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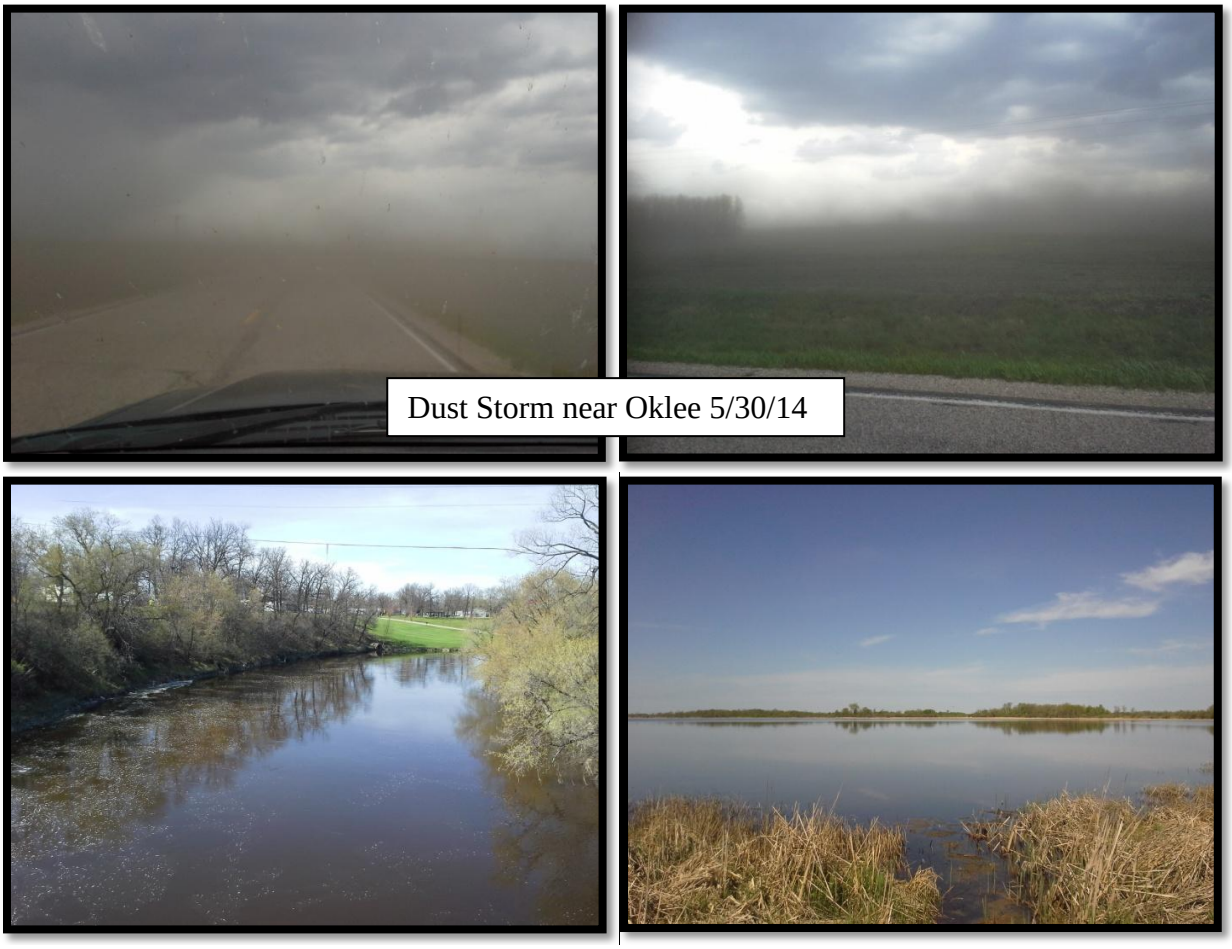
Long-Term Monitoring Program

The first round of samples was completed and a second round was started for the Red Lake Watershed District long term monitoring program. We've had plenty of runoff and high flows to sample so far this year.

High E. coli concentrations were again found in the Beltrami County monitoring sites on Darrigan's Creek and the North Cormorant River (CSAH 36).



Dust Storm near Oklee 5/30/14

Clearwater River Watershed Restoration and Protection (WRAP) Project

- Objective 3 – Flow Monitoring
  - Gopher One calls were made in preparation for the installation of water level logger deployment pipes at new flow monitoring sties.
  - A research permit application was submitted in order to get permission to install continuous monitoring equipment in Judicial Ditch 73 within the boundaries of Rydell National Wildlife Refuge. The permit was approved.
  - HOBO water level loggers were deployed.


- Red Lake Department of Natural Resources staff conducted flow measurements using their River Surveyor Acoustic Doppler flow meter.

- Objective 4 – Continuous Dissolved Oxygen Monitoring
  - Supplies were purchased for deploying dissolved oxygen loggers.
  - Deployment pipes for dissolved oxygen loggers were installed.

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The first 2014 deployments of Clearwater River dissolved oxygen loggers began on May 27th.

- Continuous dissolved oxygen loggers will be deployed by the RLWD at the following sites in 2014. There is a goal of 10 2-week deployments at each site.
  - Poplar River at CSAH 30 (S003-127)
  - Lost River at 109th Ave (S005-283)
  - Lost River at 139th Ave (S000-924)
  - Silver Creek at CR111 (S002-082)
  - Ruffy Brook at CSAH 11
  - Clearwater River at CSAH 22 (S002-929)
  - Clearwater River at CSAH 11 (S002-752)
- The MPCA is also planning to deploy some dissolved oxygen loggers in the Clearwater River. They will be deployed for a shorter period of time – just the months of July and August.
  - Clearwater River, at CSAH 2 (S001-908)
  - Clearwater River, in Red Lake Falls (S002-118)
  - Lost River, north of Brooks (S002-133)
  - Hill River, north of Brooks (S002-134)
  - Clearwater River at CR127 (S002-916)
  - Lower Badger Creek at CR114 (S004-837)

