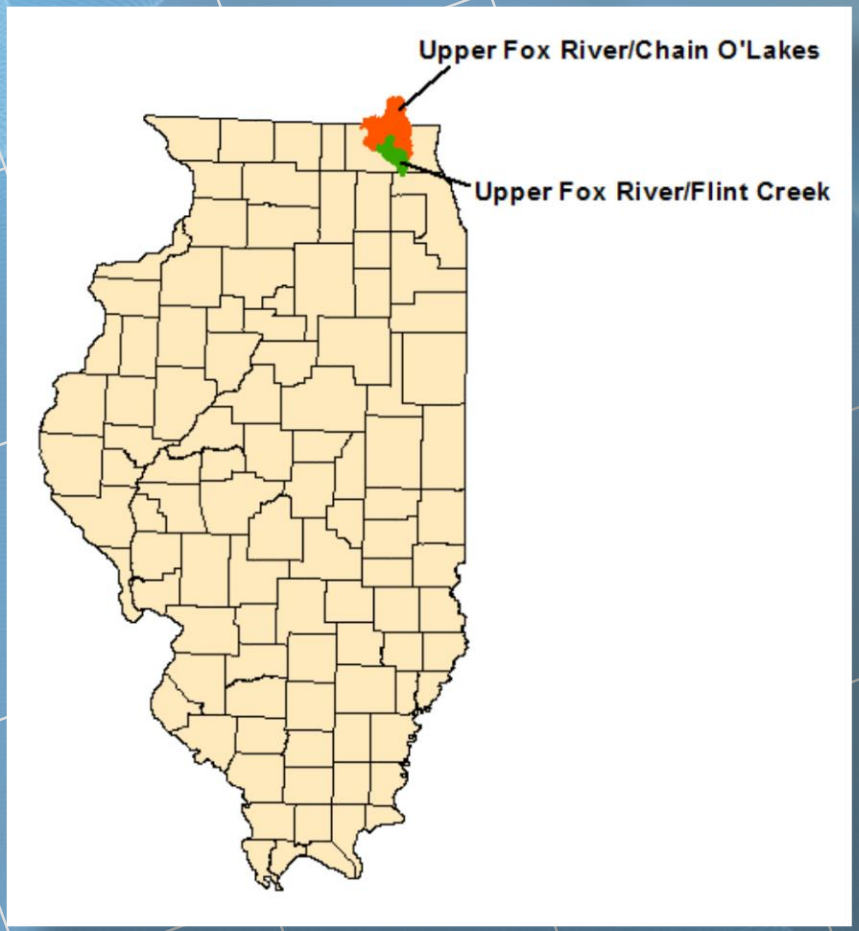
Illinois EPA

Total Maximum Daily Load Development for the Upper Fox River/Chain O'Lakes Watershed and Upper Fox River/Flint Creek Watershed

Stage 3 Public Meeting

September 11, 2019



CDM Smith

Total Maximum Daily Load (TMDL) Process

- Illinois EPA TMDL Overview
  - What is a Total Maximum Daily Load
  - TMDL vs. Load Reduction Strategy (LRS)
- Summary of Impairments
- TMDL and LRS Analysis
- Implementation Plan

Two Principal Goals of the Clean Water Act

- Restore and maintain the chemical, physical, and biological integrity of the nation's water
- Where attainable, to achieve water quality that promotes protection and propagation of fish, shellfish, and wildlife, and provides for recreation in and on the water

Water Quality Standards Consist of Three Elements

- The designated beneficial use or uses of a water body or segment of a water body
  - Recreation, aquatic life, food processing and public water supply, and aesthetic quality
- The water quality criteria that are necessary to protect the use or uses of that particular water body
  - Numeric or narrative standards
- An antidegradation policy
  - To ensure that improvements are conserved, maintained, and protected – usually via permits

TMDL Elements

**Parameters with Numeric Water Quality Standards*

$$TMDL = LC = \sum WLA + \sum LA + MOS + RC$$

- **LC** (Loading Capacity) – the maximum amount of pollution loading a water body can receive without violating water quality standards
- **WLA** (Waste Load Allocation) – the portion of the TMDL allocated to existing or future ***point sources.*** ***Reductions implemented through NPDES program**
- **LA** (Load Allocation) – the portion of the TMDL allocated to existing or future ***nonpoint sources*** and ***natural backgrounds.*** ***Reductions are voluntary.**
- **MOS** (Margin of Safety) – an accounting of uncertainty about the relationship between pollutant loads and receiving water quality
- **RC** (Reserve Capacity) – portion of the load explicitly set aside to account for growth in the watershed

LRS Elements

For Parameters without Numeric Water Quality Standards

LRS Target = Loading Capacity

- Loading Capacity – the maximum amount of pollution loading a water body can receive without violating narrative standards
- Target concentrations are developed by Illinois EPA using data from surrounding waterbodies that are currently supporting their designated uses
- LRS provides guidance for voluntary nonpoint source reductions

Illinois EPA TMDL Development Process

Watershed Characterization, Data Analysis, Methodology Selection

Stage 1:
Both Reports Completed by AECOM in 2010

Data Collection (optional)

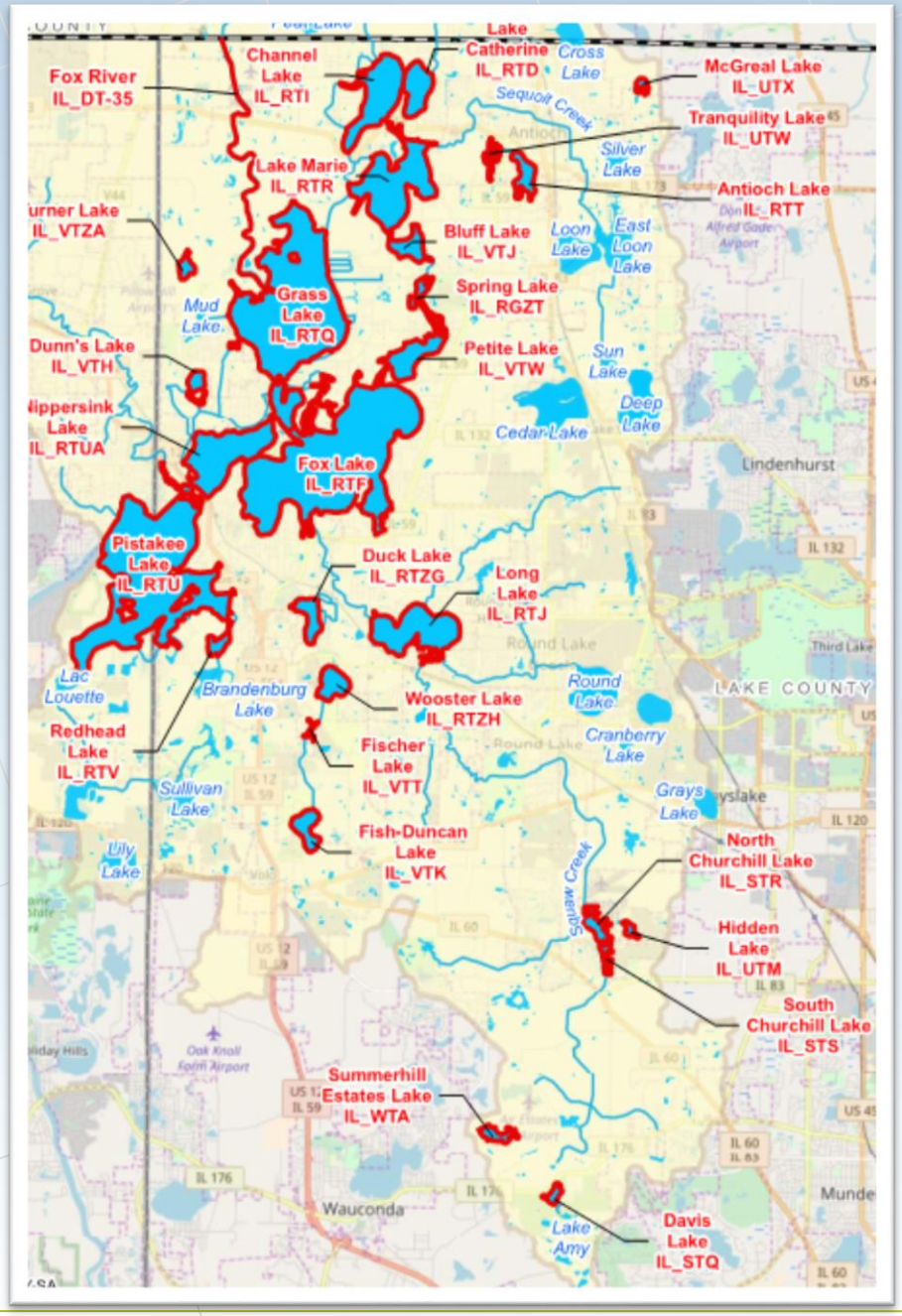
Stage 2:
Additional Sampling Since 2010

Model Calibration, TMDL Scenarios, Implementation Plan

Stage 3:
Results presented today

Stage 3 Report Contents

- Section 1 – Methodology Development
  - TMDL Overview
  - Model/Calculation Methodology and Development
- Section 2 – Total Maximum Daily Loads
  - TMDL Endpoints and LRS Targets
  - Pollutant Sources
  - TMDL Allocations and Load Reduction Strategies
- Section 3 – Implementation Plan
  - BMP Recommendations
  - Planning Level Costs and Funding Sources
  - Milestones, Monitoring, and Success Criteria
- Section 4 – References



