyst Extension
  - Advanced License required to run Extract-for-Web tool
- PTMApp-Desktop Toolbar Version: 3.1.0289 or later

INPUT DATA

	Dataset	PTMApp Name	Description	Format
1	Plan Boundary			
		bound_1w1p	Project boundary; naming convention for boundary of 1W1P planning area	polygon
2	SSURGO			
		ssurgo_cpi	SSURGO - Crop productivity index	raster
		ssurgo_hs	SSURGO - Hydraulic rating	raster
		ssurgo_hsg	SSURGO – Hydrologic group	raster
		ssurgo_dtgw	SSURGO - Depth to groundwater	raster
3	Curve Number			
		curve_num	Curve number raster	raster
4	Elevation Products			
		raw_dem	Non-conditioned digital elevation model	raster
		fdr_total	Flow direction raster from fill all	raster
		fac_total	Flow accumulation from fill all	raster
		hyd_dem	Hydrologically-conditioned digital elevation model	raster
		us_tt	Upstream travel time in hours	raster
		ds_tt	Downstream travel time in hours	raster
5	RUSLE Inputs			
		rusle_kw	RUSLE - Soil erodibility factor	raster
		rusle_r	RUSLE - Rainfall-runoff erosivity factor	raster
		rusle_c	RUSLE - Cover management factor	raster
		rusle_p	RUSLE - Support practice factor	raster
		rusle_m	RUSLE - m-weight factor	raster
6	Travel Time			
		tt_grid	Cell to cell travel time in seconds	raster
7	Priority Locations			
		p_res_pts	Point locations of priority resources and/or plan regions, with water quality goals in attributes	point

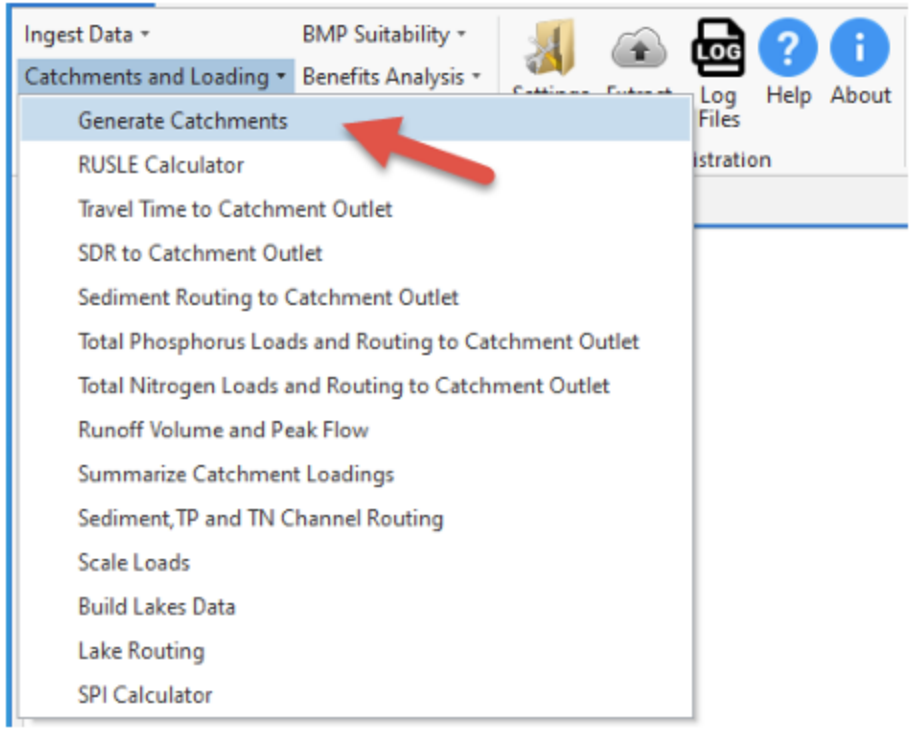
DEMO – Ingest Data Module



Key Steps

- Clips all data files to the study watershed/geography
- Calculates downstream flow length
- Calculates upstream flow length