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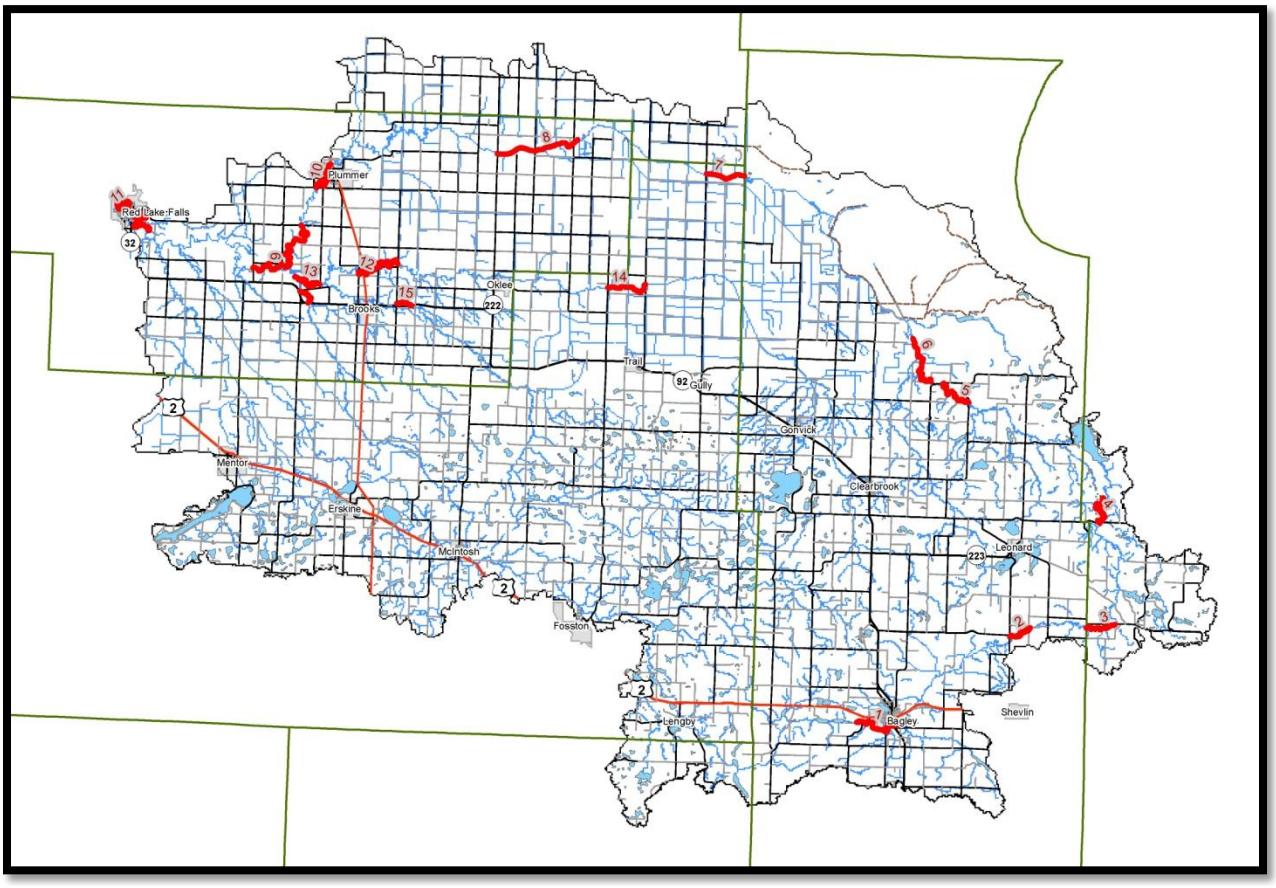
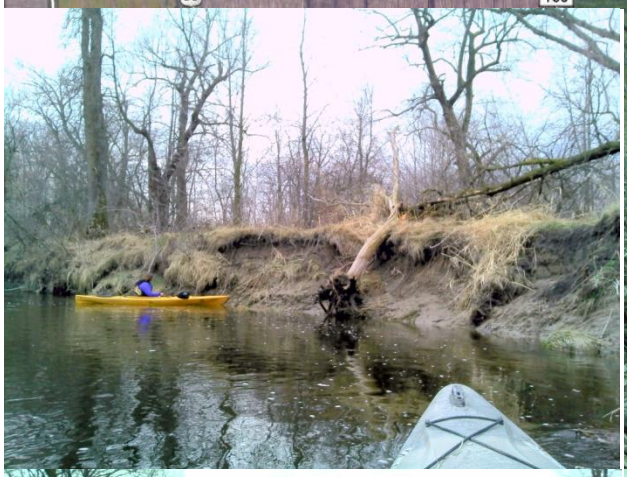
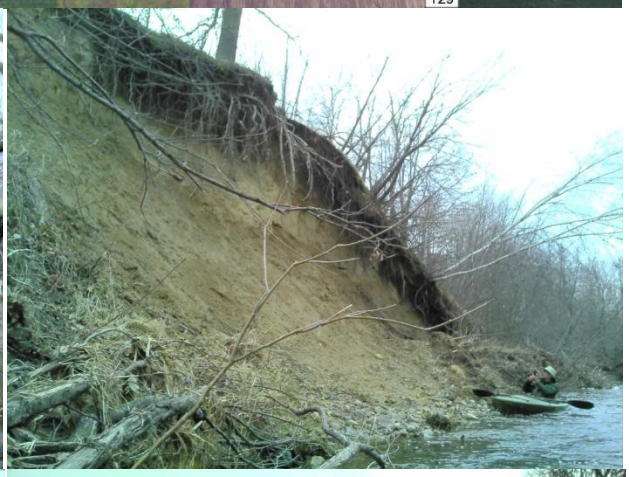
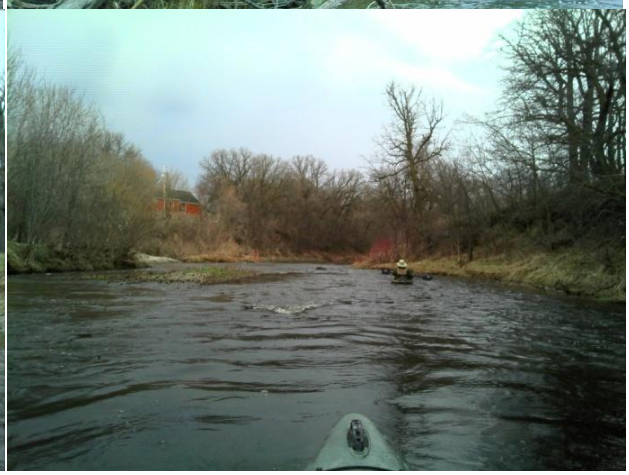
- Objective 5 – Stream Channel Stability Assessment



