Pioneer-Sarah Creek TMDL & WRAPS Technical Stakeholder Group Meeting

March 3, 2016

WENCK ASSOCIATES

Responsive partner.
Exceptional outcomes.

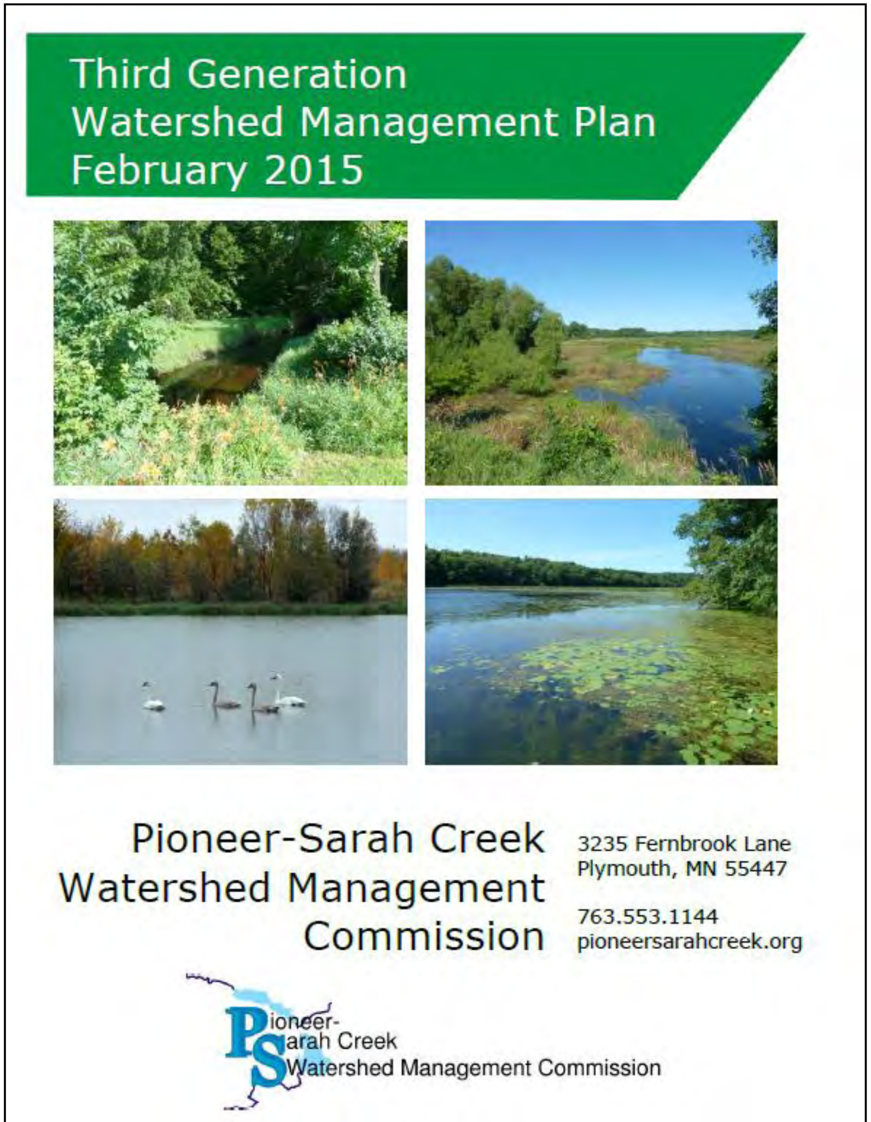
Presented by

Diane Spector, Wenck Associates, Inc.

Agenda

- Relationship to Local Water Management Plan
- TMDL Background and Definitions

Relationship to Watershed Plan



Local Water Management Plan Due:

After December 31, 2016 and
Before December 31, 2018

Thrive MSP 2040

WATER RESOURCES
POLICY PLAN

The *2040 Water Resources Policy Plan* is a framework for building strategies that integrate wastewater, water supply, and surface water as related areas of a comprehensive water picture. It provides for continued high-quality, affordable wastewater collection and treatment to support economic growth and development in ways that protect our valued water and land resources. The plan carries forward the vision of *Thrive MSP 2040* for growth and development of the Twin Cities toward economic success and vibrancy in the decades ahead.