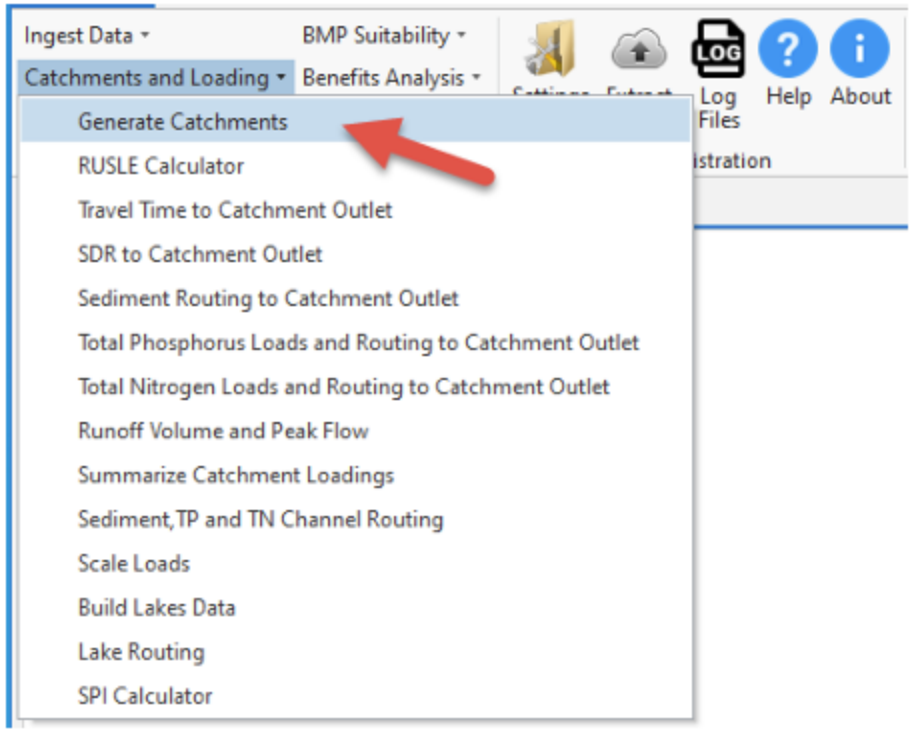
DEMO – Catchments and Loading Module

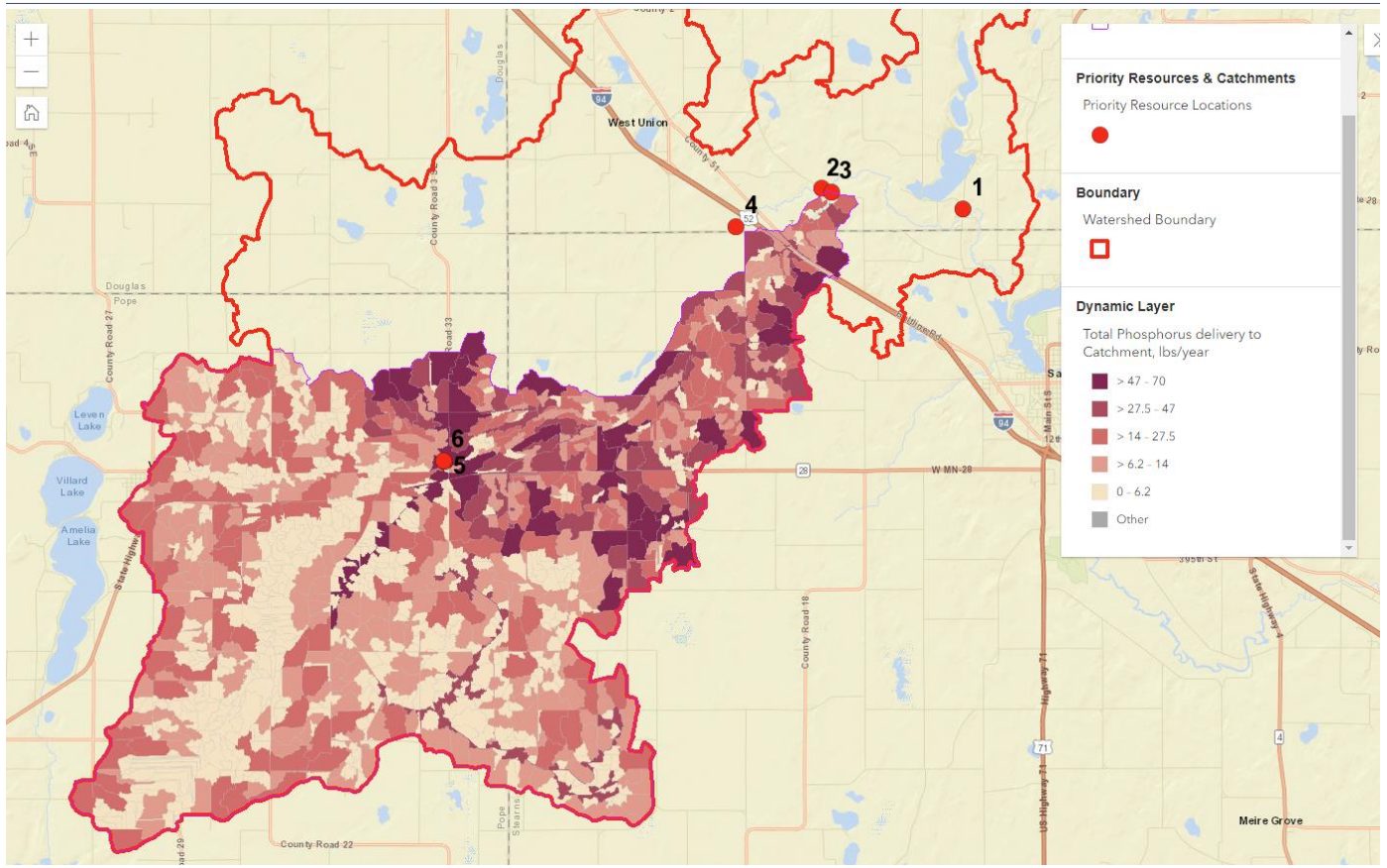


Key Steps

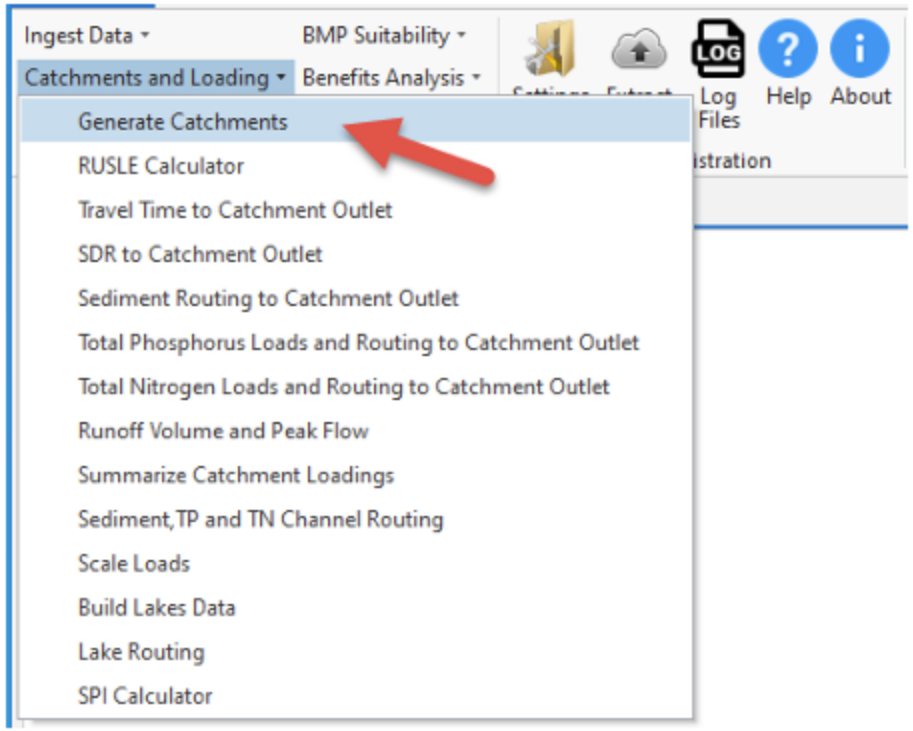
- Generates Catchments
- Calculates Up/Down travel times
- Sediment/TP/TN loading calculations
- Lake Routing (optional)
- Scale loads (optional)
- SPI