Upper Fox River/Chain O'Lakes Impaired Segments

- A total of 28 impaired lakes
  - Large portion of the overall Chain O' Lakes system
- One impaired segment of the Fox River (DT-35)

Upper Fox River/Chain O'Lakes TMDL Impairments

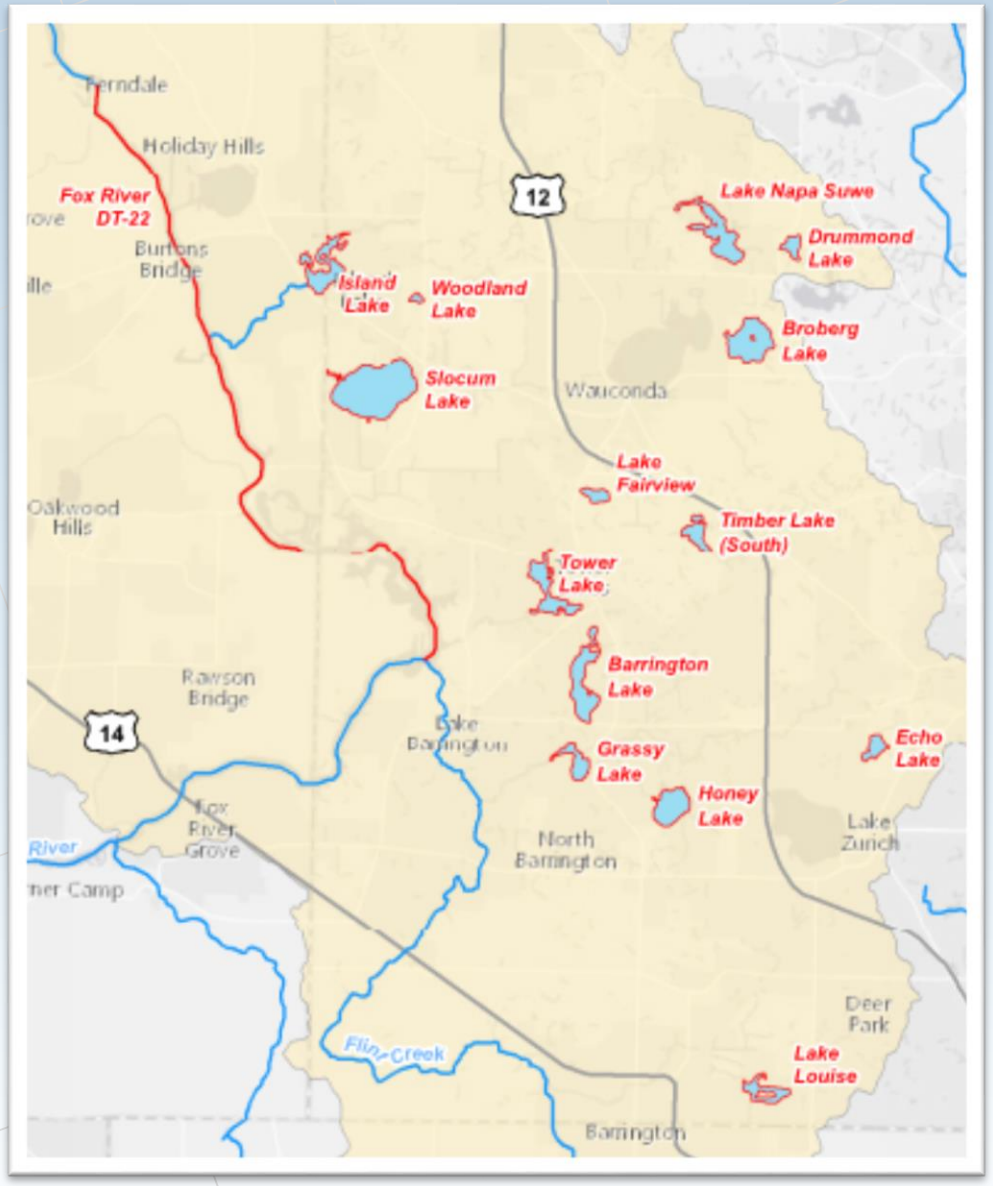
TMDL Parameters	Impaired Waterbodies	
Phosphorus	Antioch Lake (RTT)	Lake Tranquility (UTW)
	Bluff Lake (VTJ)	Long Lake (RTJ)
	Channel Lake (RTI)	McGreal Lake (UTX)
	Davis Lake (STQ)	Nippersink Lake (RTUA)
	Duck Lake (RTZG)	North Churchill Lake (STR)
	Dunn's Lake (VTH)	Petite Lake (VTW)
	Fischer Lake (VTT)	Pistakee Lake (RTU)
	Fish-Duncan Lake (VTK)	Redhead Lake (RTV)
	Fox Lake (RTF)	South Churchill Lake (STS)
	Grass Lake (RTQ)	Spring Lake (RGZT)
	Hidden Lake (UTM)[1]	Summerhill Estates Lake (WTA)
	Lake Catherine (RTD)	Turner Lake (VTZA)
	Lake Marie (RTR)	Wooster Lake (RTZH)
Fecal Coliform	Deep Lake (VTD)	

[1] Waterbody also listed as impaired for Dissolved oxygen and pH. These impairments are directly related to excess nutrients (total phosphorus) in the waterbody and are addressed via total phosphorus TMDLs.

Upper Fox River/Chain O'Lakes LRS Impairments

LRS Parameters	Impaired Waterbodies	
Total Suspended Solids (TSS)	Antioch Lake (RTT)	Nippersink Lake (RTUA)
	Bluff Lake (VTJ)	North Churchill Lake (STR)
	Dunn's Lake (VTH)	Pistakee Lake (RTU)
	Duck Lake (RTZG)	Redhead Lake (RTV)
	Fish-Duncan Lake (VTK)	Round Lake (RTH)
	Fischer Lake (VTT)	South Churchill Lake (STS)
	Fox Lake (RTF)	Spring Lake (RGZT)
	Grass Lake (RTQ)	Summerhill Estates Lake (WTA)
	Hidden Lake (UTM)	Lake Tranquility (UTW)
	Long Lake (RTJ)	Turner Lake (VTZA)
	Lake Marie (RTR)	
Sedimentation and Siltation	Fox River (DT-35)	

Upper Fox River/Flint Creek Watershed Impaired Segments



- A total of 13 impaired lakes
- One impaired segments of the Fox River (DT-22)

Upper Fox River/Flint Creek TMDL Impairments

TMDL Parameters	Impaired Waterbodies	
Phosphorus	Lake Barrington (RTZT)	Lake Napa Suwe (STO)
	Drummond Lake (UTI)	Lake Louise (VTZJ)
	Echo Lake (RTZR)	Slocum Lake (RTP)
	Grassy Lake (VTI)	Timber Lake (South) (RTZQ)
	Honey Lake (RTZU)	Tower Lake (RTZF)
	Island Lake (RTZI)	Woodland (Highland) Lake (STV)[1]
	Lake Fairview (STK)	
Fecal Coliform	Lake Barrington (RTZT)	Honey Lake (RTZU)
Chloride[2]	Fox River (DT-22)	
Copper[2]	Fox River (DT-22)	

[1] Waterbody also listed as impaired for dissolved oxygen. This impairment is directly related to excess nutrients (total phosphorus) in the waterbody and are addressed via total phosphorus TMDLs.

[2] Current impairment not confirmed. Delisting recommended.

