Planning for a Water Quality Monitoring Effort

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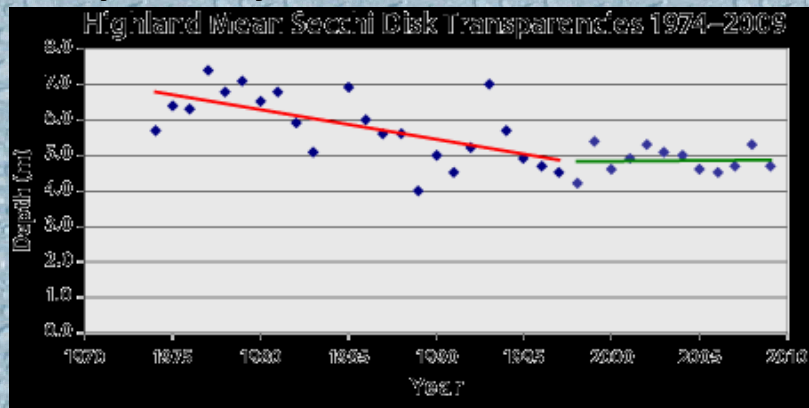
Red Lake Watershed District
BWSR Academy, October 26, 2011

Questions

- What are our reasons for monitoring?
- Where do I monitor?
- What do I monitor for?
- How do I collect the data?
- What do I do with the data?
- Who will use the information I gather?
- Where can I get help?

Reasons for Monitoring Water Quality

- Assessment
  - Is the water quality good enough to support aquatic life and recreation?
- Trends
  - Is the water quality improving over time?
- Project effectiveness
  - Has the project improved water quality?
  - Pre/post project monitoring
  - Get started early

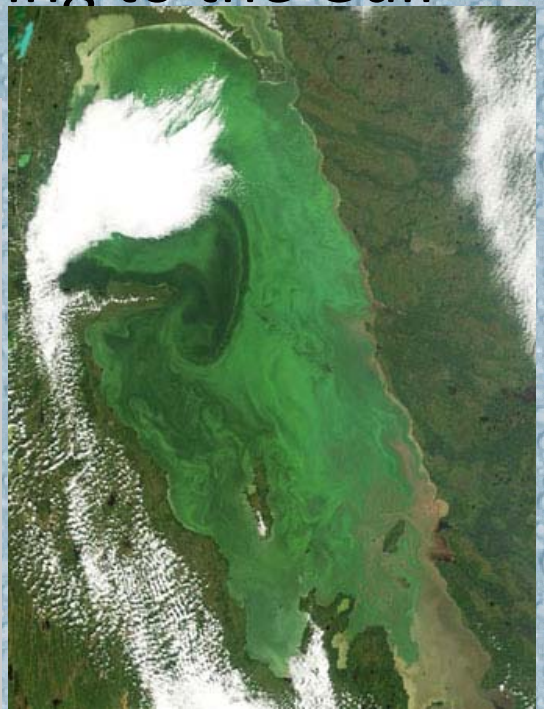


Reasons for Monitoring Water Quality

- Public information
- Public health concerns
- Investigation
  - Wastewater/chemical spills/discharges

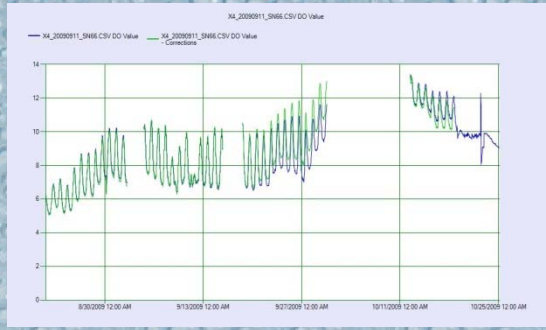
Reasons for Monitoring Water Quality

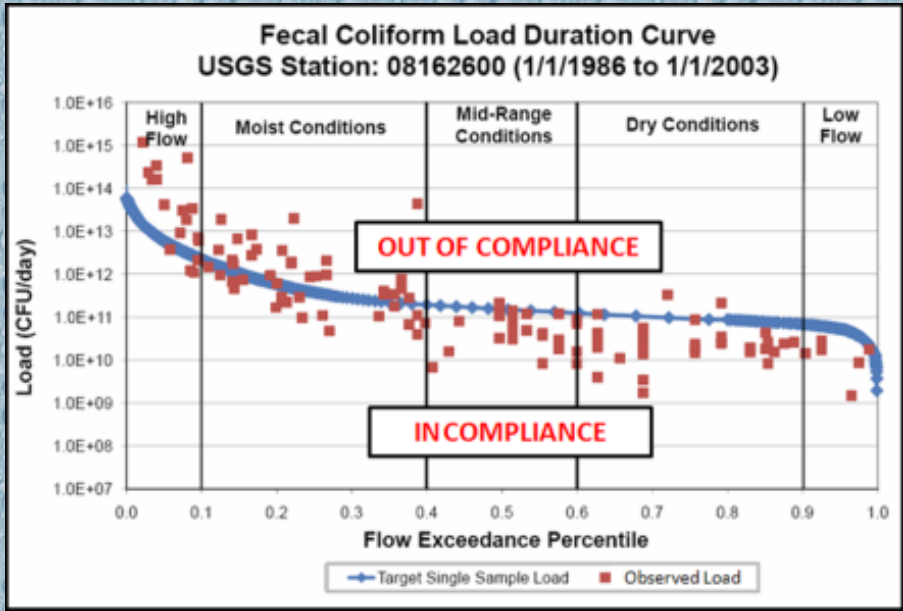
- Pollutant load monitoring
  - Sediment and phosphorus heading to Lake Winnipeg
  - Nitrogen and other pollutants heading to the Gulf of Mexico



