Metadata worksheets for 2012 Clean Water Fund Performance Report

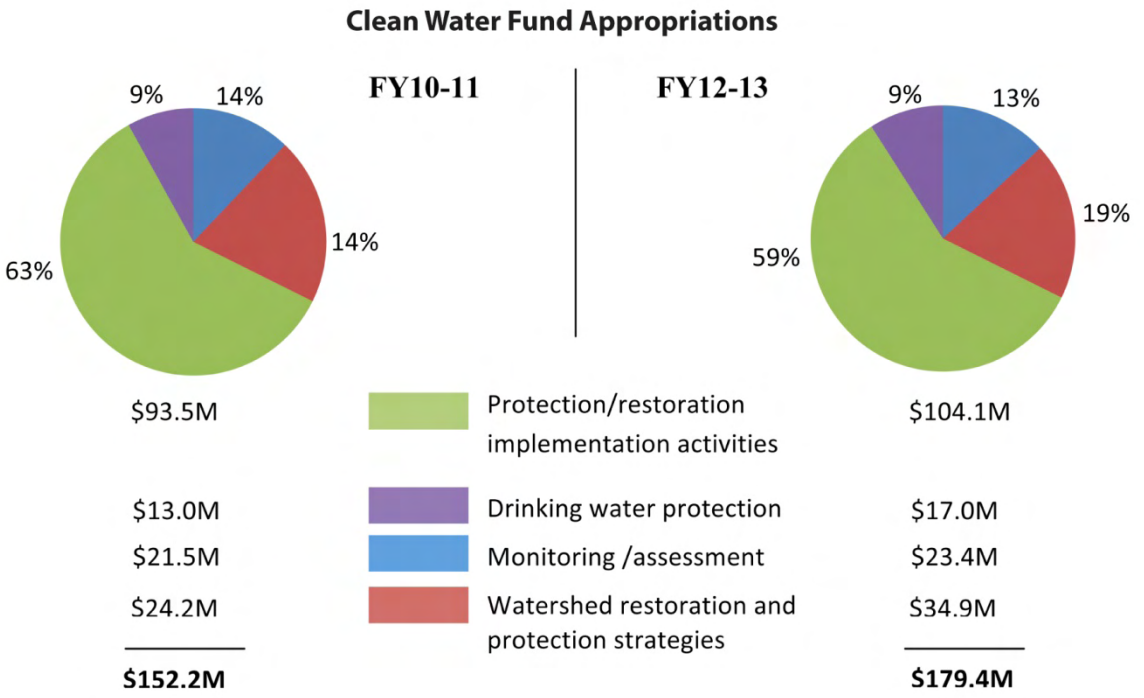
The following metadata worksheets provide detailed information on each of the 18 performance measures listed in the "Clean Water Fund Performance Report," covering fiscal years 2010-2011. Each metadata worksheet includes measure background, methodology used, target or goal, supporting data, caveats and limitations, staff contacts and other useful information. The metadata serves as the foundation for the performance measures and provide documentation necessary to collect consistent and accurate data for the measures over time.

Investment Measures

Total Clean Water Fund dollars appropriated by activity

Measure Background

Visual Depiction



Measure Description

This measure communicates the overall amount of Clean Water Legacy Act funding allocated in a particular year and provides a break-down of that funding in specific categories to demonstrate funding trends over time. This measure provides context for the other financial measures and can be tracked in future years to determine overall appropriation trends. It is the primary investment that enables resources to be spent on the actions that will ultimately help achieve outcomes.

Associated Terms and Phrases

Drinking water protection includes:

- *Source water protection strategies*: Wellhead protection, source water assessment, and surface water intake protection activities that protect water from streams, rivers, lakes, or aquifers that is used for drinking.
- *Water supply planning:* Activities to maintain a safe and sustainable water supply, including the development of local public water supply plans, regional water supply plans, and groundwater management area plans.

Groundwater: The water beneath the land surface that fills the spaces in rock and sediment. It is replenished by precipitation. Groundwater occurs everywhere in Minnesota and supplies about 75 percent of Minnesota's drinking water and nearly 90 percent of the water used for agricultural irrigation. Groundwater also discharges to surface water and allows streams to flow beyond rain and snowmelt periods and sustains lake levels during dry spells.

Protection/restoration implementation includes:

- *Restoration implementation activities*: Implementation of best management practices, improved sewage treatment or other pollution reduction measures to bring an impaired waterbody into attainment with water quality standards. These activities are often funded in response to an approved Total Maximum Daily Load study (TMDL) that determines how much pollution needs to be reduced in order to achieve water quality standards.
- *Protection implementation activities*: Implementation of best management practices to prevent degradation and/or improve waterbodies or aquifers currently meeting water quality standards.

Monitoring and assessment includes:

- *Condition monitoring* – Monitoring consistently throughout the open water season with the objective of assessing the ambient, or background, condition of a lake or stream reach. Results are compared against water quality standards to determine if designated uses are supported.
- *Load monitoring* - Flow and chemistry monitoring conducted at the mouth (or outlet) of each major watershed. Monitoring is conducted at least monthly, and more frequently during events (i.e., snowmelt or rain events). The objective of load monitoring is to capture the entire hydrograph (or variation in the amount of water flowing past a location per unit time), and to determine the pollutant load carried by a stream or river. Results are compared against water quality standards to determine if designated uses are supported.
- *Problem investigation monitoring* – Monitoring with the objective of supporting water quality goals, often in cooperation with other interested agencies. May be conducted in response to accidental wastewater spills or discharges that may affect surface waters. Results are compared against water quality standards to determine if designated uses are supported.
- *Surface Water Assessment Grant (SWAG):* An MPCA grant that passes through funding to local partners for the purpose of conducting condition monitoring. Results are compared against water quality standards to determine if designated uses are supported.
- *Groundwater level monitoring* – Monitoring with the objective of collecting baseline data on groundwater level fluctuations and trends in local and regional aquifers.
- *Groundwater quality monitoring* – Monitoring with the objective of collecting baseline data on groundwater chemistry fluctuations and trends in local and regional aquifers.

Watershed: The surrounding land area that drains into a lake, river or river system. The watershed size used for this measure is at the "major watershed" scale. There are 81 major watersheds in Minnesota.

Watershed restoration and protection strategies includes:

- *Restoration strategies*: Planning activities to restore waterbodies not meeting water quality standards ("impaired"), including the development of a Total Maximum Daily Load study (TMDL) for an impaired water. A "TMDL" means a scientific study that contains a calculation of the maximum amount of a pollutant that may be introduced into a surface water and still ensure that applicable water quality standards for that water are restored and maintained. It results in pollution reduction goals for all sources of a pollutant in a watershed.
- *Protection strategies*: Planning activities to protect high quality ground and surface waters that are currently achieving water quality standards.

Target
There is no specific numeric target for this measure to date. A numeric target for this measure may be appropriate after funding trends over time are established.

Baseline
FY 10-11 serves as the baseline for this measure.

Geographical Coverage
Statewide

Data and Methodology

Methodology for Measure Calculation
The information for this measure is calculated every biennium according to appropriations for each major category.

Data Source
The data for this measure are provided by the Clean Water Fund Interagency Team following biennial appropriations.

Data Collection Period
Data for this measure span fiscal year (FY) 2010-2011 and FY2012-2013.

Data Collection Methodology and Frequency

Supporting Data Set
See graphic above.

Caveats and Limitations
None at this time.

Future Improvements
None at this time.

Financial Considerations

Contributing Agencies and Funding Sources

Funding displayed in this measure are for the programs and activities of the Minnesota Pollution Control Agency, Board of Water and Soil Resources, Department of Natural Resources, Department of Health, Department of Agriculture and Public Facilities Authority. These agencies also direct funding to a myriad of local government and nonprofit agencies.

Communication Strategy

Target Audience

Stakeholders with interest in this measure include the State legislature, the Clean Water Council, and state agency partners.

Associated Messages

This measure is intended to demonstrate a focus on funding implementation activities. Although there are no numeric targets for this measure, the trend should demonstrate a majority of CWF funding going to implementation activities.

Outreach Format

The principle outreach format for this measure is on the websites of state agencies and possibly the Legislative Coordinating Commission's site.

Other Measure Connections

This measure doesn't explicitly link to other measures, but does help to shed light on what types of projects are receiving funding, which affects progress in under other measure categories. In other words, this measure shows the source of much "inputs" for the "output" and "outcome" measures.

Measure Points of Contact

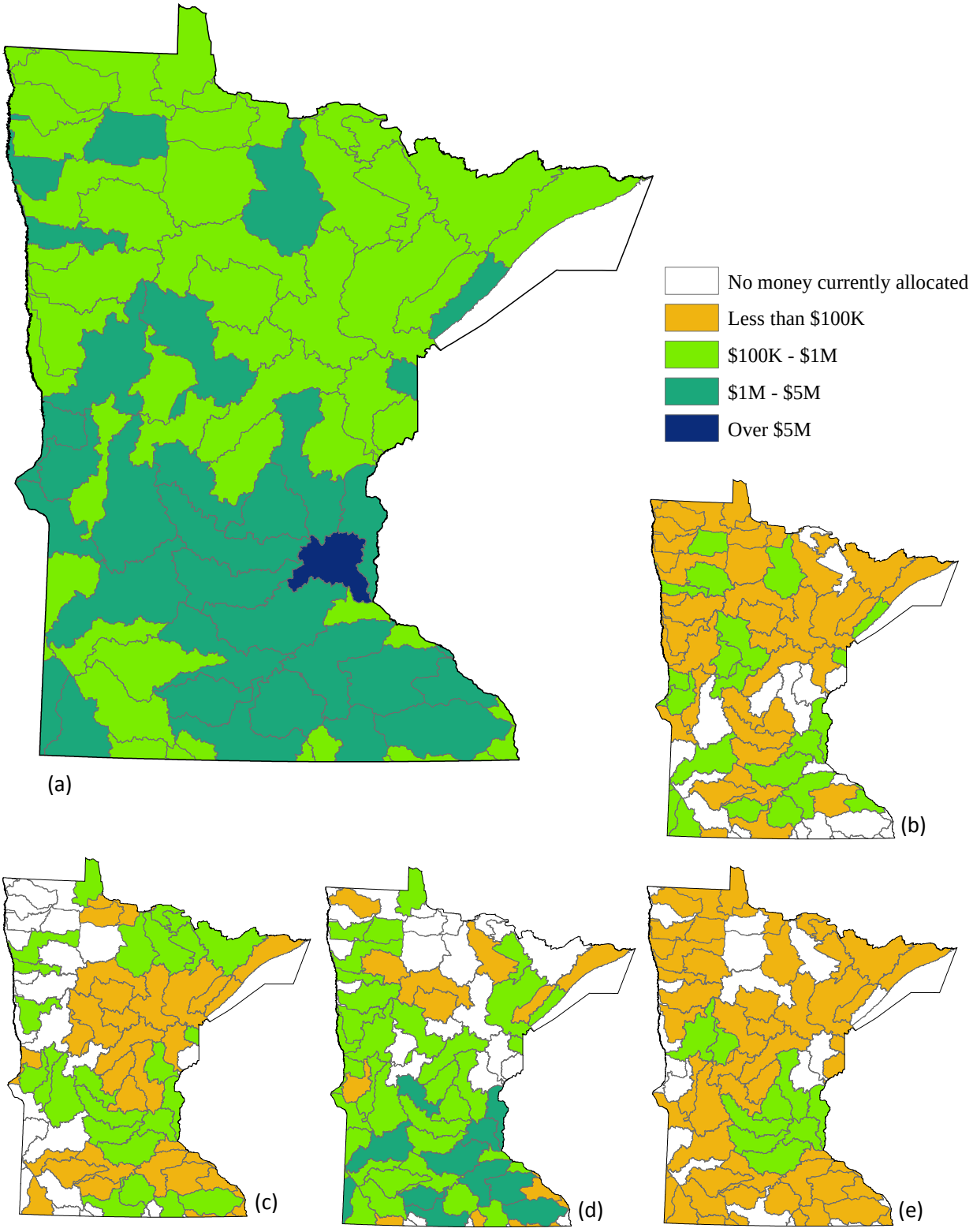
- BWSR contact: Marcey Westrick, marcey.westrick@state.mn.us
- DNR contact: Julie Westerlund, julie.westerlund@state.mn.us
- MDA contact: Margaret Wagner, margaret.e.mangan@state.mn.us
- MDH contact: Tannie Eshenaur, tannie.eshenaur@state.mn.us
- MPCA contact:
    - Monitoring and assessment -- Dana Vanderbosch, dana.vanderbosch@state.mn.us
    - Watershed restoration and strategy development -- Jeff Risberg (TMDLs, CWP) – jeff.risberg@state.mn.us
    - Bill Dunn (wastewater/stormwater) – bill.dunn@state.mn.us
- PFA contact: Jeff Freeman, jeff.freeman@state.mn.us
- Metropolitan Council contact: Lanya Ross, lanya.ross@metc.state.mn.us

Total dollars allocated per watershed or statewide to: 1) monitoring/assessment, 2) watershed restoration/protection strategies, 3) protection/restoration implementation activities, and 4) drinking water protection

Measure Background

Visual Depiction

The figures on the next page illustrate the total FY10-11 Clean Water Fund allocations by watershed for (a) combined watershed-specific projects and statewide activities and technical assistance that benefit all watersheds; (b) monitoring and assessment; (c) watershed restoration/protection strategies; (d) protection/restoration implementation activities; and (e) drinking water protection.


No money currently allocated
Less than $100K
$100K - $1M
$1M - $5M
Over $5M
(a)
(b)
(c)
(d)
(e)

Measure Description

This measure provides a relative sense of the amount of allocations per watershed for each of Minnesota's 81 major watersheds, as well as spending for activities that are more statewide in scope. This data is consistent with data submitted to the Minnesota Legacy website, located at http://www.legacy.leg.mn/funds/clean-water-fund.

Associated Terms and Phrases

Aquifer: Water-bearing porous soil or rock that yield significant amounts of water to wells.

Drinking water protection includes:

- *Source water protection strategies*: Wellhead protection, source water assessment, and surface water intake protection activities that protect water from streams, rivers, lakes, or aquifers that is used for drinking.
- *Water supply planning:* Activities to maintain a safe and sustainable water supply, including the development of local public water supply plans, regional water supply plans, and groundwater management area plans.

Groundwater: The water beneath the land surface that fills the spaces in rock and sediment. It is replenished by precipitation. Groundwater occurs everywhere in Minnesota and supplies about 75 percent of Minnesota's drinking water and nearly 90 percent of the water used for agricultural irrigation. Groundwater also discharges to surface water and allows streams to flow beyond rain and snowmelt periods and sustains lake levels during dry spells.

Implementation includes:

- *Restoration activities*: Implementation of best management practices, improved sewage treatment or other pollution reduction measures to bring an impaired waterbody into attainment with water quality standards. These activities are often funded in response to an approved Total Maximum Daily Load study (TMDL) that determines how much pollution needs to be reduced in order to achieve water quality standards.
- *Protection activities*: Implementation of best management practices to prevent degradation and/or improve waterbodies or aquifers currently meeting water quality standards.

Monitoring and assessment includes:

- *Condition monitoring* – Monitoring consistently throughout the open water season with the objective of assessing the ambient, or background, condition of a lake or stream reach. Results are compared against water quality standards to determine if designated uses are supported.
- *Load monitoring* - Flow and chemistry monitoring conducted at the mouth (or outlet) of each major watershed. Monitoring is conducted at least monthly, and more frequently during events (i.e., snowmelt or rain events). The objective of load monitoring is to capture the entire hydrograph (or variation in the amount of water flowing past a location per unit time), and to

determine the pollutant load carried by a stream or river. Results are compared against water quality standards to determine if designated uses are supported.

- *Problem investigation monitoring* – Monitoring with the objective of supporting water quality goals, often in cooperation with other interested agencies. May be conducted in response to accidental wastewater spills or discharges that may affect surface waters. Results are compared against water quality standards to determine if designated uses are supported.
- *Surface Water Assessment Grant (SWAG):* An MPCA grant that passes through funding to local partners for the purpose of conducting condition monitoring. Results are compared against water quality standards to determine if designated uses are supported.
- *Groundwater level monitoring* – Monitoring with the objective of collecting baseline data on groundwater level fluctuations and trends in local and regional aquifers.
- *Groundwater quality monitoring* – Monitoring with the objective of collecting baseline data on groundwater chemistry fluctuations and trends in local and regional aquifers.

Partners: According to the Clean Water Legacy Act, partners are eligible regional and local government units, state agencies, political subdivisions, joint powers organizations, tribal entities, special purpose units of government, as well as the University of Minnesota and other public education institutions, according to the rules of the funding program (MN Statutes 114D.15). Partners can also include eligible nonprofit or other nongovernmental organizations, depending on the rules of the funding program.

Public Agencies: According to the Clean Water Legacy Act, public agencies means all state agencies, political subdivisions, joint powers organizations, and special purpose units of government with authority, responsibility, or expertise in protecting, restoring, or preserving the quality of surface waters, managing or planning for surface water and related lands, or financing waters-related projects. (MN Statutes 114D.15). Public agencies includes the University of Minnesota and other public education institutions.

Statewide: Spending for activities that are more statewide in scope. This includes projects with more of a statewide orientation than a watershed one, as well as technical assistance for projects provided by stat**e** agencies.

Watershed: The surrounding land area that drains into a lake, river or river system. The watershed size used for this measure is at the "major watershed" scale. There are 81 major watersheds in Minnesota.

Watershed restoration and protection strategies includes:

- *Restoration strategies*: Planning activities to restore waterbodies not meeting water quality standards ("impaired"), including the development of a Total Maximum Daily Load study (TMDL) for an impaired water. A "TMDL" means a scientific study that contains a calculation of the maximum amount of a pollutant that may be introduced into a surface water and still ensure that applicable water quality standards for that water are restored and maintained. It results in pollution reduction goals for all sources of a pollutant in a watershed.

- *Protection strategies*: Planning activities to protect high quality ground and surface waters that are currently achieving water quality standards.

Target
Not applicable

Baseline
FY 2010-11 – the first full biennium of appropriations from the Clean Water Fund.

Geographical Coverage
Coverage is by watershed or statewide.

Data and Methodology *(Note: Data is consistent with data submitted to the Minnesota Legacy website, http://www.legacy.leg.mn/funds/clean-water-fund)*

Methodology for Measure Calculation
Due to the wide variation in state agency program objectives and project management structures, each agency and even units within agencies may use different methods to calculate the dollars reported by this measure. For detailed methodology employed by each agency, contact the people listed in this report. These general guidelines were adopted by all agencies for this report to provide consistency:

Watershed-specific allocations: Best professional judgment was used to determine the distribution of spending for projects occurring in multiple watersheds or projects with unclear boundaries. In general, funding in projects benefiting multiple watersheds was divided equally among those watersheds.

Statewide and technical assistance: The amount of spending on statewide work and technical assistance is consistent with values reported to the Minnesota Legacy website. This category generally includes the total annual cost of projects with a "statewide" benefit including costs of state agency staff providing oversight and technical assistance for all statewide or watershed-specific projects; program activities; and money passed through to partners and contractors working on state-wide projects. Total cost does not include easements.

See "caveats and limitations" below for more information.

Data Source
The primary data source used to develop this measure is the website "Minnesota's Legacy: Watch the Progress" at http://www.legacy.leg.mn/funds/clean-water-fund.

Details needed to allocate spending by watershed were derived from the following sources:

- BWRS's database eLINK4WEB
- DNR's project databases
- Metropolitan Council's database EIMS
- MDA's project databases

- MDH's databases for grant programs
- MPCA's databases including: MAPs/SWIFT, STORET/EQuis, Watershed DELTA, and individual project databases
- PFA's project databases

Data Collection Period

Fiscal year 10-11

Data Collection Methodology and Frequency

Data should be collected annually.

It should be noted that monitoring and assessment data collection is complicated by the SWAG contract process. SWAG contracts are finalized the spring after the start of a new fiscal year, and sites monitored through SWAGs are established in STORET/EQuIS in early summer after a contract has been executed. Therefore, the earliest the watershed estimates can be made is 1.25 years after the start of a new fiscal year (i.e., can report on FY11 by the end of the first quarter of FY12). Staff salary estimates per watershed could be developed within 6 months after the start of a new fiscal year (i.e., can report on FY11 by the start of the second quarter of FY11).

Supporting Data Set

The table on page 8 provides the data used to report on this measure.

Caveats and Limitations

Overall: The process for collecting data for this measure is a complex process and the results do not represent an exact accounting of funding allocations. Rather, the measure is intended to provide a general sense of how funds are allocated across the state using watersheds as the common geographic unit. For many projects, funding was not allocated by watershed boundaries (county, city, region, etc.) so best professional judgment was employed to determine how to assign project allocations to one or more watershed. Likewise, best professional judgment was used to determine how to allocate funding for projects that had spending in more than one activity category (i.e. monitoring and strategy development and implementation). For detailed information for funding allocations in this measure for a particular project or state agency, contact the agency representative listed below ("Measure Points of Contact").

Monitoring/assessment: Making estimates by fiscal year is difficult, as the FY divides the field season. Note that the monitoring/assessment FY estimate will actually be the cost to monitor and assess the watershed sites begun the summer of the new FY (i.e., FY11 estimate will be the cost to monitor and assess the 2010 watershed sites). Because the monitoring and assessment work is split between MPCA staff and local partners, data is stored in many areas, and much of the data manipulation must be done manually, a large amount of work must be undertaken to break expenses down by watershed.

Future Improvements

It is anticipated that this measure will continue to evolve in future years as agencies improve their process for collecting data. For example, the state agencies are investigating an automated computer system to collect this data in a coordinated way.