Upper Fox River/Flint Creek LRS Impairments

LRS Parameters	Impaired Waterbodies	
Total Suspended Solids (TSS)	Lake Barrington (RTZT)	Lake Napa Suwe (STO)
	Drummond Lake (UTI)	Lake Louise (VTZJ)
	Echo Lake (RTZR)	Slocum Lake (RTP)
	Grassy Lake (VTI)	Timber Lake (South) (RTZQ)
	Island Lake (RTZI)	Tower Lake (RTZF)
	Lake Fairview (STK)	Woodland (Highland) Lake (STV)
Sedimentation and Siltation	Fox River (DT-22)	

Water Quality Data Sources

- Data compiled for each impaired waterbody during Stage 1 used in analysis
- Additional data collected by IEPA, Lake County, and others between Stage 1 and Stage 3 was incorporated as appropriate

Alkalinity, Total	Orthophosphate as P, Total
Chloride	pH
Chlorophyll a	Phosphorus
Chlorophyll a, corrected	Secchi
Dissolved Oxygen (DO)	Solids, Dissolved
E. coli	Solids, Fixed
Fecal Coliform	Solids, Suspended Volatile
Nitrogen, ammonia as N	Solids, Total
Nitrogen, Nitrite + Nitrate as N	Solids, Total Suspended (TSS)
Nitrogen, Nitrate as N	Solids, Total Volatile
Nitrogen, Nitrite as N	Specific Conductivity
Nitrogen, Total Kjeldahl	Temperature
Orthophosphate as P, Dissolved	Copper, Dissolved

Flow and Hydraulic Data Sources

- Thirteen active USGS Gages in the watersheds near impaired waterbodies
- Primary gages used in analyses include:
  - 05550001 – Fox River at Algonquin, IL
  - 05545750 – Fox River near New Munster, WI
  - 05527950 – Mill Creek at Old Mill Creek, IL
  - 05548280 – Nippersink Creek
  - 05547755 – Squaw Creek

Area Ratio Method: Flow Estimates for Ungaged Basins

$$Q_{ungaged} = Q_{gaged} \times A_{ungaged} / A_{gaged}$$

- Factors to consider in surrogate gage selection include: proximity, land use, and relative basin size

Point Source Discharges

- NPDES Permitted Facilities discharging upstream of impaired segments in the **Upper Fox River/Chain O'Lakes Watershed**:

NPDES Permit Number	Facility
IL0045144	Village of Fox Lake-Tall Oaks STP
IL0034746	Fremont School District #79
IL0046043	Camp Hickory
IL0050661	Dayspring Bible College and Seminary STP
IL0054615	Camp Henry Horner STP
IL0020354	Village of Antioch STP
IL0026093	Village of Richmond STP
IL0026433	Village of Hebron WWTP
IL0031861	City of Woodstock-North STP
IL0074985	Spring Grove STP

Point Source Discharges

- NPDES Permitted Facilities discharging upstream of impaired segments in the **Upper Fox River/Flint Creek Watershed**:

NPDES Permit Number	Facility
IL0001716	Rohm & Haas Chemical, LLC
IL0020109	Wauconda Village WWTF
IL0021067	City of McHenry Central WWTP
IL0027286	Mount Saint Joseph Home STP
IL0031933	Northern Moraine WW Rec Dist WWTP
IL0038202	IAWC-Terra Cotta STP
IL0053457	City of Crystal Lake WWTP #3
IL0065480	Snap-On Tools Co
IL0070874	Port Barrington Shores STP
IL0072851	Mathews Company
IL0074969	Johnsburg STP, Village Of
IL0075973	Oak Creek Townhomes WWTF
IL0077836	Wonder Lake Water Reclamation Facility
IL0079553	Huntsman International LLC
IL0024716	North Barrington Elementary School STP
IL0027286	Mount Saint Joseph Home-STP

Applicable Water Quality Targets: TMDL Parameters

Parameter	Water Quality Standard
Fecal Coliform	**200 cfu/100mL** (geometric mean[1])
Chloride	**500 mg/L**
Copper, Dissolved	**18.6 mg/L** (lowest calculated standard)
Total Phosphorus	**0.05 mg/L** (Lakes/Impoundments only)

[1] Geometric mean based on minimum of five samples taken over not more than a 30-day period.

Applicable Water Quality Targets: LRS Parameters

Parameter	Chain O'Lakes	Flint Creek
Sedimentation/Siltation	**13.6 mg/L** as Non-Volatile Suspended Solids (NVSS)	**7.0 mg/L** as Non-Volatile Suspended Solids (NVSS)
Total Suspended Solids	**18.2 mg/L**	**11.3 mg/L**

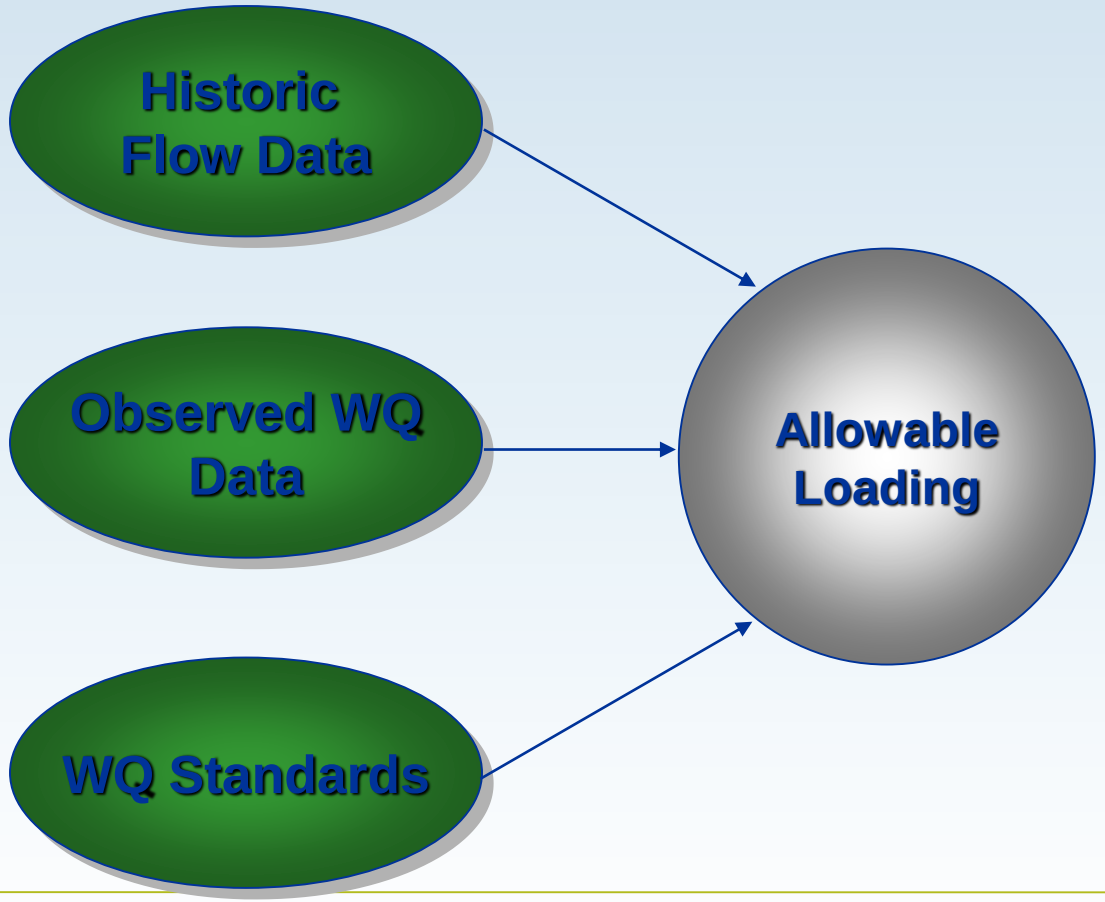
Note: LRS Parameters do not have numeric water quality standards. Targets are watershed-specific and are based on assessment of unimpaired waterbodies in each HUC 10 Basin