Reasons for Monitoring Water Quality

- TMDLs (Total Maximum Daily Loads)
  - Verification of assessments
  - Continuous water quality monitoring
  - Pollutant identification
    - Which pollutant is causing low dissolved oxygen levels?
  - Stressor identification
  - Current loads
    - Flow record
    - Water quality record

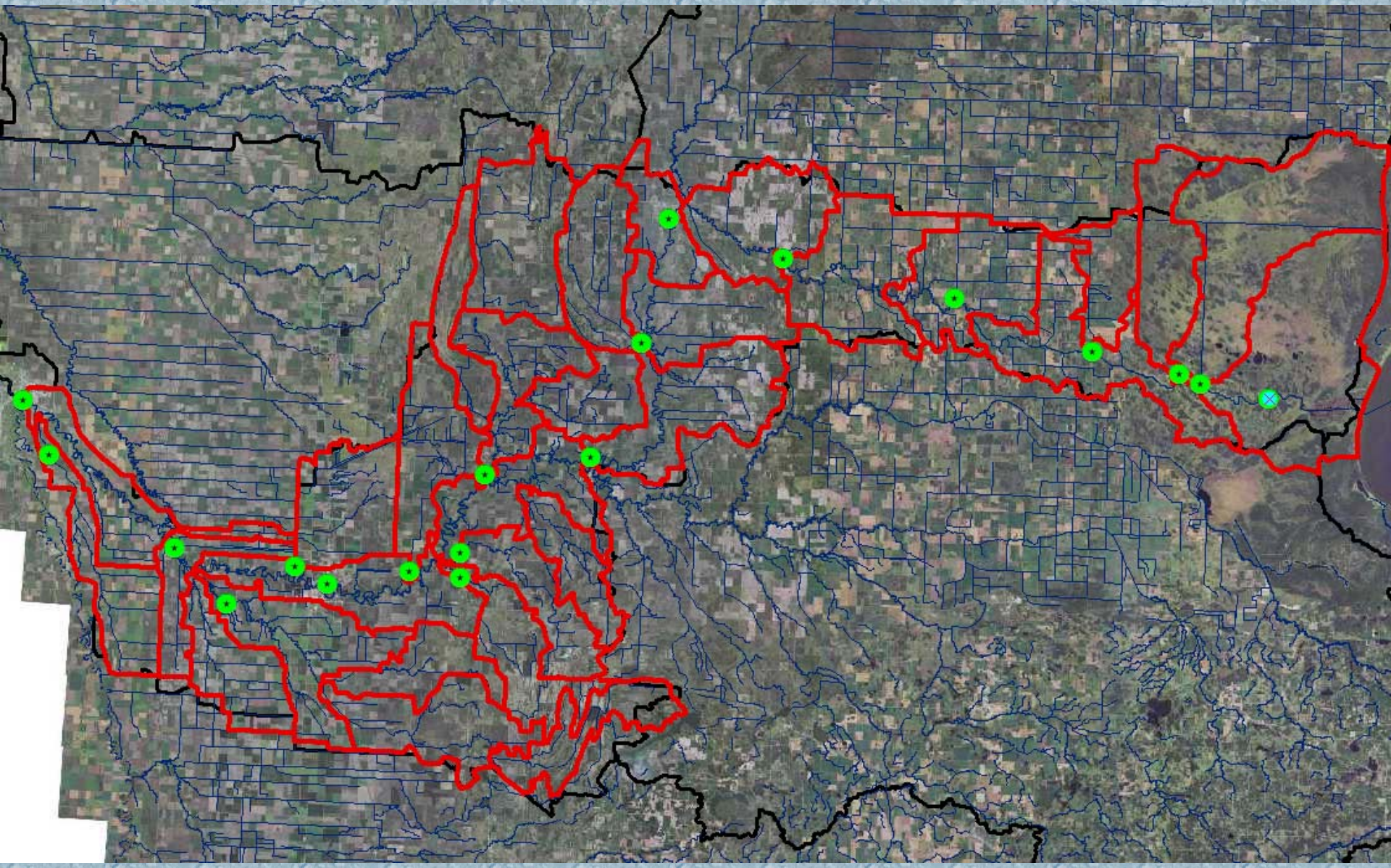




Where should I monitor water quality?

- Rivers and streams
  - Typically start at the lower end of the watershed or subwatershed
  - Add sites (HUC 12 or minor subwatershed level)
  - After finding a problem, work upstream to discover the source
  - Bracket suspected sources of water quality problems
  - Regional Assessment Locations (RALs)
  - Sites/waterbodies targeted by the MPCA in the Surface Water Assessment Grant (SWAG) RFPs
- Most Lakes have established sites you can re-visit

How are SWAG Sites Chosen?