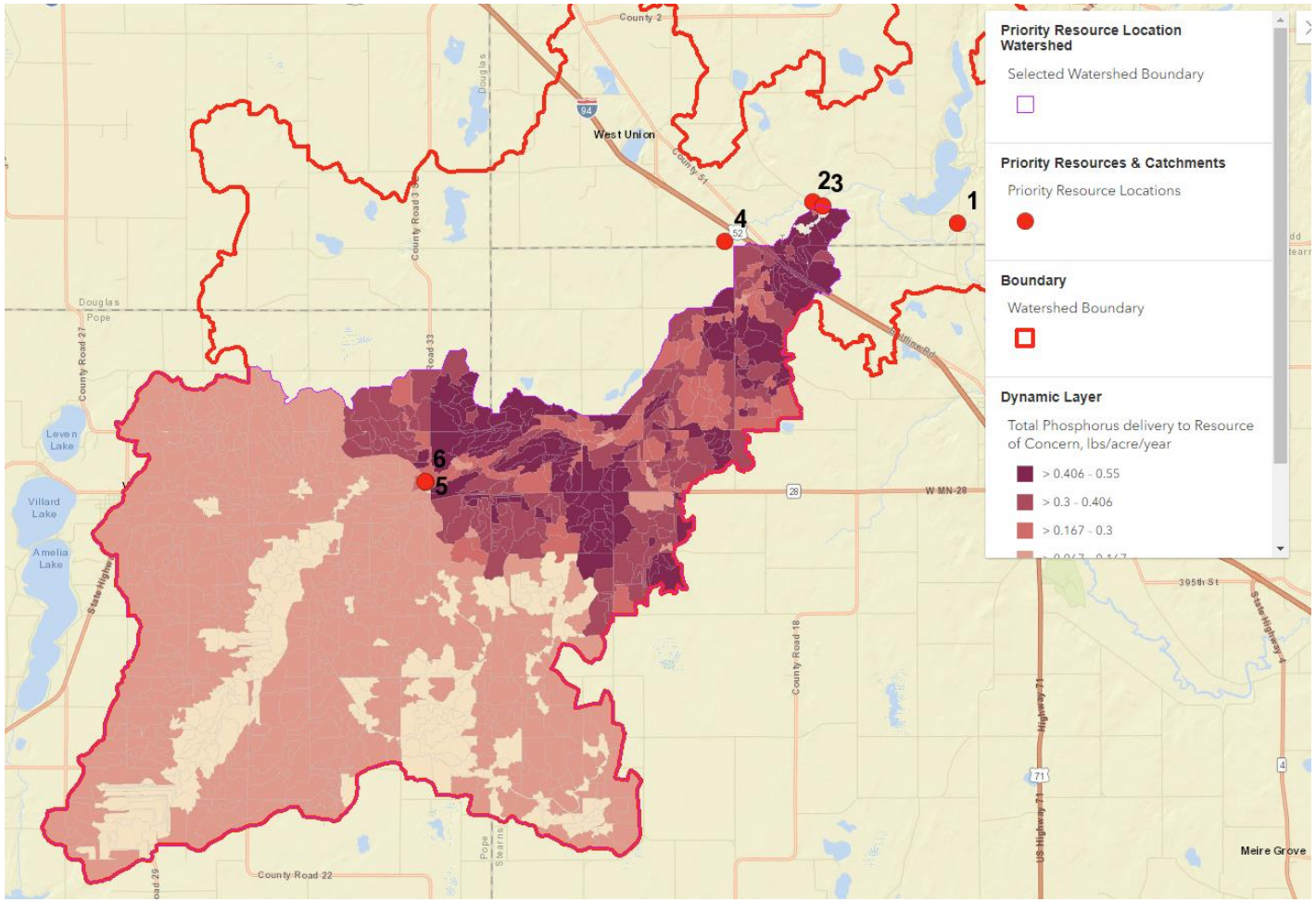
DEMO – Catchments and Loading Module



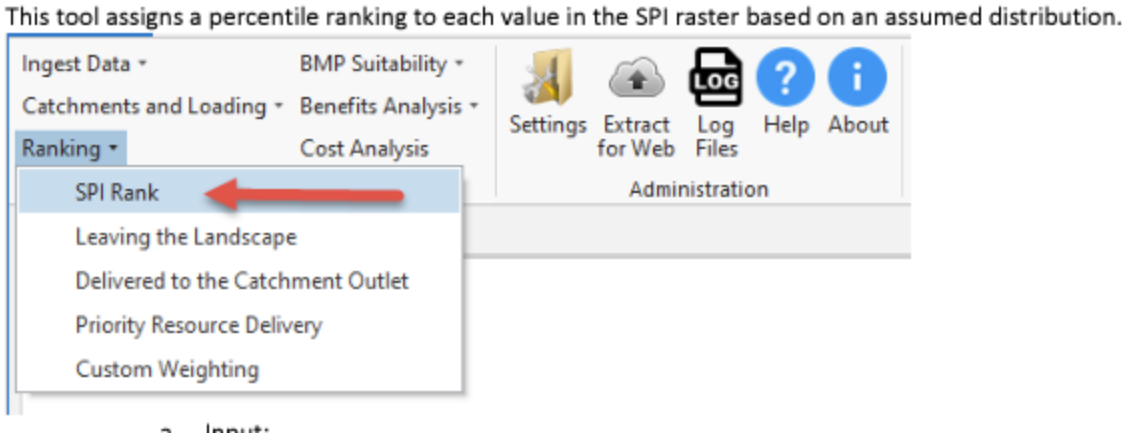


DEMO – Catchments and Loading Module





DEMO – Ranking Module



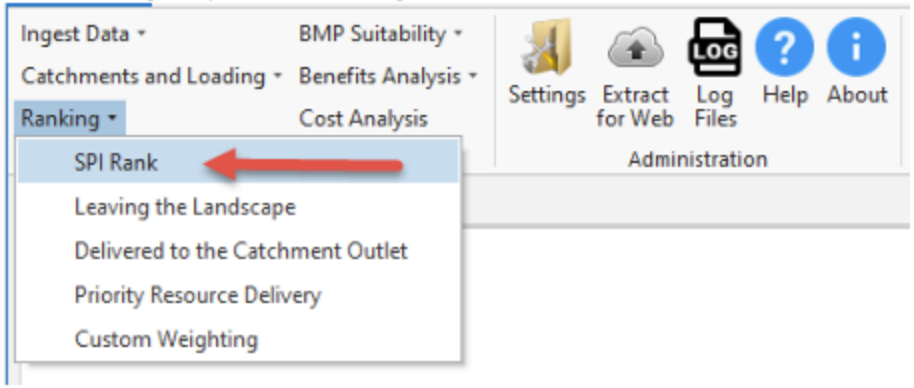
Key Steps

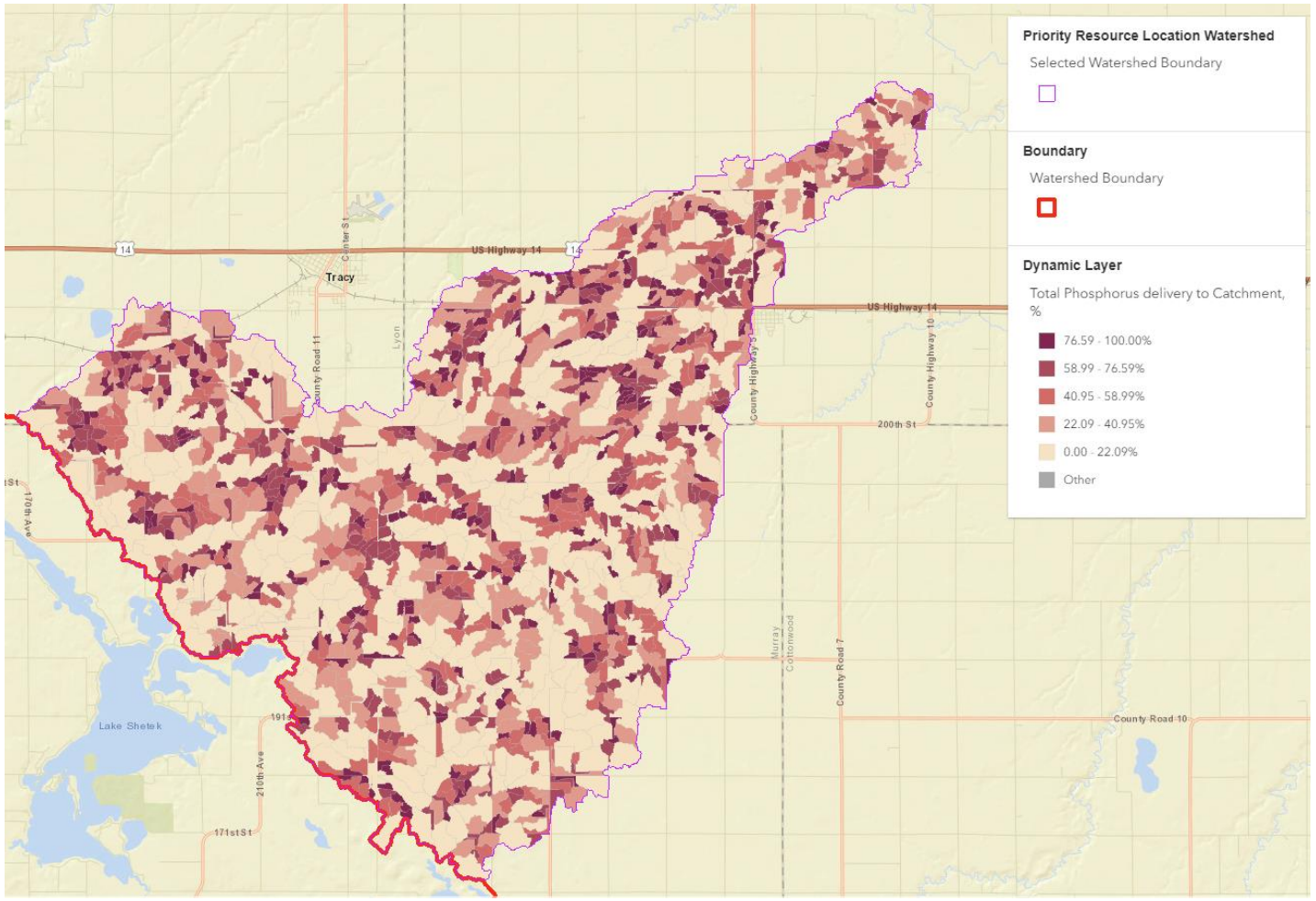