Financial Considerations

Contributing Agencies and Funding Sources

BWSR, DNR, MDA, MDH, MetCouncil, MPCA, PFA

Measure Points of Contact

- BWSR contact: Marcey Westrick, marcey.westrick@state.mn.us
- DNR contact: Julie Westerlund, julie.westerlund@state.mn.us
- MDA contact: Margaret Wagner, margaret.e.mangan@state.mn.us
- MDH contact: Tannie Eshenaur, tannie.eshenaur@state.mn.us
- MPCA contact:
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    - Watershed restoration and strategy development -- Jeff Risberg (TMDLs, CWP) – jeff.risberg@state.mn.us
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- PFA contact: Jeff Freeman, jeff.freeman@state.mn.us
- Metropolitan Council contact: Lanya Ross, lanya.ross@metc.state.mn.us

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Supporting Data Set – FY 10-11 (in millions of dollars)

		Monitoring					Watershed Restoration & Protection Strategies			Implementation						Drinking Water					TOTAL
		DNR	Met Council	MDA	MPCA	*Sub-Total*	DNR	MPCA	*Sub-Total*	BWSR	DNR	MDA	MPCA	PFA	*Sub-Total*	DNR	Met Council	MDA	MDH	*Sub-Total*	
STATEWIDE PROJECTS & TECHNICAL ASSISTANCE		$3.15	$0.00	$0.68	$3.75	***$7.58***	$1.69	$10.55	***$12.24***	$0.00	$4.37	$4.67	$0.00	$0.00	***$9.04***	$0.96	$0.00	$0.59	$2.06	***$3.61***	**$32.46**
WATERSHED PROJECTS (BY NAME AND HUC #)																					
Big Fork River	09030006	$0.00	$0.00	$0.00	$0.76	***$0.76***	$0.00	$0.18	***$0.18***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.95**
Blue Earth River	07020009	$0.00	$0.00	$0.00	$0.09	***$0.09***	$0.00	$0.15	***$0.15***	$0.59	$0.00	$0.11	$0.00	$0.74	***$1.44***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$1.68**
Bois De Sioux River	09020101	$0.00	$0.00	$0.00	$0.65	***$0.65***	$0.00	$0.07	***$0.07***	$0.13	$0.00	$0.00	$0.00	$0.07	***$0.20***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.92**
Buffalo River	09020106	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.25	***$0.25***	$0.24	$0.00	$0.06	$0.00	$0.00	***$0.30***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.58**
Cannon River	07040002	$0.00	$0.00	$0.00	$0.45	***$0.45***	$0.00	$0.02	***$0.02***	$0.32	$0.00	$0.14	$0.00	$1.51	***$1.96***	$0.00	$0.09	$0.00	$0.00	***$0.09***	**$2.51**
Cedar River	07080201	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.18	***$0.18***	$0.16	$0.00	$0.16	$0.00	$0.61	***$0.93***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$1.11**
Chippewa River	07020005	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.31	***$0.31***	$0.28	$0.00	$0.09	$0.00	$0.00	***$0.37***	$0.00	$0.00	$0.00	$0.03	***$0.03***	**$0.71**
Clearwater River	09020305	$0.00	$0.00	$0.00	$0.11	***$0.11***	$0.00	$0.00	***$0.00***	$0.05	$0.00	$0.00	$0.00	$0.00	***$0.05***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.17**
Cloquet River	04010202	$0.00	$0.00	$0.00	$0.01	***$0.01***	$0.00	$0.01	***$0.01***	$0.00	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.04**
Cottonwood River	07020008	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.02	***$0.02***	$0.16	$0.00	$0.07	$0.00	$0.00	***$0.23***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.29**
Crow Wing River	07010106	$0.00	$0.00	$0.00	$0.71	***$0.71***	$0.00	$0.10	***$0.10***	$0.14	$0.00	$0.00	$0.00	$0.00	***$0.14***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.94**
Des Moines River - Headwaters	07100001	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	***$0.00***	$0.57	$0.00	$0.00	$0.00	$0.00	***$0.57***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.58**
East Fork Des Moines River	07100003	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.02	***$0.02***	**$0.02**
Kettle River	07030003	$0.00	$0.00	$0.00	$0.04	***$0.04***	$0.00	$0.01	***$0.01***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.05**
Lac Qui Parle River	07020003	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	***$0.00***	$0.14	$0.00	$0.00	$0.00	$0.00	***$0.14***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.14**
Lake of the Woods	09030009	$0.00	$0.00	$0.00	$0.01	***$0.01***	$0.00	$0.13	***$0.13***	$0.17	$0.00	$0.00	$0.00	$0.00	***$0.17***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.30**
Lake Superior - North	04010101	$0.00	$0.00	$0.00	$0.01	***$0.01***	$0.00	$0.01	***$0.01***	$0.04	$0.00	$0.00	$0.00	$0.00	***$0.04***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.07**
Lake Superior - South	04010102	$0.00	$0.00	$0.00	$0.44	***$0.44***	$0.00	$0.01	***$0.01***	$0.16	$0.00	$0.00	$0.25	$0.00	***$0.41***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.86**
Le Sueur River	07020011	$0.00	$0.00	$0.00	$0.12	***$0.12***	$0.00	$0.45	***$0.45***	$0.28	$0.00	$0.09	$0.00	$0.00	***$0.37***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.94**
Leech Lake River	07010102	$0.00	$0.00	$0.00	$0.04	***$0.04***	$0.00	$0.00	***$0.00***	$0.08	$0.00	$0.00	$0.00	$0.00	***$0.08***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.13**
Little Fork River	09030005	$0.00	$0.00	$0.00	$0.04	***$0.04***	$0.00	$0.20	***$0.20***	$0.00	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.25**
Little Sioux River	10230003	$0.00	$0.00	$0.00	$0.03	***$0.03***	$0.00	$0.00	***$0.00***	$0.06	$0.00	$0.00	$0.00	$0.00	***$0.06***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.10**
Long Prairie River	07010108	$0.00	$0.00	$0.00	$0.38	***$0.38***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.38**
Lower Big Sioux River	10170203	$0.00	$0.00	$0.00	$0.40	***$0.40***	$0.00	$0.00	***$0.00***	$0.04	$0.00	$0.00	$0.00	$1.04	***$1.08***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$1.48**
Lower Des Moines River	07100002	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.01**
Lower Minnesota River	07020012	$0.00	$0.12	$0.00	$0.14	***$0.26***	$0.00	$0.11	***$0.11***	$1.73	$0.00	$0.33	$0.01	$1.14	***$3.21***	$0.04	$0.09	$0.00	$0.00	***$0.13***	**$3.71**
Lower St. Croix River	07030005	$0.00	$0.04	$0.00	$0.37	***$0.41***	$0.00	$0.63	***$0.63***	$0.95	$0.00	$0.02	$0.22	$0.05	***$1.23***	$0.09	$0.09	$0.00	$0.09	***$0.27***	**$2.54**
Minnesota River - Headwaters	07020001	$0.00	$0.00	$0.00	$0.08	***$0.08***	$0.00	$0.00	***$0.00***	$0.03	$0.00	$0.00	$0.00	$0.90	***$0.93***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$1.02**
Minnesota River - Mankato	07020007	$0.00	$0.00	$0.00	$0.06	***$0.06***	$0.00	$0.04	***$0.04***	$0.19	$0.00	$0.00	$0.00	$0.37	***$0.55***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.65**
Minnesota River - Yellow Medicine River	07020004	$0.00	$0.00	$0.00	$0.71	***$0.71***	$0.00	$0.00	***$0.00***	$0.02	$0.00	$0.18	$0.00	$3.26	***$3.47***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$4.19**

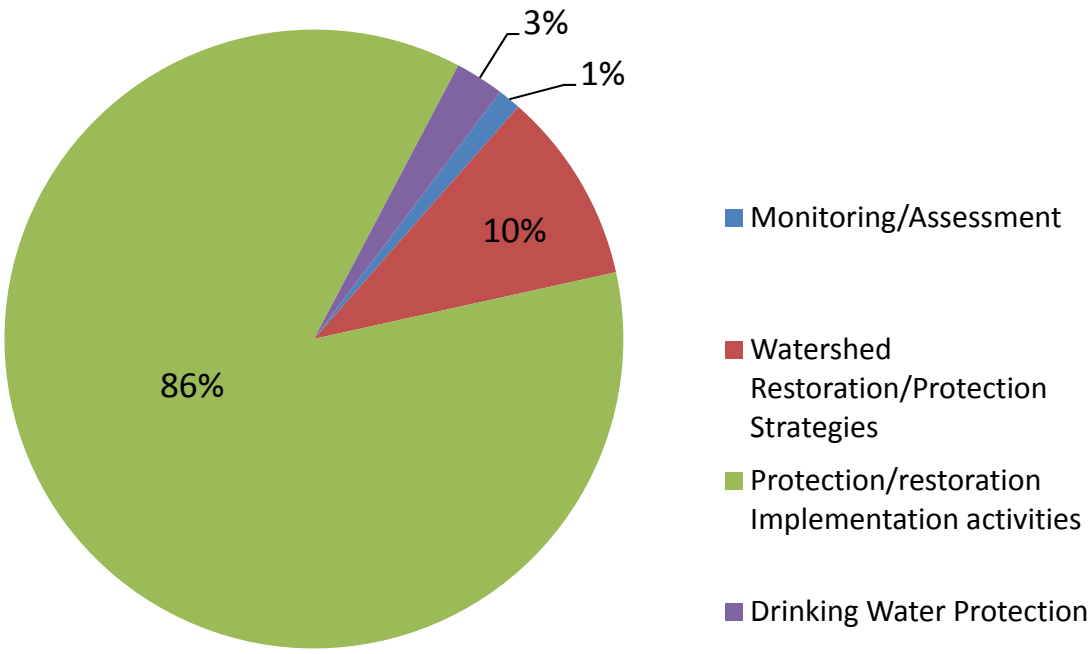
		Monitoring					Watershed Restoration & Protection Strategies			Implementation						Drinking Water					TOTAL
		DNR	Met Council	MDA	MPCA	*Sub-Total*	DNR	MPCA	*Sub-Total*	BWSR	DNR	MDA	MPCA	PFA	*Sub-Total*	DNR	Met Council	MDA	MDH	*Sub-Total*	
Mississippi River - Brainerd	07010104	$0.00	$0.00	$0.00	$0.03	***$0.03***	$0.00	$0.00	***$0.00***	$0.31	$0.00	$0.01	$0.00	$0.00	***$0.32***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.35**
Mississippi River - Grand Rapids	07010103	$0.00	$0.00	$0.00	$0.06	***$0.06***	$0.00	$0.02	***$0.02***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.02	***$0.02***	**$0.10**
Mississippi River - Headwaters	07010101	$0.00	$0.00	$0.00	$0.07	***$0.07***	$0.00	$0.00	***$0.00***	$0.04	$0.00	$0.00	$0.00	$0.02	***$0.06***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.13**
Mississippi River - La Crescent	07040006	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	***$0.00***	$0.03	$0.00	$0.00	$0.00	$0.00	***$0.03***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.04**
Mississippi River - Lake Pepin	07040001	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.03	***$0.03***	$0.08	$0.00	$0.04	$0.00	$0.00	***$0.12***	$0.00	$0.09	$0.00	$0.01	***$0.09***	**$0.24**
Mississippi River - Reno	07060001	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.02	***$0.02***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.03	***$0.03***	**$0.04**
Mississippi River - Sartell	07010201	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.05	***$0.05***	$0.15	$0.00	$0.02	$0.00	$0.00	***$0.17***	$0.00	$0.00	$0.00	$0.03	***$0.03***	**$0.26**
Mississippi River - St. Cloud	07010203	$0.00	$0.00	$0.00	$0.08	***$0.08***	$0.00	$0.05	***$0.05***	$0.28	$0.00	$0.00	$0.00	$0.71	***$0.99***	$0.09	$0.00	$0.00	$0.16	***$0.25***	**$1.38**
Mississippi River - Twin Cities	07010206	$0.00	$0.16	$0.00	$0.78	***$0.94***	$0.00	$0.34	***$0.34***	$3.15	$0.29	$0.03	$0.28	$0.35	***$4.10***	$0.09	$0.09	$0.00	$0.03	***$0.20***	**$5.58**
Mississippi River - Winona	07040003	$0.00	$0.00	$0.00	$0.63	***$0.63***	$0.00	$0.02	***$0.02***	$0.00	$0.00	$0.03	$0.00	$0.00	***$0.03***	$0.00	$0.00	$0.00	$0.04	***$0.04***	**$0.72**
Mustinka River	09020102	$0.00	$0.00	$0.00	$0.65	***$0.65***	$0.00	$0.22	***$0.22***	$0.00	$0.00	$0.05	$0.00	$0.00	***$0.05***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.92**
Nemadji River	04010301	$0.00	$0.00	$0.00	$0.39	***$0.39***	$0.00	$0.27	***$0.27***	$0.00	$0.00	$0.00	$0.25	$0.00	***$0.25***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.93**
North Fork Crow River	07010204	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.40	***$0.40***	$0.19	$0.00	$0.01	$0.37	$0.11	***$0.69***	$0.04	$0.09	$0.00	$0.04	***$0.17***	**$1.28**
Otter Tail River	09020103	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.00	***$0.00***	$0.66	$0.00	$0.00	$0.00	$0.07	***$0.73***	$0.00	$0.00	$0.08	$0.02	***$0.11***	**$0.86**
Pine River	07010105	$0.00	$0.00	$0.00	$0.06	***$0.06***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.07**
Pomme de Terre River	07020002	$0.00	$0.00	$0.00	$0.01	***$0.01***	$0.00	$0.16	***$0.16***	$0.29	$0.00	$0.02	$0.00	$0.00	***$0.31***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.48**
Rainy River - Baudette	09030008	$0.00	$0.00	$0.00	$0.01	***$0.01***	$0.00	$0.10	***$0.10***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.11**
Rainy River – Black River	09030004	$0.00	$0.00	$0.00	$0.01	***$0.01***	$0.00	$0.10	***$0.10***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.12**
Rainy River - Headwaters	09030001	$0.00	$0.00	$0.00	$0.01	***$0.01***	$0.00	$0.33	***$0.33***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.35**
Rainy River - Rainy Lake	09030003	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.11	***$0.11***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.03	***$0.03***	**$0.14**
Rapid River	09030007	$0.00	$0.00	$0.00	$0.01	***$0.01***	$0.00	$0.10	***$0.10***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.10**
Red Lake River	09020303	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.15	***$0.15***	$0.21	$0.00	$0.00	$0.00	$0.00	***$0.21***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.38**
Red River of the North – Grand Marais Creek	09020306	$0.00	$0.00	$0.00	$0.04	***$0.04***	$0.00	$0.00	***$0.00***	$0.58	$0.00	$0.00	$0.00	$0.00	***$0.58***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.63**
Red River of the North – Marsh River	09020107	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.02**
Red River of the North – Sandhill River	09020301	$0.00	$0.00	$0.00	$0.45	***$0.45***	$0.00	$0.20	***$0.20***	$0.28	$0.00	$0.00	$0.00	$0.00	***$0.28***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.95**
Red River of the North – Tamarac River	09020311	$0.00	$0.00	$0.00	$0.04	***$0.04***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.04**
Redeye River	07010107	$0.00	$0.00	$0.00	$0.37	***$0.37***	$0.00	$0.04	***$0.04***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.11	$0.00	***$0.12***	**$0.53**
Redwood River	07020006	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.02	***$0.02***	$0.00	$0.00	$0.00	$0.00	$0.31	***$0.31***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.33**
Rock River	10170204	$0.00	$0.00	$0.00	$0.10	***$0.10***	$0.00	$0.00	***$0.00***	$0.47	$0.00	$0.01	$0.00	$0.03	***$0.50***	$0.00	$0.00	$0.00	$0.02	***$0.02***	**$0.62**
Root River	07040008	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.34	***$0.34***	$1.58	$0.00	$0.80	$0.00	$0.03	***$2.40***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$2.74**
Roseau River	09020314	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.03**
Rum River	07010207	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.03	***$0.03***	$0.19	$0.00	$0.00	$0.00	$0.50	***$0.69***	$0.04	$0.09	$0.00	$0.02	***$0.15***	**$0.87**
Sauk River	07010202	$0.00	$0.00	$0.00	$0.07	***$0.07***	$0.00	$0.16	***$0.16***	$1.22	$0.00	$0.04	$0.36	$0.00	***$1.61***	$0.00	$0.00	$0.02	$0.00	***$0.02***	**$1.87**
Shell Rock River	07080202	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.01	$0.00	$0.00	***$0.01***	$0.00	$0.00	$0.00	$0.04	***$0.04***	**$0.06**
Snake River	07030004	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.28	***$0.28***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.28**

		Monitoring					Watershed Restoration & Protection Strategies			Implementation						Drinking Water					TOTAL
		DNR	Met Council	MDA	MPCA	*Sub-Total*	DNR	MPCA	*Sub-Total*	BWSR	DNR	MDA	MPCA	PFA	*Sub-Total*	DNR	Met Council	MDA	MDH	*Sub-Total*	
Snake River	09020309	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.00	***$0.00***	$0.13	$0.00	$0.00	$0.00	$0.00	***$0.13***	$0.00	$0.00	$0.00	$0.05	***$0.05***	**$0.20**
South Fork Crow River	07010205	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.45	***$0.45***	$0.00	$0.00	$0.07	$0.13	$0.03	***$0.22***	$0.04	$0.09	$0.00	$0.00	***$0.13***	**$0.83**
St. Louis River	04010201	$0.00	$0.00	$0.00	$0.01	***$0.01***	$0.00	$0.01	***$0.01***	$0.15	$0.00	$0.00	$0.25	$0.00	***$0.40***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.43**
Thief River	09020304	$0.00	$0.00	$0.00	$0.42	***$0.42***	$0.00	$0.00	***$0.00***	$0.38	$0.00	$0.00	$0.00	$0.00	***$0.38***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.81**
Two Rivers	09020312	$0.00	$0.00	$0.00	$0.04	***$0.04***	$0.00	$0.00	***$0.00***	$0.10	$0.00	$0.00	$0.00	$0.00	***$0.10***	$0.00	$0.00	$0.00	$0.05	***$0.05***	**$0.19**
Upper Big Sioux River	10170202	$0.00	$0.00	$0.00	$0.37	***$0.37***	$0.00	$0.00	***$0.00***	$0.16	$0.00	$0.00	$0.00	$0.00	***$0.16***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.53**
Upper Iowa River	07060002	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.01	$0.00	$0.00	***$0.01***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.01**
Upper Red River of the North	09020104	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.00	***$0.00***	$0.51	$0.00	$0.00	$0.00	$0.00	***$0.51***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.53**
Upper St. Croix River	07030001	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.01**
Upper Wapsipinicon River	07080102	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.00**
Upper/Lower Red Lake	09020302	$0.00	$0.00	$0.00	$0.05	***$0.05***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.05**
Vermilion River	09030002	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.11	***$0.11***	$0.19	$0.00	$0.00	$0.00	$0.00	***$0.19***	$0.09	$0.00	$0.00	$0.01	***$0.10***	**$0.39**
Watonwan River	07020010	$0.00	$0.00	$0.00	$0.11	***$0.11***	$0.00	$0.02	***$0.02***	$0.00	$0.00	$0.06	$0.00	$4.24	***$4.29***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$4.43**
Wild Rice River	09020108	$0.00	$0.00	$0.00	$0.08	***$0.08***	$0.00	$0.00	***$0.00***	$0.18	$0.00	$0.00	$0.00	$0.00	***$0.18***	$0.00	$0.00	$0.00	$0.01	***$0.01***	**$0.26**
Winnebago River	07080203	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	$0.00	***$0.00***	$0.00	$0.00	$0.00	$0.00	***$0.00***	**$0.00**
Zumbro River	07040004	$0.00	$0.00	$0.00	$0.02	***$0.02***	$0.00	$0.06	***$0.06***	$1.04	$0.00	$0.03	$0.00	$0.28	***$1.35***	$0.00	$0.00	$0.00	$0.04	***$0.04***	**$1.47**

Total dollars awarded in grants and contracts to non-state agency partners

Measure Background

Visual Depiction



Measure Description

This measure provides statewide numbers for the amount of Clean Water funding awarded to non-state agency partners on monitoring/assessment, watershed restoration and protection strategies, restoration and protection implementation activities, and drinking water protection. The data collected for this measure is consistent with the information provided to the Minnesota Legacy website: http://www.legacy.leg.mn/

Associated Terms and Phrases

Aquifer: Water-bearing porous soil or rock that yield significant amounts of water to wells.

Groundwater: The water beneath the land surface that fills the spaces in rock and sediment. It is replenished by precipitation. Groundwater occurs everywhere in Minnesota and supplies about 75

percent of Minnesota's drinking water and nearly 90 percent of the water used for agricultural irrigation. Groundwater also discharges to surface water and allows streams to flow beyond rain and snowmelt periods and sustains lake levels during dry spells.

Protection/restoration implementation includes:

- *Restoration implementation activities*: Implementation of best management practices, improved sewage treatment or other pollution reduction measures to bring an impaired waterbody into attainment with water quality standards. These activities are often funded in response to an approved Total Maximum Daily Load study (TMDL) that determines how much pollution needs to be reduced in order to achieve water quality standards.
- *Protection implementation activities*: Implementation of best management practices to prevent degradation and/or improve waterbodies or aquifers currently meeting water quality standards.

Monitoring/Assessment includes:

- *Condition monitoring* – Monitoring consistently throughout the open water season with the objective of assessing the ambient, or background, condition of a lake or stream reach. Results are compared against water quality standards to determine if designated uses are supported.
- *Load monitoring* - Flow and chemistry monitoring conducted at the mouth (or outlet) of each major watershed. Monitoring is conducted at least monthly, and more frequently during events (i.e., snowmelt or rain events). The objective of load monitoring is to capture the entire hydrograph (or variation in the amount of water flowing past a location per unit time), and to determine the pollutant load carried by a stream or river. Results are compared against water quality standards to determine if designated uses are supported.
- *Problem investigation monitoring* – Monitoring with the objective of supporting water quality goals, often in cooperation with other interested agencies. May be conducted in response to accidental wastewater spills or discharges that may affect surface waters. Results are compared against water quality standards to determine if designated uses are supported.
- *Surface Water Assessment Grant (SWAG):* An MPCA grant that passes through funding to local partners for the purpose of conducting condition monitoring. Results are compared against water quality standards to determine if designated uses are supported.
- *Groundwater level monitoring* – Monitoring with the objective of collecting baseline data on groundwater level fluctuations and trends in local and regional aquifers.
- *Groundwater quality monitoring* – Monitoring with the objective of collecting baseline data on groundwater chemistry fluctuations and trends in local and regional aquifers.

Partners: According to the Clean Water Legacy Act, partners are eligible regional and local government units, state agencies, political subdivisions, joint powers organizations, tribal entities, special purpose units of government, as well as the University of Minnesota and other public education institutions, according to the rules of the funding program (MN Statutes 114D.15). Partners can also include eligible nonprofit or other nongovernmental organizations, depending on the rules of the funding program.

Public Agencies: According to the Clean Water Legacy Act, public agencies means all state agencies, political subdivisions, joint powers organizations, and special purpose units of government with authority, responsibility, or expertise in protecting, restoring, or preserving the quality of surface waters, managing or planning for surface water and related lands, or financing waters-related projects. (MN Statutes 114D.15). Public agencies includes the University of Minnesota and other public education institutions.

Research: The collection of information about watershed or aquifer health including mapping and modeling.

Statewide projects and technical assistance: Spending for activities that are more statewide in scope. This includes projects with more of a statewide orientation than a watershed one, as well as technical assistance for projects provided by stat**e** agencies.

Watershed: The surrounding land area that drains into a lake, river or river system. The watershed size used for this measure is at the "major watershed" scale. There are 81 major watersheds in Minnesota.

Watershed restoration and protection strategies includes:

- *Restoration strategies*: Planning activities to restore waterbodies not meeting water quality standards ("impaired"), including the development of a Total Maximum Daily Load study (TMDL) for an impaired water. A "TMDL" means a scientific study that contains a calculation of the maximum amount of a pollutant that may be introduced into a surface water and still ensure that applicable water quality standards for that water are restored and maintained. It results in pollution reduction goals for all sources of a pollutant in a watershed.
- *Protection strategies*: Planning activities to protect high quality ground and surface waters that are currently achieving water quality standards.
- *Source water protection strategies*: Wellhead protection, source water assessment, and surface water intake protection activities that protect water from streams, rivers, lakes, or aquifers that is used for drinking.
- *Water supply planning:* Activities to maintain a safe and sustainable water supply, including the development of local public water supply plans, regional water supply plans, and Groundwater Management Area *plans.*

Target

Not applicable

Baseline

Fiscal Year 2010-2011 – the first full biennium of appropriations from the Clean Water Fund.

Geographical Coverage

Grants and contracts to non-state agencies is presented as statewide totals per category, though much of it has been allocated to watershed-specific projects.

Data and Methodology

Methodology for Measure Calculation

Due to the wide variation in state agency program objectives and project management structures, each agency and even units within agencies may use different methods to calculate the dollars reported by this measure. For detailed methodology employed by each agency, contact the people listed in this report. The general guidelines were adopted by all agencies for this report to provide consistency.