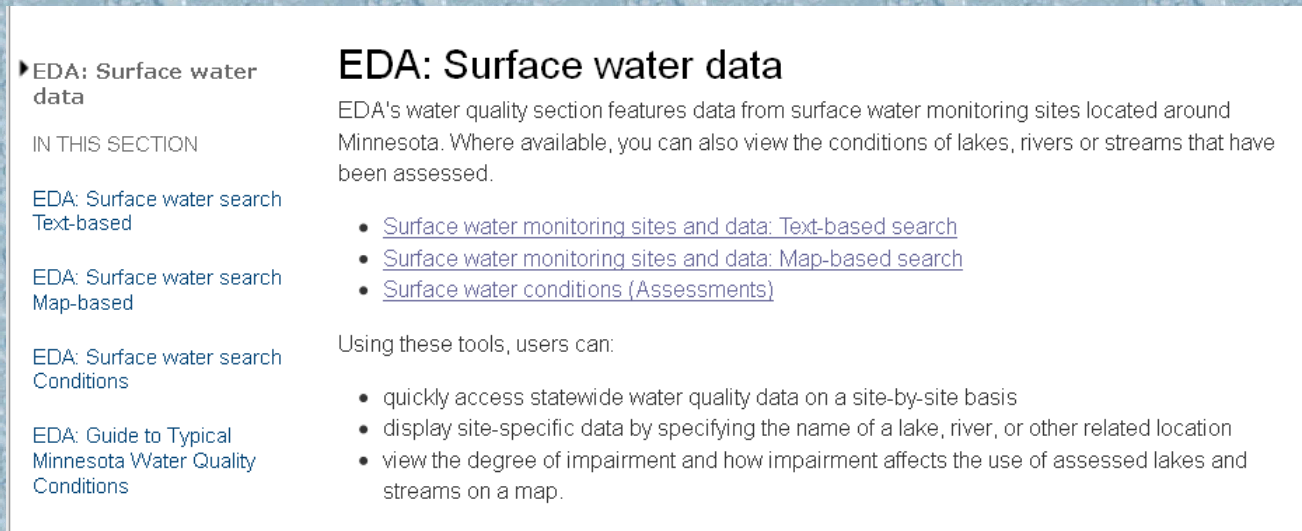


Things to consider when choosing a monitoring site

- Is it representative of the stream?
- Is there much effect from backwater?
- Proximity to potential sources of pollutants.
- Coordination with other local monitoring programs
- Visit potential sites
- Safety and Accessibility

Finding Existing Monitoring Sites

- MPCA Environmental Data Access (EDA)
- Every site that has been officially established in the STORET/EQUIS databases.
- Google “MPCA EDA” to get to the site
- Map-based search



EDA: Surface water data

IN THIS SECTION

EDA: Surface water search Text-based

EDA: Surface water search Map-based

EDA: Surface water search Conditions

EDA: Guide to Typical Minnesota Water Quality Conditions

EDA: Surface water data

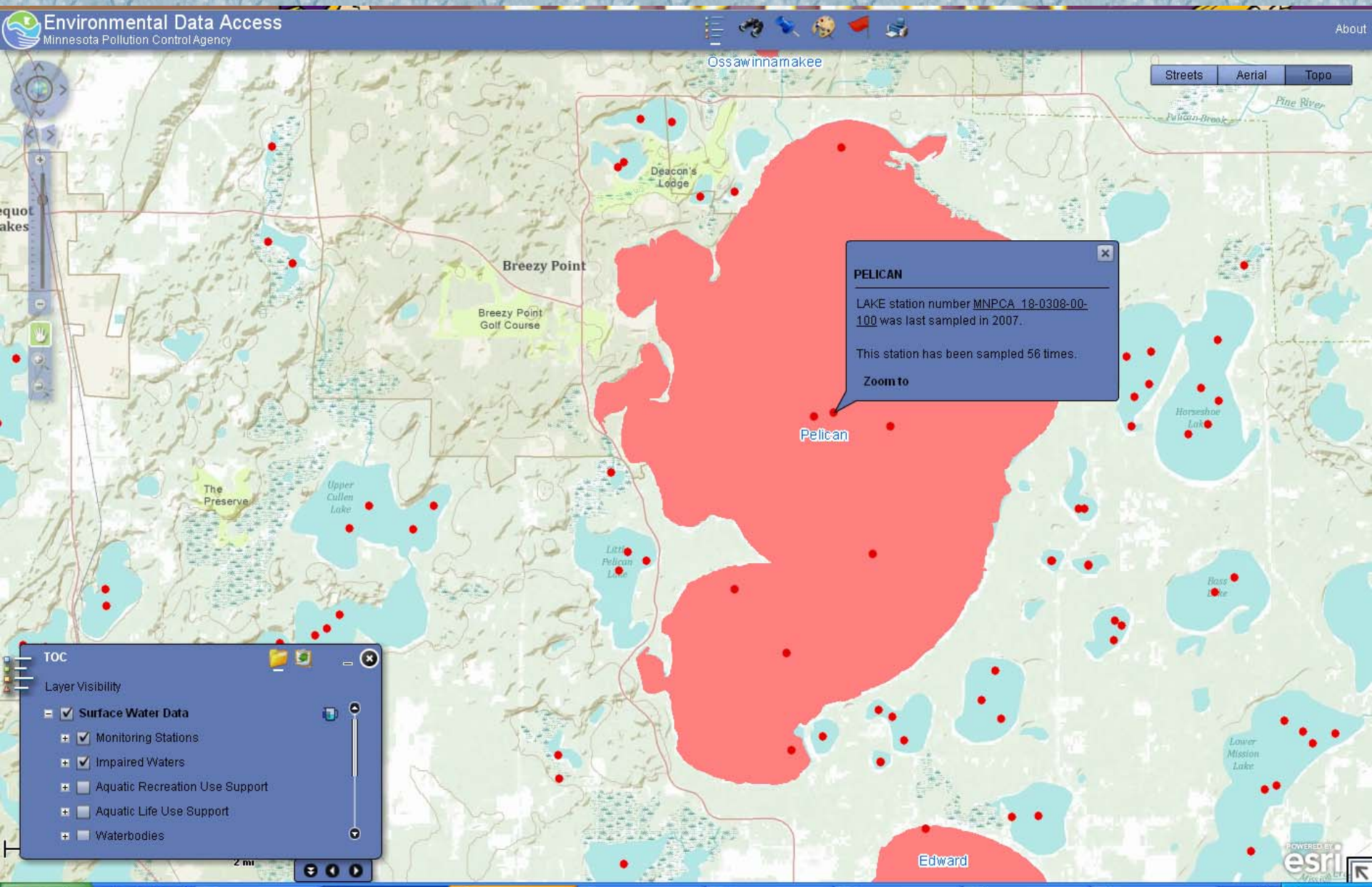
EDA's water quality section features data from surface water monitoring sites located around Minnesota. Where available, you can also view the conditions of lakes, rivers or streams that have been assessed.