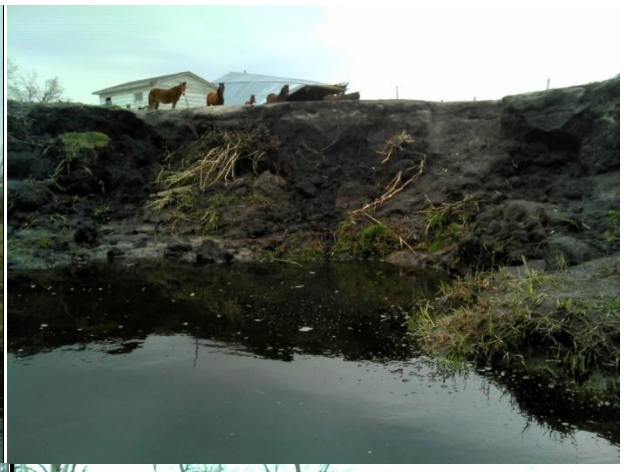
- A reach of the Lost River from CR 129 to CR 119 (Reach 12) was paddled and Bank Erosion Hazard Index ratings, depths, bankfull widths, photos, and more were recorded along the trip. This winding section of the river provided many outside banks to assess. It was a longer trip because of all of the bends. We traveled over 1.6 miles along the river before we had traveled 0.5 miles "as the crow flies" from our starting point.

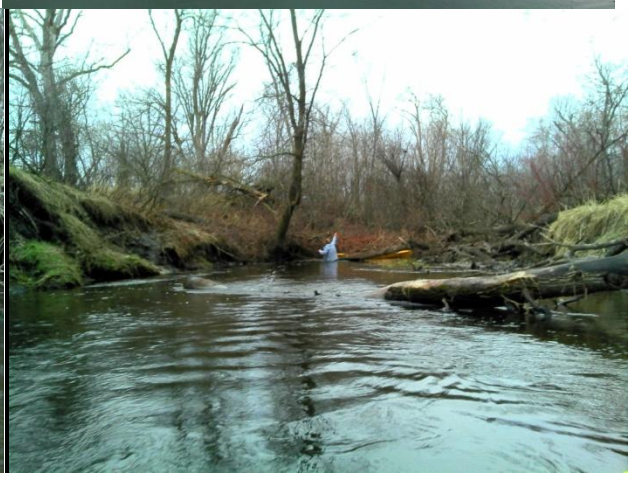




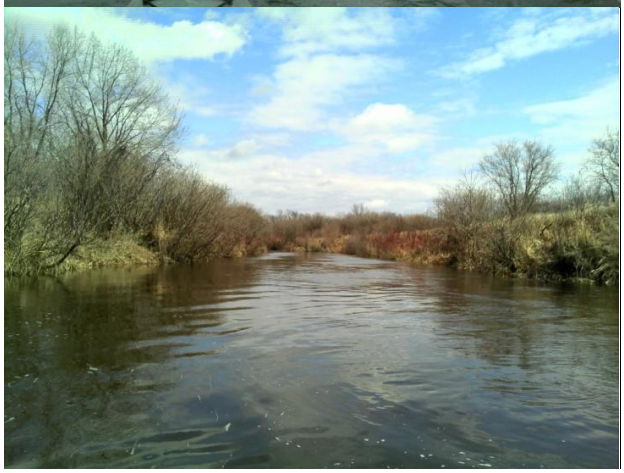


- A reach of the Hill River was inspected via kayak on May 7th for the purpose of conducting Bank Erosion Hazard Index ratings and other measurements. There are a lot of log jams in the lower end of this reach that required a number of portages and made travel along the reach difficult. A livestock operation downstream of Highway 92 has created some streambank instability problems. Stream banks appeared to be more stable within the wooded reach. It also started raining during the latter part of the trip.

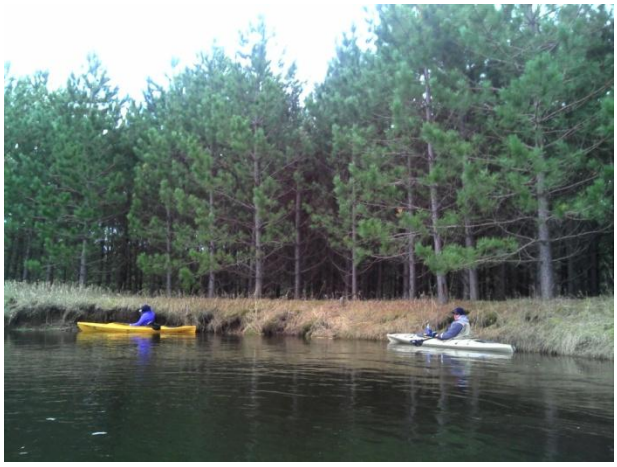




- A reach of the channelized portion of the Lost River between CSAH 28 and CSAH 6, north of the town of Trail was kayaked for the purpose of Bank Erosion Hazard Index ratings, Pfankuch ratings, and other measurements. Despite being channelized, this reach was fairly stable. One of the bank stabilization structures that the District installed downstream of CSAH 28 had been damaged by some excavation.



- The Reach of the Clearwater River between CSAH 2 and 253rd Ave was inspected via kayak on May 14th. Bank Erosion Hazard Index ratings, bankfull widths, depths, photos, and Pfankuch ratings were also collected along the reach. There was only one bank along this reach that had an active erosion with much of a bare bank. The rest of the reach was fairly stable. The river's gradient hasn't quite transitioned to that of the steeper trout stream reach yet at this point.
-



- A reach of the trout stream portion of the Clearwater River between CSAH 3 and CSAH 22 (Pinewood Road) was inspected via kayak on May 15th. Bank Erosion Hazard Index ratings, bankfull widths, depths, photos, and Pfankuch ratings were also collected along the reach. There was a lot of significant erosion and bank instability in the upper, pastured section of this reach. As soon as we passed the pastured area, the banks became much more stable. One of the key factors in the stability of this reach is the presence/absence of brush/shrubs along the edge of the river. There were a couple of cabins/residences along the reach which demonstrated the importance leaving vegetation near the river. The yards were mowed in both circumstances. The one that left brush, grass, and shrubs along the river had a stable bank. The other residence had mowed right up to the edge of the banks and the bank was very actively eroding. The current was swift through this section, which made stopping to take measurements a little more difficult, but we got it done. The river has recently cut a new channel around an old weir just upstream of CSAH 22. The new channel was newer and had a lot of low overhanging brush to get through, which made paddling through there a bit more of a challenge than the old channel would have been.