Data Source

The primary data source used to develop this measure is the Minnesota Legacy website at http://www.legacy.leg.mn/funds/clean-water-fund.

Additional details needed to determined awards to non-state agency partners were derived from the following sources:

- BWRS's database eLINK4WEB
- DNR's project databases
- Metropolitan Council's database EIMS
- MDA's project databases
- MDH's databases for grant programs
- MPCA's databases including: MAPs/SWIFT, STORET/EQuis, Watershed DELTA, and individual project databases
- PFA's project databases

Data Collection Period

Fiscal year 2010-2011 – the first full biennium of appropriations from the Clean Water Fund.

Data Collection Methodology and Frequency --

Overall: Data for this measure should be collected annually.

Monitoring: Condition monitoring and load monitoring funds are passed through to partners annually. The amounts of those contracts and the grantee/contractor's names are all captured in MAPS/SWIFT. This information is combined with other data required to be reported to the Minnesota Legislature for its web page annually. Other types of contracts with external partners are executed as needed, and are not on a set schedule.

Implementation activities For data that is entered in eLINK, BWSR staff extracts the data by querying eLINK for BMPs implemented with Clean Water Fund dollars. Local grant recipients enter financial information into eLINK every six months, recording only those BMPs that are fully implemented at that time.

Supporting Data Set

Total Dollars Awarded in Grants and Contracts to Partners

Agency	Monitoring/Assessment	Watershed Restoration/ Protection Strategies	Protection/restoration Implementation activities	Drinking Water Protection	Total
BWSR	-	-	$34,991,091	-	$34,991,091
DNR	-	-	-	-	-
MDA	-	-	$5,241,097	$312,184	$5,553,281
MDH	-	-	-	$1,326,507	$1,326,507
MetCouncil	-	-	-	$118,000	$118,000
MPCA	$828,340	$6,906,702	$2,311,209	$0	$10,046,251
PFA	-	-	$16,677,912	$0	$16,677,912
Total	$828,340	$6,906,702	$59,221,309	$1,756,691	$68,713,042

Approximately 45 percent of the total FY10-11 $152.2 million appropriation from the Clean Water Fund was awarded in grants and contracts to non-state agency partners. The balance of the remaining appropriation is largely used by state agencies to provide statewide monitoring, watershed protection and restoration strategy development, technical assistance and oversight on Clean Water Fund-supported projects.

Caveats and Limitations

Overall: The data collected for this measure do not represent an exact accounting of funding allocations to non-state agency partners but are intended to provide a general sense on the level of funding awarded and for what purpose. Best professional judgment was used to determine how to allocate funding for projects that had spending in more than one activity category (i.e. monitoring and strategy development and implementation). Due to law, some funds are allocated in phases, and thus, over time the information in this measure will change. For detailed information for funding allocations in this measure for a particular project or state agency, contact the agency representative listed below ("Measure Points of Contact").

Future Improvements

It is anticipated that this measure will continue to evolve in future years as agencies improve their process for collecting data.

Financial Considerations

Contributing Agencies and Funding Sources

BWSR, DNR, MDA, MDH, MetCouncil , MPCA, PFA

Measure Points of Contact

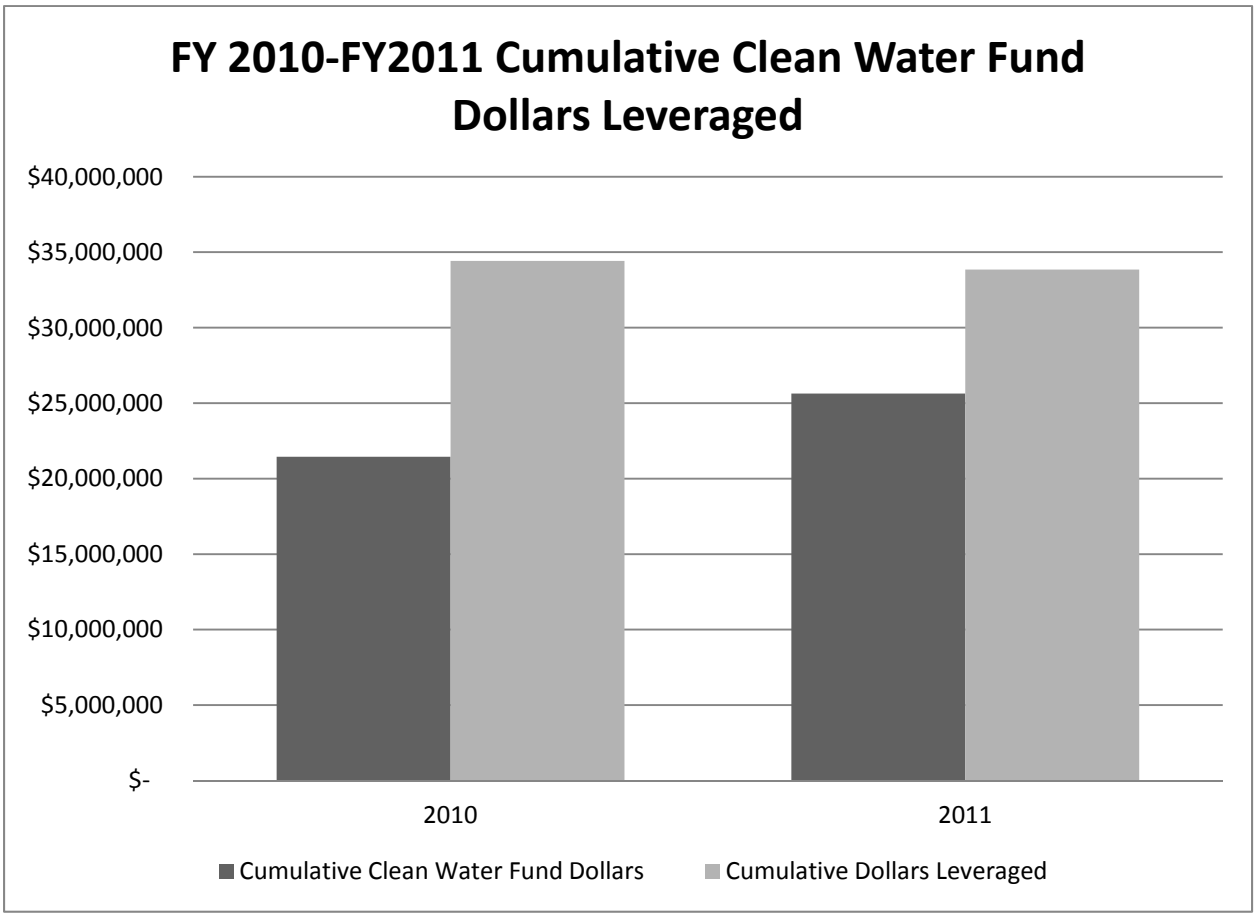
- BWSR contact: Marcey Westrick, marcey.westrick@state.mn.us
- DNR contact: Julie Westerlund, julie.westerlund@state.mn.us
- MDA contact: Margaret Wagner, margaret.wagner@state.mn.us
- MDH contact: Tannie Eshenaur, tannie.eshenaur@state.mn.us
- MPCA contact:
    - Monitoring and assessment -- Dana Vanderbosch, dana.vanderbosch@state.mn.us
    - Watershed restoration and strategy development -- Jeff Risberg (TMDLs, CWP) – jeff.risberg@state.mn.us
    - Bill Dunn (wastewater/stormwater) – bill.dunn@state.mn.us
- PFA contact: Jeff Freeman, jeff.freeman@state.mn.us
- Metropolitan Council: Lanya Ross, lanya.ross@metc.state.mn.us

Amount of money leveraged by Clean Water Fund implementation activities

Measure Background

Visual Depiction

The graphics depict the annual amount of leveraged dollars calculated statewide by the various agencies receiving Clean Water funding for implementation projects.



Measure Description

This measure communicates the dollars leveraged through Clean Water Fund appropriations, beginning in FY 2010-2011. The Clean Water appropriations comprise funding from multiple state grant and loan programs as well as individual on-farm demonstration projects (Discovery Farms Minnesota and Root River Field-to-Stream Partnership). It is a direct financial measure of dollars spent on implementation activities.

Associated Terms and Phrases

To better understand this measure, it is necessary to understand the following terms and phrases:

1. **Leveraged Funds**: For this measure, leveraged funds means the amount paid from any source other than Clean Water funding. The amount of leveraged funds is calculated by subtracting Clean Water dollars issued or awarded from the total cost of a project.
2. **Clean Water Funding**: For this measure, the term Clean Water Funding refers to Clean Water grants and AgBMP loans distributed through local governments for BMP implementation through special Clean Water Fund appropriations to various State grant and loan programs starting in FY10. This measure also includes dollars leveraged from on-farm demonstration projects that focus on implementing best management practices. A list of CWF programs can be found at http://www.cdf.leg.mn/.
3. **TMDL Grant Program** is designed to fund up to 50% for a maximum of $3 million for mandates resulting from an USEPA approved TMDL and Agency approved implementation plan that requires capital improvements that are beyond their current NPDES permit.
4. **Phosphorus Reduction Grant program** is designed to fund up to 75% (until June 30, 2010), and after that 50% for a maximum of $500,000 for more stringent treatment for phosphorus treatment to 1.0 mg/L or less due to a permit requirement.
5. **Ag BMP Loan Program**: This program provides low interest loans (typically 3%) with local financial institutions to farmers, agriculture supply businesses, and rural landowners. The loans are for proven pollution prevention practices that are recommended in an area's water and environmental plans. The program uses a perpetual revolving loan account structure where repayments from prior loans are continually reused to fund new loans. This program prioritizes the use of Clean Water funds to areas for implementation of practices recommended in approved TMDL Implementation Plans.
6. **Clean Water Fund Grant Program** – A grant program administered through BWSR with Clean Water Fund appropriations. More information regarding his program can be found at http://www.bwsr.state.mn.us/cleanwaterfund/index.html .
7. **BWSR** – Minnesota Board of Water and Soil Resources
8. **DNR** – Minnesota Department of Natural Resources
9. **MDA** – Minnesota Department of Agriculture
10. **MDH** – Minnesota Department of Health
11. **MPCA** – Minnesota Pollution Control Agency
12. **PFA** - Minnesota Public Facilities Authority

Target

There is no specific numeric target for this measure.

Baseline

FY 2010 serves as the baseline for this measure in which data collection will begin.

Geographical Coverage

Statewide

Data and Methodology

Methodology for Measure Calculation

For the purpose of this measure, any funds that are not Clean Water funds, including landowner contributions, local government unit aid, equity, and any loan, even if required as matching dollars, are included as part of the dollar amount leveraged. To calculate this measure, state agency staff collects financial information by each program and sum these figures to provide a single count for each watershed and the state.

Data Source

Component programs of the Clean Water Fund Grants	**Responsible State Agency**	**Funding Availability***	**Data Source for Leveraged Funds**
TMDL Grant Program	PFA	FY10, 11	PFA spreadsheet Project applications MPCA reviewed and approved accepted as-bid
Phosphorus Reduction Grant program	PFA	FY10, 11	PFA spreadsheet Project applications MPCA reviewed and approved accepted as-bid
Clean Water Fund Grants	BWSR	FY10,11	eLINK
Ag BMP Loans	MDA	FY10,11	AgBMP Loan Program database
On-Farm Demonstrations (Discovery Farms, Root River Field-to-Stream Partnership and Rosholt Farm)	MDA	FY10, 11	Project work plans and progress reports
Clean Water Partnership Grants	MPCA	FY10, 11	Project work plans and progress reports
St. Louis River Direct Appropriation	MPCA	FY10, 11	Project work plans and progress reports
Source Water Protection Grants	MDH	FY11	Project work plans and progress reports

Data Collection Period

FY 2010 - FY 2011

Data Collection Methodology and Frequency

For programs administered by PFA, data collection involves reviewing accepted as-bid contract awards as compared to accepted grant award.

For programs administered by BWSR, funding cycles are on an annual basis. Local grant recipients are required to enter financial information regarding leveraged funds in eLINK, BWSR's web-based reporting and tracking tool. More information on eLINK is available at www.bwsr.state.mn.us/outreach/eLINK/manual/index.html.

The AgBMP Loan program has a revolving loan structure with regular borrower repayments. It also received periodic infusion of capital into the corpus of the program revolving pool. Data is maintained by the program in an internal database system in coordination with the state's SWIFT accounting system (data prior to July 1, 2011 is stored in MAPS accounting system). Status updates can be recalculated for any period or geographical area as needed.

- The total amount leveraged for the AG BMP Loan program equals non-state financing for loan-assisted projects. This money comes from the borrower, financing from private lenders, and other conservation financial assistance programs.
- The AgBMP loan program is supported by multiple funding sources. It is important to note that this program prioritizes the use of Clean Water funds to areas for implementation of practices recommended in approved TMDL Implementation Plans. All other funding sources, primarily federal funds, are used to finance any priority or practice identified in local comprehensive water or environmental plans.

Supporting Data Set

Clean Water Grants

Table 1. PFA Clean Water Grant Funds

Fiscal Year	TMDL and Phosphorus Grants	TMDL and Phosphorus Grants Leveraged Dollars	Small Community Grants	Small Community Grants Leveraged Dollars
2010	$ 7,039,235	$ 8,544,201	$ 140,000	
2011	$ 8,757,154	$ 11,964,665	$ 741,523	$1,165,539

Table 2. BWSR Clean Water Competitive Grant Funds

Fiscal Year	BWSR Clean Water Funding	Leveraged Dollars
2010	$ 11,807,597	$ 21,901,021
2011	$ 12,619,876	$ 15,268,561

* Does not included CWF Rim Easements

Table 3. MPCA Clean Water Partnership Grant Funds

Fiscal Year	MPCA Clean Water Partnership Funding	Leveraged Dollars
2010	$ 619,970	$ 1,799,510
2011	$ 1,314,165	$ 2,688,530

Table 4. MPCA St. Louis River Grant Funds

Fiscal Year	MPCA St. Louis River Grant Funds	Leveraged Dollars
2010/2011	$ 750,000	$ 1,993,000

Table 5. St. Croix River Association Grant Funds (implementation portion)

Fiscal Year	SCRA Grant Funds (implementation)	Leveraged Dollars
2010	$ $216,717	$ 224,416

Table 6. MDH Clean Water Fund Source Water Protection Grant Funds

Fiscal Year	MDH Clean Water Source Water Protection Funding	Leveraged Dollars
2011	$ 374,895	$ 608,835

Table 7. Clean Water Fund supported AgBMP Loans

Fiscal Years	AgBMP Loans Issued	Total Project Costs	Cumulative Dollars Leveraged
2010/11	$ 3,427,020	$ 5,703,168	$ 2,276,148

*Data for MDA's AgBMP loans were reported as of 1/25/2012, this number reflects CWF supported loans issued in 2010 -2011. If loans were pending at the time of reporting they are not included in this table.

Table 8. Dollars leveraged for on-farm demonstrations

Fiscal Years	Name of project	Clean Water Fund Investment	Non-state matching Funds	Percent Leverage
2010/11	Discovery Farms Minnesota	$ 250,000	$ 420,000	68%
2010/11	Root River Field-to-Stream Partnership	$ 395,000	$ 125,000	31.6%
2010/11	Rosholt Farm	$ 23,882	$125,000	523 %

Table 9. Cumulative Clean Water Funding and Leveraged Dollars

Fiscal Year	Cumulative Clean Water Fund Dollars	Cumulative Dollars Leveraged
2010	$ 21,450,827	$ 34,417,026
2011	$ 25,634,921	$ 33,844,007

Caveats and Limitations

For PFA, the above estimates account for only TMDL or Phosphorus eligible costs. Often other facility improvements are also pursued at the same time to utilize economies of scale and other fixed costs such as equipment mobilization.

For most Clean Water Fund programs, BWSR requires a 25% match requirement for all grant dollars. BWSR also has a $30,000 grant minimum as well.

In FY11, up to $300K from AgBMP loan program may be used for administrative purposes; any amount not used for that purpose by the end of the fiscal year will be added to the program's revolving loan funds.

Future Improvements

Nothing identified at this time

Communication Strategy

Target Audience

Stakeholders with interest in this measure include the State legislature, the Clean Water Council, and state agency partners.

Associated Messages

This measure depicts how much non-state funds the Clean Water Fund is leveraging and is a direct measure of dollars being spent of implementation.

Measure Points of Contact

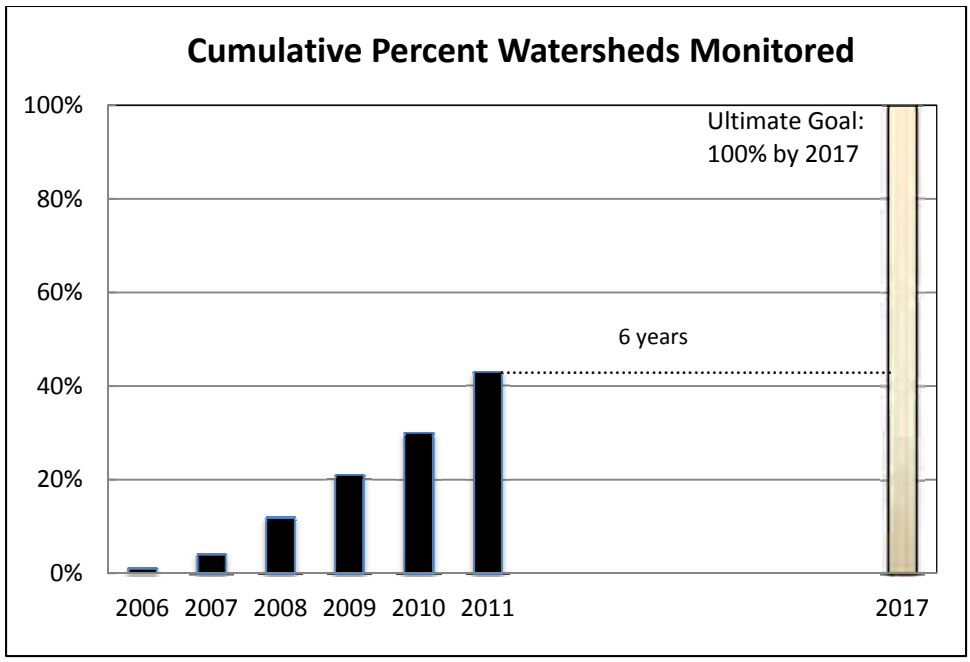
- Bill Dunn, Clean Water Revolving Fund Coordinator, Minnesota Pollution Control Agency
  bill.dunn@state.mn.us
- Conor Donnelly, Board of Water and Soil Resources
  conor.donnelly@state.mn.us
- Margaret Wagner, Minnesota Department of Agriculture
  margaret.wagner@state.mn.us
- Tannie Eshenaur, Minnesota Department of Health
  tannie.eshenaur@state.mn.us

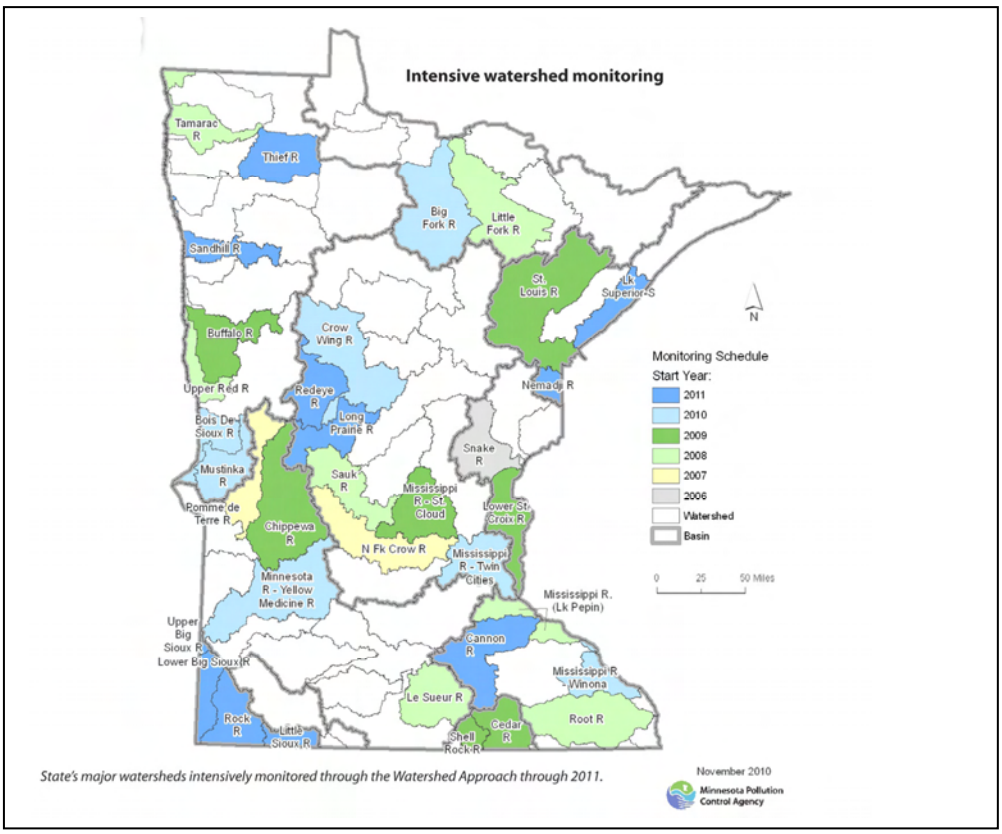
Surface Water Quality Measures

Percent of State's Major Watersheds Intensively Monitored through the Watershed Approach

Measure Background

Visual Depiction





Measure Description

Percent of the state's major watersheds that have been intensively monitored for background condition for water chemistry and biology through the MPCA's intensive watershed monitoring approach.

Associated Terms and Phrases

Condition monitoring: Monitoring the background, or ambient, condition of a lake or stream reach. This type of monitoring typically requires monitoring once or twice per month during the open water season for a minimum of two years. The resulting data are compared to state and federal water quality standards put in place to support various uses (drinking water, aquatic recreation, aquatic life, consumption, etc.) to determine if the resource is exceeding standards (i.e., is "impaired") and in need of restoration or is meeting standards and in need of protection.

Intensive watershed monitoring (IWM): A ten-year rotational cycle wherein an average of 8 of Minnesota's 81 major (8-digit hydrologic unit code) watersheds are intensively monitored each year. The outlet of each major watershed is monitored for physical and chemical parameters monthly on a continual basis for baseflow and more frequently during "events", such as snowmelt and storms (termed 'load monitoring'). During intensive watershed monitoring, additional focus is placed on monitoring the outlets of subwatersheds (12 -digit hydrologic unit code) for biota (fish and invertebrates) and physical habitat, and to sample for chemical parameters ten times. One-time biological, physical and chemical sampling is also conducted at the outlet of the 14 -digit hydrologic unit code watersheds. During intensive watershed monitoring, all lakes $\geq$500 acres and at least 25% of lakes 100-499 acres are monitored for physical and chemical parameters (there is currently no tool that allows us to assess lakes for biology).

Load monitoring: Flow and chemistry monitoring conducted at the mouth (or outlet) of each major (8-digit hydrologic unit code scale) watershed. Monitoring is conducted at least monthly, and then more frequently during events (i.e., snowmelt or rain events). As with the intermediate load monitoring, the objective is to capture the entire hydrograph, and to determine the pollutant load carried by a stream or river. Watershed loads are also used to assess trends in the stream water quality of a watershed over time, and to see how data from a given year compare to the long-term record for a watershed.