- Surface water monitoring sites and data: Text-based search
- Surface water monitoring sites and data: Map-based search
- Surface water conditions (Assessments)

Using these tools, users can:

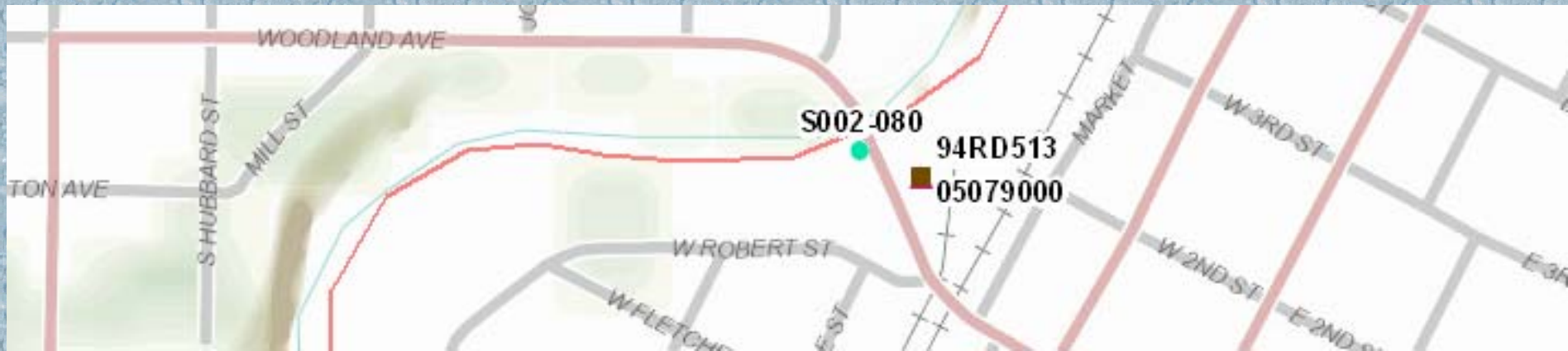
- quickly access statewide water quality data on a site-by-site basis
- display site-specific data by specifying the name of a lake, river, or other related location
- view the degree of impairment and how impairment affects the use of assessed lakes and streams on a map.

Using the MPCA EDA Search Tool



What do I name the sites?

- "Local" site name that makes sense to you
  - Contact the previous sampler
  - Combine waterbody name with location
- Unique code for sharing data on the State/National level.
  - Use EDA to see who has sampled there and to get the STORET ID #, or "S-code" (S002-080)



Funding

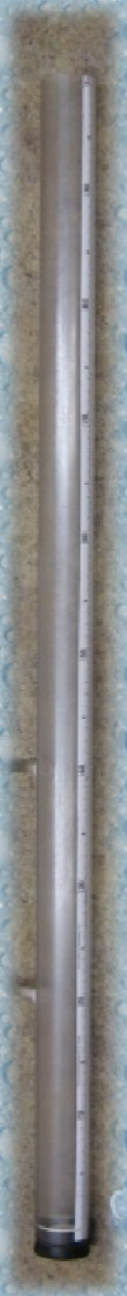
- # = $ +

- Local Government Units
- Surface Water Assessment Grants (SWAG)
  - The MPCA needs local staff like <u>you</u> to collect the data it wants.
- Annual monitoring budget
- Utilize volunteers (River Watch)

How much data do we need?

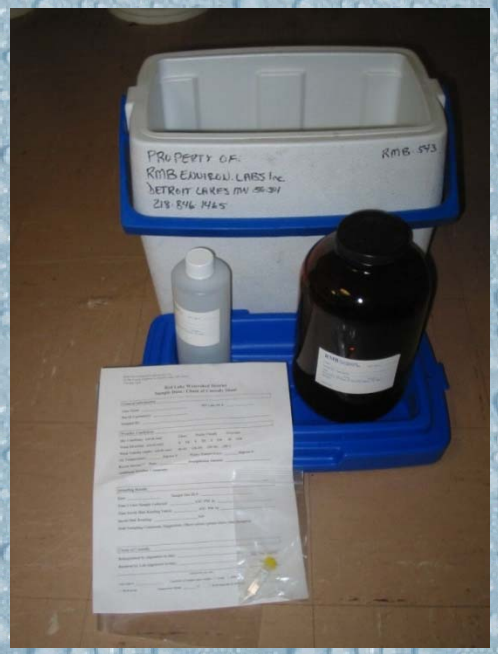
- Assessment Purposes
  - MPCA *Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment: 305(b) Report and 303(d) List*
  - >20 sets of field measurements
  - 5 E. coli samples from each summer calendar month
  - MPCA assessment schedule (1/10years)
  - Plan to do your own assessments using MPCA methods