Methodology Overview

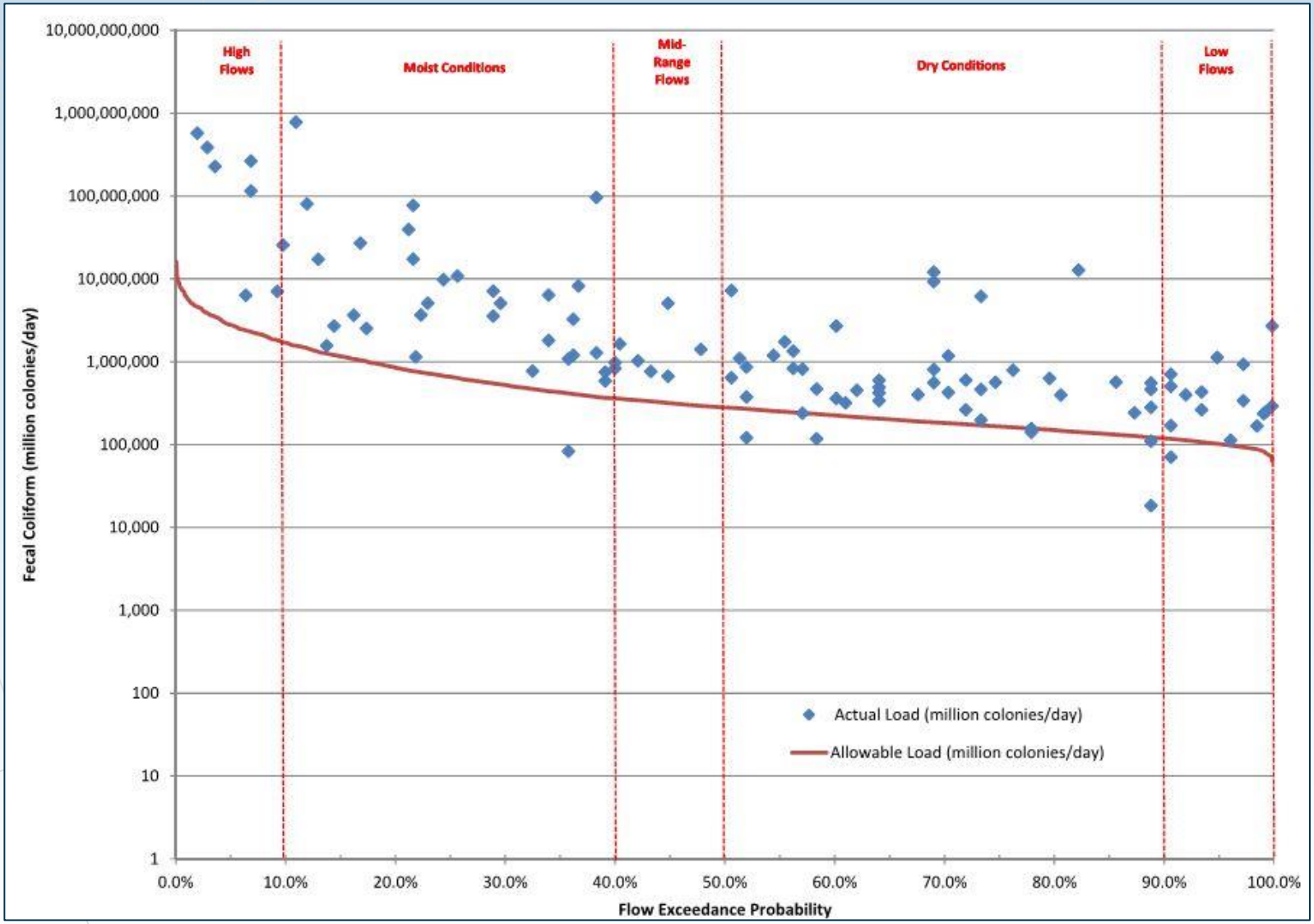
Waterbody Type	Potential Causes of Impairment	Stage 3 Assessment	Methodology
Streams	Fecal Coliform	TMDL	Load Duration Curve
	Chloride *(Fox River DT-22)*	No TMDL Developed[1]	Load Duration Curve
	Copper *(Fox River DT-22)*	No TMDL Developed[1]	Load Duration Curve
	Sedimentation & Siltation	LRS	Load Duration Curve
Lakes/ Impoundments	Total Phosphorus	TMDL	Simplified Lake Analysis Model (SLAM)
	Dissolved Oxygen *(Woodland Lake, Hidden Lake)*	No TMDL Developed	Impairment addressed through phosphorus TMDL
	TSS	LRS	Spreadsheet Loading Analysis

[1] Current impairment not confirmed during assessment, recommend delisting

Streams - Load Duration Curves (LDC) Fecal Coliform, Chloride, Copper & Sedimentation/Siltation



Load Duration Curve Example



Load Duration Curve Interpretation

Contributing Source Area	Duration Curve Zone				
	High Flow	Moist	Mid-Range	Dry	Low Flow
Point Source				M	H
Onsite Wastewater System			H	M	
Riparian Areas		H	H	H	
Stormwater: Impervious Areas		H	H	H	
Combined sewer overflows	H	H	H		
Stormwater: Upland	H	H	M		
Bank Erosion	H	M			

Loading Capacities

Fecal Coliform

Estimated Mean Daily Flow (cfs)	Load Capacity (mil.col /day)
1	4,894
10	24,466
50	48,932
100	244,663
500	489,332
1,000	2,446,689
5,000	4,893,434

Note: Segments listed for Chloride and Copper are recommended for delisting based on lack of current impairment, additional TMDL components not calculated.

Chloride

Estimated Mean Daily Flow (cfs)	Load Capacity (lbs/day)
1	2,695
10	26,953
50	134,764
100	269,529
500	1,347,643
1,000	2,695,286
5,000	13,476,428

Dissolved Copper

Estimated Mean Daily Flow (cfs)	Load Capacity (lbs/day)
1	101
10	1,002
50	5,014
100	10,025
500	50,132
1,000	100,265
5,000	1,002,646

Loading Capacities- LRS Parameters

NVSS (Fox River/Chain O'Lakes)

Estimated Mean Daily Flow (cfs)	Load Capacity (lbs /day)
1	38
10	377
50	1,887
100	3,773
500	18,867
1,000	37,734
10,000	377,340

NVSS (Fox River/Flint Creek)

Estimated Mean Daily Flow (cfs)	Load Capacity (lbs /day)
1	74
10	732
50	3,666
100	7,330
500	36,656
1,000	73,312
10,000	733,118

Note: LRS target load calculations are equivalent to loading capacities at a given flow range and do not include WLA, LA, MOS, RC allocations

LDC Seasonal Variation and Margin of Safety

- Seasonal Variation
  - Inherent in the load duration analysis due to the load duration analysis representing the range of expected stream flows
    - Critical Period for fecal coliform is primary contact recreation season (May – October)
    - Flow and concentration data trimmed to critical period for LDC analyses
- Margin of Safety (MOS)
  - An explicit 10% MOS was included to account for data variability and uncertainty

Fecal Coliform Waste Load Allocation (WLA)

- **Individual NPDES Permitted Facilities**
  - No permitted dischargers in impaired subbasins with discharges of fecal coliform
- **MS4 Discharges**
  - Represent runoff from municipal areas with separate stormwater sewer systems
  - Multiple municipalities in each segment's sub-watershed
  - Initial allocations based on proportion of watershed in each municipal area

Table 2-36 Allocation Summary for MS4s in the Tower Lake Watershed

NPDES ID	Source	Municipal Area in Subbasin (acres)	Percent of Total Municipal Area in Subbasin	Fecal Coliform MS4 Allocation (mil col/day)
ILR400209	Hawthorn Woods	422	27%	2,681
ILR400216	Lake Barrington	543	35%	3,449
ILR400228	North Barrington	114	7.3%	725
ILR400249	Tower Lakes	483	31%	3,069
ILR400501	Wauconda	3.3	0.2%	21
Total MS4		**1,565**	**100%**	**9,945**