Major watershed: 8-digit hydrologic unit code (HUC) watersheds in Minnesota; there are 81 in Minnesota.

Target

Intensively monitor ~10 percent of the state's major watersheds per year; 100% through 2017 (end of the first cycle).

Baseline

The first watershed was intensively monitored for stream biology in 2006 as a pilot project. Two additional watersheds were intensively monitored for stream biology in 2007, but 2008 marks the year the state was fully ramped up for the full IWM monitoring effort. Therefore, the last year of the first 10-year intensive monitoring cycle will be 2017.

Geographical Coverage

Statewide.

Data and Methodology

Methodology for Measure Calculation

The number, cumulative percent and the identity of watersheds that have been intensively monitored is kept in a spreadsheet (OPM1_watersheds intensively monitored.xls) that automatically updates the bar graph. The total number and cumulative percent is added to the GIS project tables (OPM1.mxd) each January to develop the statewide map. Both the spreadsheet and the GIS project are found in this folder on the MPCA's server: X:\Agency_Files\Water\Condition Monitoring\Measures\Lakes & Streams\OPM1_Watersheds intensively monitored.

Data Source

MPCA spreadsheet tracks the IWM schedule. The number, cumulative percent and the identity of watersheds that have been intensively monitored is kept in a spreadsheet (OPM1_watersheds intensively monitored.xls).

Data Collection Period

2006-2017 for the first IWM cycle.

Data Collection Frequency

Updated annually (each January) based on new watershed monitoring starts; a schedule has been developed for the full 10 years and is updated annually.

Supporting Data Set

IWM year	# watersheds intensively monitored	Cumulative % completed	Names of watersheds
2006	1	1%	Snake River
2007	2	4%	Pomme de Terre, North Fork Crow River
2008	7	12%	Tamarac R, Upper Red R, Root R, Le Sueur, Little Fork, Mississippi R (Lake Pepin)
2009	7	21%	Buffalo R, Chippewa R, St. Louis R, Lower St. Croix R, Cedar R, Shell Rock R, Mississippi R (St. Cloud)
2010	7	30%	Big Fork R, Crow Wing R, Minnesota R (Yellow Medicine R), Mississippi R (Winona), Bois de Sioux R, Mustinka R, Mississippi R (Twin Cities)
2011	11	Underway	Thief R., Sandhill R, Redeye R, Long Prairie R, Cannon R, Rock R, Upper Big Sioux, Lower Big Sioux, Little Sioux R, Nemadji R, Lake Superior South

Caveats and Limitations

It takes two years to complete the IWM monitoring, so this measure tracks start dates only; assessment follows after the second year of intensive monitoring. This won't always show a steady 10% of watersheds per year since the size of watersheds (and their associated number of sites) will vary from year to year. The 10-year schedule requires us to start between 6 and 8 watersheds each year to stay on track.

Future Improvements

NA

Financial Considerations

Contributing Agencies and Funding Sources

Funding for monitoring that supports the MPCA's Intensive Watershed Monitoring design comes from the Minnesota Clean Water Fund.

Communication Strategy

Target Audience

Local, state and federal agencies and the general public.

Associated Messages

This measure conveys our progress in meeting our statewide monitoring responsibilities. Since restoration and protection planning work follows condition monitoring and assessment, this measure also conveys to other MPCA staff and local partners when restoration and protection planning may begin in their regions.

Other Measure Connections

EDWOM1 reports findings from condition monitoring data that has been assessed, including the percentage of lakes and streams that are meeting or exceeding water quality standards statewide and by watershed.

Measure Points of Contact

Dana Vanderbosch, MPCA, dana.vanderbosch@state.mn.us

Number of non-point source best management practices (BMPs) implemented with Clean Water funding and estimated pollutant load reductions

Measure Background

Visual Depiction

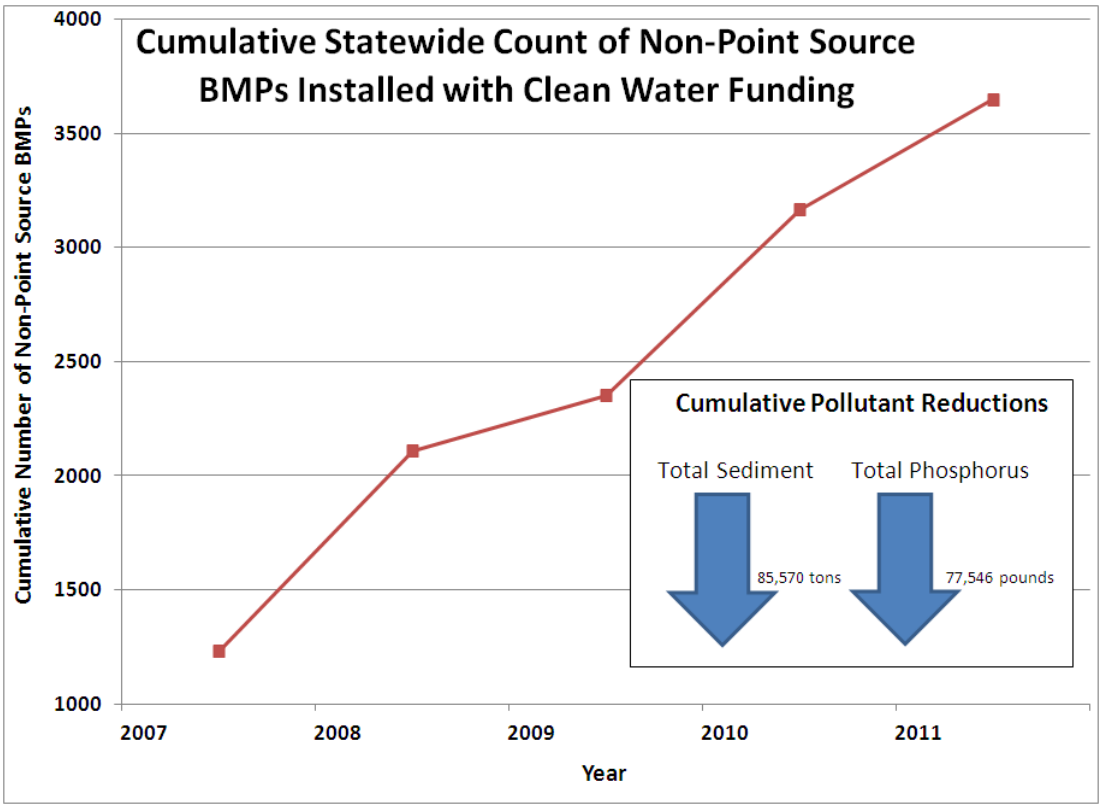


Figure 1

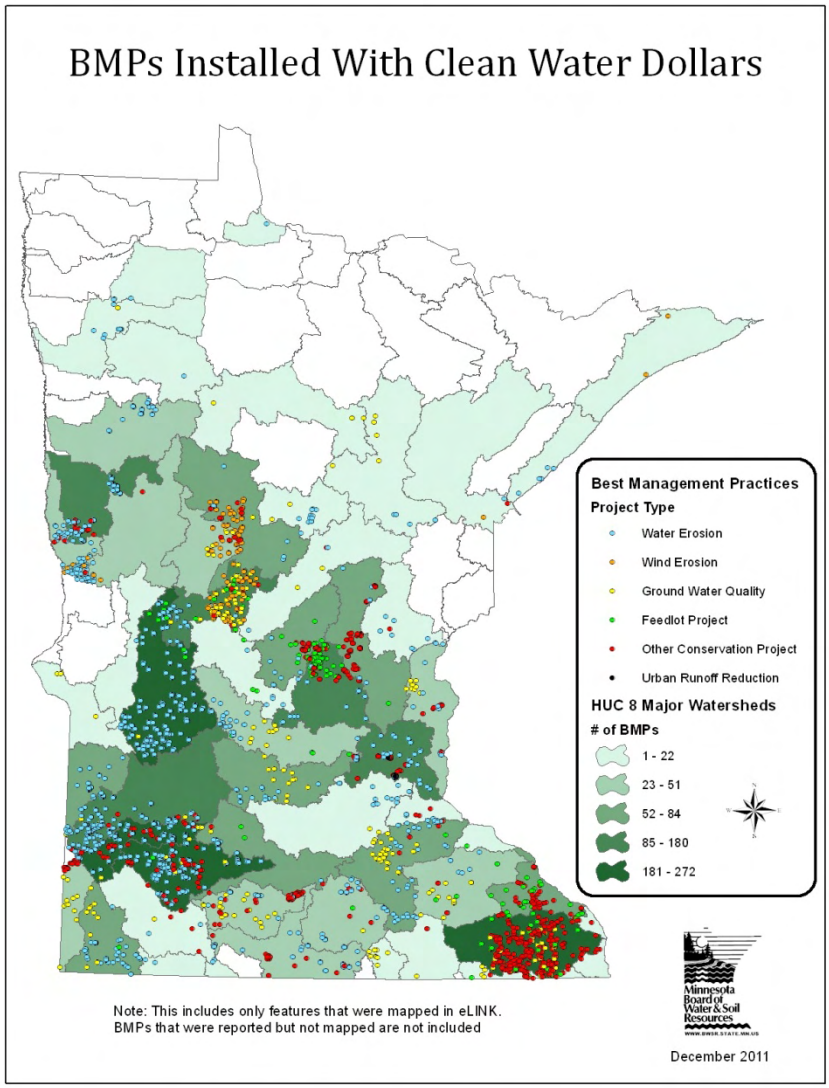


Figure 2

Measure Description

This measure communicates the number of BMPs implemented with Clean Water funds and the estimated associated reduction in sediment and phosphorus reaching surface waters. It does not reflect BMPs implemented through other programs aimed at accelerating BMP adoption. This measure is strictly concerned with Clean Water Fund-supported implementation programs.

It is an indirect or surrogate measure of environmental response. It does not provide information on watershed health, but does provide information on efforts to reduce pollutant loads over time that are likely to improve watershed health.

Associated Terms and Phrases

To better understand this measure, it is necessary to understand the following terms and phrases. Definitions used in this measure are as follows:

BMPs: Conservation practices that improve or protect water quality in agricultural, forested, and urban areas.

Clean Water Funding: For this measure, the term Clean Water Funding refers to Clean Water Grants distributed to local governments for BMP implementation through special Clean Water Fund appropriations to various State grant programs. Clean Water funding also refers to AgBMP loans issued to local governments for the implementation of any practice that protects or restores water quality. A list of CWF grant and loans programs can be found at http://www.legacy.leg.mn/.

Phosphorus: In this measure, we report the estimated reduction in the amount of total phosphorus reaching surface waters as a result of runoff or soil erosion (sheet, rill, gully erosion, or steam channel).

Sediment Loss: The estimated amount of sediment reaching the nearest surface water body as a result of soil erosion from water (sheet, rill, gully erosion, or stream channel).

Target

There is no specific numeric target for this measure to date.

Baseline

FY 2010 serves as the baseline for this measure.

Geographical Coverage

Statewide and by watershed

Data and Methodology

Methodology for Measure Calculation

The Clean Water Fund comprises funding from multiple state grant and loan programs. To calculate this measure, state agencies first collect data on the number of BMPs implemented with Clean Water Funds by each program and then sum these figures to provide a single count for each watershed and for the state.

Pollutant estimates are entered into the Minnesota Board of Water and Soil Resources' (BWSR's) web-based grant reporting and tracking tool, eLINK, by grant recipients when entering BMP data. The State of Minnesota does not require a specific methodology for developing pollutant load estimates. Pollutant load reductions using existing models developed for estimating pollutant load are acceptable. BWSR provides pollutant estimators for eLINK based on soil erosion (sheet, rill, gully and stream channel). Sediment reduction estimates in eLINK are based on the distance to the nearest surface waters and soil loss calculations using USDA's Revised Universal Soil Loss Equation (RUSLE2). Phosphorus reduction estimates are derived from sediment reduction estimates. Detailed information on the calculations used in eLINK for estimating pollutant load reductions is available at ftp://ftp.bwsr.state.mn.us/elink/Manual2006/19PolRedCalc.pdf.

Estimates of pollutant load reductions for AgBMP loans are based on tabled values reported in scientific literature. Values are determined using empirical data, however they are averages and are not site-specific. The MDA continues to gather information about the effectiveness of agricultural BMPs and support research projects that provide more comprehensive empirical data on practices that the loan program supports.

Estimating the environmental benefit of specific management practices can be done numerous ways. The most common are to develop computer models, use values in from the scientific literature, or base estimates on the best professional judgment of experts. Regardless of the method used, some uncertainty remains in every estimate. State agencies continue to improve and refine estimates, enabling them to better quantify the environmental benefits of conservation practices.

The table below shows the source of the BMP data for each of the Competitive Clean Water Grants component programs.

Data Source

Clean Water Fund programs	**Responsible Agency**	**Funding availability by fiscal year**	**Database**
Competitive Clean Water Legacy Grants	BWSR	FY 07, 08, 09	eLINK
Competitive Clean Water Fund Grants	BWSR	FY 10, 11	eLINK
Clean Water Fund Ag BMP Loans (CWF is one of five funding sources that support this loan program, CWF supported loans must be issued in areas with completed TMDL plans)	MDA	FY 10, 11	AgBMP Loan Program database

For programs administered by BWSR, local grant recipients are required to enter BMP data in eLINK. More information on eLINK is available at www.bwsr.state.mn.us/outreach/eLINK/manual/index.html.

Data Collection Period

The data collection period was FY2007 through FY2011 for Clean Water Grants and FY2010 through FY2011 for AgBMP loans. As explained below in Caveats and Limitations, there is a lag time between grants being awarded and BMPs being fully implemented and recorded. The dataset will be complete once all of the BMPs funded with FY2007-2011 are fully implemented and recorded. Until then, the dataset for this measure only provides a snapshot in time. Data collection will continue for the duration of the Clean Water Fund (until 2034).

Data Collection Methodology and Frequency

Data on the number of and type of BMPs implemented with Clean Water Funds are extracted from various databases established by state agencies to track Clean Water Grants programs (see Data Source above). The data collection methods and frequency vary by program. The programs and respective databases existed well before Clean Water Funds became available and therefore were not designed specifically with Clean Water Fund tracking in mind.

For data that is entered in eLINK, BWSR staff extracts the data by querying eLINK for BMPs implemented with Clean Water Fund dollars. Local grant recipients enter BMP information into eLINK every six months, recording only those BMPs that are fully implemented at that time. BMP data is analyzed by the fiscal year the grant was awarded rather than the calendar year the BMP was installed.
AgBMP loan information is stored in MDA's AgBMP loan database. It is updated whenever new loans are issues. Reports can be generated at any time and for any geographic region.

Supporting Data Set

Below are data sets from each of the state agencies participating in data collection for this measure (see Data Source above).

Cumulative Non-Point Source BMPs funded by Clean Water Fund

Watershed	Cumulative Number of BMPs						Estimated Pollutant Load Reductions	
	FY 07	FY08	FY09	FY10	FY11	Total	Sediment (T/yr)	Phosphorus (lbs/yr)
Statewide	1229	2110	2350	3166	3650	3650	85,570	77,546

Caveats and Limitations

- This measure only tracks BMPs implemented with funding from Clean Water Legacy Grants and Clean Water Fund Grants and Loans. BWSR FY 2007-2009 Clean Water Legacy grants were included as a baseline due to the lag time between when grant funds are awarded and when BMPs are fully implemented and recorded in eLINK. The Clean Water Fund baseline dataset will be complete once all of the BMPs funded with FY2010-2011 are fully implemented and recorded.
- Clean Water Fund Grants are for two years, resulting in a lag time between when funds are awarded and when BMPs are fully implemented and recorded in eLINK. This measure reports only BMPs that are fully implemented; it does not report on those that are planned or in progress.
- Pollution reductions entered into eLINK are calculated at the field scale, not the watershed scale.
- BMPs vs. Projects: The Minnesota Department of Agriculture's AgBMP Loan Program database does not record BMPs implemented per se, but rather loan projects completed. Most loan projects involve a single BMP or cluster of related BMPs. For example, a loan might finance an entire feedlot runoff control system or just one component. The same is true for most other conservation financial assistance programs. A BMP crosswalk is being developed to facilitate multi-program tracking.
- Potential Double-Counting of BMPs: An individual BMP may be co-funded by several Clean Water Fund implementation programs. For example, a gully/grade stabilization structure might be funded 75% through a BWSR grant and 25% by an AgBMP loan—with both programs counting the same structure in their respective databases. In another example, a BWSR grant might provide financial incentives for a farmer to switch to no-till, while an AgBMP loan finances

the farmers' purchase of a no-till drill —again, both programs might record the same structure. Until a method is developed to identify such projects and coordinate the way they are recorded, it is necessary to report eLINK-entered data and AgBMP Loan data as separate figures or, if totaled, it should be noted that data might overlap and result in double-counted BMPs.

- Incomplete Data on Pollutant Load Reductions: Currently, pollutant load reductions can be calculated only for BMPs recorded in eLINK. As noted under Data Source above, not all Clean Water funded BMPs are recorded in eLINK at this time; some are recorded only in other program-specific databases.

In Future Improvements below, we describe efforts to address to these limitations.

Future Improvements

Improvements to this measure will be made over time. The type of pollutant reductions estimated in eLINK will expand in the short-term; therefore, this measure will track additional estimated pollutant load reductions associated with BMPs implemented with Clean Water funding.

Ideally this measure will be able to compare estimated pollutant load reductions in a particular watershed with pollutant load reduction targets established through TMDLs and other plans. However, accurate comparisons would require tracking all BMPs in a watershed, not just those implemented using Clean Water funding, as well as point source pollutant load reductions.

Eventually the tracking of BMPs in this measure may be replaced by measures of targeted implementation.

Financial Considerations

Contributing Agencies and Funding Sources

This measure only tracks BMPs funded with Clean Water funding, although eLINK tracks a larger universe of BMPs funded through a wide array of funding sources.

Communication Strategy

Target Audience

Stakeholders with interest in this measure include the State legislature, the Clean Water Council, and state agency partners.

Associated Messages

This primary message associated with this measure is to demonstrate the amount of implementation occurring as a result of available funds. In addition, this measure provides information on expected pollutant load reductions associated with implementation. Therefore, a secondary message is that pollutant load reductions in the short-term will help to create water quality improvements in the long-term.

Other Measure Connections

This measure doesn't explicitly link to other measures, but will help to provide an understanding of trends in key water quality and quantity parameters for lakes, streams, and groundwater.

Measure Points of Contact

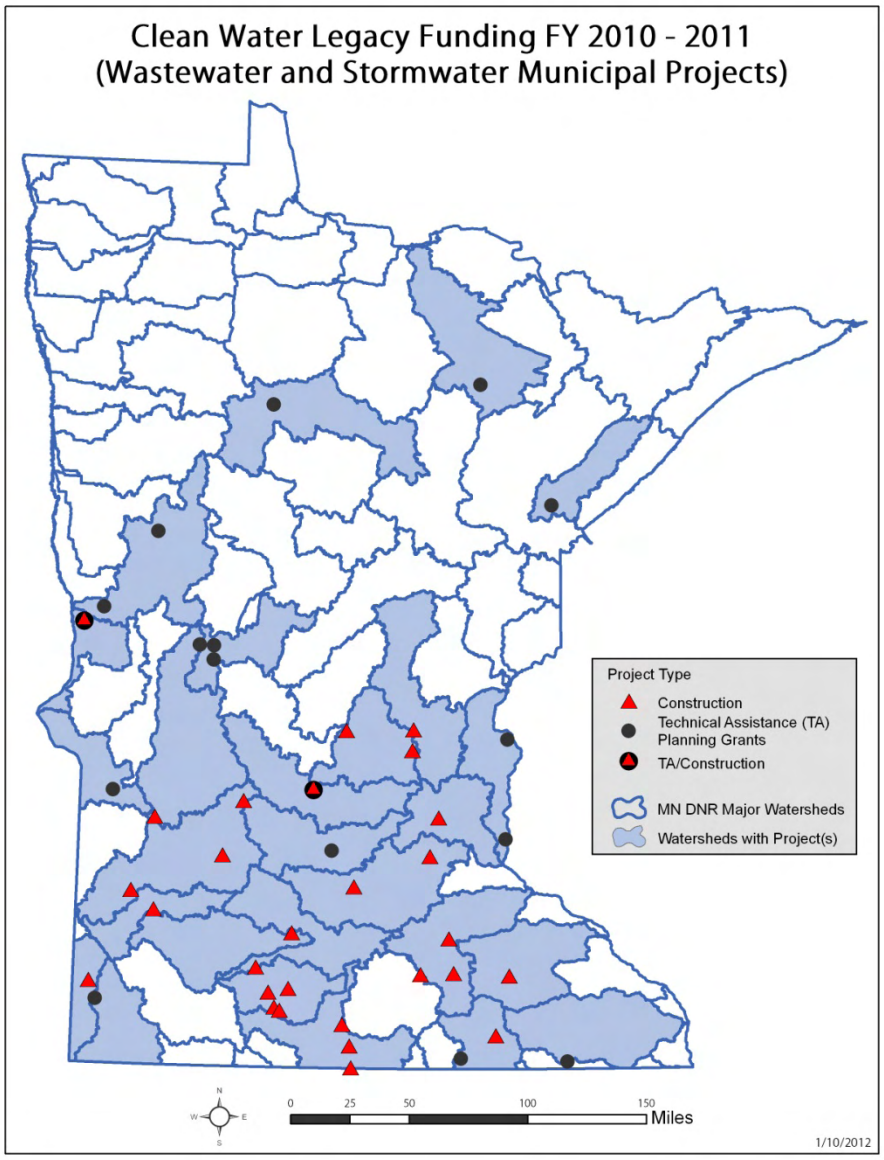
Agency Information

Conor Donnelly, Board of Water and Soil Resources, conor.donnelly@state.mn.us
Dwight Wilcox, Minnesota Department of Agriculture, dwight.wilcox@state.mn.us

Number of municipal point source construction projects implemented with Clean Water Funding and estimated pollutant load reductions

Measure Background

Visual Depiction



Clean Water Legacy Funding of point source wastewater projects

17 – Technical assistance planning grants

28 – Construction projects

Measure Description

This measure is designed to document and track outcomes on the wastewater and stormwater point source construction projects initiated with Clean Water Funds and the estimated reduction in pollutant loadings reaching surface waters. The focus of this measure is limited to phosphorus. It does not

provide information on other federal and state funded projects and their resulting environmental progress.

These projects are a result of increased treatment requirements resulting from a TMDL waste load allocation or statewide permit requirements. As a result of these capital construction projects, a municipality is able to achieve the required treatment to adhere to an enforceable permit condition.

Associated Terms and Phrases

None

Target

No specific numeric target exists in this measure. Clean Water Funds are provided as grants and loans to municipalities to build projects to provide additional wastewater and stormwater treatment in order to meet the more stringent discharge limits. The appropriations are available for a five year period because these projects are complex and require significant time for planning and design.

Baseline

No base year is needed for this measure.

Geographical Coverage

This measure has both statewide and watershed impacts and actions.

Data and Methodology

Methodology for Measure Calculation

There are 3 primary types of pollutants (fecal coliform, mercury and phosphorus) that are addressed by CW funds for municipal projects. Pollutant reduction estimates are based, for the most part, on how projects are expected to function after initiation of operations. Currently pollution loading reductions is only calculated for phosphorus in wastewater projects.