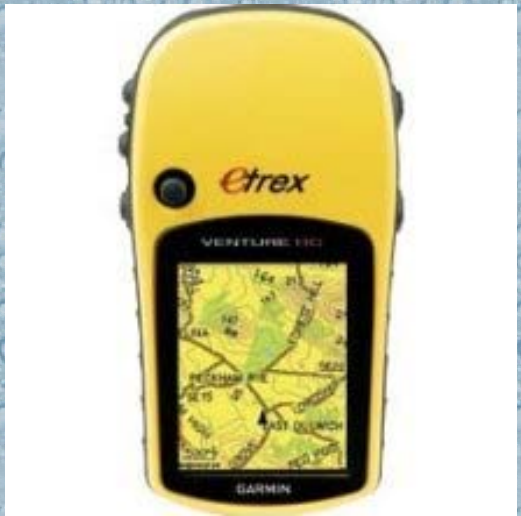
Basic Stream Equipment



- Transparency tube
- Van-Dorn style sampler
- Something to measure stage
  - Survey rod
  - Fiberglass measuring tape with a weight/lock on the end (10ths/100ths)
- Multi-parameter sonde
- Turbidimeter

Basic Lake Sampling Equipment



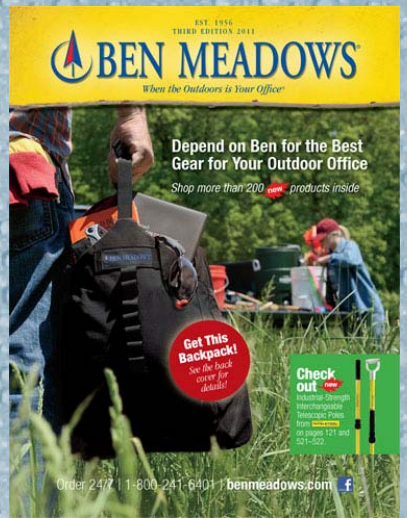


Advanced equipment

- HOBO water level loggers ($495)
- Flow measuring equipment (>$2,400)
- Continuous water quality monitoring equipment $4,000 - $10,000
- Yellow-clad steel tape ($20 - $50)

Where do I get this equipment?

- Ben Meadows (samplers, measuring tapes, survey rods, calibration supplies)
- Forestry Suppliers (similar to Ben Meadows)
- Lab Safety Supplies (calibration supplies)
- Sondes: Company sales reps (Travis Degroot, YSI)
  - YSI, Hydrolab, Eureka, In-Situ, Stevens-Greenspan
- HACH (turbidimeters)
- Wildco (samplers)
- Borrowing/Sharing

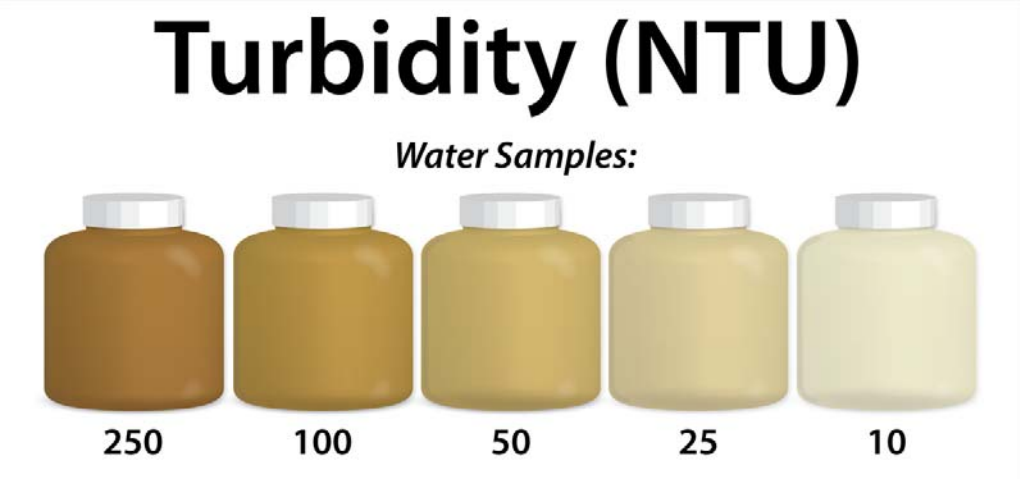


How do I use this stuff to collect data?

- Quality, comparable, representative
- Standard Operating Procedures
- Training sessions
  - (March) Annual Red River Basin Water Quality Monitoring Training Session at UMC Crookston
- Find someone who'll let you help with sampling for a few days.

What field data should I be collecting?

- Dissolved Oxygen (5 mg/L, 7 mg/L)
- Turbidity (25 NTU, 10 NTU)
- Transparency
- Stage (water level)
- Temperature
- pH (6.5 – 8.5)
- Specific Conductivity
- Photos
- Other observations



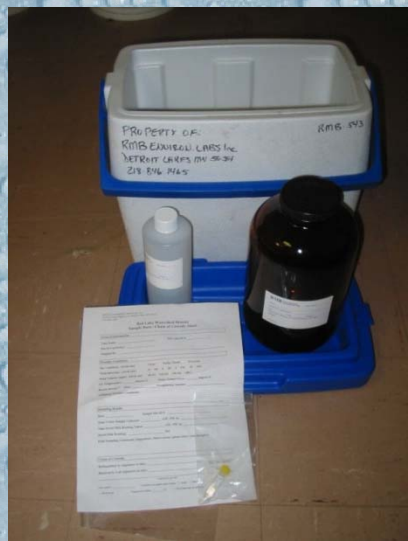
Sample Analysis - Basics

- E. coli bacteria (126/1260 CFU/100 ml)
- Total suspended solids
- Total Phosphorus
- Ammonia nitrogen
- Nitrates and Nitrites
- Total Kjeldahl nitrogen

RMB
Environmental Laboratories, Inc.