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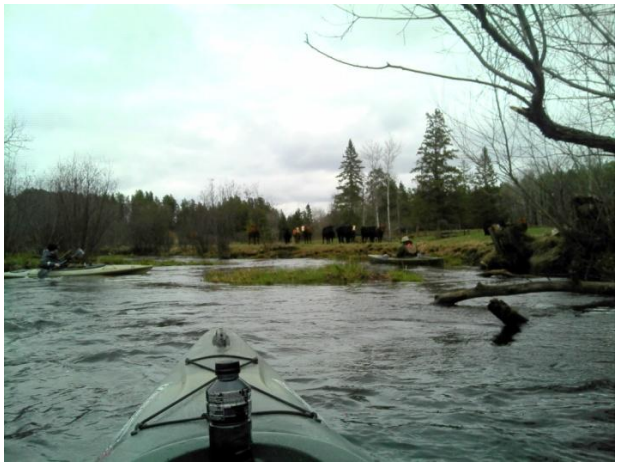
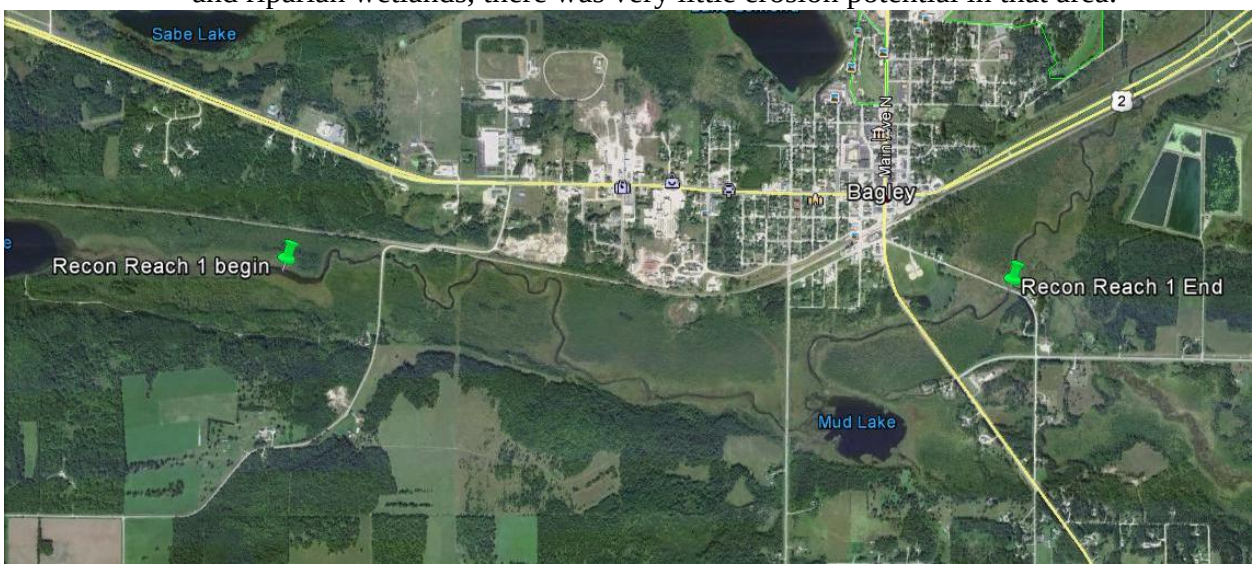


- DNR staff conducted a BEHI rating assessment of a reach in the headwaters of the Clearwater River south of Bagley on May 13th. Because of the low gradient and riparian wetlands, there was very little erosion potential in that area.



- Objective 9 – Civic Engagement
  - Website ideas were provided to Emmons and Olivier Consulting staff and they began working on a webpage dedicated to the Clearwater River watershed.

Thief River Watershed Assessment Project
(Watershed Restoration and Protection - WRAP)

- Task 5 – Flow Monitoring
  - Flow was measured in Judicial Ditch 30.
- Task 7 – Stressor Identification
  - RLWD staff worked with Source Molecular and the MPCA Project Manager to plan microbial source tracking (DNA analysis to identify the source of the fecal pollution) sample collection for this summer.
- Task 8 – Water Quality Modeling
  - The HSPF model (RESPEC consulting) of the Thief River watershed should be nearing completion.
  - The International Water Institute is working on incorporating LIDAR-derived data for the Thief River watershed into their Water Quality Decision Support System. They have been provided with the flow line, culvert inventory, LIDAR surfaces, and stream power index files that were created by RLWD staff.
- Task 11 – Civic Engagement
  - Website ideas were provided to Emmons and Olivier Consulting staff and they began working on a webpage dedicated to the Thief River watershed.

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Red Lake River Watershed Assessment Project
(Watershed Restoration and Protection - WRAP)

- Task 3 – Continuous Dissolved Oxygen Monitoring
  - Dissolved oxygen will be continuously monitored with a HOBO optical dissolved oxygen logger during the summer of 2014. Further upstream sites that were monitored in 2013 had high rates of low daily minimum dissolved oxygen levels. The percentage of daily minimums that fell below the water quality standard of 5 mg/L decreased from upstream to downstream. So, it will be interesting to see what the rate at a site that is located in a part of the river that isn't channelized, has better riparian cover, and features some rocky riffles. A dissolved oxygen logger deployment pipe was installed at the CSAH 7 (Smiley Bridge) crossing of the Red Lake River, which is the closest crossing upstream of Thief River Falls. The first deployment of the dissolved oxygen logger began on May 23rd, 2014.
- Task 5 – Flow monitoring
  - Flow was measured in Judicial Ditch 60, Cyr Creek, and County Ditch 96.
  - The MPCA installed an ultrasonic stage monitoring gage on the Smiley Bridge (CSAH 7) crossing of the Red Lake River.

- Task 7 – Stressor Identification
  - Plans were made for the collection of Microbial Source Tracking samples. These samples will be shipped to a lab in Miami, Florida that will test for DNA that indicates that the fecal contamination came from a particular type of animal. The plan is to test the Red Lake River samples for DNA that indicates that the pollution came from humans, cattle, or birds. These samples will be collected at sites with existing or probable E. coli impairments. Existing data will be examined to make the best guess about the timing of the samples and aim for the time of year when the sites have historically had the highest E. coli concentrations.
- Task 10 – Civic Engagement
  - Website ideas were provided to Emmons and Olivier Consulting staff and they began working on a webpage dedicated to the Red Lake River watershed.