- Develops normalized ranks (i.e., percentages) of loading information and SPI

- Option for user's to input a custom weighting to ranks

DEMO – Ranking Module

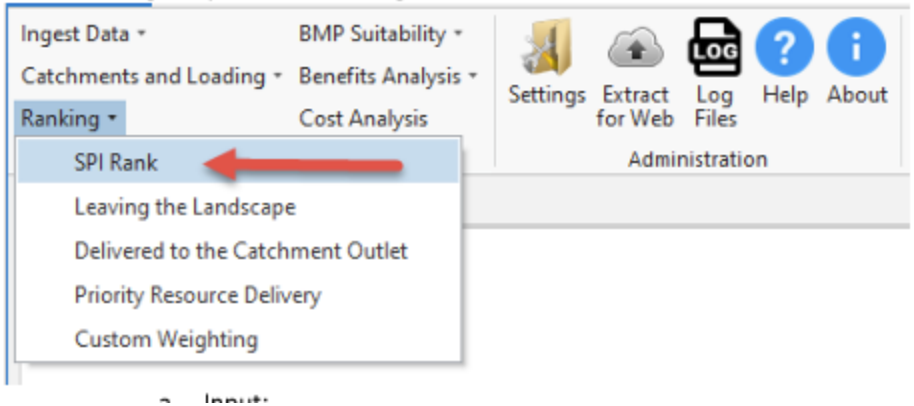
This tool assigns a percentile ranking to each value in the SPI raster based on an assumed distribution.