Sample Analysis

- Others: orthophosphorus, chlorides
- Lakes: chlorophyll-a, total phosphorus
- TMDL pollutant ID: biochemical oxygen demand, chemical oxygen demand
- Drinking water related: total organic carbon



Before heading into the field

- Checklists for equipment (until they're in your head)
- A matrix/checklist with sites and times that they should be sampled
- Write sampling dates on your calendar
- Make sure equipment is calibrated, schedule next calibration on your calendar
- Map(s) of site locations, DeLorme Gazetteer
- Field data sheets
- Site descriptions (site name, RP location)

Sample Schedule Examples

2011 - 2012 Thief River SWAG Sampling Schedule for Pennington County Staff

				SWAG Sample Analysis - COC #1									TMDL Sample Analysis - COC #2								
S-code	Site	River	Sample Period	TVS	TKN	E. coli	NH3	NO2 NO3	TP	Chl-a	Pheo-phytin	TSS	E. coli	NH3	TP	OP	TSS	TKN	NO2 NO3	COD	BOD
S002-079	760	Thief	May 2011 1 thru 15	1	1		1	1	1	1	1	1	1			1				1	1
S004-966	JD30/TR	JD30/TR		1	1		1	1	1			1	1								
S004-494	41	CD20		1	1		1	1	1			1	1			1				1	1
S002-079	760	Thief	May 2011 15 thru 31	1	1		1	1	1	1	1	1	1			1				1	1
S004-966	JD30/TR	JD30/TR		1	1		1	1	1			1	1								
S004-494	41	CD20		1	1		1	1	1			1	1			1				1	1
S002-079	760	Thief	June 2011 1 thru 15	1	1	1	1	1	1	1	1	1				1				1	1
S004-966	JD30/TR	JD30/TR		1	1	1	1	1	1			1									
S004-494	41	CD20		1	1	1	1	1	1			1				1				1	1
S002-079	760	Thief	June 2011 16 thru 30	1	1	1	1	1	1	1	1	1				1				1	1
S004-966	JD30/TR	JD30/TR		1	1	1	1	1	1			1									
S004-494	41	CD20		1	1	1	1	1	1			1				1				1	1
S002-079	760	Thief	July 2011 1 thru 15	1	1	1	1	1	1	1	1	1				1				1	1
S004-966	JD30/TR	JD30/TR		1	1	1	1	1	1			1									
S004-494	41	CD20		1	1	1	1	1	1			1				1				1	1
S002-079	760	Thief	July 2011 16 thru 31	1	1	1	1	1	1	1	1	1				1				1	1
S004-966	JD30/TR	JD30/TR		1	1	1	1	1	1			1									
S004-494	41	CD20		1	1	1	1	1	1			1				1				1	1
S002-079	760	Thief	Aug 2011 1 thru 15	1	1	1	1	1	1	1	1	1				1				1	1
S004-966	JD30/TR	JD30/TR		1	1	1	1	1	1			1									
S004-494	41	CD20		1	1	1	1	1	1			1				1				1	1
S002-079	760	Thief	Aug 2011 16 thru 31	1	1	1	1	1	1	1	1	1				1				1	1
S004-966	JD30/TR	JD30/TR		1	1	1	1	1	1			1									
S004-494	41	CD20		1	1	1	1	1	1			1				1				1	1
S002-079	760	Thief	Sept 2011 1 thru 15	1	1		1	1	1	1	1	1	1			1				1	1
S004-966	JD30/TR	JD30/TR		1	1		1	1	1			1	1								
S004-494	41	CD20		1	1		1	1	1			1	1			1				1	1
S002-079	760	Thief	Sept 2011 15 thru 31	1	1		1	1	1	1	1	1	1			1				1	1
S004-966	JD30/TR	JD30/TR		1	1		1	1	1			1	1								
S004-494	41	CD20		1	1		1	1	1			1	1			1				1	1
S002-079	760	Thief	June 2012 1 thru 10		1	1		1	1	1	1					1	1			1	1
S004-966	JD30/TR	JD30/TR				1								1	1	1	1	1	1	1	1
S004-494	41	CD20				1															
S002-079	760	Thief	June 2012 11 thru 20		1	1		1	1	1	1					1	1			1	1
S004-966	JD30/TR	JD30/TR				1								1	1	1	1	1	1	1	1
S004-494	41	CD20				1															
S002-079	760	Thief	June 2012 21 thru 30		1	1		1	1	1	1					1	1			1	1
S004-966	JD30/TR	JD30/TR				1								1	1	1	1	1	1	1	1
S004-494	41	CD20				1															
S002-079	760	Thief	July 2012 1 thru 10		1	1		1	1	1	1					1	1			1	1
S004-966	JD30/TR	JD30/TR				1								1	1	1	1	1	1	1	1
S004-494	41	CD20				1															
S002-079	760	Thief	July 2012 11 thru 20			1								1	1	1	1	1	1	1	1
S004-966	JD30/TR	JD30/TR				1								1	1	1	1	1	1	1	1
S004-494	41	CD20				1															
S002-079	760	Thief	July 2012 21 thru 31		1	1		1	1	1	1					1	1			1	1
S004-966	JD30/TR	JD30/TR				1								1	1	1	1	1	1	1	1
S004-494	41	CD20				1															
S002-079	760	Thief	Aug 2012 1 thru 10		1	1		1	1	1	1					1	1			1	1
S004-966	JD30/TR	JD30/TR				1								1	1	1	1	1	1	1	1
S004-494	41	CD20				1															
S002-079	760	Thief	Aug 2012 11 thru 20		1	1		1	1	1	1					1	1			1	1
S004-966	JD30/TR	JD30/TR				1								1	1	1	1	1	1	1	1
S004-494	41	CD20				1															
S002-079	760	Thief	Aug 2012 21 thru 31		1	1		1	1	1	1					1	1			1	1
S004-966	JD30/TR	JD30/TR				1								1	1	1	1	1	1	1	1
S004-494	41	CD20				1															