Fecal Coliform Reserve Capacity

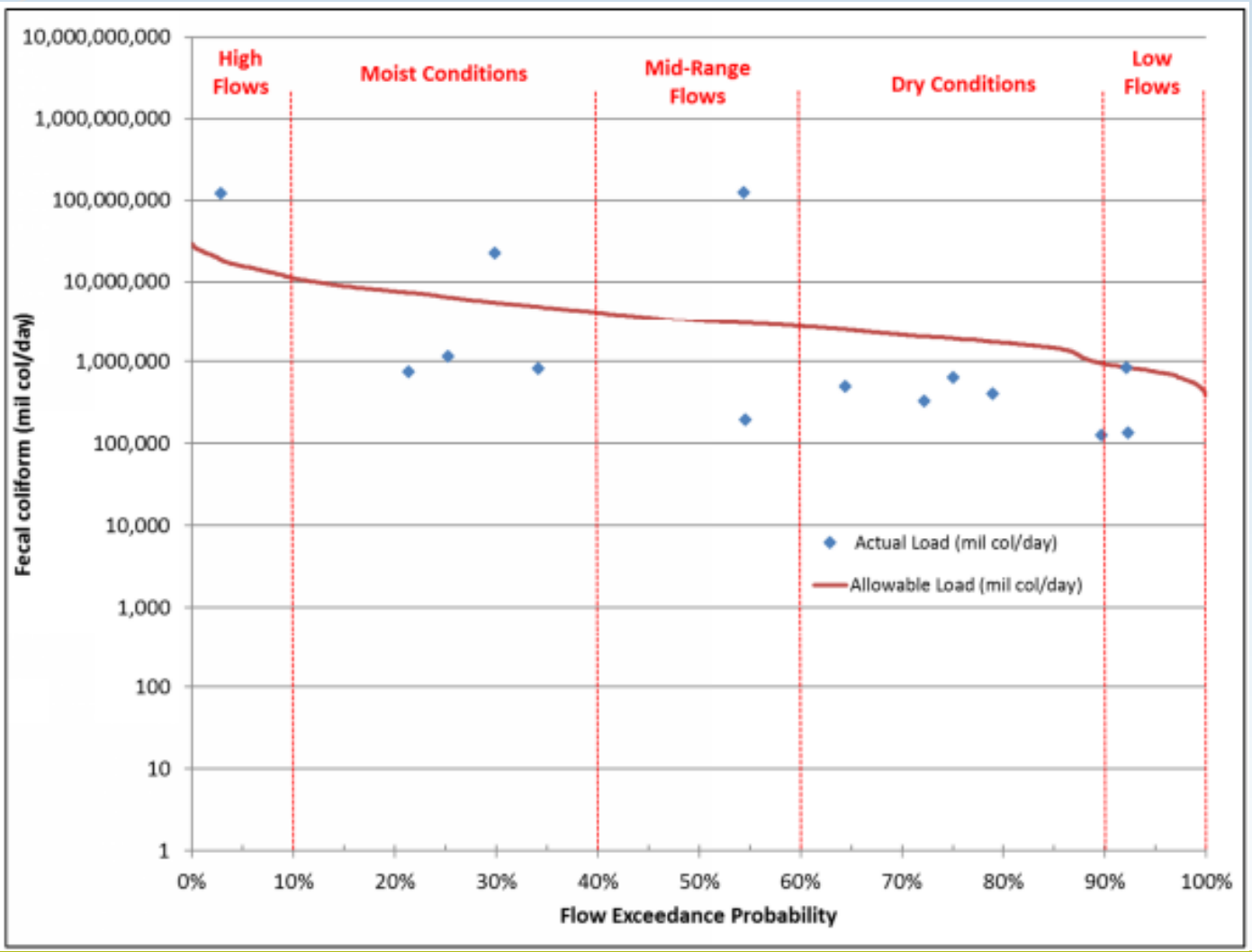
- A portion of a TMDL's LC may be set as a RC to allow for future population growth and development potentially leading to increased pollutant loads in the future.
- Not included for fecal coliform TMDL calculations due to lack of existing individual NPDES permitted facilities discharging fecal coliform to impaired subbasins

Fecal Coliform TMDL Table
Fox River DT-22

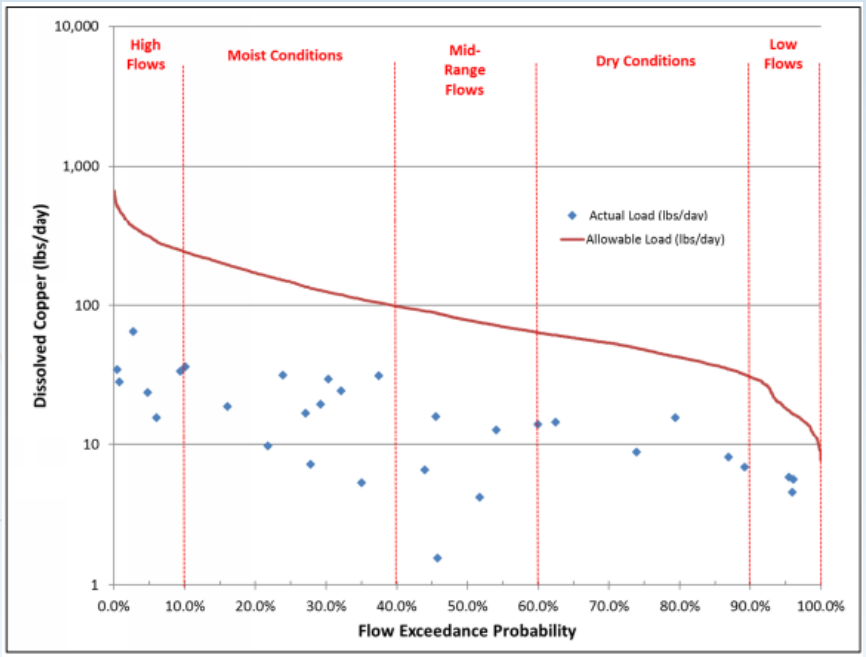
Zone	Flow Exceedance Range (%)	LC (mil col/day)	LA (mil col/day)	WLA (mil col/day)	MOS	Actual Load[1] (mil col/day)	Percent Reduction Needed (%)
High	0 - 10	15,499,866	10,946,984	3,002,895	1,549,987	121,377,401	87%
Moist	10 - 20	8,844,162	6,113,001	1,846,744	884,416	no data	no data
	20 - 30	6,508,054	4,416,305	1,440,943	650,805	18,392,022	65%
	30 - 40	4,789,031	3,167,793	1,142,335	478,903	812,008	0%
Mid-Range	40 - 50	3,598,938	2,501,136	737,908	359,894	no data	no data
	50 - 60	2,928,960	2,496,356	139,708	292,896	111,400,261	97%
Dry	60 - 70	2,404,438	2,024,286	139,708	240,444	487,058	0%
	70 - 80	1,888,731	1,560,150	139,708	188,873	586,664	0%
	80 - 90	1,439,140	1,155,518	139,708	143,914	125,854	0%
Low Flow	90 - 100	738,308	524,769	139,708	73,831	761,347	3%

[1] Actual Load was calculated using the 90th percentile of observed fecal coliform concentrations in a given flow range (EPA 2007)

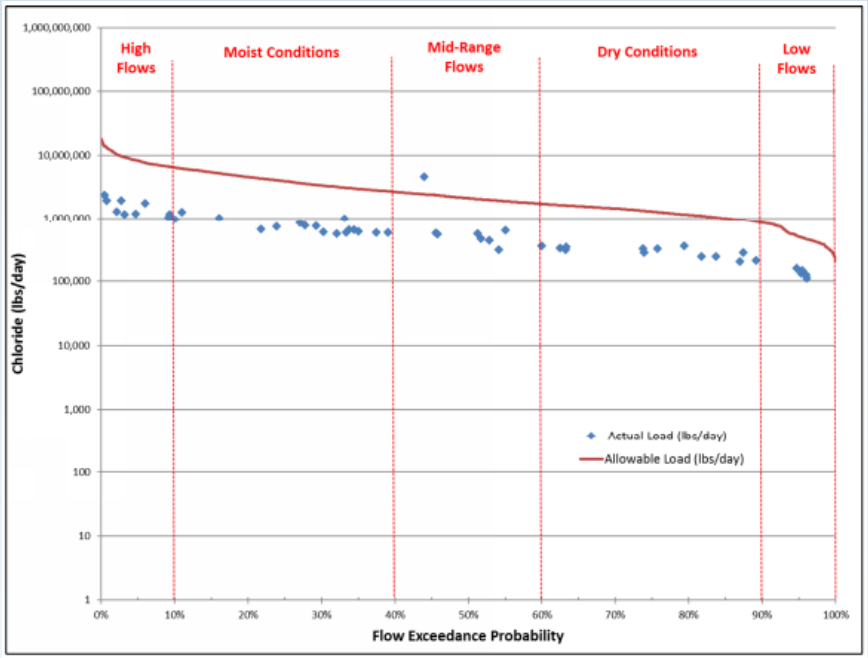
Fecal Coliform Load Duration Curve
Fox River DT-22