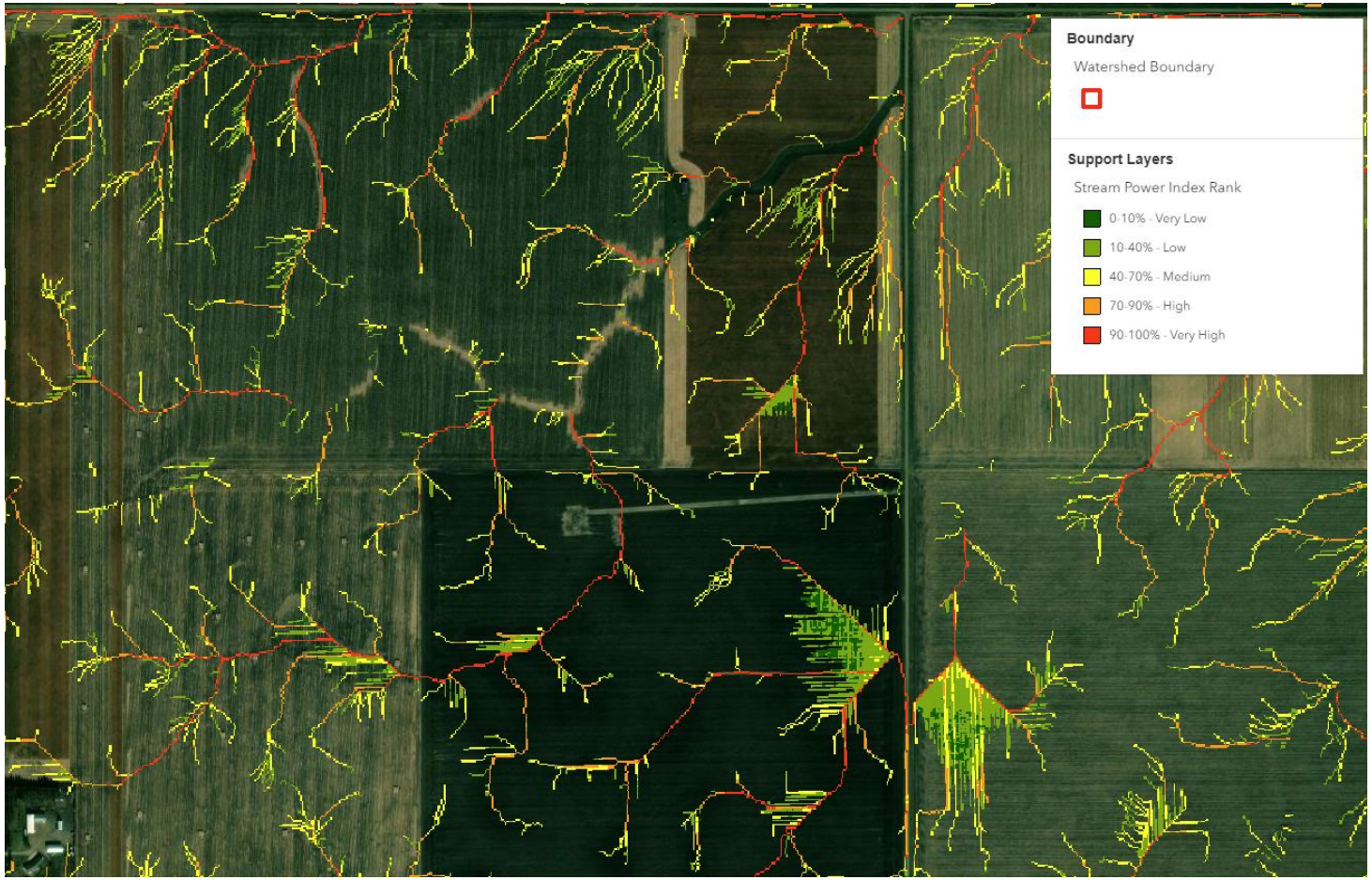




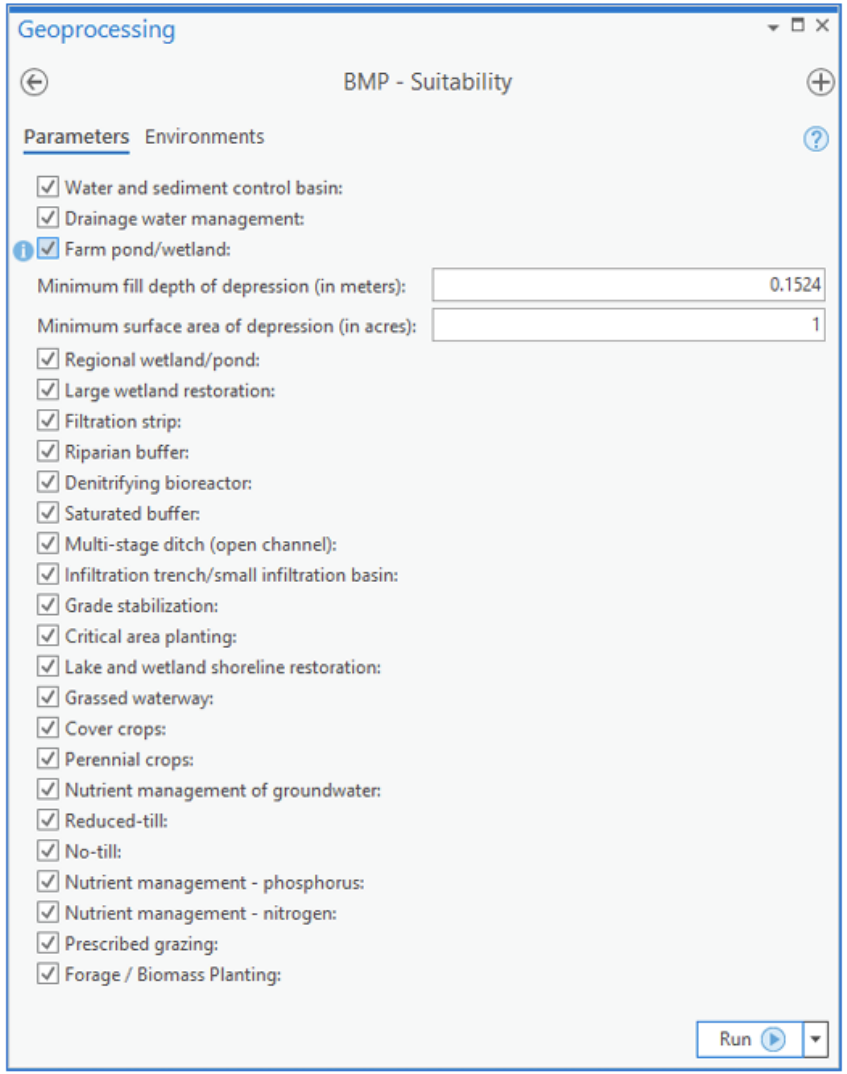
DEMO – Ranking Module

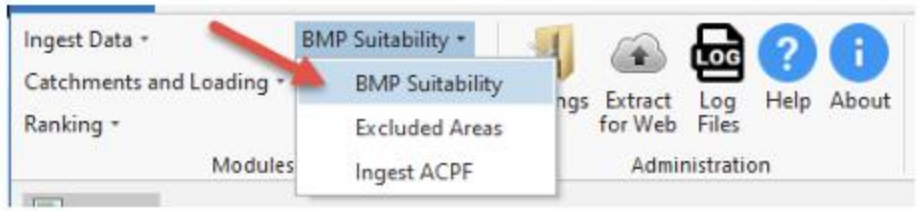
This tool assigns a percentile ranking to each value in the SPI raster based on an assumed distribution.