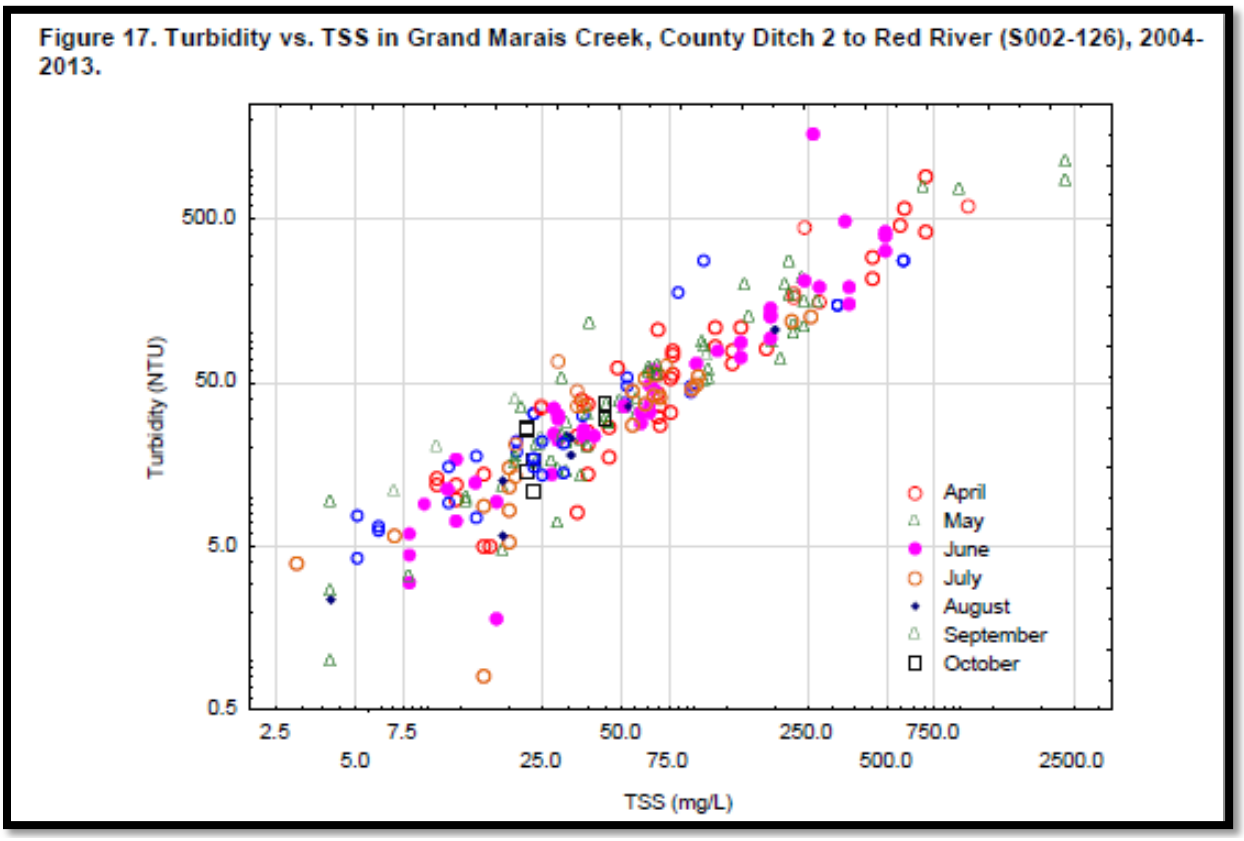
Grand Marais Creek Watershed Restoration and Protection Project

In May, Emmons and Olivier Resources (EOR) staff worked on data compilation, data analysis, a geomorphic report, revised reporting maps, and an addendum to the watershed conditions report. EOR staff completed an addendum to the Grand Marais Creek Watershed Conditions Report that includes an unofficial assessment of water quality data. This information should be predictive of the results of the official assessment that the MPCA will conduct in September. Red Lake Department of Natural Resources staff finished conducting flow measurements for this year. There are plans to have a similar contract with them to collect 5 more sets of flow measurements at Grand Marais Creek sites in 2015.

The CSAH 190 crossing of Grand Marais Creek has had enough high E. coli concentrations to warrant some extra sampling in 2014 to help verify whether or not there is a problem in that part of that watershed.

Because of the construction of the Grand Marais Creek Outlet Restoration Project, flows in the cut-off channel will become infrequent. Therefore, the MPCA has decided that it won't assess that reach of the river. It may a bit of a shame that a lot of data collected at CR64 will then go unused for assessment purposes, but that's the way it has to be. It wouldn't make sense to require a TMDL on the cut-channel reach CD2 to Red River based on data collected from flows that will, mostly, no longer flow through that reach.

Figure 17. Turbidity vs. TSS in Grand Marais Creek, County Ditch 2 to Red River (S002-126), 2004-2013.



Turbidity concentrations in excess of the (soon to be former) water quality standard of 25 NTU were frequent in the watershed. 58% of the measurements made at the Grand Marais Creek cut-off channel monitoring site exceeded the standard. Turbidity has a strong, positive correlation with total suspended solids in the Grand Marais Creek watershed.

Table 18. Data summary, turbidity sampling by month, Grand Marais Creek, headwaters to CD2, 2004-2013. Months in which >10% of samples violated the turbidity standard and at least three samples violated the standard are shown in **bold red font.**

Waterbody	Monitoring Station	Month	Number of Samples	Min-Max NTU	No. Samples >25 NTU
Grand Marais Creek, headwaters to CD2 (AUID 09020306-507)	S002-083	**April**	**8**	**5.9 – 183**	**5**
		May	**7**	**3.25 – 59.6**	**4**
		June	6	1.0 – 38.1	2
		July	5	0.7 – 3.3	0
		August	8	1.2 – 196.5	2
		September	5	1.4 – 24.0	0
		October	10	4.3 – 165.6	2
		November	3	16.3 -16.8	0
	S002-983	May	2	7.2 – 221.0	1
		June	5	4.8 – 9.8	0
		July	1	5.5	0
		August	1	30.4	1
		September	1	6.0	0
		October	3	11.7 – 16.9	0
	S002-984	**April**	**21**	**1.5 – 42.7**	**4**
		May	7	2.9 – 182.7	1
		June	5	0.7 – 13.5	0
		July	7	3.0 – 20.7	0
		August	7	1.3 – 58.0	2
		September	4	10.7 – 64.2	2
		October	**6**	**7.9 – 133.6**	**4**
		November	1	36.3	1

Dissolved oxygen levels along the main channel of Grand Marais Creek can fall very low during the warm summer months.

Table 15. Dissolved oxygen (mg/L) by month, 2004-2013.
Bold red font highlights samples below the water quality standard for 2B waters (5 mg/L).