Other TMDL Load Duration Curves
Fox River DT-22



Copper



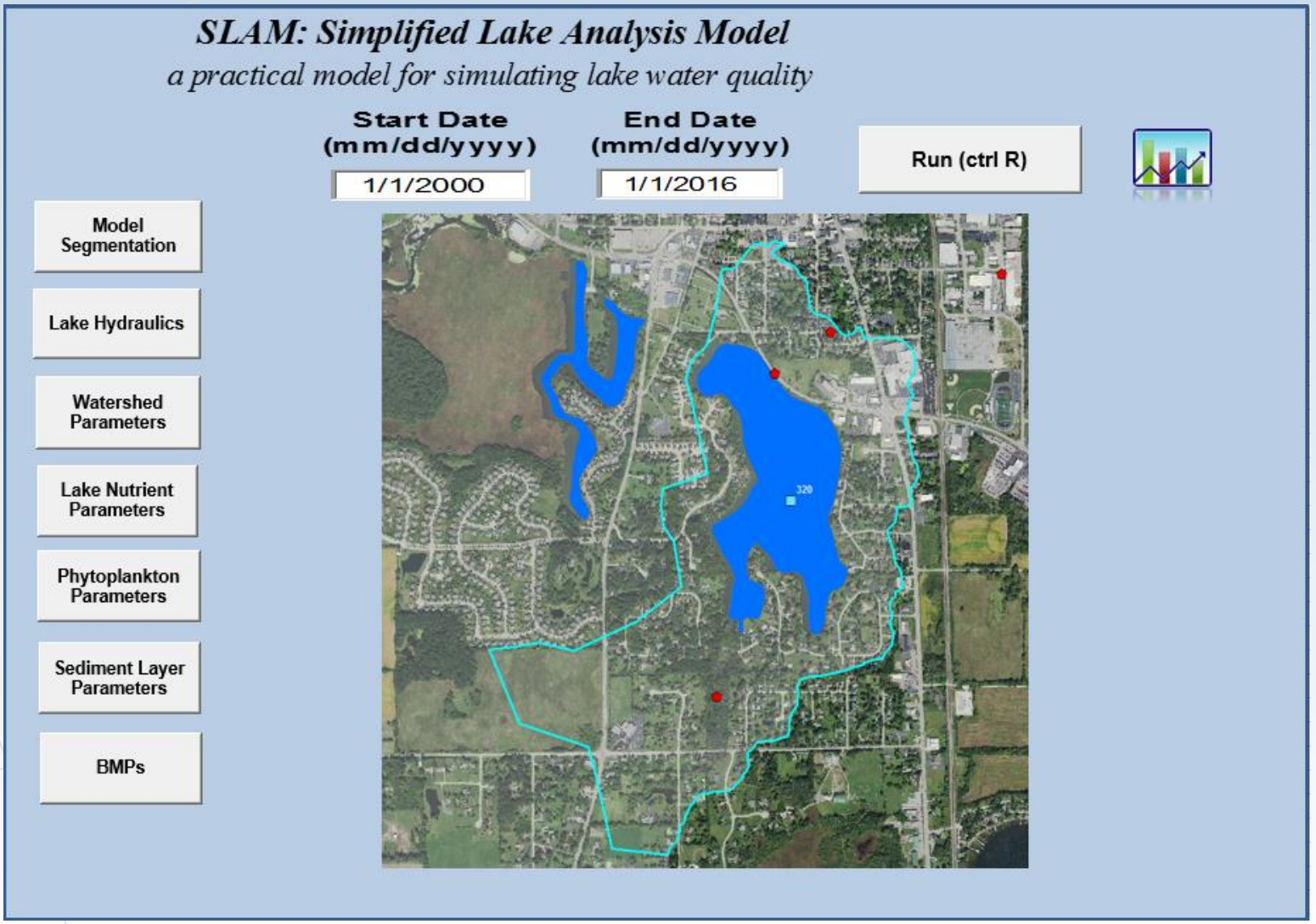
Chloride

Note: Current impairments not confirmed

Sedimentation/Siltation LRS Target Table
Fox River DT-22

Zone	Flow Exceedance Range (%)	Target Loading Capacity (lbs/day of NVSS)	Current Load[1] (lbs/day of NVSS)	Percent Reduction Needed (%)
High	0 - 10	115,437	441,772	74%
Moist	10 - 20	75,672	135,303	44%
	20 - 30	54,940	152,116	64%
	30 - 40	41,345	90,176	54%
Mid-Range	40 - 50	33,562	14,570	0%
	50 - 60	26,425	77,437	66%
Dry	60 - 70	22,041	44,220	50%
	70 - 80	18,200	27,019	33%
	80 - 90	14,088	38,707	64%
Low Flow	90 - 100	7,001	27,435	74%

SLAM Analysis for Phosphorus in Lakes



SLAM Model for TP in Lakes

- SLAM – Simplified Lake Analysis Model
- Developed for TMDL analysis of lakes and impoundments
- Represents nutrient and phytoplankton dynamics
- Builds on USEPA's BATHTUB model algorithms, but also includes:
  - Explicit modeling of lake and sediment interactions
  - Daily time-steps for inputs and outputs
  - Ability to link inputs/outputs from discrete models
- Used to model total phosphorus impairments for all impaired lakes in both watersheds (41 total lakes)

Linked SLAM Inputs/Outputs for Chain O'Lakes

Waterbody Grouping within Discrete Models	Upstream Contributing Lake(s)	Downstream Receiving Lake(s)
Antioch Lake	-	Lake Tranquility
Bluff Lake	Lake Marie	Spring Lake
Lake Catherine and Channel Lake	-	Lake Marie
Davis Lake	-	-
Duck Lake	Wooster Lake	Fox Lake
Dunn's Lake	-	Nippersink Lake
Fischer Lake	Fish-Duncan Lake	Wooster Lake
Fish-Duncan Lake	-	Fischer Lake
Fox Lake and Nippersink Lake	Grass Lake, Petite Lake, Duck Lake, Dunn's Lake, Long Lake	Pistakee Lake
Grass Lake	Lake Marie	Nippersink Lake; Fox Lake
Hidden Lake	-	-
Long Lake	-	Fox Lake
Lake Marie	Lake Catherine and Channel Lake, Lake Tranquility	Grass Lake; Bluff Lake
McGreal Lake	-	-
North and South Churchill Lake	-	-
Petite Lake	Spring Lake	Fox Lake
Pistakee Lake	Nippersink Lake, Redhead Lake	-
Redhead Lake	-	Pistakee Lake
Spring Lake	Bluff Lake	Petite Lake
Summerhill Estates Lake	-	-
Lake Tranquility	Antioch Lake	Lake Marie
Turner Lake	-	-
Wooster Lake	Fischer Lake	Duck Lake

SLAM Model Inputs

- **Lake morphology and hydraulics**: surface area, average and maximum depth, volume, inflows, mixing lengths, and thermal stratification
- **Model segmentation**: number of geographically distinct segments of a reservoir to be modeled, flow direction, and an estimate of longitudinal dispersion between segments
- **Watershed inflows**: estimated runoff and point source discharge into the reservoir's watershed, and average annual phosphorus load to each segment as a function of land use using runoff coefficients and point source data
- **In-lake nutrients**: initial nutrient concentrations in the lake; estimates of settling velocity nutrient uptake; and burial fractions. Seasonality factors may be included to account for expected variations in settling velocity and nutrient uptake over time.
- **Sediment layer dynamics**: sediment characteristics used for calculating nutrient fluxes, or seasonally prescribed nutrient fluxes can be used.

Total Phosphorus Loading Capacity
Fox River/Flint Creek Watershed

Waterbody	Segment	Total Phosphorus Loading Capacity (lbs/day)
Lake Barrington	RTZT	0.656
Drummond Lake	UTI	0.124
Echo Lake	RTZR	0.582
Grassy Lake	VTI	1.497
Honey Lake	RTZU	0.654
Island Lake	RTZI	2.297
Lake Fairview	STK	1.127
Lake Napa Suwe	STO	0.415
Lake Louise	VTZJ	0.392
Slocum Lake	RTP	2.660
Lake Louise	VTZJ	0.390
Timber Lake (South)	RTZQ	0.550
Slocum Lake	RTP	2.665
Timber Lake (South)	RTZQ	0.548
Tower Lake	RTZF	1.121
Woodland (Highland) Lake	STV	0.038

Total Phosphorus Loading Capacity
Fox River/Chain O'Lakes Watershed

Waterbody	Segment	Loading Capacity (lbs/day)
Antioch Lake	RTT	0.60
Bluff Lake	VTJ	2.88
Lake Catherine	RTD	4.83
Channel Lake	RTI	6.80
Davis Lake	STQ	0.30
Duck Lake	RTZG	2.98
Dunn's Lake	VTH	0.79
Fischer Lake	VTT	1.22
Fish-Duncan Lake	VTK	1.77
Fox Lake	RTF	54.4
Grass Lake	RTQ	101.1
Hidden Lake	UTM	0.10
Long Lake	RTJ	13.2
Lake Marie	RTR	11.3

Waterbody	Segment	Loading Capacity (lbs/day)
McGreal Lake	UTX	0.19
Nippersink Lake	RTUA	49.1
North Churchill Lake	STR	0.51
Petite Lake	VTW	4.73
Pistakee Lake	RTU	149
Redhead Lake	RTV	0.54
South Churchill Lake	STS	0.39
Spring Lake	RGZT	1.72
Summerhill Estates Lake	WTA	0.20
Lake Tranquility	UTW	0.41
Turner Lake	VTZA	0.60
Wooster Lake	RTZH	3.69

Total Phosphorus Seasonal Variation and Margin of Safety

- Seasonal Variation
  - Accounted for by developing the model and performing all calculations of load on a multi-year basis.
  - Modeling was performed to project over a 16-year period (2000-2015)
- Margin of Safety (MOS)
  - Both Implicit and Explicit
  - Implicit – conservative assumptions and model coefficients used
  - Explicit – an additional 10% MOS was included to account for data variability and uncertainty

Total Phosphorus Waste Load Allocation (WLA)

- Individual NPDES Permitted Facilities
  - Two facilities contributing to lakes in Flint Creek Watershed
  - Ten facilities contributing to lakes in Chain O'Lakes Watershed

Fox River/Flint Creek Individual Permitted WLAs

NPDES Permit Number	Permit Name	Sub-watershed	Estimated Total Phosphorus Concentration (mg/L)	DAF (MGD)	WLA-DAF[1] (lbs/day)
IL0024716	North Barrington Elementary School STP	Grassy Lake	7.0[1]	0.005	0.292
IL0027286	Mount Saint Joseph Home-STP	Grassy Lake	5.0[1]	0.0125	0.521
				Total WLA	**0.813**

[1] Facility does not have permit limits for total phosphorus, but may have potential to discharge phosphorus in effluent. Estimated discharge concentrations derived using data for comparable facilities with similar treatment processes.