DEMO – BMP Suitability Module

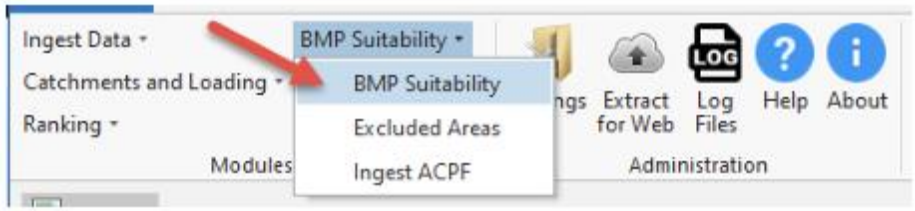


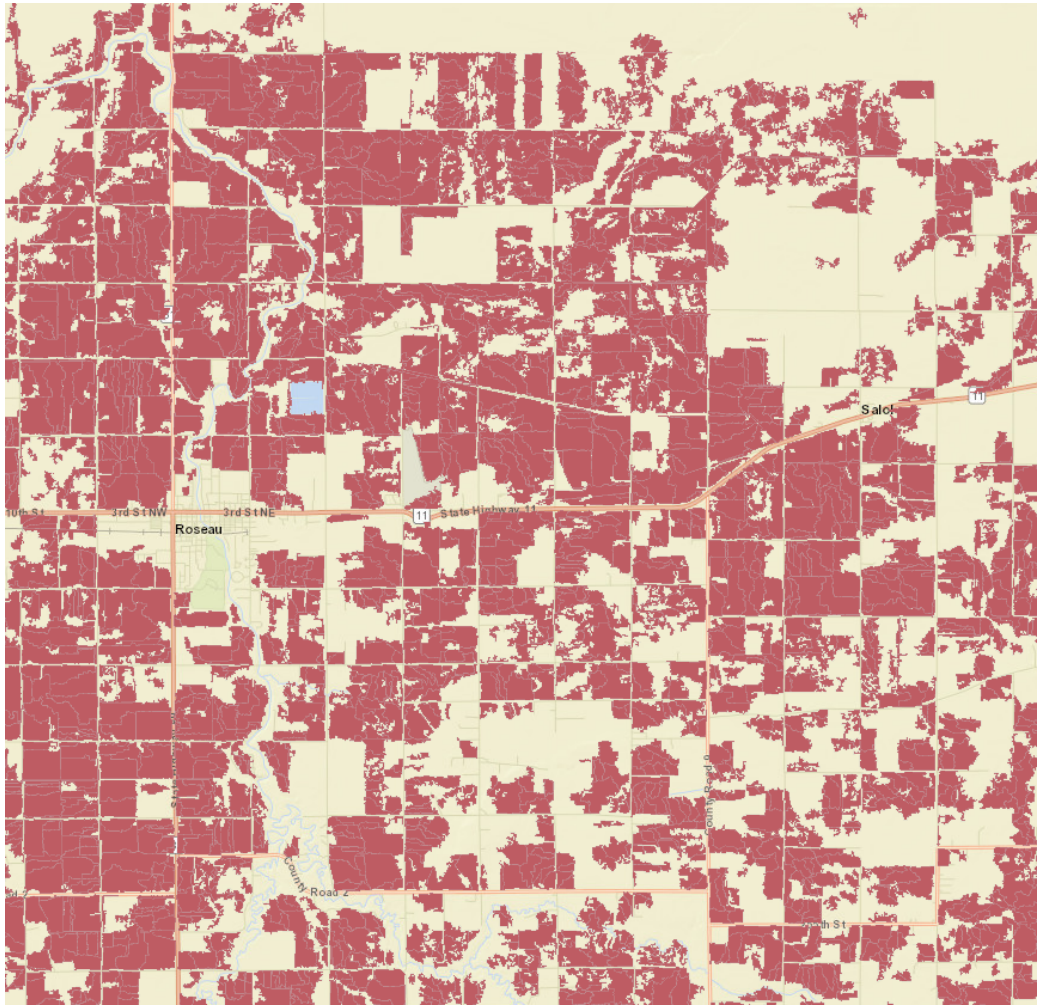


Key Steps

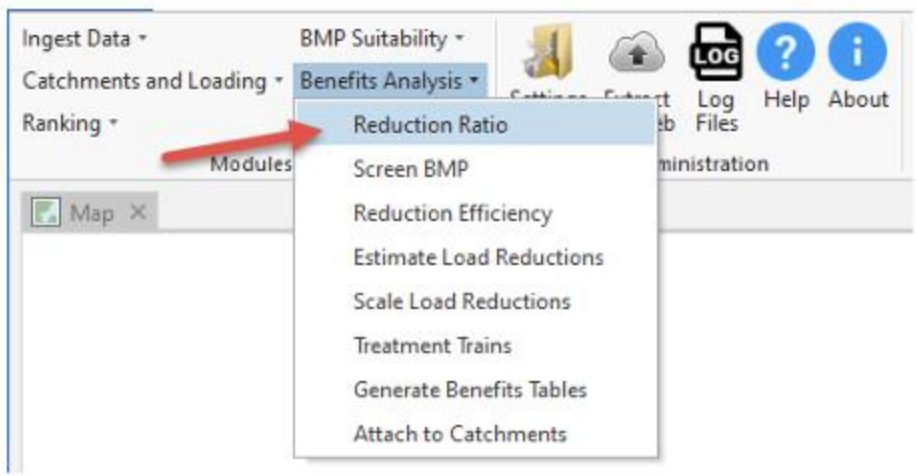
- Identifies possible areas for BMPs
- Allows users to exclude areas for BMPs
- Add WQ benefits to ACPF data