Waterbody	Monitoring Station	Month	No. of Samples	Minimum DO (mg/L)	No. of Samples < 5 mg/L
Grand Marais Creek, headwaters to CD2 (AUID 09020306-507)	S002-083	April	6	8.2	0
		May	5	6.8	0
		June	4	**4.1**	1
		July	3	**2.7**	2
		August	6	**1.0**	4
		September	4	**0.6**	1
		October	6	**2.3**	5
		November	3	5.2	0
	S002-983	May	2	**4.3**	1
		June	3	8.3	0
		July	1	**1.1**	1
		August	1	9.2	0
		September	1	10.4	0
		October	2	13.8	0
	S002-984	April	11	9.5	0
		May	7	6.1	0
		June	4	5.5	0
		July	4	**1.4**	3
		August	5	**<0.1**	4
		September	3	**3.0**	1
		October	4	**2.1**	2
		November	1	15.5	0

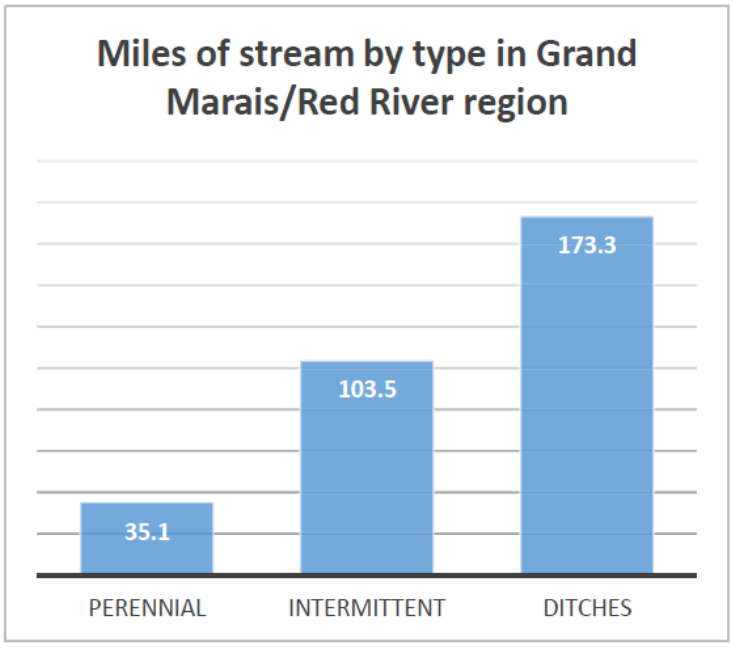
Table 4. Potential causes of low dissolved oxygen

Cause	Description
Nutrients/Eutrophication	Excessive aquatic plant growth and subsequent decay or organic matter depletes dissolved oxygen.
Stream Flow	Reductions in flow can result in stagnant pools (reduced mixing) and/or increased temperatures (decreased oxygen solubility).
Temperature	The solubility of oxygen (and other gases) in water decreases as water temperature increases.

Table 5. Potential causes of high pH

Cause	Description
Eutrophication	Decomposition of excessive algal or plant production can result in very high levels of carbon dioxide in the water.
Alkaline geology and soils	Alkaline species as sodium carbonate or sodium bicarbonate may be leached into streams from runoff and seepage.
Discharge of ammonia producing waste.	Examples of wastes with high potential for conversion of nitrogenous compounds to ammonia include industrial sources such as paper mills, but also municipal (sewage) and agricultural (manure) sources.

EOR staff also completed a report on the geomorphology work that was done in the watershed entitled "Geomorphic and Hydrologic Influences on TMDL Impairments in the Grand Marais Creek Watershed." Not surprisingly, the report states that channelization is the most widespread stream impact in the region and has many direct impacts on aquatic biota. Connectivity is also an important impact on aquatic biota that my be affected by stream geomorphology. Many, if not most, of the streams in this watershed are ephemeral. Without perennial streamflow, fish would need to migrate to refuge areas and deeper water areas during periods of low flow. The vast majority of the stream network is either ditched natural streams or channels that were created for surface water drainage.



Miles of perennial, intermittent and ditched streams in the Grand Marais / Red River HUC (09030206).

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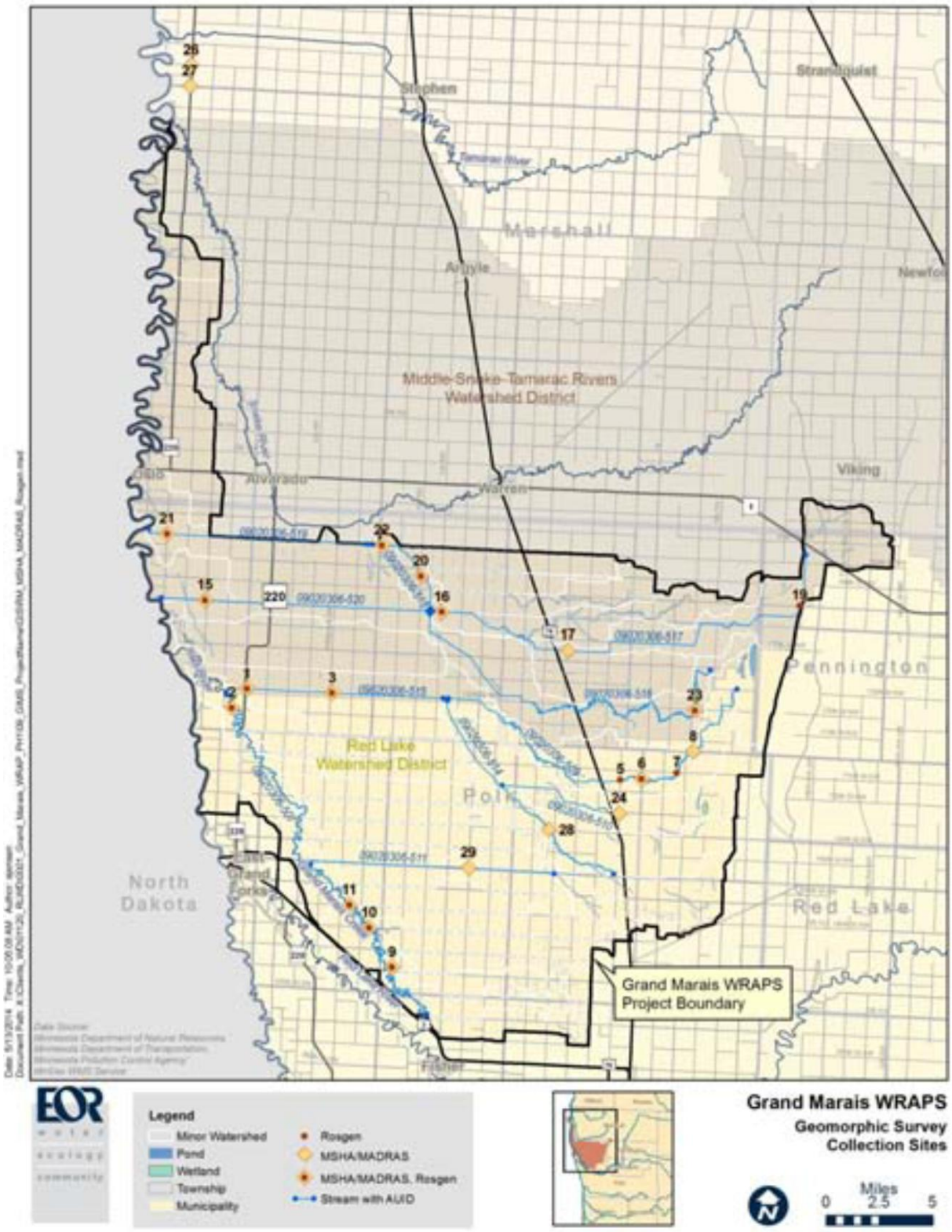