Local Plan Requirements

- Explain how the city will implement the Commission's Plan, including specifically addressing adoption and enforcement of a manure management ordinance.
- Show how the city will take action to achieve the load reductions and other actions identified in TMDL Implementation Plans.
- Updated Implementation Plan identifying the specific structural, nonstructural, and programmatic solutions to the problems and issues identified in the LWMP.

What is a TMDL/WRAPS?

- Total Maximum Daily Load – diagnostic study that sets limits on pollutant loading
- Watershed Restoration and Protection Strategies – a report explaining the actions needed to meet the TMDLs for the impaired waters and to protect the good-quality waters
- The TMDL is the WHAT and the WRAPS is the HOW

Status of Impaired Waters

Current TMDL/WRAPS:

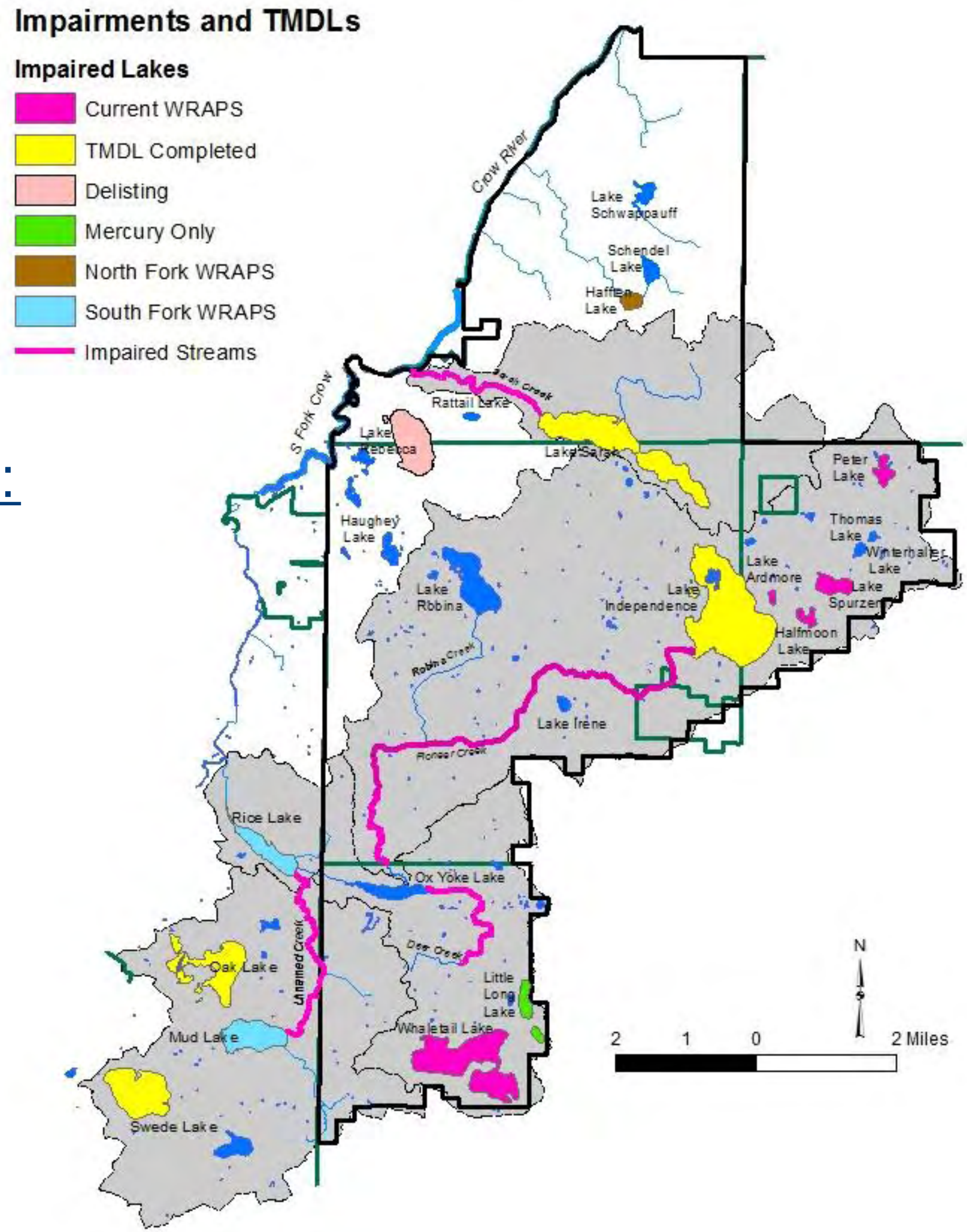
- 4 streams
- 5 lakes

Other TMDLs:

- 7 lakes

Other:

- 2 lakes



How are TMDLs calculated?

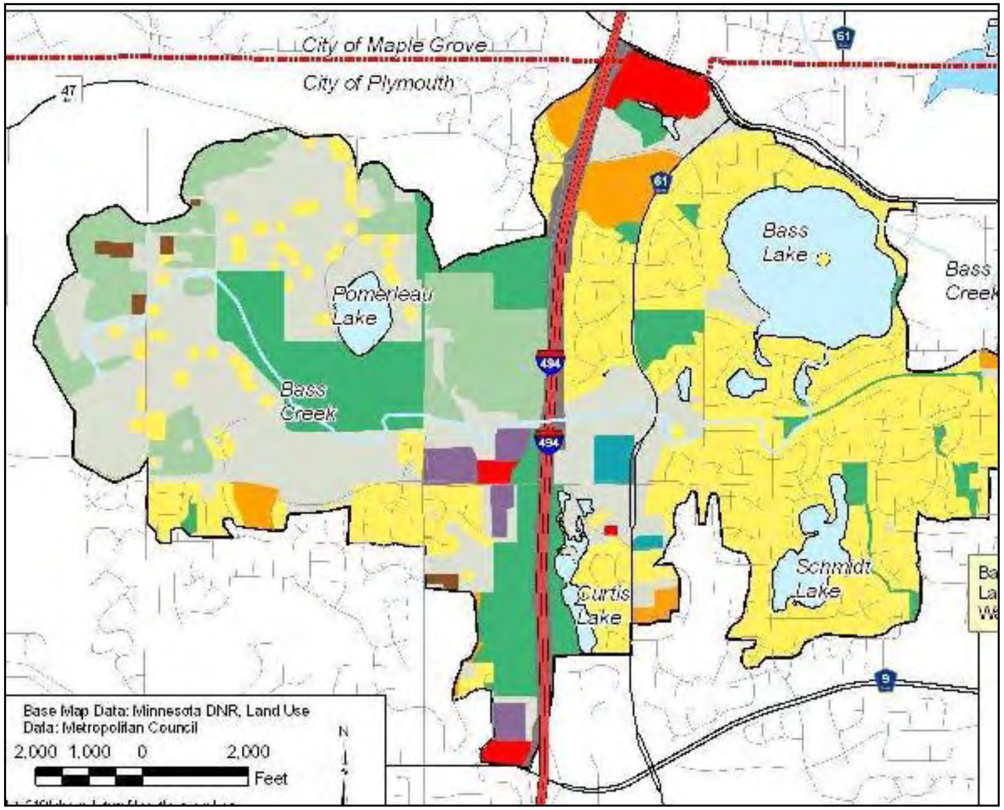
Identify and measure or quantify sources of pollutant load

- Watershed runoff
- Point sources
- Septic systems
- Lake bottom sediments
- Stream sediment oxygen demand
- Atmospheric deposition

How are TMDLs calculated?

Model watershed hydrology and pollutant loading

- Hydrologic and water quality model
- Predict runoff volume based on actual precipitation
- Predict pollutant load



How are TMDLs calculated?