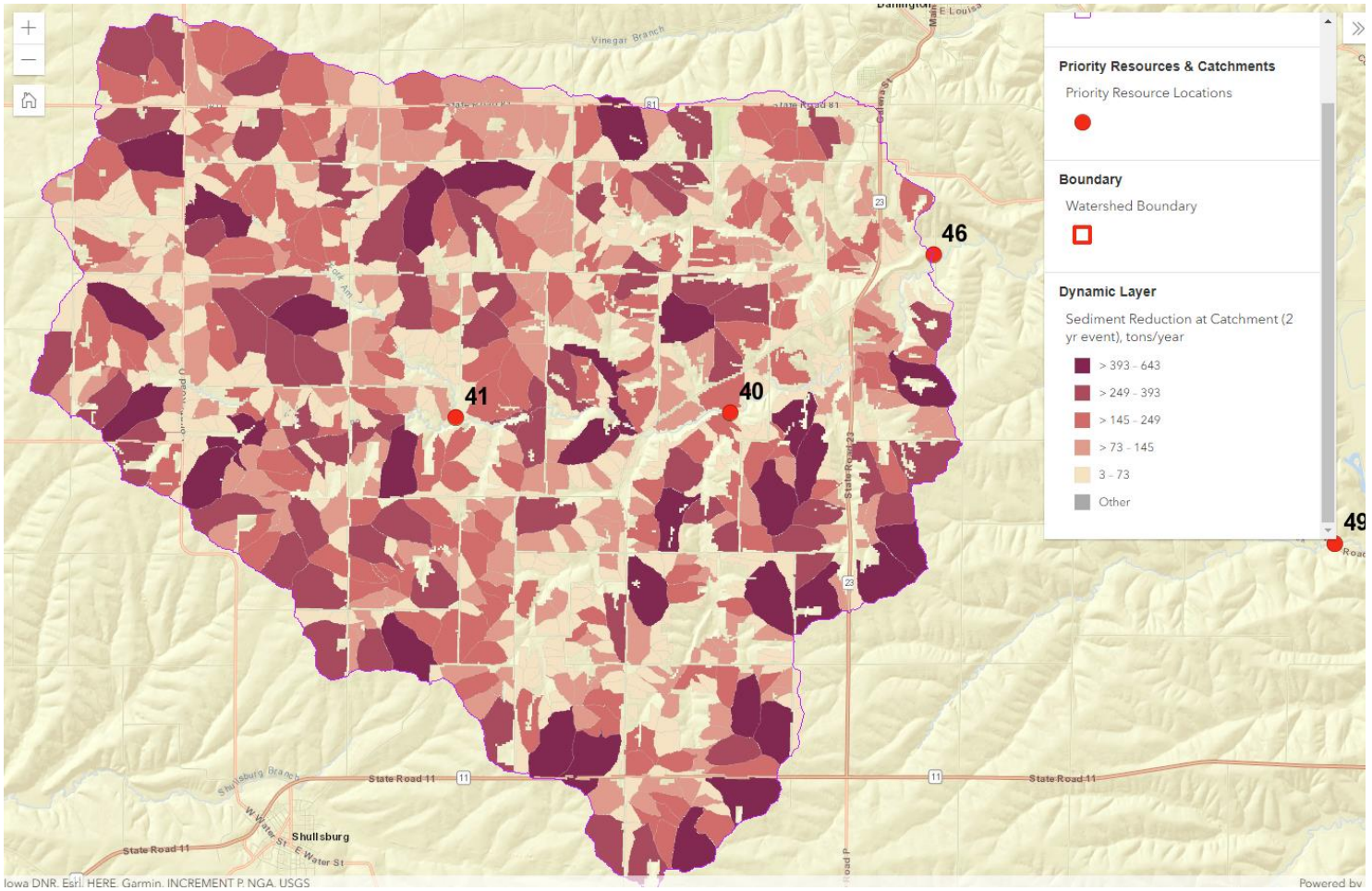
DEMO – BMP Suitability Module



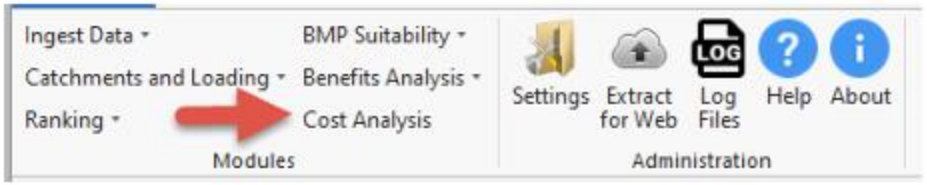


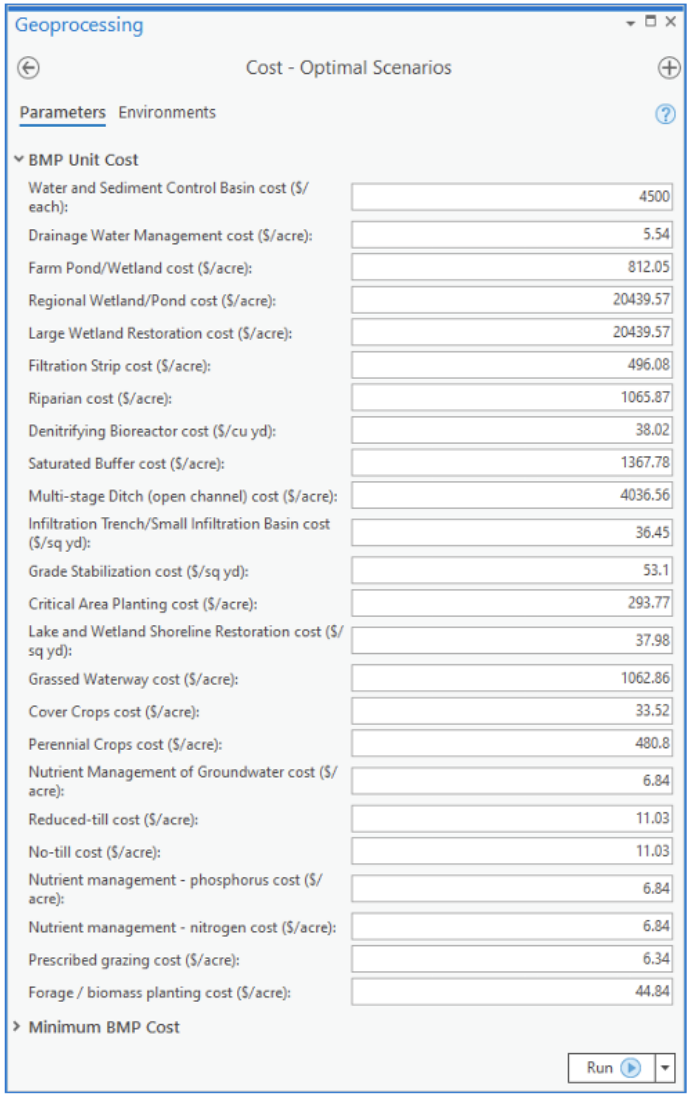
DEMO – Benefits Analysis Module





DEMO – Cost Analysis Module

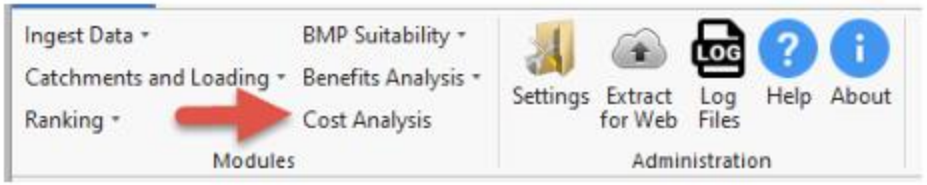


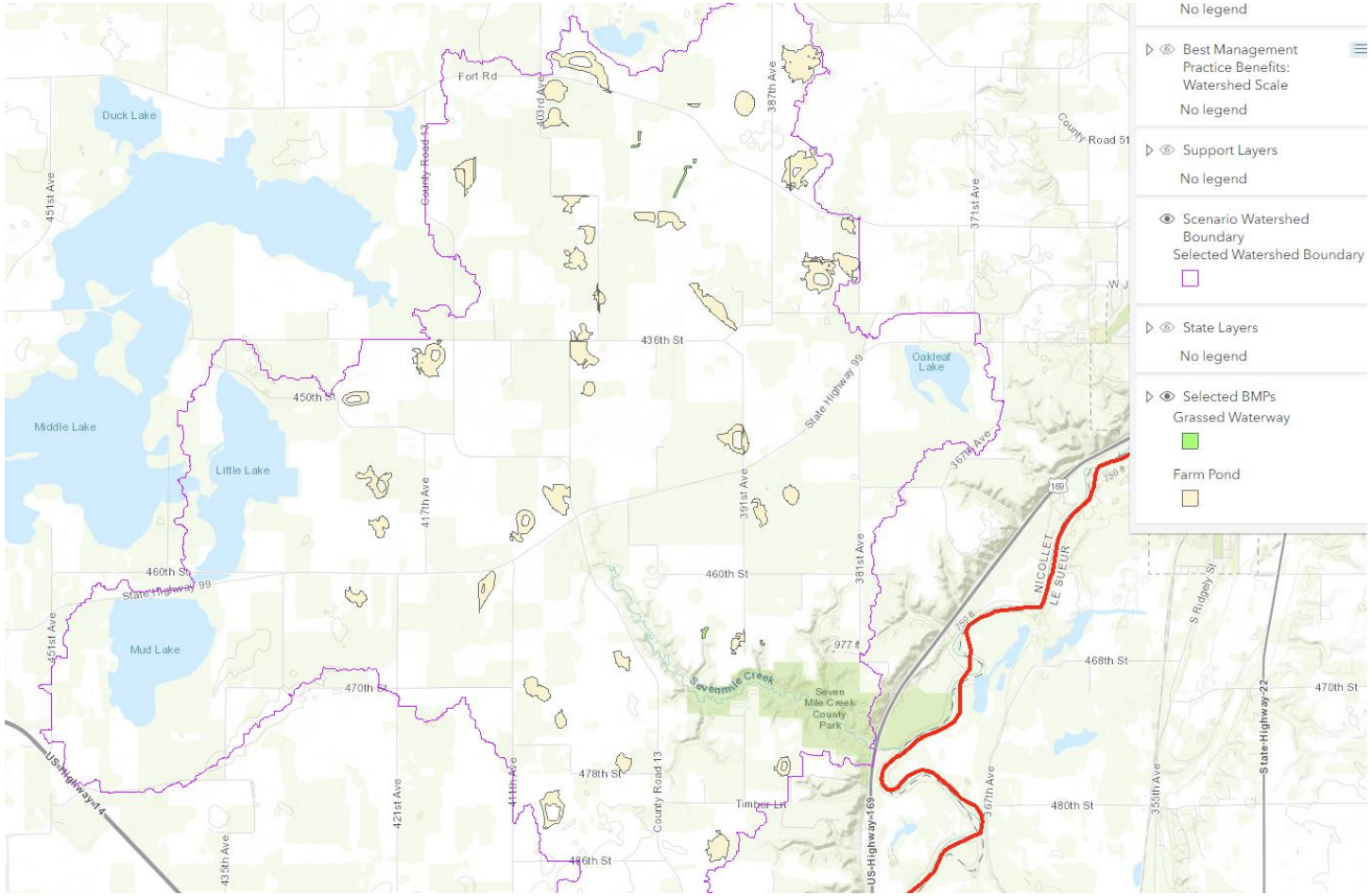


Key Steps

- Cost estimate approximated at EQIP cost-share rate
- Life cycle cost estimate

DEMO – Cost Analysis Module





Questions


BWSR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IT SERVICES


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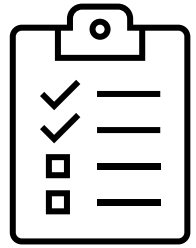
WATER
LAND &
LEGACY
AMENDMENT


HOUSTON
ENGINEERING INC.


International Water Institute

Next steps in our outcomes estimation journey

- ❑ Join December 6th for the AFT Retrospective Soil Health Calculator (R-SHEC) Tool webinar
- ❑ Fill out the 8-question (2-min) online evaluation survey
- ❑ Schedule a free "coaching" session with us
  - ❑ **Email atappross@farmland.org, RE: Coaching Request**
- ❑ Order a free print copy of the OET Guide
  - ❑ Keyword: "AFT outcomes tools"



Please keep in touch:
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Michelle

American Farmland Trust