Table 2. Minnesota Stream Health Assessment (MSHA) scores for Grand Marais Creek Watershed.

	Category (score range)						
SITE (-AUID)	Surrounding Land use (0-5)	Riparian (0-15)	Substrate (0-27)	Cover (0-17)	Channel morphology (0-36)	Total (0-100)	Rating
#1: CD2-Site 1 (-515)	0	5	7	0	7	19	poor
#2: GMC-Site 4 (-507)	5	10	6	0	12	33	poor
#3: CD2-Site 2 (-515)	0	6	7	11	7	31	poor
#6: Brandt Creek-Site 1b (-509)	0	9	10	0	15	34	poor
#8: Brandt Creek-Site 2b (-509)	5	6	16	5	2	34	poor
#9: GMC-Site 3 (-507)	3	9	6	0	12	30	poor
#10: GMC-Site 2 (-507)	0	7	7	0	7	21	poor
#11: GMC-Site 1(-507)	0	7	3	0	7	17	poor
#15: JD75-Site 1(-520)	0	5	7	8	7	27	poor
#16: JD75-Site 2(-517)	0	5	7	8	7	27	poor
#17: JD75-Site 3a (-517)	0	4	7	8	7	26	poor
#20: JD1-Site 2 (-518)	0	4	7	0	7	18	poor
#21: JD1-Site 1(-519)	0	4	7	0	7	18	poor
#22: JD1-Site 3(-519)	0	8	7	0	7	22	poor
#23: CD44 (-516)	5	12	15	8	19	59	fair
#24: CD66 (-510)	0	8	7	0	10	25	poor
#26: JD9(-999)	0	5	7	0	7	19	poor
#27: CD12 (-999)	0	7	7	0	7	21	poor
#28: CD66 (-514)	0	8	7	11	10	36	poor
#29: CD126 (-511)	0	4	3	11	13	31	poor
Median score	**0**	**6**	**7**	**0**	**7**	**26**	**poor**
Avg. score	**1**	**6.7**	**7.5**	**3.4**	**8.8**	**27.2**	**poor**

MSHA Qualitative habitat ratings:
Good: MSHA score above the median of the least-disturbed sites (MSHA>66)
Fair: MSHA score between the median of the least-disturbed sites and the median of the most-disturbed sites (45 < MSHA < 66)
Poor: MSHA score below the median of the most-disturbed sites (MSHA<45)

Most of the small ditches in the headwaters are very stable with low bank erosion rates. However, following ditch maintenance, localized gullies may form on the interface of the field and ditch due to the steepened gradient created by the removal of sediment from the streambed. Many of the ditches then act as sediment sinks (collectors) for years after they have been dredged for maintenance as they accumulate sediment coming from farm fields, gullies, and other sources.

Geomorphic and hydrologic management could improve conditions for fish and aquatic life in the Grand Marais Creek watershed. Much of the field erosion likely occurs in gullied areas during high flows. Therefore, control of field and gully erosion, both water and wind-driven, are important for improving stream health in this region.

Interrelationships between water quality and geomorphology suggest that stream geometry could be managed to promote lower water temperatures and higher dissolved oxygen levels. This could be done by allowing channelized streams to form more natural meandering stream channels that are narrow but deep within the larger trapezoidal ditch or 2-stage ditch.

Connectivity could be improved both longitudinally and laterally. Laterally, two-stage ditches would allow for re-establishment of floodplain function in this intensively drained landscape. Longitudinally, fish blockages at dams and culverts could be modified to allow for aquatic life passage.

Both of the aforementioned reports are available on the prairiebasin.com website under "Project Documents."

A lot of water with high turbidity was flowing into Grand Marais Creek from County Ditch 32.

Clearwater River Watershed Surface Water Assessment Grant (SWAG)

A Quality Assurance Project Plan (QAPP) was approved for this project.

Concerns about the safety and accessibility of the Ruffy Brook monitoring site were passed along to the MPCA project manager. The MPCA refused to move the site location.

Clearwater County Soil and Water Conservation District (SWCD), Red Lake County SWCD, and East Polk County SWCD staff began sampling for this project in May. RLWD staff accompanied Clearwater County and East Polk County staff on their first sampling trips.

E. coli concentrations exceeded the chronic water quality standard (>126 CFU/100 ml) in the Clearwater River in Red Lake Falls, Lost River north of Brooks, and Lost River at CSAH 28.

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Burnham Creek Watershed Restoration Project

- Permit applications have been submitted for the Burnham Creek Watershed Restoration project.
- Phase I of this project will be channel maintenance (excavation and turf establishment along the legal ditch system.
- In Phase II of this project, grade stabilization structures will be installed to reduce headcutting (downward erosion in the channel). These rock structures will be designed to allow fish passage.
- In Phase III, rock structures will be built downstream of a large NRCS grade stabilization weir to allow fish passage past that point.

- Phase IV is the portion of the project in which the area around the Spring Gravel Dam washout will be stabilized and restored. Eroding stream banks will be stabilized using the toe wood – sod mat technique. The old sheet pile dam and an old bridge will be removed from the flood plain.