Data Source

The data source for this measure is based on the projected or documented facility.

Data Collection Period

Data used is primarily from projects receiving an award in Fiscal Years 2010 and 2011. In some cases, longer time frames are used in order to establish trend lines or provide a more historical context.

Data Collection Methodology and Frequency

Data collected in this measure will consist of engineering calculation of the facility operations based on existing discharge reports compared to expected discharge based on existing flows.

This is a brief description the calculation methods used for TMDL and Phosphorus reduction grant projects, where the pollutant of concern to be reduced is phosphorus.

The before project annual phosphorus load value (pounds per year or lb/yr) came from a calculation using before project discharge monitoring report data (either 2009 or 2010 as appropriate) for average daily phosphorus concentration and average daily flow.

The after project annual phosphorus load (lb/yr) calculation was prepared one of two ways. First, if the construction project has been completed with one full year of operation discharge monitoring report data available, the average daily phosphorus concentration and average daily flow were used to calculate the annual load (lb/yr). Second, if the construction project was not complete, the after project annual load was estimated using the permit phosphorus average daily concentration effluent limit (typically 1.0 mg/L) and the design average daily wet weather flow for the project location.

The projected reduction load calculation was the before project load minus the after project load.

Please note: in some project cases the before project discharge monitoring report average daily effluent phosphorus concentration data was showing the facility was doing pilot studies and already reducing phosphorus at or below after project required effluent phosphorus concentration limit. At these project locations, the construction project was effectively putting in place permanent infrastructure to complete the phosphorus treatment similar to the pilot study temporary equipment. The projected reduction load calculations for these projects were assigned zero (0) lb/yr.

Supporting Data Set

Phosphorus load reduction from CWL point-source funding programs

2010 Projects		Projected Phosphorus Load Reduction (lb/yr)
Blue Earth - Phase 2	Blue Earth River	0
Comfrey	Minnesota River (Mankato)	158
Faribault	Cannon River	5,421
MCES Blue Lake Plant Improvements	Lower Minnesota River	9,664
Renville	Minnesota River (Yellow Medicine River)	8,012
St. Cloud - Ph 1	Mississippi River (St. Cloud)	4,355
St. James	Watonwan River	7,036
Waseca	Cannon River	0
Willmar - Phase 1b	Minnesota River (Yellow Medicine River)	55,315
Zimmerman	Mississippi River (St. Cloud)	173
		90,134
2011 Projects		
Arlington	Lower Minnesota River	0
Butterfield	Watonwan River	0
Crystal - Stormwater	Mississippi River (Twin Cities)	120
Doran	Bois de Sioux River	32
Elmore	Blue Earth River	188
Essig	Cottonwood River	93
Forest City Twp	North Fork Crow River	18
Mantorville - Mantor Drive	Zumbro River	482
Marshall - Stormwater	Redwood River	1,062
Minneota	Minnesota River (Yellow Medicine River)	299
Odin	Watonwan River	(included in Ormsby)
Ormsby	Watonwan River	481
Owatonna	Cannon River	10,291
Pipestone	Lower Big Sioux River	1,069
Princeton	Rum River	0
Red Rock Twp - Nicolville	Cedar River	28
Watson	Chippewa River	116
Winnebago	Blue Earth River	0
		14,279
Grand total		104,413

Analysis of the impacts of wastewater treatment improvements in the Watonwan River watershed

The Lower Minnesota River Dissolved Oxygen TMDL Report (MPCA, 2004) set a total phosphorus (TP) loading target of 45,095 pounds for a two-month (August-September) critical low flow period. Prior to the TMDL, total phosphorus loading to the Lower Minnesota River for this critical period was estimated at 75,620 pounds, necessitating a reduction need of 30,525 pounds. The portion of this reduction suggested for the Watonwan River watershed was 912 pounds. The portion of the reduction for all point sources was 25,204 pounds.

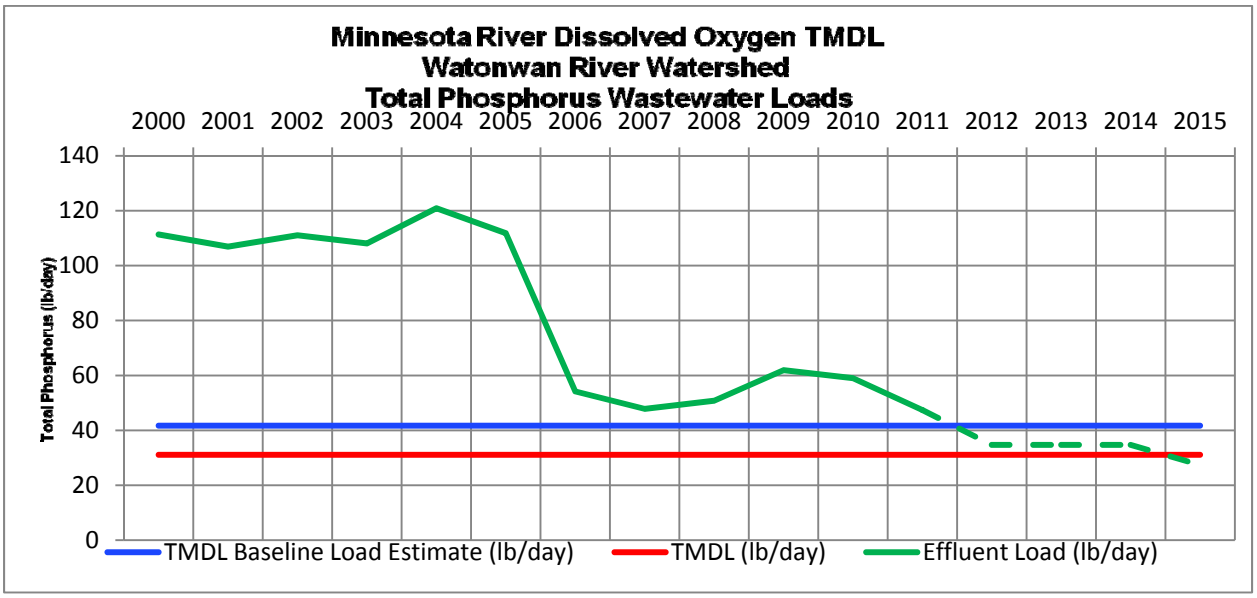
Since establishment of the TMDL, the following communities in the Watonwan River watershed have improved their wastewater treatment and reduced phosphorus loading to the Watonwan and Minnesota Rivers. The impacts of these improvements relative to the Lower Minnesota River Dissolved Oxygen TMDL are reported below:

Total Phosphorus (TP) Reductions			
	lbs./year	**lbs./2 mos.**	
Butterfield	**-29**	**-5**	
LaSalle	**113**	**19**	
Lewisville	**467**	**78**	
Madelia	**17658**	**2951**	
Odin	**x**	**x**	
Ormsby	**481**	**80**	**(Odin-Ormsby combined)**
St. James	**7036**	**1173**	
Total	**25726**	**4296**	

Percent of total Lower Minnesota River TMDL reduction need	**14.1%**
Percent of Watonwan River's portion of the TMDL reduction need	**471.1%**
Percent of total point source reduction need for TMDL	**17.0%**

As further perspective, the average annual total phosphorus load exiting the mouth of the Watonwan River from 2000 to 2008 was 161,000 pounds (MPCA and MSU-Mankato Water Resources Center, 2009). The impact of the wastewater treatment improvements relative to this load are reported below:

Percent of Watonwan River annual total phosphorus load (2000-2008)	**16.0%**



Caveats and Limitations

- This measure only tracks projects implemented with funding from Clean Water Fund Grants.
- Projects that record zero pounds of phosphorus removed are a result of an expansion in treatment capacity while still operating the facility at less than design flows.

Future Improvements

Additional data measures will be developed to address the two other pollutants – fecal coliform and mercury. Cost per pollutant unit removed may also consider if there is value in pursuing that type of performance indicator.

Financial Considerations

Contributing Agencies and Funding Sources

Not applicable

Communication Strategy

Target Audience

Municipal entities and trade associations

Measure Points of Contact

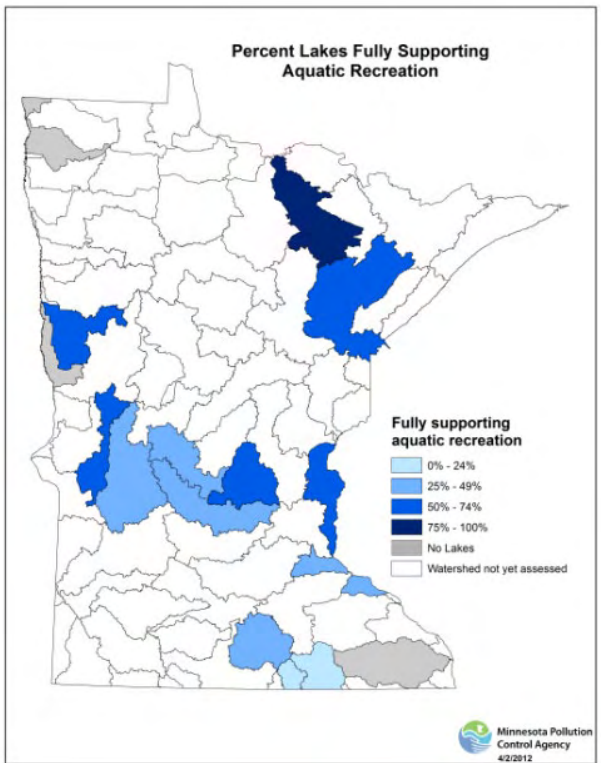
- Bill Dunn, Minnesota Pollution Control Agency, bill.dunn@state.mn.us
  MPCA wastewater/stormwater financial assistance website: www.pca.state.mn.us/ppl

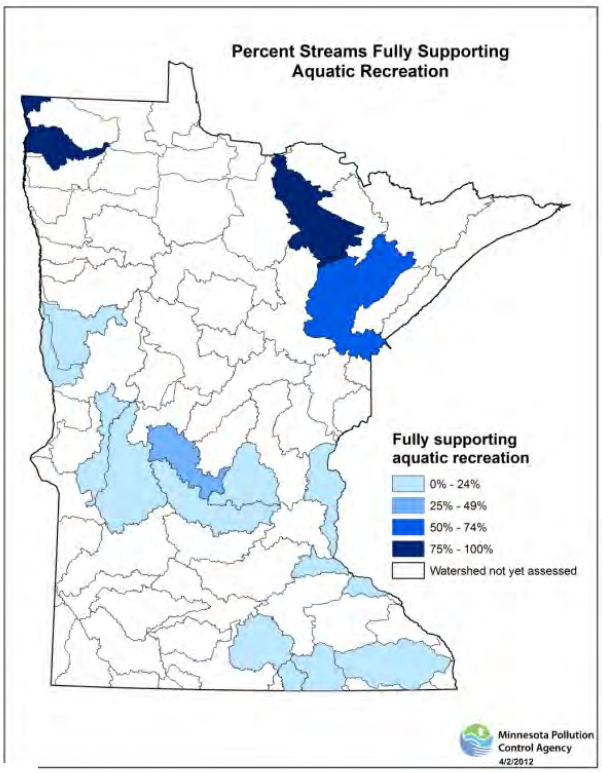
- Jeff Freeman, Minnesota Public Facilities Authority, jeff.freeman@state.mn.us
  Public Facilities Authority website: http://www.positivelyminnesota.com/pfa

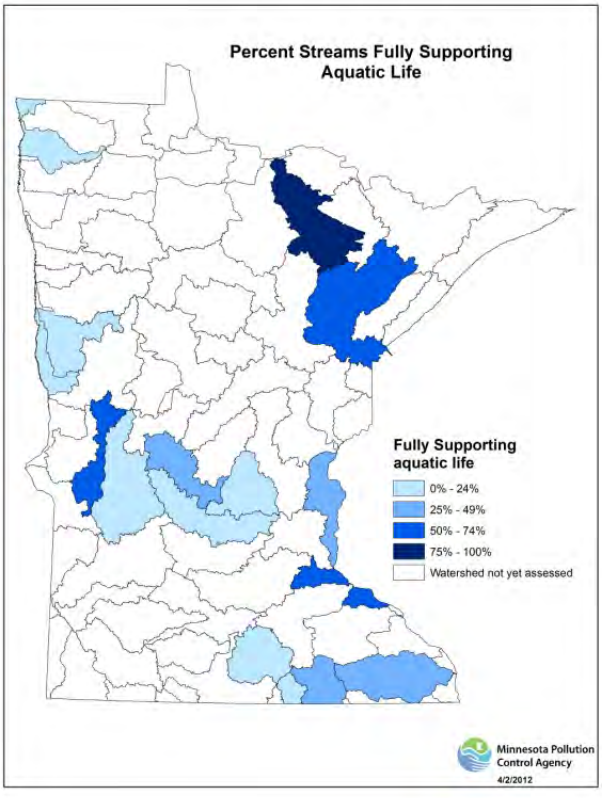
Rate of impairment/unimpairment of surface water statewide and by watershed

Measure Background

Visual Depiction







Measure Description

The intent of this measure is to communicate the impairment "rate" of lakes and streams, by designated use, statewide and also by watershed. While we have the ability to report data for each main category of designated use for which we have standards, the focus at least initially will be on aquatic recreation for lakes and streams, and on aquatic life for streams. This measure will be presented at statewide and watershed scales, with a separate map for each use/resource type combination (i.e., aquatic recreation/lakes, aquatic recreation/streams, etc.).

Associated Terms and Phrases

Assessment: The process of summarizing the biological, chemical and physical data available for a lake or stream site and comparing the data against water quality standards to determine if designated uses are supported.

Condition monitoring: Monitoring the background, or ambient, condition of a lake or stream reach. This type of monitoring typically requires monitoring once or twice per month during the open water season for a minimum of two years. The resulting data are compared to state and federal water quality standards put in place to support various uses (drinking water, aquatic recreation, aquatic life, consumption, etc.) to determine if the resource is exceeding standards (i.e., is "impaired") and in need of restoration or is meeting standards and in need of protection.

Designated use: The identified use for which a waterbody is managed (support of aquatic communities, recreation in or on the water, consuming the water or fish taken from the water).

Impairment: One or more designated use is not being met, as determined by a comparison to applicable water quality standards.

Impairment rate: Percentage of lakes or streams impaired for a specific designated use (statewide, or watershed-by-watershed).

Intensive watershed monitoring (IWM): A 10-year rotational cycle wherein an average of 8 of Minnesota's 81 major (8-digit hydrologic unit code) watersheds are intensively monitored each year. The outlet of each major watershed is monitored for physical and chemical parameters monthly on a continual basis for baseflow and more frequently during "events", such as snowmelt and storms (termed 'load monitoring'). During intensive watershed monitoring, additional focus is placed on monitoring the outlets of subwatersheds (12 -digit hydrologic unit code) for biota (fish and invertebrates) and physical habitat, and to sample for chemical parameters ten times. One-time biological, physical and chemical sampling is also conducted at the outlet of the 14 -digit hydrologic unit code watersheds. During intensive watershed monitoring, all lakes $\geq$500 acres and at least 25% of lakes 100-499 acres are monitored for physical and chemical parameters (there is currently no tool that allows us to assess lakes for biology).

Load monitoring: Flow and chemistry monitoring conducted at the mouth (or outlet) of each major (8-digit hydrologic unit code scale) watershed. Monitoring is conducted at least monthly, and then more frequently during events (i.e., snowmelt or rain events). As with the intermediate load monitoring, the objective is to capture the entire hydrograph, and to determine the pollutant load carried by a stream or

river. Watershed loads are also used to assess trends in the stream water quality of a watershed over time, and to see how data from a given year compare to the long-term record for a watershed.

Major watershed: 8-digit hydrologic unit code (HUC) watersheds in Minnesota; there are 81 in Minnesota.

Target

Ultimately, the target is 100% of Minnesota's waters supporting designated uses, or a 0% impairment "rate" for all designated uses.

Baseline

Five watersheds (those monitored intensively in 2006, 2007 and two in 2008) were comprehensively assessed in 2010 to pilot a new assessment process. Eleven more watersheds were assessed in 2011. On average, eight watersheds are expected to assessed annually from 2012 on.

Geographical Coverage

Statewide and watershed.

Data and Methodology

Methodology for Measure Calculation

We will calculate the impairment "rate" for each designated use for which we have data by dividing the total number of resources assessed by those resources not meeting standards. For example, the impairment rate for aquatic recreation for lakes will be the total number of lakes that we assessed in a watershed divided by the number of those lakes found to be impaired for aquatic recreational use support. The statewide rate will be calculated by adding the total number of lakes assessed divided by the number of lakes statewide found to be impaired for aquatic recreational use support.

Assessment data are queried from the MPCA's Assessment database (ADB) and combined with lake/stream and watershed information found in the Core_WU database. The assessment results are summarized in a spreadsheet (AssessmentResults.xls), which is loaded into an Access database (AssessmentResults.mdb). The tables in this database are joined to four separate GIS projects each July to develop the statewide maps showing watershed assessment results. AssessmentResults.xls, AssessmentResults.mdb and the GIS projects can all be found in X:\Agency_Files\Water\Condition Monitoring\Measures\Lakes & Streams\EDWOM1_ImpairmentUnimpairment Rate on the MPCA's server. Detailed methods for querying database systems for the assessment data, manipulating it and loading it to the GIS projects are also found in AssessmentResults_procedure.docx in this folder.

Data Source

The MPCA's Assessment database (or ADB) stores results of the MPCA's annual assessments. Lake/stream watershed information is found the MPCA's Core_WU database.

Data Collection Period

The MPCA uses the most recent ten years of monitoring data in the EQuIS surface water data management database when assessing a lake or stream reach. Monitoring data are collected by the MPCA annually with each major watershed intensively sampled every 10 years. The vast majority of

monitoring occurs in the year we start intensively monitoring a given watershed; however, there is some additional sampling in the following year. Additional data comes into EQuIS (the state's water quality data management system) from a variety of state, local and citizen partners from their own monitoring efforts and programs, which follow various schedules (i.e., may be a one year sampling project or an ongoing monitoring effort, etc.). These externally collected data are also used to assess lake and stream condition, if this data meets the MPCA's quality standards.

Data Collection Frequency

On average, eight watersheds are comprehensively assessed each winter, and assessment maps are updated each July.

Supporting Data Set

Stream aquatic life and aquatic recreation assessment data:

Watersheds	AQL_NS	AQL_ FS	**AQL_ TOTAL**	AQR_ NS	AQR_ FS	**AQR_ TOTAL**
St. Louis River 04010201	19 (32%)	41 (68%)	**60**	17 (46%)	20 (54%)	**37**
Sauk River 07010202	23 (74%)	8 (26%)	**31**	15 (65%)	8 (35%)	**23**
Miss River (St. Cloud) 07010203	17 (77%)	5 (23%)	**22**	19 (90%)	2 (10%)	**21**
North Fork Crow 07010204	19 (86%)	3 (14%)	**22**	15 (94)	1 (6%)	**16**
Pomme de Terre 07020002	6 (50%)	6 (50%)	**12**	2 (100%)	0 (0%)	**2**
Chippewa River 07020005	22 (85%)	4 (15%)	**26**	16 (100%)	0 (0%)	**16**
Le Sueur River 07020011	20 (95%)	1 (5%)	**21**	8 (100%)	0 (0%)	**8**
St. Croix River (Stillwater) 07030005	17 (61%)	11 (39%)	**28**	19 (83%)	4 (17%)	**23**
Miss R./Lake Pepin (Red Wing) 07040001	8 (50%)	8 (50%)	**16**	19 (95%)	1 (5%)	**20**
Root River 07040008	45 (55%)	37 (45%)	**82**	19 (100%)	0 (0%)	**19**
Cedar River 07080201	24 (69%)	11 (31%)	**35**	16 (100%)	0 (0%)	**16**
Shell Rock River 07080202	2 (100%)	0 (0%)	**2**	3 (100%)	0 (0%)	**3**

Red River of the North 09020104	6 (100%)	0 (0%)	**6**	5 (100%)	0 (0%)	**5**
Buffalo River 09020106	14 (88%)	2 (12%)	**16**	22 (88%)	3 (12%)	**25**
Tamarac River 09020311	5 (83%)	1 (17%)	**6**	1 (25%)	3 (75%)	**4**
Little Fork River 09030005	6 (15%)	33 (85%)	**39**	0 (0%)	12 (100%)	**12**

AQL = aquatic life; AQR = aquatic recreation; NS = non-support for designated uses; FS = full support for designated uses

Lake aquatic life and aquatic recreation assessment data:

Watersheds	AQR_ NS	AQR_ FS	**AQR_ TOTAL**	AQL_ NS	AQL_ FS	**AQL_ TOTAL**
St. Louis River 04010201	7 (29%)	17 (71%)	**24**			**0**
Sauk River 07010202	32 (70%)	14 (30%)	**46**	0 (0%)	49 (100%)	**49**
Miss River (St. Cloud) 07010203	35 (50%)	35 (50%)	**70**			**0**
North Fork Crow 07010204	41 (59%)	29 (41%)	**70**	0 (0%)	27 (100%)	**27**
Pomme de Terre 07020002	4 (33%)	8 (67%)	**12**	0 (0%)	6 (100%)	**6**
Chippewa River 07020005	34 (53%)	30 (47%)	**64**			**0**
Le Sueur River 07020011	5 (71%)	2 (29)	**7**	0 (0%)	6 (100%)	**6**
St. Croix River (Stillwater) 07030005	53 (50%)	54 (50%)	**107**			**0**
Miss R./Lake Pepin (Red Wing) 07040001	6 (60%)	4 (40%)	**10**			**0**
Root River 07040008			**0**			**0**
Cedar River 07080201	1 (100%)	0 (0%)	**1**			**0**
Shell Rock River 07080202	5 (100%)	0 (0%)	**5**			**0**

Red River of the North 09020104			**0**			**0**
Buffalo River 09020106	17 (50%)	17 (50%)	**34**			**0**
Tamarac River 09020311			**0**			**0**
Little Fork River 09030005	0 (0%)	15 (100%)	**15**	0 (0%)	5 (100%)	**5**

AQL = aquatic life; AQR = aquatic recreation; NS = non-support for designated uses; FS = full support for designated uses

Caveats and Limitations

We do not randomly select the watersheds or sites/lakes that are intensively monitored, so the impairment/unimpairment rates must be characterized as representative of the body of lakes or streams sampled. The rates cannot be characterized as an unbiased statewide picture of lake and stream condition.

Also, the watersheds assessed to date are largely located in central and southern Minnesota. Because water quality varies so widely by region, it is important to display the impairment/unimpairment rates by watershed until all 81 major watersheds have been intensively monitored and assessed. After all watersheds have been monitored and assessed, we will be able to determine a statewide estimate of the impairment/unimpairment rates for the various uses, but even then it will not be an unbiased estimate. The rates may always be biased towards impairment, as much of the monitoring conducted on the local level is aimed at resources that are suspected to have pollution problems.

At this point, we are not able to report an impairment rate for aquatic life use support for lakes, as we do not have standards yet to evaluate that use (indices of biotic integrity for lakes are under development).

Sites and lakes are delisted as water integrity is restored or as corrections to the impaired waters list are made. For this reason, we may see impairment/unimpairment rates change for a given watershed from one year to the next, and we also expect to see impaired rates diminish over time for some watersheds.