2010 Monitoring Checklist — Write in the date sampled/visited

Site	Mar/Apr	May	June	July	August	September	October
Clearwater River							
O-6 (+ BOD)							
50-I (FMO)							
LR10 (+ BOD)							
50-O							
52							
53-I							
53-O							
59 (+BOD)							
62 (+ BOD)							
63 (FMO)							
81							
109 (+ BOD)							
131							
133 (FMO)							
780 (+ BOD)							
782							
785							
PL30							
PL40							
797							
Lower Badger							
CLBK1 (TP, OP TSS, EC)							
157		ec only		ec only		ec only	
128 (+ BOD)							
Red Lake River							
RLRGreenwood							
75/750 (+ BOD)							
86							
790							
799 (FMO)							
89(Burnham + BOD)							
BL18							
Murray Bridge							
PC19 (+ BOD)							
Kripple Creek							
Cyr Creek							
Thief River							
15 (+ BOD)							
40							
98							
757 (+ BOD)							
760							
140							
6 sample and flow							
41							
X4							
Upper/Lower Red Lakes							
Blackduck R (+BOD)							
Cormorant R - BC9							
Dorrigan's Ck - BC3							
O'Brien's Ck - BC4							

Field Data Sheets

RED LAKE WATERSHED DISTRICT STREAM FIELD SHEET

Individual Observers-First and Last Names : _____

Sonde S/N: _____

Handpad S/N: _____

Turbidimeter S/N: _____

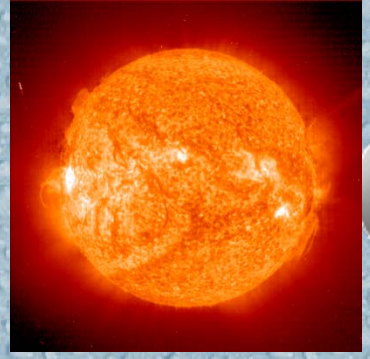
SITE ID & INFO										
FIELD INFO.	A	B	C	D	E	F	G	H	I	J
DATE										
TIME (military)										
Sample #										
STAGE: Surface*										
Sample Bottles used										
Stream Water Depth*										
Actual Sample Depth*										
GAGE TYPE*										
Appearance: 1A-clear; 1B-tea-colored; 2-cloudy; 3-muddy; 4-green; 5-muddy & green										
Appearance:										
Recreation Suitability: 1-Beautiful; 2-Excellent body contact; 3-Body contact impaired; 4-no swim/boating OK; 5-recreation nearly impossible										
Recreation Suitability:										
StreamCondition* H-N-L or NoFlow										
Rain Event (Y/N)*										
T-Tube Reading 60 cm : First / Final AVG	/	/	/	/	/	/	/	/	/	/
*(Circle which tube used if it is greater than 60cm)	100/120	100/120	100/120	100/120	100/120	100/120	100/120	100/120	100/120	100/120
Water Temp *C										
Conductivity (uS/cm)										
DO (% Saturation)										
DO (mg/l)										
pH										
Turbidity (NTUs) Hach 2100P *										
Turbidity (FNUs) Eureka Manta Sonde *										
SAMPLE DEVICE* (Van Dorn / or see instructions)										
SAMPLE TYPE* (Grab)										
QA* (Field Dup)										

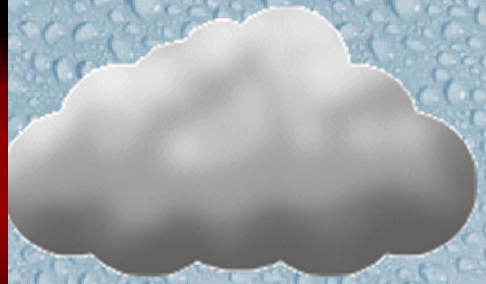
Observer(s): _____ Date: _____

FIELD NOTES: station name/location, vegetation status (leaf out, cropping, harvest), land use, erosion, wildlife, general phenolo
wind, cloud cover, recent precipitation, ice condition, picture #, foam, any floating or suspended matter in sample or stream, etc.
Also record here if NO FLOW.

A	
B	
C	
D	
E	
F	
G	
H	
I	
J	

Safety Threats





- Bridges
- Busy Roads
- Swift currents, Deep Water
- Chemicals
- Mud
- Poor water quality (bacteria, etc)
- Weather
- Sulfuric Acid

Safe Monitoring

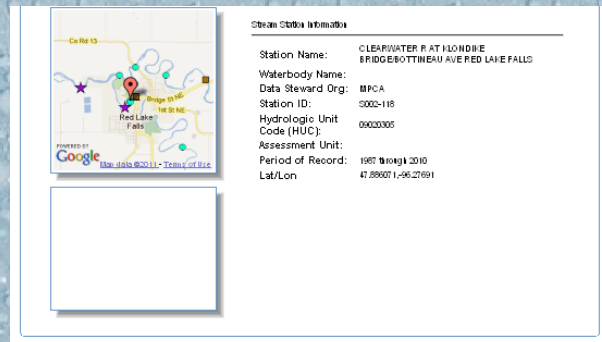
- Footwear (waders, traction, etc)
- Physical Fitness
- Vests, Flashers
- Park vehicle between you and traffic
- First aid kit
- Sunscreen and Sunglasses
- Hydration
- Be aware of natural hazards