Total Phosphorus Waste Load Allocation (WLA)

Fox River/Chain O'Lakes Individual Permitted WLAs

NPDES Permit Number	Facility Name	Impacted Lake/Model	Model Calibration		TMDL/WLA Calculations		
			Current Average Measured Flow (MGD)	Current Average Effluent Concentration (mg/L of P)	DAF (MGD)	Permit Effluent Limit (mg/L of P)	WLA (lbs/day)
IL0045144	Village of Fox Lake-Tall Oaks STP	Dunn's Lake	0.152	0.480	0.5	1.0	0.63[1]
IL0034746	Fremont School District #79[2]	Long Lake	0.005	5.0[3]	0.01	n/a	0.42
IL0046043	Camp Hickory[2]	Long Lake	0.014	5.0[3]	0.014	n/a	0.58
IL0050661	Dayspring Bible College and Seminary STP[2]	Long Lake	0.009	5.0[3]	0.03	n/a	1.25
IL0054615	Camp Henry Horner STP	Wooster Lake	0.0014	3.872	0.014	n/a	0.45[4]
IL0020354	Village of Antioch STP	Lake Marie	1.32	0.752	2.0	1.0	8.26[1]
IL0026093	Village of Richmond STP	Pistakee Lake	0.311	0.586	0.5	1.0	4.17
IL0026433	Village of Hebron WWTP	Pistakee Lake	0.078	0.502	0.33	1.0	2.75
IL0031861	City of Woodstock-North STP	Pistakee Lake	2.175	0.578	3.5	1.0	29.2
IL0074985	Spring Grove STP	Pistakee Lake	0.042	5.0[3]	0.075	n/a	3.13

Total Phosphorus Waste Load Allocation (WLA)

- MS4 Discharges
  - Represent runoff from municipal areas with separate stormwater sewer systems
  - Multiple municipalities in many of the lake watersheds
  - 100% of the watershed may be within a MS4 permitted municipal area in some cases
  - Allocations based on proportion of watershed in each municipal area

Table 2-23 Allocation Summary for MS4s in the Wooster Lake Watershed

Source	NPDES ID	Municipal Area in Subbasin (acres)	Percent of Total Subbasin Area	Total Phosphorus WLA (lbs/day)
Fox Lake Village	ILR400339	132	25.0%	0.047
Round Lake Village	ILR400243	78.9	15.0%	0.028
Volo Village	ILR400657	6.3	1.2%	0.002
Total MS4		**217**	**41.1%**	**0.078**

Total Phosphorus Reserve Capacity

- A portion of a TMDL's LC may be set as a RC to allow for future population growth and development potentially leading to increased pollutant loads in the future.
- Explicit RC was not included in the total phosphorus TMDL calculations for lakes without POTWs or other point sources that may be expected to increase discharge as a result of projected population growth in the area.
- Implicit RC included for Long, Pistakee, and Wooster Lakes through using permitted facility design flows as TMDL model inputs which are considerably greater than existing discharge flows used in calibration models.
  - Room for growth built in to the permits already

Example Total Phosphorus TMDL for Lakes

Table 2-39 TMDL Summary for North (STR) and South Churchill (STS) Lakes

Segment	Loading Source	LC (lbs/day)	WLA-MS4s (lbs/day)	WLA-Facilities (lbs/day)	LA (lbs/day)	MOS (10% of LC)	Current Load (lbs/day)	Reduction Needed (lbs/day)	Reduction Needed (Percent)
North Churchill Lake	Internal	0.082	-	-	0.074	0.008	0.17	0.09	52%
	External	0.43	0.39	-	-	0.043	1.08	0.65	60%
	Total	0.51	0.39	-	0.074	0.051	1.25	0.74	59%
South Churchill Lake	Internal	0.30	-	-	0.27	0.030	0.62	0.32	52%
	External	0.091	0.034	-	0.049	0.009	0.18	0.09	50%
	Total	0.39	0.034	-	0.32	0.039	0.80	0.41	52%
Combined Total	Internal	0.38	-	-	0.34	0.038	0.79	0.41	52%
	External	0.52	0.42	-	0.049	0.052	1.26	0.74	59%
	Total	0.90	0.42	-	0.39	0.090	2.05	1.15	56%

- Overall phosphorus reductions needed in impaired lakes range from 15% to 85%

Spreadsheet Loading Analysis
TSS in Lakes

- For Developing LRS for TSS impaired lakes
  - 21 TSS impairments in the Chain O'Lakes Watershed
  - 12 TSS impairments in the Upper Fox/Flint Creek Watershed
- Spreadsheet calculations:
  - Using inputs and data developed through SLAM assessments (flow, volume, loads, etc.)
  - Calculate current loads and loading capacity to determine load reduction requirements

Table 2-42 LRS Summary for TSS in Lake Barrington

Location	Target Concentration (mg/L)	Existing Concentration[1] (mg/L)	Average Overland and Tributary Flow (cfs)	Target Loading Capacity (lbs/day)	Current Load[1] (lbs/day)	Percent Reduction Needed (%)
RTZT	11.3	13.0	0.4	24	27	13%

[1] Existing Concentration was calculated using the 90th percentile of observed TSS concentrations in a given location (USEPA 2007)

Implementation Plan for Upper Fox River Watersheds

- Identify Best Management Practices (BMPs) to help meet water quality criteria
- Provides general watershed-wide implementation strategies
- USEPA nine minimum elements of a watershed plan
- Intended to supplement existing watershed plans
- Additional input from public on site-specific practices and plans can be included in final plan

Existing Watershed Planning Documents Chain O'Lakes Watershed

- *Fish Lake Drain Watershed Management Plan* (Lake County Stormwater Management Commission [LCSMC] 2008)
- *Squaw Creek Watershed Management Plan* (LCSMC 2004a)
- *Letter to IEPA regarding stakeholder priority projects for Long Lake* (Illinois Sierra Club 2017)
- *Sequoit Creek Watershed Management Plan* (LCSMC 2004b)
- *Lake Catherine/Channel Lake-Lake Management Plan* (Friends of Lake Catherine & Channel Lakes 2017)
- *The Nippersink Creek Watershed Plan* (Watershed Resource Consultants, Inc. Fluid Clarity, Ltd, and The Nippersink Creek Watershed Planning Committee 2008)

Existing Watershed Planning Documents Fox River/Flint Creek Watershed

- *9 Lakes Watershed-Based Plan* (Chicago Metropolitan Agency for Planning's [CMAP] 2014)
- *Boone-Dutch Creek Watershed Plan* (CMAP 2016)
- *Silver Creek and Sleepy Hollow Creek Watershed Action Plan* (CMAP 2011)

USEPA Nine Minimum Elements

1. Identify causes and sources of pollution
2. Describe the nonpoint source BMPs needed
3. Estimate pollutant load reductions expected through BMPs
4. Estimate the level of technical assistance needed, associated costs, potential funding sources
5. Include public information/education component
6. Develop implementation schedule
7. Develop measurable interim milestones
8. Identify indicators of improvement
9. Develop a monitoring component

Adaptive Management

- Phased approach
  - Acknowledges uncertainty about what policy or practice is “best”
  - Thoughtful selection of the policies or practices to be applied
  - Careful implementation designed to reveal the critical knowledge that may be currently lacking
  - Monitoring of key response indicators
  - Incorporation of the results into future decisions

Potential BMPs for Load Reductions

TSS

- Filter strips
- Urban Reforestation/Riparian Buffer Restoration
- Wetlands
- Stormwater Retention Basins (dry and wet ponds)
- Vegetated Swales
- Permeable Pavement
- Sand Filters
- Compost Blankets, Filter Berms, and Filter Socks
- Rain Barrels/Rain Gardens/Green Roofs
- Bio-Retention Cells
- Streambank Stabilization and Erosion Control
- Street Sweeping

Phosphorus

- Same as TSS, plus phosphorus-based lawn fertilizer restrictions

Fecal Coliform

- Illicit discharge elimination
- Pet waste education
- Septic system maintenance