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Stream Habitat Program

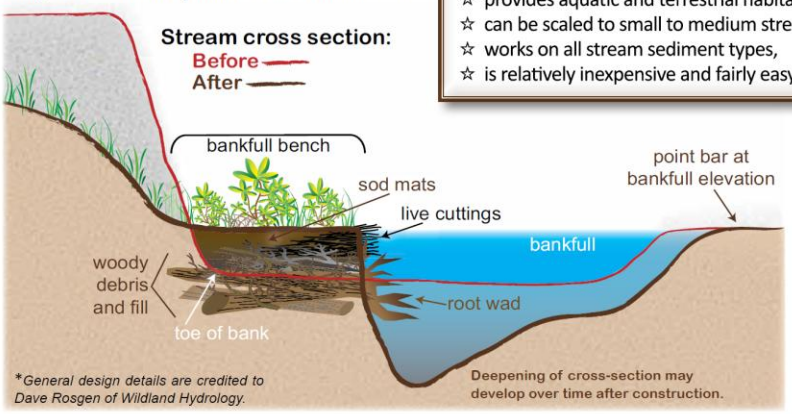
Stream Restoration: Toe Wood-Sod Mat

Purpose of a Toe Wood-Sod Mat

All streambank restoration project goals should be to: 1) restore channel function, dimensions and connection to the floodplain, 2) provide short-term protection that promotes natural long-term stability, 3) allow the channel to adjust over the long-term, 4) protect meanders (a.k.a., sinuosity) of a stream to prevent a meander cutoff. A toe wood-sod mat provides the opportunity to add stability, habitat, and streambank protection where it is needed.

The toe wood-sod mat is a preferred design because it:

- ☆ restores channel dimensions (width & depth),
- ☆ protects a once vulnerable and unstable cutbank,
- ☆ restores the connection to the floodplain with a bankfull bench,
- ☆ incorporates transplanted sod mat(s) and live cuttings that grow quickly and develop dense roots,
- ☆ utilizes all natural materials using local vegetation and sod,
- ☆ provides aquatic and terrestrial habitat,
- ☆ can be scaled to small to medium streams,
- ☆ works on all stream sediment types,
- ☆ is relatively inexpensive and fairly easy to install.



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Other Notes

- Construction of the Pennington County Soil and Water Conservation District's rain garden project at the Ralph Engelstad Arena in Thief River Fallls is planned to start this summer.
- The Agassiz Audobon Society is working with watershed districts to identify areas for potential kiosk locations at impoundments that will provide bird watching information to visitors.
- At the May 22, 2014 RLWD Board of Managers meeting, Vanessa Lane, University of Minnesota-Crookston presented further information on Professor Dan Svedarsky's Cattail Management proposal for wetland wildlife and bioenergy potential. Lane stated that a feasibility study will be completed to see what the economics would be of harvesting cattails. The study will concentrate on a hemi-marsh, which is an area of 50% water coverage and 50% cattails, which would benefit waterfowl habitat. Lane stated that a LCCMR grant was received, but funds are not available until July 1st. They requested $9,250 from the District to help support the salaries and expenses for two employees until the grant is received. The Board voted to approve the request in the amount of $9,250 to study Cattail Management for wetland wildlife and bioenergy potential.
- Travis Torkelson was hired as a summer Water Quality Assistant.

May Meetings/Events

- **May 1, 2014** – Clearwater River Surface Water Assessment Grant monitoring begins.
- **May 6-9 and 12-15, 2014** – Clearwater River geomorphology reconnaissance
- **May 31, 2014** – Thief River and Red Lake River HSPF models are due to be completed by RESPEC.

Plans for Summer 2014

- Thief River Watershed Restoration and Protection Project.
  - Creating Stream Power Index maps.
  - Create a web page dedicated to the Thief River Watershed
  - Flow measurements
  - Longitudinal sampling during runoff events
  - Flow characterization
  - Finish a summary of existing data
  - Work on writing WRAPS report
  - Technical Advisory Committee meeting
  - Collect Microbial Source Tracking (Fecal DNA) samples.
  - HSPF model is scheduled to be completed
- Red Lake River Watershed Assessment Project
  - Stream Power Index Analysis of the watershed
  - HSPF model is scheduled to be completed

  - Create a webpage dedicated to the Red Lake River
  - Flow characterization
  - Flow measurements
  - Finish assessing water quality conditions based upon 2004-2013 data.
  - Finish a summary of existing data that will include the assessment results.
  - Begin writing parts of the WRAPS report
  - Technical Advisory Committee meeting
  - Send flow data from select sites to MPCA staff for a "trial run" of entry into the State's HYDSTRA database.
  - Collect Microbial Source Tracking (Fecal DNA) samples.
- Clearwater River Watershed Restoration and Protection Project
  - HSPF model is scheduled to be completed
  - Flow measurements
  - Water level logger deployments
  - Dissolved oxygen logger deployments
  - Geomorphology Reconnaissance and Bank Erosion Hazard Index ratings of banks along 16 reaches of the Clearwater River at some of its significant tributaries.
  - Intensive study of dissolved oxygen levels and nutrients in the Poplar River near Fosston.
  - Compile existing data and summarize existing reports
- Clearwater River Surface Water Assessment Grant sampling, administration, and data management.
- Deploy HOBO water level loggers as the ice starts to melt and spring runoff begins.

Upcoming Meetings/Events

- **June 9-12, 2014** - Clearwater River geomorphology reconnaissance
- **June 27, 2014** – Red River Basin Monitoring Advisory Committee meeting in Fertile
- **June 30, 2014** – Clearwater River HSPF model should be completely finalized.
- **July 7-11, 2014** – Clearwater River geomorphology
- **July 8, 2014** – Marshall County Water Resources Advisory Committee meeting at Florian Park at 9:30 AM
- **July 21-24, 2014** – Clearwater River geomorphology
- **August 2014** – Technical Advisory Committee meeting for the ongoing WRAP projects within the RLWD (date not set).
- **August 11-15, 2014** – Clearwater River geomorphology
- **August 2014** – Enter and submit monitoring data from the Red Lake River and Grand Marais Creek watersheds to the MPCA for EQuIS entry prior to the official water quality assessment.
- **September 2014** – Holding a public kick-off meeting for the Clearwater River WRAP
- **November 2014** – Thief River WRAP stakeholders meeting (date not set)

RED LAKE WATERSHED DISTRICT MONTHLY WATER QUALITY REPORT	May 2014

Quotes of the Month:

"Accept challenges, so that you may feel the exhilaration of victory."
– George S. Patton

"A smooth sea will never teach us how best to sail the boat."
– Anonymous

Red Lake Watershed District Monthly Water Quality Reports are available online at: http://www.redlakewatershed.org/monthwq.html.

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