This measure reflects the lakes and stream reach assessment decisions made for those resources for which we have sufficient data for assessment and whose datasets allow us to make a clear assessment decision. Each year, there are a small number of resources for which the assessment data indicates the resource is hovering near the impairment thresholds. In such cases, we delay an assessment decision to allow additional time to gather more data.

Future Improvements

As new standards are available (for example, indices of biotic integrity for lakes), we will be able to report additional impairment/unimpairment results.

Financial Considerations

Contributing Agencies and Funding Sources

Funding for core monitoring that supports the MPCA's Intensive Watershed Monitoring design comes from the Minnesota Clean Water Fund, though it should be noted that the MPCA considers all surface water monitoring data stored in EQuIS when assessing the condition of Minnesota's lakes and streams. Additional data beyond that collected through the IWM design is collected through local and other state programs supported by Clean Water and non-Clean Water Funds. For example, a lake association may monitor their lake annual through member dues and submit these data to EQuIS.

Communication Strategy

Target Audience

Local, state and federal agencies and the general public.

Associated Messages

This measure conveys our progress in assessing lakes and streams statewide. Since restoration and protection planning work follows condition monitoring and assessment, this measure also conveys to other MPCA staff and local partners when restoration and protection planning may begin in their regions. This measure also has enormous interest for citizens who want to know how resources in their area are fairing. The impairment/unimpairment rates must be carefully understood, though, as they come with many caveats (see Caveats and Limitations). The impairment/unimpairment rate does not provide any direct information on resources that have been delisted, so this measure alone gives no real sense of progress being made to improve water quality.

Other Measure Connections

This measure relates closely to "Percent of state's watersheds intensively monitored through the watershed approach". That measure combined with this one provides a complete picture of which watersheds have been comprehensively assessed, and the impairment/unimpairment results from those assessments.

Measure Points of Contact

Dana Vanderbosch, MPCA, Lakes & Streams Monitoring supervisor, dana.vanderbosch@state.mn.us .

Changes over time in key water quality parameters for lakes, streams, and wetlands

Measure Background

Measure Description

This measure features a variety of graphics intended to show changes over time in the chemical, biological and physical characteristics of lakes, streams and wetlands, on a statewide scale or within a major watershed or ecoregion. It is important to understand that the broader the scale, the longer it generally takes to detect water quality changes. For this reason, it will take many years of monitoring to detect improvements or declines in water quality at a statewide scale. We may be able to detect trends in watersheds in a shorter amount of time. Monitoring a given lake or stream reach consistently for a decade or more is prohibitively expensive. Therefore, there is a balance between tracking trends on a scale that is meaningful, but that can also be supported financially long-term.

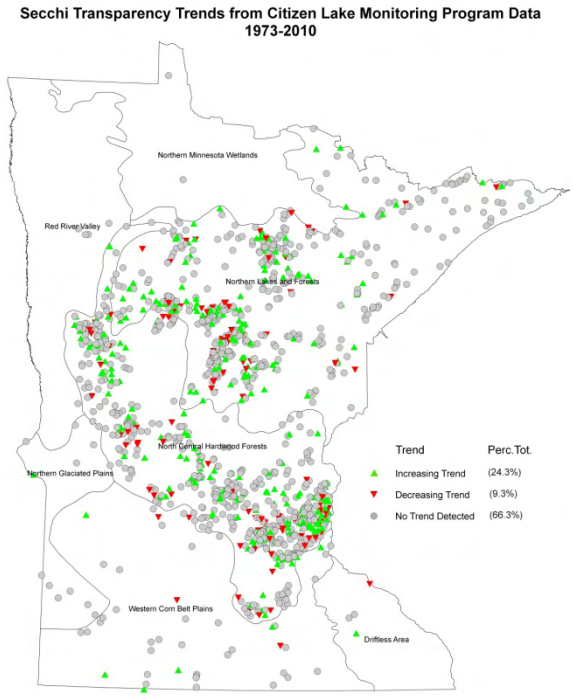
We have selected several monitoring programs to provide water quality information to detect the general condition and changes in lake, stream, and wetland water quality in Minnesota over time. Annually, we will be reporting statewide trends from the MPCA's Citizen Lake and Stream Monitoring Programs and estimates of watershed pollutant yields from the MPCA's Major Watershed Load Monitoring network. Every five years, we will be presenting the results from National Aquatic Resources Surveys, which are financially supported and coordinated by USEPA and produce snapshots in time of lake, stream and wetland condition. Since 2006, the MPCA has been conducting comprehensive watershed lake and stream monitoring on a 10-year rotational basis (termed 'Intensive Watershed Monitoring'). Every ten years, we will be able to report on changes in water quality to a watershed since the last time it was monitored. For each resource type (lake, stream, and wetland), we have chosen a handful of 'key' parameters to track, those factors that tend to be the key indicators of pollution.

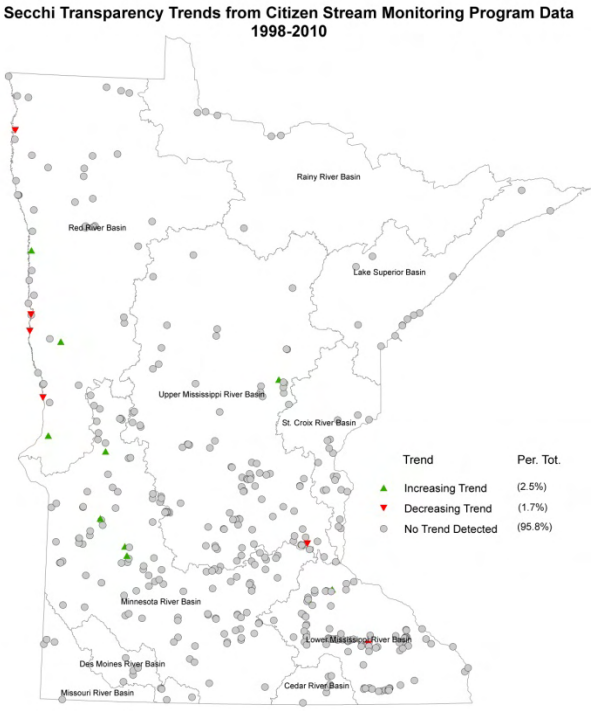
The differing types of water resources, key parameters and temporal scales combined to create enough complexity to warrant breaking this measure into three subcategories.

Visual Depiction

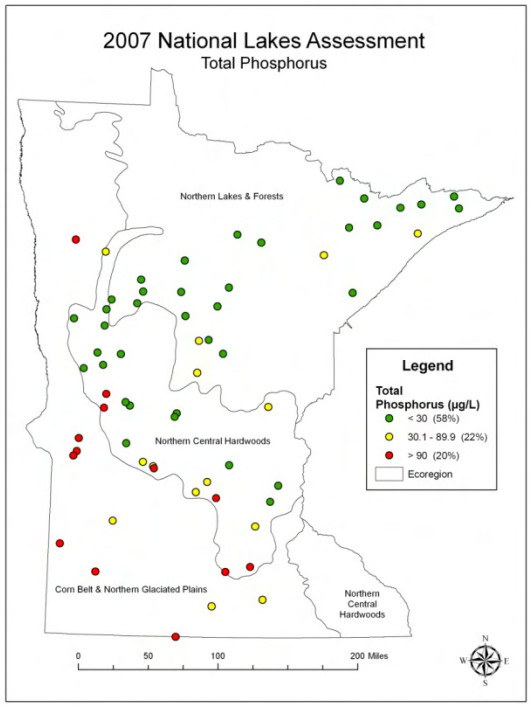
EDWOM 2a) Changes in lakes over time in total phosphorus, chlorophyll-a, and transparency

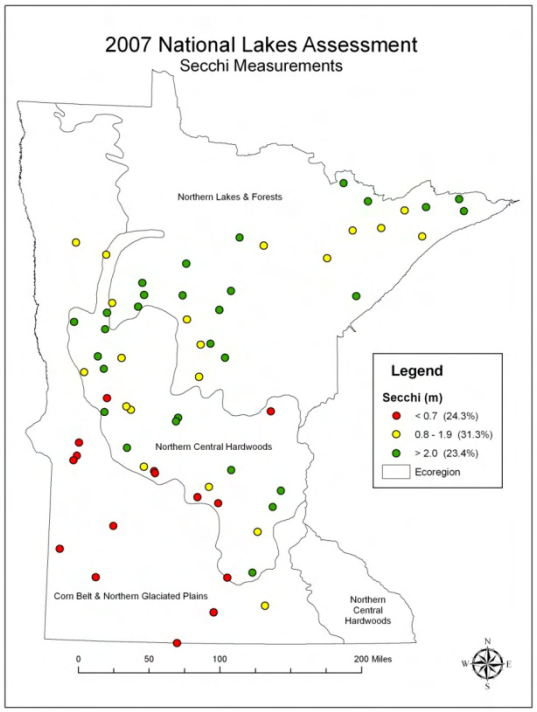
Annual reporting (Citizen Monitoring Program data)

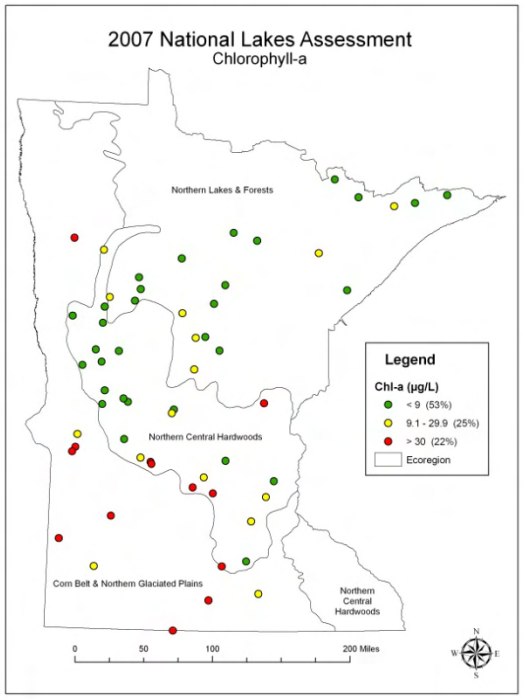




Every 5 years (National Lake Assessment survey data)







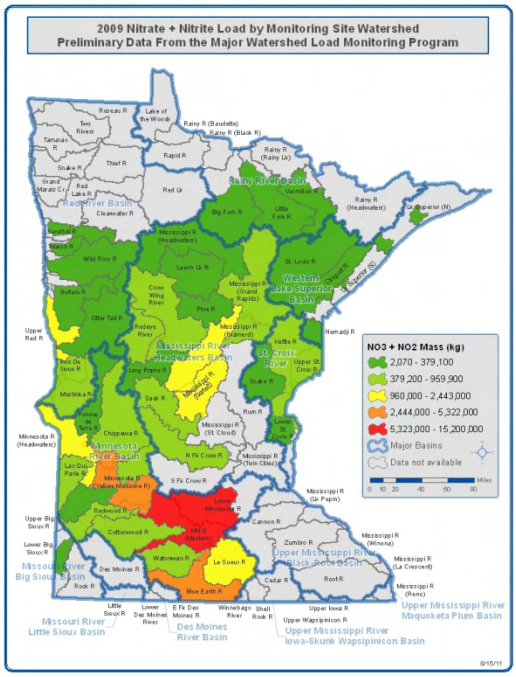
Pie charts showing percentages of lakes meeting/exceeding ecoregional expectations for each parameter will supplement statewide maps.

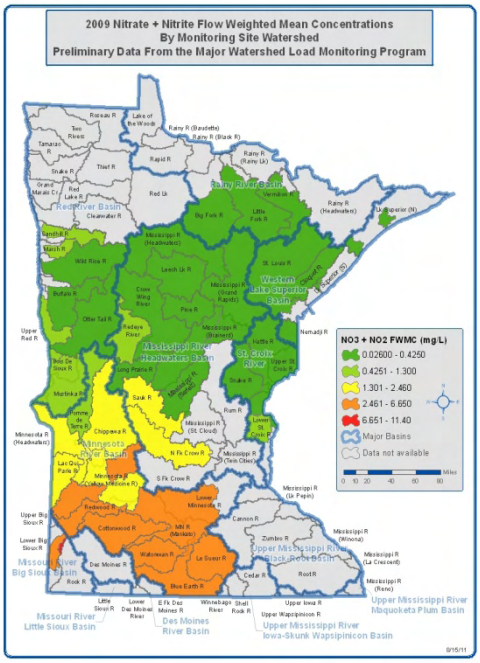
Every ten years (Intensive Watershed Monitoring report out):

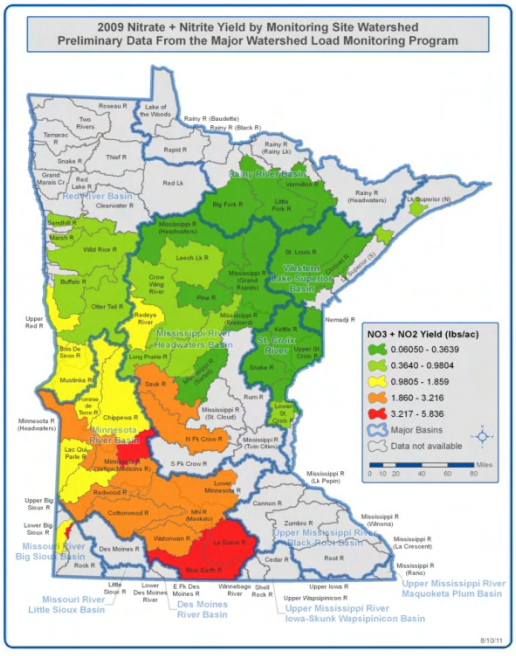
To be developed ~2018 after completion of first 10-year IWM cycle

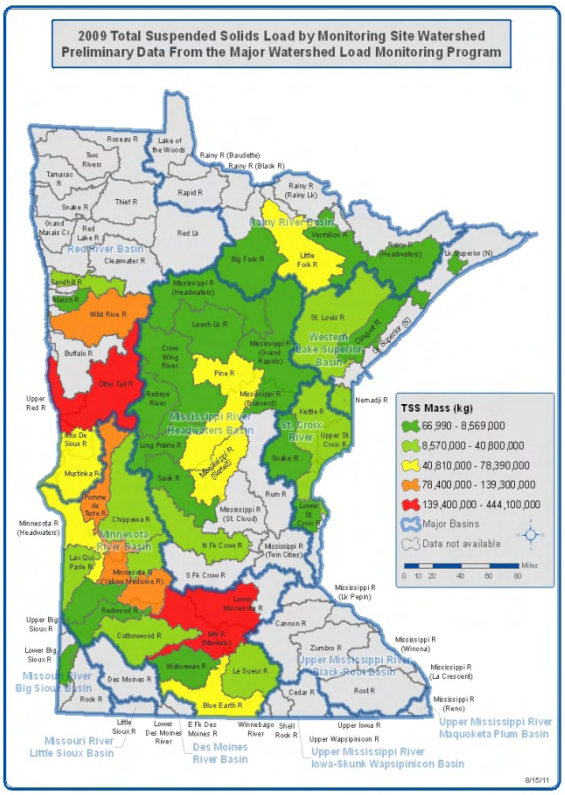
EDWOM 2b) Changes in streams over time in nitrite-nitrate, total suspended solids, total phosphorus, and biology (fish, plants, invertebrates)

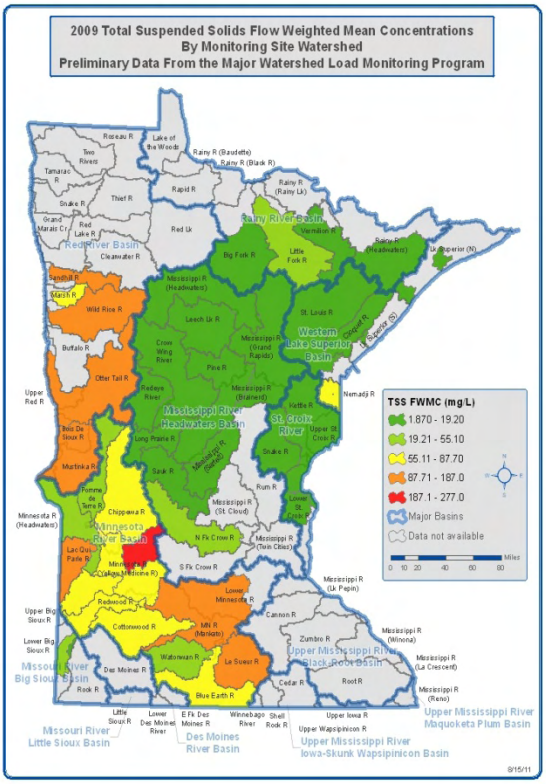
<u>Annual reporting (pollutant maps for loads, flow-weighted means, and yields)</u>

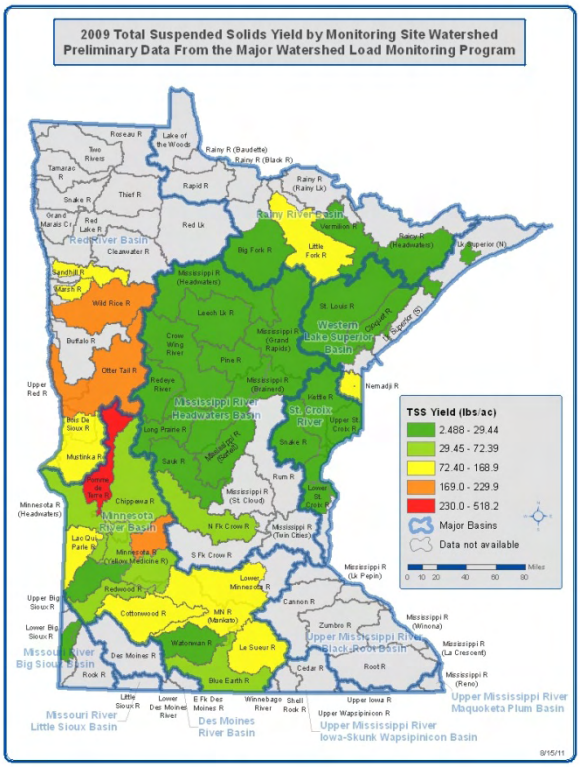


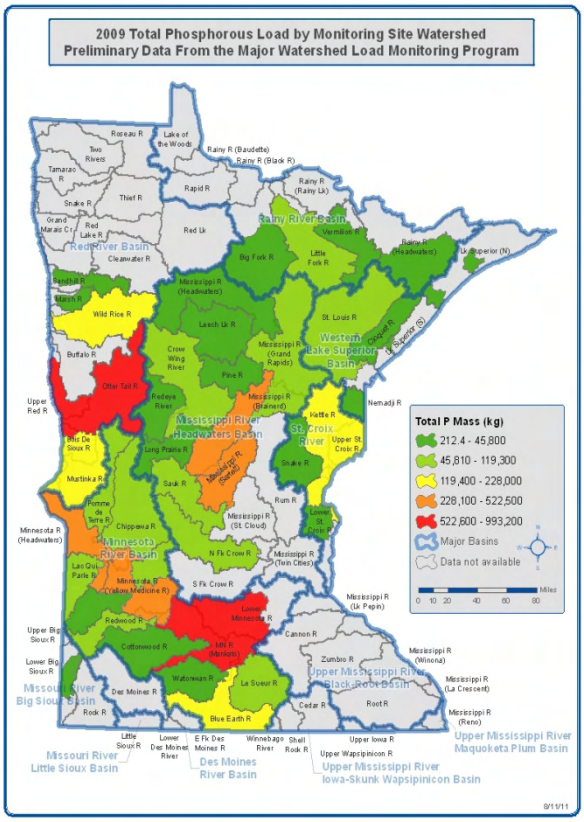


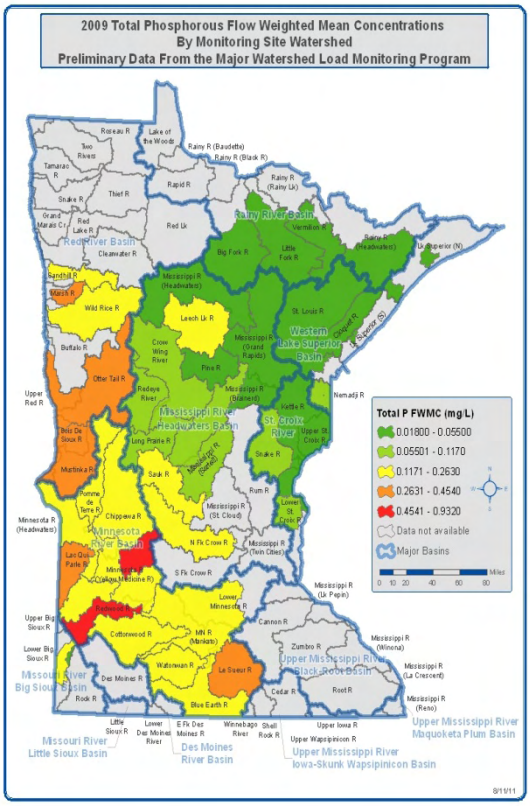



2009 Total Suspended Solids Load by Monitoring Site Watershed
Preliminary Data From the Major Watershed Load Monitoring Program
TSS Mass (kg)
66,990 - 8,569,000
8,570,000 - 40,800,000
40,810,000 - 78,390,000
78,400,000 - 139,300,000
139,400,000 - 444,100,000
Major Basins
Data not available
Miles
0 10 20 40 60 80
Red River Basin
Rainy River Basin
Western Lake Superior Basin
Mississippi River Headwaters Basin
St. Croix River
Minnesota River Basin
Upper Mississippi River Black-Root Basin
Missouri River Big Sioux Basin
Missouri River Little Sioux Basin
Des Moines River Basin
Upper Mississippi River Iowa-Skunk Wapsipinicon Basin
Upper Mississippi River Maquoketa Plum Basin
8/15/11


2009 Total Suspended Solids Flow Weighted Mean Concentrations
By Monitoring Site Watershed
Preliminary Data From the Major Watershed Load Monitoring Program
TSS FWMC (mg/L)
1.870 - 19.20
19.21 - 55.10
55.11 - 87.70
87.71 - 187.0
187.1 - 277.0
Major Basins
Data not available
Miles
0 10 20 40 60 80
Red River Basin
Rainy River Basin
Western Lake Superior Basin
Mississippi River Headwaters Basin
St. Croix River
Minnesota River Basin
Upper Mississippi River Black-Root Basin
Missouri River Big Sioux Basin
Missouri River Little Sioux Basin
Des Moines River Basin
Upper Mississippi River Iowa-Skunk Wapsipinicon Basin
Upper Mississippi River Maquoketa Plum Basin
8/15/11


2009 Total Suspended Solids Yield by Monitoring Site Watershed
Preliminary Data From the Major Watershed Load Monitoring Program
TSS Yield (lbs/ac)
2.488 - 29.44
29.45 - 72.39
72.40 - 168.9
169.0 - 229.9
230.0 - 518.2
Major Basins
Data not available
Miles
0 10 20 40 60 80
Red River Basin
Rainy River Basin
Western Lake Superior Basin
Mississippi River Headwaters Basin
St. Croix River
Minnesota River Basin
Upper Mississippi River Black-Root Basin
Missouri River Big Sioux Basin
Missouri River Little Sioux Basin
Des Moines River Basin
Upper Mississippi River Iowa-Skunk Wapsipinicon Basin
Upper Mississippi River Maquoketa Plum Basin
8/15/11