Potential BMPs

Filter Strips

- Control contaminant levels by removing loads from runoff
- Filter strip widths based on slopes
- Varying slopes and soil types in watersheds

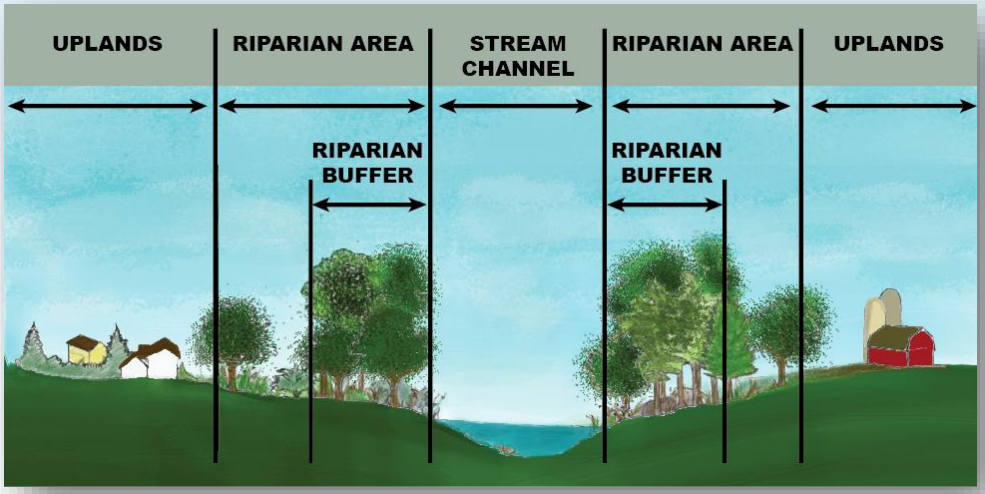
NRCS Filter Strip Flow Lengths Based on Slope

Percent Slope	0.5%	1.0%	2.0%	3.0%	4.0%	≥ 5.0%
Minimum (ft)	36	54	72	90	108	117
Maximum (ft)	72	108	144	180	216	234

Fox River/Chain O'Lakes – Filter Strip Example

Riparian Buffers

- Control contaminants by filtering loads from runoff
- Enhanced infiltration of runoff
- Add stability to streambanks
- Reduce erosion
- Benefit aquatic life through water temperature and dissolved oxygen improvements
- Added benefits to wildlife



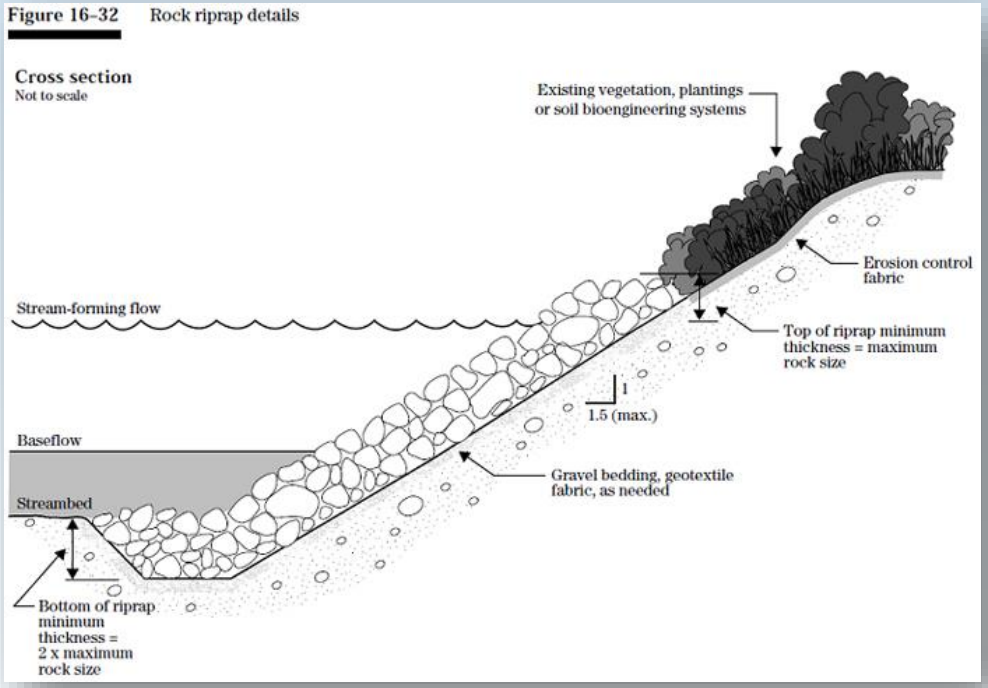
www.mychamplain.net

Stormwater Retention Basins

- Trap sediment prior to reaching a receiving water
- Typically earthen embankments
- Release water slowly to filter sediments and slow high flows through the receiving water, reducing instream erosion

Streambank Stabilization/Erosion Control

- **Stone Toe Protection** – bank stabilization
- **Rock Riffle Grade Control** – pool/riffle sequence
- **Floodplain Excavation** – decrease bank slope



http://www.tippecanoecountyswcd.org

Cost Estimates of BMPs

- Estimated costs for BMPs provided in Implementation Plans
  - NRCS EQIP repayment schedules
- Provided on a general per-unit basis (acre, site, etc.)
- Many costs are site-specific and can be highly variable

Information and Education

- Public education and participation is key to successful implementation
- Increased public awareness can increase implementation of BMPs
- Small incremental improvements and individual adoption of BMPs can result in much lower costs
- Watershed groups, public meetings, ongoing efforts:
  - Fox Waterway Agency
  - Lake County Stormwater Management Commission (SMC)
  - Fox River Ecosystem Partnership
  - Flint Creek Watershed Partnership

Funding Programs for Conservation/Implementation

- The Conservation Fund
- Streambank Stabilization and Restoration Program
- Clean Water Act Section 319 Grants
- Wetland Program Development Grants
- Rivers, Trails, and Conservation Assistance
- Great Lakes Restoration Initiative
- Agricultural Conservation Easement Program
- Environmental Quality Incentive Program

Local SWCD and NRCS Contact Information

County	Address	Phone
Cook County	2358 Hassell Rd, Suite B Hoffman Estates, IL 60169	(630) 584-8240
Lake County & McHenry County	1648 S Eastwood Dr. Woodstock, IL 60098	(815) 338-0099

Implementation Milestones

Milestones	Description	Estimated Schedule
Funding	Develop grant application(s)	Short term: 1-2 years
Implement Short-term Projects	Identify and implement short-term pilot projects that can be completed (i.e. willing landowners and available funding)	Mid-term: 2-5 years
Monitoring	Implement monitoring plan	Continuous: 1-20 years
Annual Stakeholder meetings	Stakeholders will convene once a year to gauge progress and discuss evolving needs and planned activities	Annually
Implement Larger Projects	Identify and implement larger projects. These projects are more likely to have multiple funding sources and stakeholders.	Mid- Term: 5-10 years
Education and outreach	Prepare and implement and education and outreach plan. Conduct at least two public meetings annually.	Immediate and Continuous: 1-20 years

Monitoring Plan

Tracking the implementation of management measures to address the following goals:

- Track implementation of BMPs in the watershed
- Estimate effectiveness
- Further monitoring of point source contributions
- Continued monitoring of impaired segments/tributaries – under various flow scenarios
- Conduct an storm sewer surveys to assess contributions
- Monitor storm-based high flow events
- Low flow monitoring of total phosphorus, chloride, DO, TSS, and fecal coliform in impaired streams and Lakes
- Dry weather monitoring of stormwater outfalls

Monitoring Plan

Tracking the implementation of management measures to address the following goals:

- Determine the extent to which management measures and practices have been implemented compared to action needed to meet TMDL endpoints
- Establish a baseline from which decisions can be made regarding the need for additional incentives for implementation efforts
- Measure the extent of voluntary implementation efforts
- Support work-load and costing analysis for assistance or regulatory programs
- Determine the extent to which management measures are properly maintained and operated

Implementation Time Line

- Should occur in phases
- Effectiveness should be measured along the way
- Funding takes time (months to years)
- Implementation after funding takes time (years)
- Results follow

Success Criteria

- Implementing BMPs should lead to improved water quality and attainment of designated uses and water quality standards
- Key components of project success include:
  - Securing funding for priority projects within 5 years
  - Meeting milestones identified
  - Meeting 25-50% of target reductions within 10 years
  - Meeting 100% of target reductions within 20 years
  - Utilizing adaptive management to ensure best practices
  - Delisting of the impaired waterbodies

Project Contacts

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http://www.epa.state.il.us/water/tmdl/report-status.html