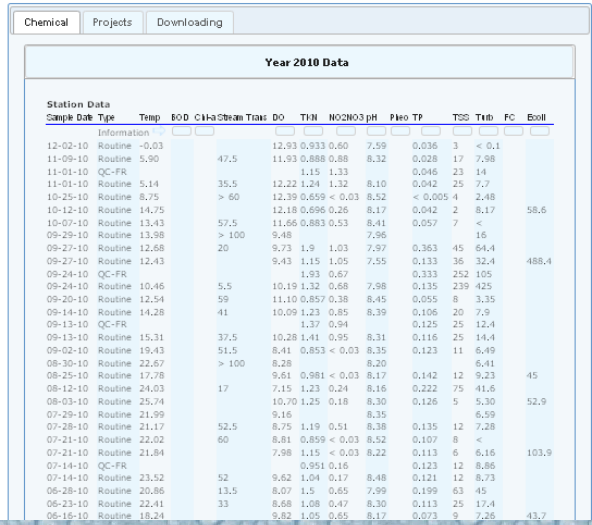
Safe Sampling

- Wading
  - 10 sq. ft. per sec.
  - Walk perpendicular to flow
  - Watch out for muck
- Boating (life vest, etc.)
- Avoid contact with H2SO4
- Be very cautious when sampling through ice
- Be aware of your surroundings

What do I do with the data?

- Fill out establishment forms and submit your data to the MPCA for entry into the EQuIS database
- Time series
- Assessment
- Excel pivot table function is a helpful data summary tool
- *Red River Watershed Water Quality Reporting Handbook* (2005)





Sample Date	Type	Temp	BOD	Chl-a	Stream Trans	DO	TKN	NO2NO3	pH	Phos	TP	TSS	Turb	FC	Ecoli
	Information														
12-02-10	Routine	-0.03				12.93	0.933	0.60	7.59		0.036	3	< 0.1		
11-09-10	Routine	5.90			47.5	11.93	0.888	0.88	8.32		0.028	17	7.98		
11-01-10	QC-FR						1.15	1.33			0.046	23	14		
11-01-10	Routine	5.14			35.5	12.22	1.24	1.32	8.10		0.042	25	7.7		
10-25-10	Routine	8.75			> 60	12.39	0.659	< 0.03	8.52		< 0.005	4	2.48		
10-12-10	Routine	14.75				12.18	0.696	0.26	8.17		0.042	2	8.17		58.6
10-07-10	Routine	13.43			57.5	11.66	0.883	0.53	8.41		0.057	7	<		
09-29-10	Routine	13.98			> 100	9.48			7.96				16		
09-27-10	Routine	12.68			20	9.73	1.9	1.03	7.97		0.363	45	64.4		
09-27-10	Routine	12.43				9.43	1.15	1.05	7.55		0.133	36	32.4		488.4
09-24-10	QC-FR						1.93	0.67			0.333	252	105		
09-24-10	Routine	10.46			5.5	10.19	1.32	0.68	7.98		0.135	239	425		
09-20-10	Routine	12.54			59	11.10	0.857	0.38	8.45		0.055	8	3.35		
09-14-10	Routine	14.28			41	10.09	1.23	0.85	8.39		0.106	20	7.9		
09-13-10	QC-FR						1.37	0.94			0.125	25	12.4		
09-13-10	Routine	15.31			37.5	10.28	1.41	0.95	8.31		0.116	25	14.4		
09-02-10	Routine	19.43			51.5	8.41	0.853	< 0.03	8.35		0.123	11	6.49		
08-30-10	Routine	22.67			> 100	8.28			8.20				6.41		
08-25-10	Routine	17.78				9.61	0.981	< 0.03	8.17		0.142	12	9.23		45
08-12-10	Routine	24.03			17	7.15	1.23	0.24	8.16		0.222	75	41.6		
08-03-10	Routine	25.74				10.70	1.25	0.18	8.30		0.126	5	5.30		52.9
07-29-10	Routine	21.99				9.16			8.35				6.59		
07-28-10	Routine	21.17			52.5	8.75	1.19	0.51	8.38		0.135	12	7.28		
07-21-10	Routine	22.02			60	8.81	0.859	< 0.03	8.52		0.107	8	<		
07-21-10	Routine	21.84				7.98	1.15	< 0.03	8.22		0.113	6	6.16		103.9
07-14-10	QC-FR						0.951	0.16			0.123	12	8.86		
07-14-10	Routine	23.52			52	9.62	1.04	0.17	8.48		0.121	12	8.73		
06-28-10	Routine	20.86			13.5	8.07	1.5	0.65	7.99		0.199	63	45		
06-23-10	Routine	22.41			33	8.68	1.08	0.47	8.30		0.113	25	17.4		
06-16-10	Routine	18.24				9.82	1.05	0.65	8.17		0.073	9	7.26		43.7

Questions?

- Online References
  - *Standard Operation Procedures for Water Quality Monitoring in the Red River Watershed*
    - www.redlakewatershed.org – link on the home page
  - EPA : *Volunteer Stream Monitoring: A Methods Manual*
  - MPCA EDA Map-Based Search Tool:
    - http://pca-gis02.pca.state.mn.us/eda_surfacewater/index.html