2009 Total Phosphorous Load by Monitoring Site Watershed
Preliminary Data From the Major Watershed Load Monitoring Program
Total P Mass (kg)
212.4 - 45,800
45,810 - 119,300
119,400 - 228,000
228,100 - 522,500
522,600 - 993,200
Major Basins
Data not available
Miles
0 10 20 40 60 80
Red River Basin
Rainy River Basin
Western Lake Superior Basin
Mississippi River Headwaters Basin
St. Croix River
Minnesota River Basin
Upper Mississippi River Black-Root Basin
Missouri River Big Sioux Basin
Missouri River Little Sioux Basin
Des Moines River Basin
Upper Mississippi River Iowa-Skunk Wapsipinicon Basin
Upper Mississippi River Maquoketa Plum Basin
8/11/11


2009 Total Phosphorous Flow Weighted Mean Concentrations
By Monitoring Site Watershed
Preliminary Data From the Major Watershed Load Monitoring Program
Total P FWMC (mg/L)
0.01600 - 0.05500
0.05501 - 0.1170
0.1171 - 0.2630
0.2631 - 0.4540
0.4541 - 0.9320
Data not available
Major Basins
Miles
0 10 20 40 60 80
Red River Basin
Rainy River Basin
Western Lake Superior Basin
Mississippi River Headwaters Basin
St. Croix River
Minnesota River Basin
Upper Mississippi River Black-Root Basin
Missouri River Big Sioux Basin
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Des Moines River Basin
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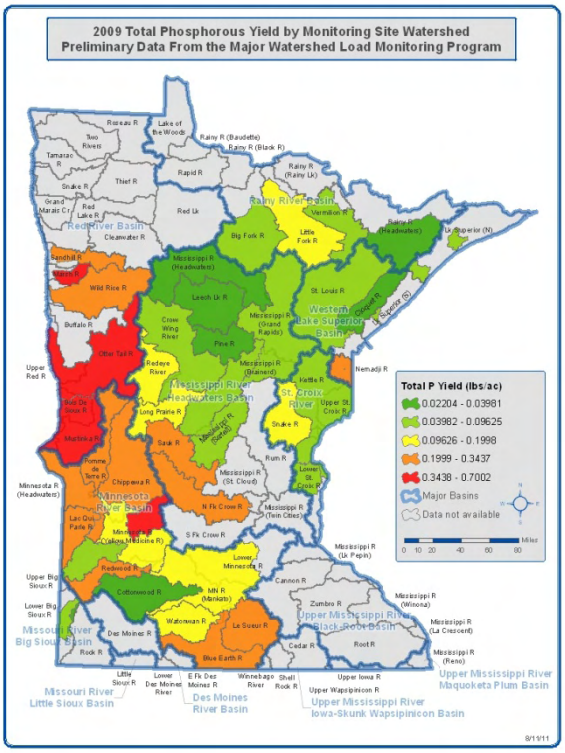
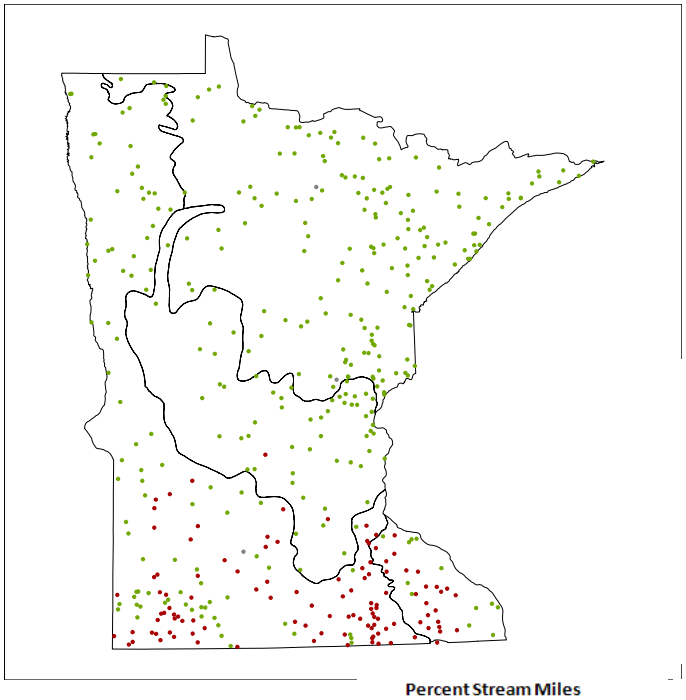
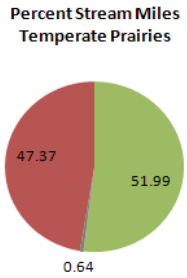
Upper Mississippi River Maquoketa Plum Basin
8/11/11

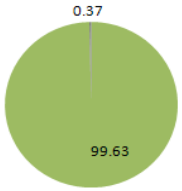

2009 Total Phosphorous Yield by Monitoring Site Watershed
Preliminary Data From the Major Watershed Load Monitoring Program
Total P Yield (lbs/ac)
0.02204 - 0.03981
0.03982 - 0.09625
0.09626 - 0.1998
0.1999 - 0.3437
0.3438 - 0.7002
Major Basins
Data not available
Miles
0 10 20 40 60 80
Red River Basin
Rainy River Basin
Western Lake Superior Basin
Mississippi River Headwaters Basin
St. Croix River
Minnesota River Basin
Upper Mississippi River Black-Root Basin
Missouri River Big Sioux Basin
Missouri River Little Sioux Basin
Des Moines River Basin
Upper Mississippi River Iowa-Skunk Wapsipinicon Basin
Upper Mississippi River Maquoketa Plum Basin
8/11/11

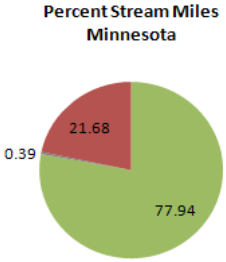
Every 5 years (National Rivers and Streams survey data)

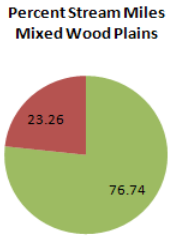
NO2+NO3-N rivers and streams, statewide and by major ecoregion, 1996-2005



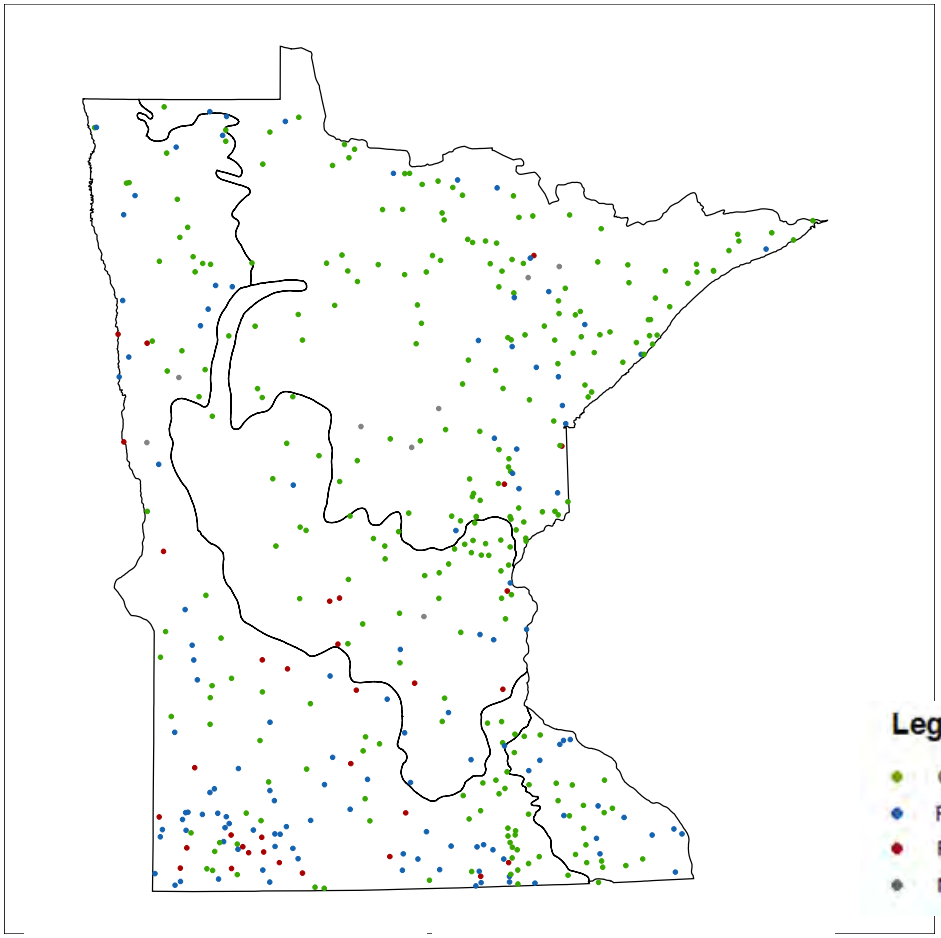


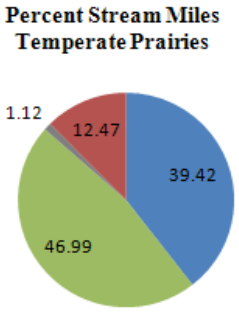


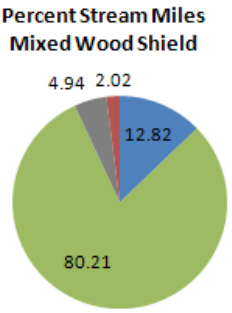


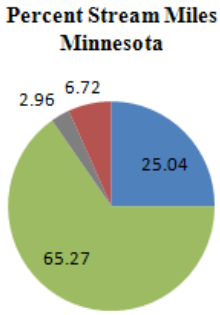


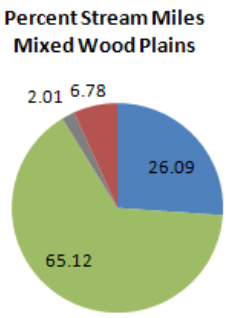
TSS-rivers and streams, statewide and by major ecoregion, 1996-2005



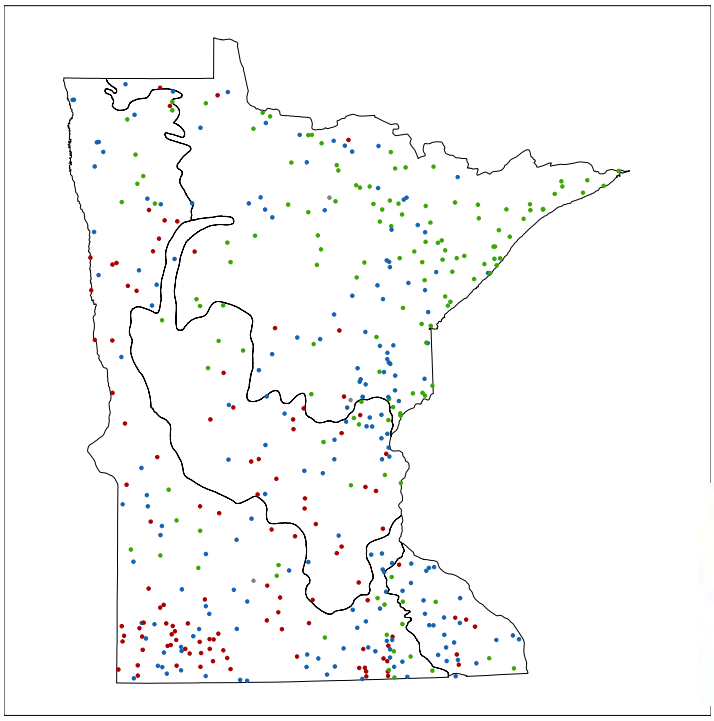


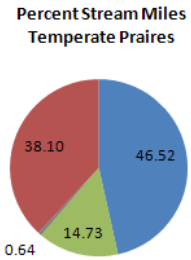


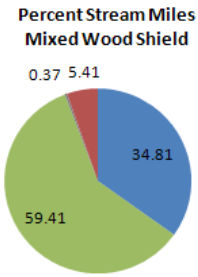


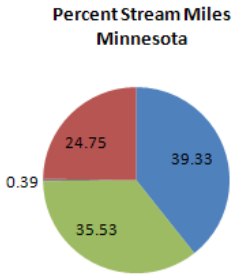


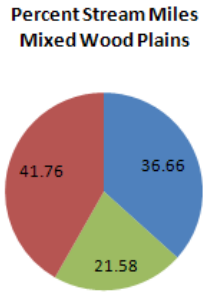
Total Phosphorus - rivers and streams, statewide and by major ecoregion, 1996-2005



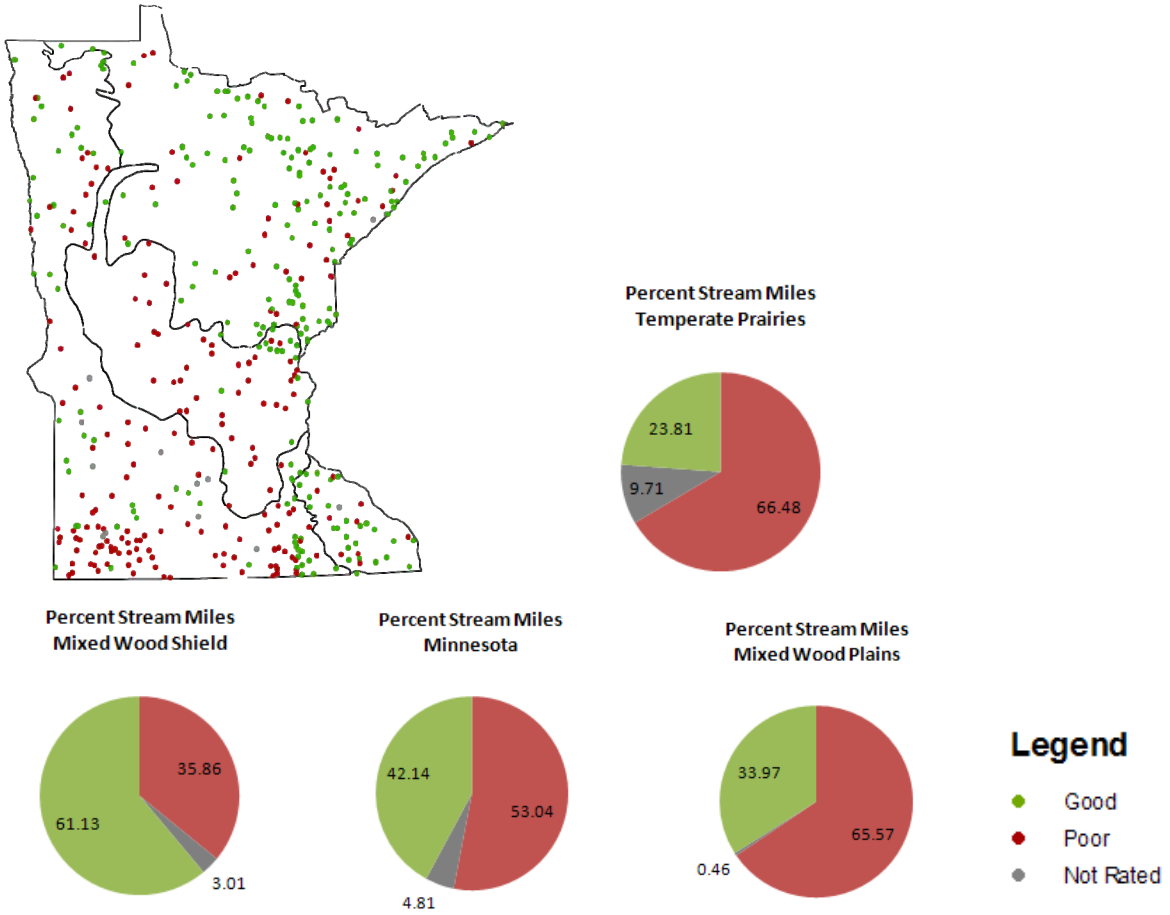




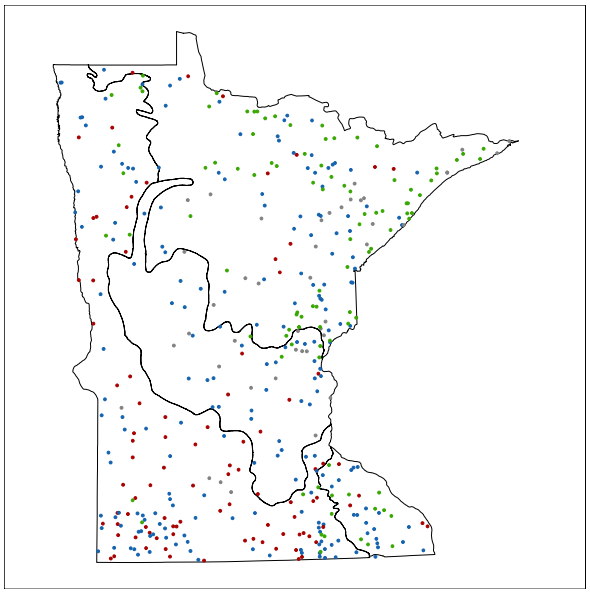


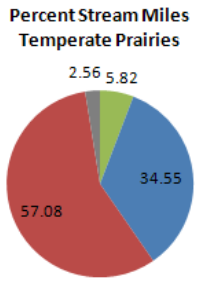


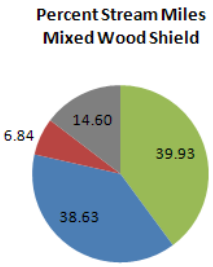
Fish IBI - rivers and streams, statewide and by major ecoregion, 1996-2005

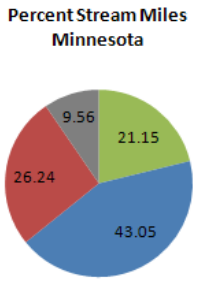


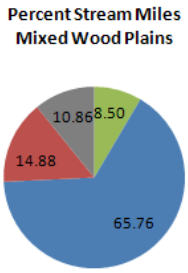
Minnesota Stream Habitat Assessment (MSHA) rivers and streams, statewide and by major ecoregion, 1996-2005











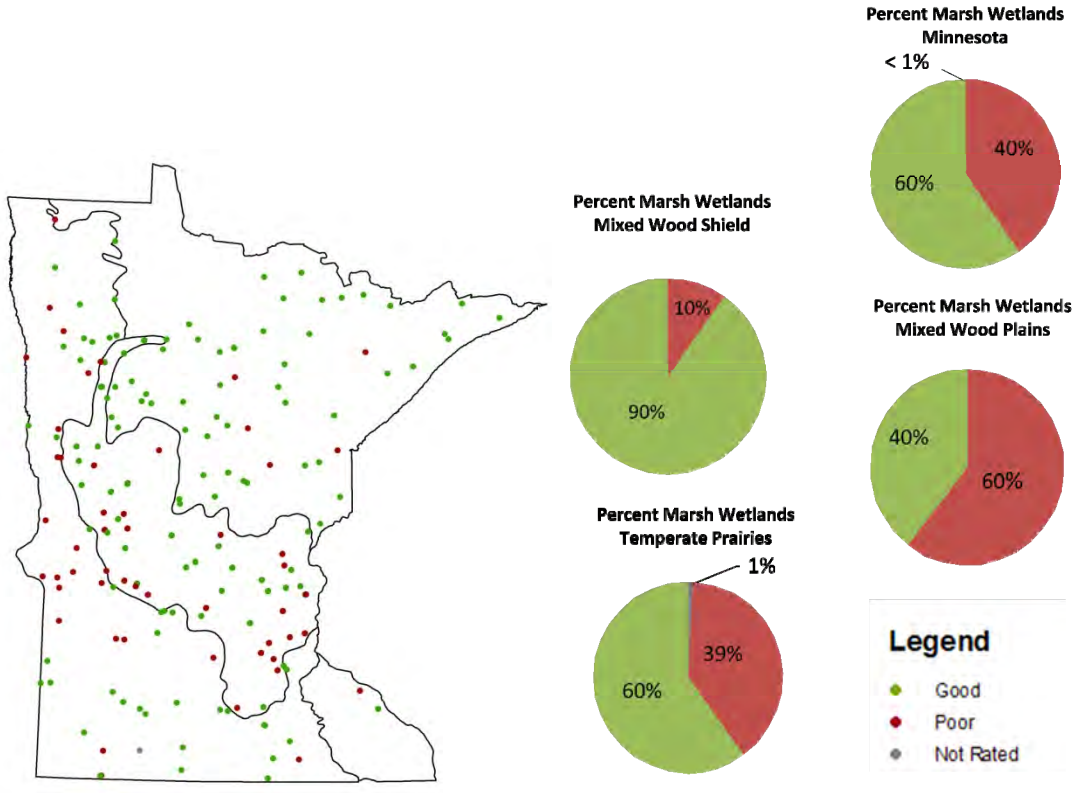
<u>Every ten years (Intensive Watershed Monitoring report out; trend analysis of load monitoring data):</u>

To be developed ~2018 after completion of first 10-year IWM cycle

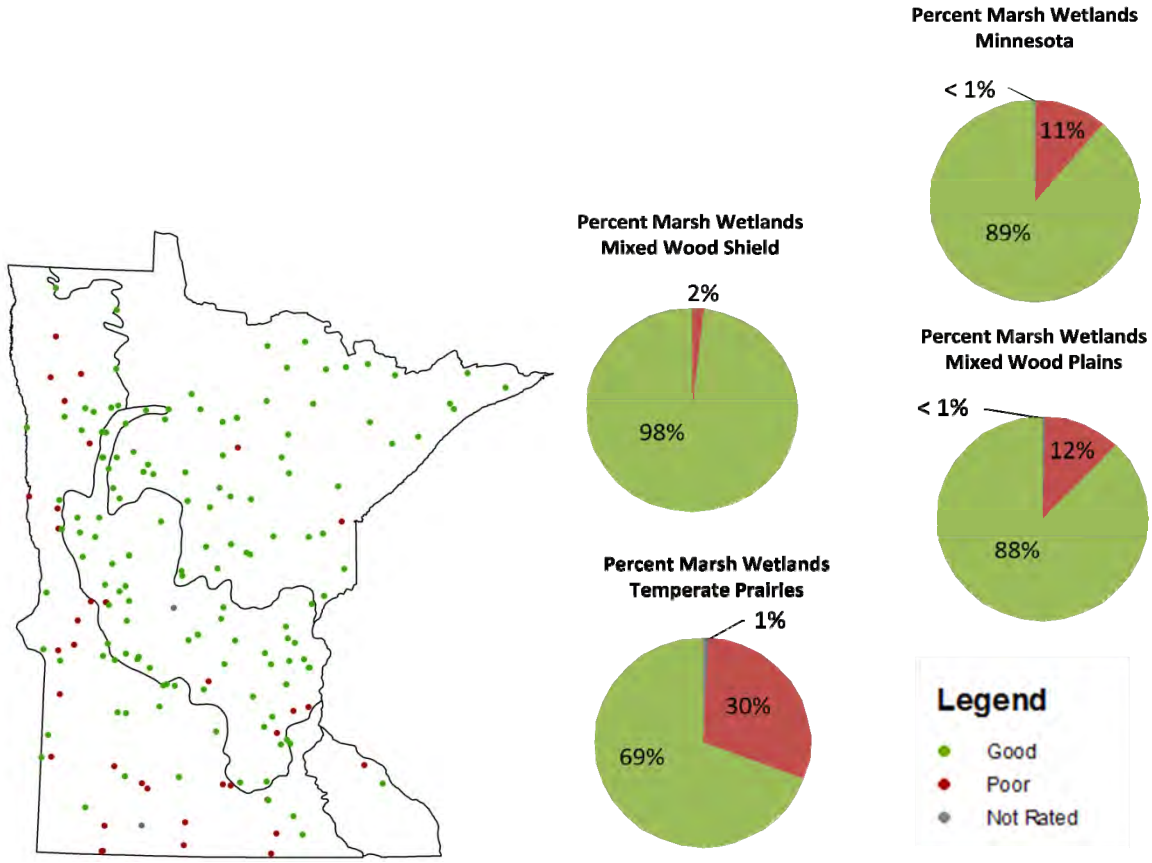
EDWOM 2c) Changes in wetlands over time in biology (plants, invertebrates)

Every 5 years (National Wetland Condition Assessment survey data)

Plant IBI - marsh wetlands, statewide and by major ecoregion. Results from 2007-2009



Invertebrate IBI - marsh wetlands, statewide and by major ecoregion. Results from 2007-2009



Associated Terms and Phrases

Citizen Lake and Stream Monitoring Programs (CLMP/CSMP): Programs supported by the MPCA where citizen volunteers collect water transparency data weekly during the open-water season on a lake or stream site of their choice. The CLMP has been operating since 1973; CSMP since 1998. CMP transparency data are the only data we have for many lakes and streams.