Model lake or stream response

- Lake response model
- Stream model
- Inputs: annual runoff volume, load, lake volume, depth, stream shape, fitting factors
- Adjust to match actual
- *Reverse calculate maximum load*

2001 Lake Response Modeling for: Crystal Lake

Modeled Parameter	Equation	Parameters	Value [Units]
TOTAL IN-LAKE PHOSPHORUS CONCENTRATION			
	$P = \dfrac{P_i}{\left(1 + C_P \times C_{CB} \times \left(\dfrac{W_P}{V}\right)^b \times T\right)}$	as f(W,Q,V) from Canfield & Bachmann (1981)	
		C_P =	1.00 [--]
		C_{CB} =	0.162 [--]
		b =	0.458 [--]
		W (total P load = inflow + atm.) =	368 [kg/yr]
		Q (lake outflow) =	1.3 [10^6 m^3/yr]
		V (modeled lake volume) =	1.2 [10^6 m^3]
		T = V/Q =	0.87 [yr]
		P_i = W/Q =	277 [ug/l]
Model Predicted In-Lake [TP]			**93.1 [ug/l]**
Observed In-Lake [TP]			**85.0 [ug/l]**
CHLOROPHYLL-A CONCENTRATION			
	$[\text{Chl}a] = CB \times 0.28 \times [TP]$	as f(TP), Walker 1999, Model 4	
		CB (Calibration factor) =	1.00 [--]
Model Predicted In-Lake [Chl-a]			**26.1 [ug/l]**
	$[\text{Chl}a] = \dfrac{CB \times B_x}{[(1 + 0.025 \times B_x \times G)(1 + G \times a)]}$	as f(TP, N, Flushing), Walker 1999, Model 1	
		CB (Calibration factor) =	1.00
	$B_x = \dfrac{X_{pn}^{1.33}}{4.31}$	P (Total Phosphorus) =	93 [ug/l]
		N (Total Nitrogen) =	1,098 [ug/l]
		B_x (Nutrient-Potential Chl-a conc.) =	54.0 [ug/l]
	$X_{pn} = \left[P^{-2} + \left(\dfrac{N - 150}{12}\right)^{-2}\right]^{-0.5}$	X_{pn} (Composite nutrient conc.)=	60.2 [ug/l]
		G (Kinematic factor) =	0.31 [--]
		F_s (Flushing Rate) =	1.15 [$year^{-1}$]
	$G = Z_{mix}(0.14 + 0.0039 F_s)$	Z_{mix} (Mixing Depth) =	2.13 [m]
	$F_s = \dfrac{Q}{V}$; $a = \dfrac{1}{SD} - 0.025 \times [\text{Chl}a]$	a (Non algal turbidity) =	0.02 [m^{-1}]
		S (Secchi Depth) =	1.03 [m]
		Maximum lake depth =	11.89 [m]
Model Predicted In-Lake [Chl-a]			**37.9 [ug/l]**
Observed In-Lake [Chl-a]			**28.8 [ug/l]**
SECCHI DEPTH			
	$SD = \dfrac{CS}{(a + 0.025 \times [\text{Chl}a])}$	as f(Chla), Walker (1999)	
		CS (Calibration factor) =	1.00 [--]
		a (Non algal turbidity) =	0.02 [m^{-1}]
Model Predicted In-Lake SD			**1.03 [m]**
Observed In-Lake SD			**0.63 [m]**
PHOSPHORUS SEDIMENTATION RATE			
	$P_{sed} = C_P \times C_{CB} \times \left(\dfrac{W_P}{V}\right)^b \times [TP] \times V$		
		P_{sed} (phosphorus sedimentation) =	244 [kg/yr]
PHOSPHORUS OUTFLOW LOAD			
	W-P_{sed} =		124 [kg/yr]

TMDL – A Number

$$TMDL = \sum WLAs + \sum LAs + MOS + RC$$

WLA = Wasteload Allocation (permitted sources)

LA – Load Allocation (non-permitted sources)

MOS – Margin of Safety

RC – Reserve Capacity (future capacity)

What is the difference between Load and Wasteload?

A *Wasteload* is a permitted source	*Load allocations* are not regulated by permit
• Industrial point source • Construction permit • MS4s: stormwater regulated in your NPDES Phase II permits	• Internal load • Natural processes • Atmospheric deposition • Non-MS4 stormwater runoff • Ag, wetland runoff