Index of biological integrity (IBI): A measure of biological health based on a community assemblage such as fish, invertebrates or algae. The MPCA uses IBIs to gauge the biological health of streams and wetlands.

Intensive watershed monitoring (IWM): A ten-year rotational cycle wherein an average of 8 of Minnesota's 81 major (8-digit hydrologic unit code) watersheds are intensively monitored each year. The outlet of each major watershed is monitored for physical and chemical parameters monthly on a continual basis for baseflow and more frequently during "events", such as snowmelt and storms (termed 'load monitoring'). During intensive watershed monitoring, additional focus is placed on monitoring the outlets of subwatersheds (12 -digit hydrologic unit code) for biota (fish and invertebrates) and physical habitat, and to sample for chemical parameters ten times. One-time

biological, physical and chemical sampling is also conducted at the outlet of the 14 -digit hydrologic unit code watersheds. During intensive watershed monitoring, all lakes ≥500 acres and at least 25% of lakes 100-499 acres are monitored for physical and chemical parameters (there is currently no tool that allows us to assess lakes for biology).

Load monitoring: Flow and chemistry monitoring conducted at the mouth (or outlet) of each major (8-digit hydrologic unit code scale) watershed. Monitoring is conducted at least monthly, and then more frequently during events (i.e., snowmelt or rain events). The objective is to capture the entire hydrograph, and to determine the pollutant load carried by a stream or river. Watershed loads are also used to assess trends in the stream water quality of a watershed over time, and to see how data from a given year compare to the long-term record for a watershed. Load monitoring also enables comparisons of relative contributions of pollutants from one major watershed to another.

Major watershed: 8-digit hydrologic unit code (HUC) watersheds in Minnesota; there are 81 in Minnesota.

Minnesota Stream Habitat Assessment (MSHA): The name of the MPCA's habitat assessment methodology.

National Aquatic Resource Surveys: Surveys of the nation's aquatic resources that are financially supported and coordinated by the U.S. Environmental Protection Agency. Often referred to as probability-based (or probabilistic) studies, these surveys provide nationally consistent and scientifically-defensible assessments of our nation's waters and can be used to track changes in condition over time. Each survey uses standardized field and lab methods and is designed to yield unbiased estimates of the condition of the whole water resource being studied. Each year, the U.S. EPA focuses on a different resource (i.e., rivers/ streams, lakes, wetlands, and coastal waters). The surveys are intended to be repeated every five years.

National Lakes Assessment Project (NLAP): The National Aquatic Resource Survey for lakes. The first NLA survey was conducted in 2007. Planning for a second survey, to take place in 2012, is underway.

National Rivers and Streams Assessment: The National Aquatic Resource Survey for rivers and streams combined and spans two field seasons. The first National Rivers and Streams Assessment was conducted in 2008-9. Planning for the next National Rivers and Streams Assessment is expected to begin in 2012.

National Wetlands Condition Assessment: The National Aquatic Resource Survey for wetlands. The first Wetlands Condition Assessment was conducted in 2011.

Pollutant flow weighted mean concentration (FWMC): The volumetric average pollutant concentration measured at the monitoring site. The FWMC and is computed by dividing watershed load by total flow volume. Flow-weighted mean concentrations allow for direct comparison of water quality between watersheds.

Pollutant load: The mass of a pollutant passing a stream location over a defined period of time (i.e. lb/yr).

Pollutant yield: Yield is the pollutant load per unit area measured at the monitoring station. This statistic represents watershed load normalized for watershed area (i.e. kg/acre/yr).

Probabilistic study: A study where sampling sites are selected randomly, so the resulting data are unbiased and can be used to generalize conditions for a given region.

Trend: Statistically significant improvement, no change or decline in a water quality parameter (chemistry, biology as measured by an index of biotic integrity (IBI), or physical characteristics).

Target

- Impaired lakes or streams: Decreasing trend for chemical parameters, increasing IBI and transparency trend.
- Unimpaired lakes or streams: Decreasing or stable (no change) trend for chemistry, increasing or stable IBI and transparency.
- Wetlands: No net loss of wetland quality (increasing or stable IBI).

Baseline

- Baseline varies depending on the parameter and site.
- Citizen Monitoring Lake/Stream Program: Citizen Lake Monitoring Program - began in 1973 at the U of MN, transferred to the MPCA in 1978. Citizen Stream Monitoring Program - began in 1998.
- Intensive Watershed Monitoring: The baseline year is 2006, when pilot studies began for biology in streams. All of the MPCA's condition monitoring activities were fully aligned in 2009. For a given watershed, the baseline year is the year it was monitored in the original 10-year cycle (2006-2017).
- Load monitoring: 2008, the year the network began operation, though not all watersheds went on-line that year.
- Probabilistic studies: The EPA began funding randomized studies in 2006 for streams. The first national lake study occurred in 2007. The first wetland study will take place in 2011.

Geographical Coverage

Both statewide and watershed scales for Citizen Monitoring Program, load monitoring and Intensive Watershed Monitoring data. Statewide and ecoregion scales for national study data.

Data and Methodology

Methodology for Measure Calculation

EDWOM 2a) Changes in lakes over time in total phosphorus, chlorophyll-a, and transparency

Annually

Citizen Lake/Stream Monitoring Program (lakes and streams monitored by citizen volunteers) –

Key parameter: transparency

Scale: Statewide

Method: Transparency trends are calculated for each lake/stream monitored through the MPCA's Citizen Lake/Stream Monitoring Program using a seasonal Kendall test. The MPCA uses the statistical program R for all of its analyses on citizen monitoring data. Only sites for which a significant statistical test result (i.e., those with sufficient data for trend analysis) is obtained will be reported in this measure. Statewide maps are created from this information, and statewide summary statistics (% of sites in this network with increasing, declining or no trend in water clarity) are manually computed. Steps to develop the annual trend maps are described in EDWOM2 procedures_Lakes and Streams.docx and stored on the MPCA's server in this folder: X:\Agency_Files\Water\Condition Monitoring\Measures\Lakes & Streams\EDWOM2_Changes over time.

Every five years

National Lake Assessment (federally funded probabilistic lake study conducted by MPCA) –

Key parameters: TP, chlorophyll-a, Secchi transparency

Scale: Statewide/ecoregion

a. Method: National Lake Assessment data are queried from the National Lakes Assessment Database (permanently stored at EPA: http://water.epa.gov/type/lakes/NLA_data.cfm. Directions for downloading data are on the site.). The database is filtered for Minnesota data and data for Secchi (m), Chl-a (ug/L), TP (ug/L), Longitude, and Latitude and stored in a spreadsheet (NLA2007WQdata.xlsx), and brought into tables in ArcGIS projects (NLA_TP.mxd, NLA_Secchi.mxd, and NLA_CHl_a.mxd) to create statewide trend maps. Detailed steps to develop the National Lake Assessment trend maps are described in EDWOM2 procedures_Lakes and Streams.docx and stored on the MPCA's server (X:\Agency_Files\Water\Condition Monitoring\Measures\Lakes & Streams\EDWOM2_Changes over time) along with spreadsheets of the data and the ArcGIS projects.

   Pie charts showing ecoregional results were developed using thresholds that correspond to Minnesota's ecoregion-based standards as follows: NLF – 'Good' - coldwater, lake trout lake standard and 'Poor' - greater than the 2b warmwater standard; CHF – 'Good' - 2b deep lake standard and 'Poor' is greater than the 2b shallow lakes standard; WCBP – 'Good' is the 2b deep lake standard and 'Poor' is greater than the 2b shallow lakes standard. For detailed procedures, see 2007 NLA pie chart procedures.xlsx in X:\Agency_Files\Water\Condition Monitoring\Measures\Lakes & Streams\EDWOM2_Changes over time\2007 NLA pie charts on the MPCA's server.

Every ten years

Intensive Watershed Monitoring (compare results of revisits to target sites (lakes ≥500 acres, outlets of subwatersheds (12-digit hydrologic unit code)) within a given watershed from visits that occurred ten years prior) –

Key parameters: TP, chlorophyll-a, Secchi transparency (lakes); TSS, TP, NO_2+NO_3, index of biotic integrity (fish, invertebrates), and physical habitat (MN Stream Habitat Assessment) for streams.

Scale: Statewide and by watershed

Method: TBD. We will monitor and assess all lakes ≥500 acres and stream sites at the outlets of subwatersheds (12-digit hydrologic unit code) within each watershed on a 10-year rotational basis. Once we have worked through the 10-year watershed cycle and are beginning a second round (2018-2027), we will be able to compare assessment results for these lakes and stream sites from the first cycle to the second. While this comparison will not provide a statistical trend, it will reveal changes in assessment status after a 10-year period of time.

EDWOM 2b) Changes in streams over time in total phosphorus, chlorophyll-a, and transparency

Annual

Watershed Pollutant Load Monitoring Network (stream outlets of major watersheds monitored by MPCA and local partners) – Annual tracking of loads.

Key parameters: total suspended solids (TSS), total phosphorus (TP), nitrite-nitrate (NO_2+NO_3)

Scale: Statewide and by watershed

Methods: The Watershed Pollutant Load Monitoring Network (WPLMN) is designed to measure and compare regional differences and long-term trends in water quality among Minnesota's major rivers (8 digit HUC and major river mainstem scale). Extensive water quality sampling occur year round at all 79 sites within WPLM network. Thirty to thirty-five mid-stream grab samples are collected annually at each site with sampling frequency greatest during periods of moderate to high flow. Annual water quality and daily average discharge data are coupled in the "Flux32" pollutant load model (U.S. Army Corp of Engineers and the Minnesota Pollution Control Agency) to compute annual pollutant loads. Site specific annual pollutant loads, flow weighted mean concentrations and other relevant data are warehoused in an MS Access database titled "SLS" on the MPCA server: X:\Agency_Files\Water\Condition Monitoring\Rivers & Streams\Major Watershed Load Monitoring\SLSstored. Although in the development phase, an averaging function will soon be in SLS to report average statistics including loads and flow weighted mean concentrations for the period of record. Output will be used to create statewide average maps.

SLS load reports are exported and used to create statewide maps of annual pollutant loads, yields, and flow weighted mean concentrations by watershed or drainage area (area above major river mainstem sites). The ArcMap project and data are on the St. Paul server (sp-07) at: U:\Projects\KParson\Water\LoadMon Copies of the output products (jpeg maps) can be found at: X:\Agency_Files\Water\GIS\projects\LoadMonitoring\Maps.

Every five years

National Flowing Waters survey (federally funded probabilistic stream study conducted by MPCA) -

Key parameters: TSS, TP, NO_2+NO_3, index of biotic integrity (fish, invertebrates), physical habitat (MN Stream Habitat Assessment)

Scale: Statewide/ecoregion

Method: Since 1996 the MPCA has been collecting data to characterize the condition of Minnesota's rivers and streams using a random survey in conjunction the environmental protection agency's (EPA) environmental monitoring and assessment program (EMAP). The random survey reduces bias that can be created when sites are targeted and allows the results to be extrapolated from a relatively small number of sites to the larger population of rivers and streams in the State. From 1996 to 2005 the MPCA used a rotating basin design, completing each major basin (4 digit HUC) once during that time period. Results reported here use the data from each basin over that 10 year time span. In 2010 the MPCA aligned its random survey work with the National Flowing Water survey but elected to enhance the sampling effort by selecting 150 sites statewide with approximately 50 sites in each Level 2 Omernik ecoregion. Consequently, future reports on stream condition will use the results of this newer survey design.

All data associated with the random surveys is housed in the MPCA biological monitoring database. Standard EMAP procedures are followed to determine whether or not candidate sites are considered target or non-target. The data is analyzed using the R Gui statistical program. The SPsurvey package that is maintained by EPA was used to create condition estimates for each metric. R and its packages up date periodically. The most updated version, R Gui 2.13.1 was used for this project.

Graphs were created by transferring the R output into Excel to create pie charts that describe the survey results statewide and within each of the three, level 2 ecoregions. Criteria used to derive the good/fair/poor ratings for nutrients were based on the draft TSS and nutrient standards for rivers. Biological thresholds were based on the statewide IBI criteria developed for each of the 9 fish and invertebrate stream classes (guidance currently in development). Habitat thresholds were derived by examining the distribution of least disturbed sites in a statewide dataset.

Further details regarding the survey design, analysis, and derivation of the criteria can be found at X:\Agency_Files\Water\Condition Monitoring\Measures\Biological Monitoring on the MPCA's server under EDWOM2_ Biological Monitoring procedures_2011.docx.

Every ten years

Load monitoring (stream outlets of major watersheds monitored by MPCA and local partners) – Statistically-based trend analyses will be conducted every ten years, at a minimum.

Key parameters: total suspended solids (TSS), total phosphorus (TP), nitrite-nitrate (NO_2+NO_3)

Scale: Statewide and by watershed

Method: TBD. Adequate data sets for purpose will not be available until 2017. Statistically based trend models to be considered include Seasonal Kendall and WQ Trend. Results will be incorporated into the long term average flow weighted mean concentration watershed maps as an insert within each watershed showing trend direction.

Intensive Watershed Monitoring (compare results of revisits to target sites (lakes ≥500 acres, outlets of subwatersheds (12-digit hydrologic unit code)) within a given watershed from visits that occurred ten years prior) –

Key parameters: TP, chlorophyll-a, Secchi transparency (lakes); TSS, TP, NO_2+NO_3, index of biotic integrity (fish, invertebrates), and physical habitat (MN Stream Habitat Assessment) for streams.

Scale: Statewide and by watershed

Method: TBD. We will monitor and assess all lakes ≥500 acres and stream sites at the outlets of subwatersheds (12-digit hydrologic unit code) within each watershed on a 10-year rotational basis. Once we have worked through the 10-year watershed cycle and are beginning a second round (2018-2027), we will be able to compare assessment results for these lakes and stream sites from the first cycle to the second. While this comparison will not provide a statistical trend, it will reveal changes in assessment status after a 10-year period of time.

EDWOM 2c) Changes in wetlands over time in total phosphorus, chlorophyll-a, and transparency

Every five years

National Wetlands Condition Assessment (federally funded probabilistic wetland study conducted by MPCA) -

Key parameters: plants

Scale: Statewide/ecoregion

Method: The IBI data used to generate these estimates of condition resides in the Wetland Biological Monitoring database (wetbioDa.mdb) or in the individual .txt data files used by the analysis software. These files are located in the 'Original Data' folders for each of the ecoregion analyses (X:\Old_P_Fo\WQPRJ\DBF\WETLANDS\WETLANDS\SpecialProjects\MonitoringStrat\Quality Survey\Results) and contain the category 1 (natural) and category 2 (man-made) assignments for each of the survey sites. Both IBIs were compared to regional reference conditions approximated by a set of least-disturbed reference sites within each of the three ecoregions. Analyses were conducted in the statistical package R using the spsurvey library developed by the Environmental Monitoring and Analysis Program (EMAP) Design Team (see: http://www.epa.gov/nheerl/arm/analysispages/software.htm). The data files and results are located in the 'Statewide' folder set up in the Results directory (see address above). The results

of each ecoregion's analysis are located in the 'Results' directory (see above) under the 'Analyses' folder set up for each ecoregion in the Biological\Category\Categorical Estimates.csv spreadsheet file. The graphics displaying the results from each ecoregion were generated by exporting the output of the R/spsurvey statistical package (i.e., Categorical Estimates.csv) into an Excel spreadsheet. This project is in the following location: X:\Agency_Files\Water\Condition Monitoring\Measures\Biological Monitoring\2011 Wetland Measures maps.mxd. Detailed procedures can be found at X:\Agency_Files\Water\Condition Monitoring\Measures\Biological Monitoring on the MPCA's server under EDWOM2_Wetland Procedures.docx.

Data Source

EDWOM 2a): Citizen monitoring data and intensive watershed monitoring chemistry data for lakes are located in the MPCA's EQuIS water quality database; lake chemistry data from national surveys is stored in the EPA's databases.

EDWOM2b): Load monitoring and intensive watershed monitoring chemistry data for streams are located in the MPCA's EQuIS water quality database; biological and physical habitat data from intensive watershed monitoring and probabilistic surveys are stored in the MPCA Biological Monitoring Unit program databases.

EDWOM 2c): Wetland data are stored in the MPCA Biological Monitoring Unit program databases.

Data Collection Period

EDWOM 2a): Citizen Monitoring Program sites are sampled annually.

National Lake Assessment surveys: Data are collected annually, with each survey conducted on a five-year rotation.

Intensive watershed monitoring: Watershed lake and stream chemistry data are collected annually, with each major watershed intensively sampled for a two year period every 10 years.

EDWOM 2b): Load monitoring sites are sampled annually.

National Rivers and Streams surveys: Data are collected annually, with each survey conducted on a five-year rotation.

Intensive watershed monitoring: Watershed stream biological and physical habitat data are collected annually, with each major watershed intensively sampled for a two year period every 10 years.

EDWOM 2c): National Wetland Condition Assessment surveys: Data are collected annually, with each survey conducted on a five-year rotation.

Data Collection Frequency

EDWOM 2a): Citizen monitoring: Transparency data are collected through volunteer efforts. Volunteers are encouraged to collect weekly data from May-September, but actual sampling frequency is variable. Data are submitted to STORET through the MPCA each fall/winter.

National Lake Assessment survey: Occurs every five years on a rotating schedule. First survey occurred in 2007. Planning for the 2012 survey is underway. Approximately fifty sites are selected randomly for each survey for national and statewide estimates, and an additional 100 sites are added to this to allow for ecoregional trend analysis. Sites are sampled once during the survey in July and August. A certain number of sites are selected for revisits for quality assurance purposes for each survey.

Intensive watershed monitoring: Data are collected by MPCA staff and local partners. Each of Minnesota's 81 major watersheds will be intensively monitoring from 2008-2017, with eight watersheds monitored on average each year. Lakes are sampled at least monthly from May-September for two years. Streams are sampled for chemistry at three times monthly May-September for the first year, and then twice per month June-August the second year.

EDWOM 2b): Load monitoring: Data are collected by MPCA staff and local partners monthly for baseline information, and during events (snowmelt and rain events) for pollutant loading. Each site is sampled between 25-35 times annually.

Stream monitoring: The MPCA sampled 30-50 sites for each of Minnesota's 11 major basins from 1996-2005. The sites were sampled from June-September using MPCA sampling methods. Fish, invertebrate, habitat, and nutrients were sampled at each of the sites with 10% duplication to ensure method consistency. The fish and invertebrate index of biological integrity (IBI) results were calculated using an index developed in 2010. Good and poor ratings were developed using the IBI index thresholds for impairment and the current water quality standards. These results were used to establish the baseline results in this measure.

In the future, random stream surveys will be tied to the National Rivers and Streams Assessment survey (i.e., every five years on a rotating schedule). Approximately fifty sites are selected randomly for each survey for national and statewide estimates, and an additional 100 sites are added to this to allow for ecoregional trend analysis. Monitoring is conducted June-September. A certain number of sites are selected for revisits for quality assurance purposes for each survey.

Intensive watershed monitoring: Biological data are collected by MPCA staff. Each of Minnesota's 81 major watersheds will be intensively monitoring from 2008-2017, with eight watersheds monitored on average each year. Streams are generally sampled for fish/habitat in the May-July, and invertebrates sampled in the July-September timeframe.

EDWOM 2c): National Wetland Condition Assessment: The MPCA established a rotating 3-year random survey of marsh type wetlands in 2007. Plants and invertebrates were sampling at 50 sites per major ecoregion for a total of 150 sites. These results were compared to MPCA IBIs and thresholds based off of reference sites to determine good and poor sites.

National Wetland Condition Assessment Survey occurs every five years on a rotating schedule, with the first wetland survey occurring in 2011. Approximately fifty sites are selected randomly for each survey for national and statewide estimates, and an additional 100 sites are added to this to allow for ecoregional trend analysis. Monitoring occurs June-September, for aquatic plants, algae, water chemistry (if wet) and soils. One hundred depressional wetlands will be sampled again in 2012, departing from the 3-year

rotation, so that the work could coincide with the national surveys. The depressional survey results were the basis of the current baseline measure. This baseline will be increased to all wetland types when the 2011-12 results are completed.

Supporting Data Set

The data sets supporting the graphics shown in this measure are large and unwieldy. In addition, substantial summarization and analyses were necessary to generate the graphics. Requests for additional information regarding the various graphics can be addressed by the contacts shown at the end of this document.

Caveats and Limitations

The only data sets included in this measure from which we can analyze true trends at this time are the Citizen Monitoring program data. Data from the National surveys are randomized so the results are unbiased, but they are not considered to be trends. The load monitoring network began operation in 2008 and sufficient data to run a trend analysis is not yet available, so the annual load monitoring maps simply display information from the most recent year. A statistical trend analysis of the load monitoring data is expected to be done ~2017-8. National probabilistic surveys of lakes, streams and wetlands, funded and coordinated by USEPA, are conducted every five years and show general statewide and ecoregional water quality and biology conditions. Lastly, the Intensive Watershed Monitoring Schedule is a rotational cycle where each major watershed is monitored every ten years, and these data will provide an opportunity (starting ~2020) to compare lake and stream assessment results from the first cycle to the second.

Most of the monitoring networks mentioned in this measure (load, intensive watershed, probabilistic studies) result in the collection data above and beyond the key parameters chosen to represent this measure. As programs develop, the key parameters for this measure may change to incorporate other parameters.

Future Improvements

The intensive watershed monitoring and load monitoring networks are all new. As the monitoring activities solidify, aspects of the measure may change accordingly. At a minimum, this measure will be modified to clarify the Methodology for Measure Calculation as those methods are developed and refined.

Financial Considerations

Contributing Agencies and Funding Sources

MPCA – Clean Water Fund and General Fund; USEPA for National Aquatic Surveys

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Communication Strategy

Target Audience

Local, state and federal agencies, legislators, and the general public.

Associated Messages

This measure conveys information about the trending condition of water quality in the state. Once Clean Water Funded activities have been ongoing for many years (>10 years), the water quality trend information will also convey information as to whether or not restoration and protection planning activities are succeeding.

Other Measure Connections

EDWOM2 touches on many of the other surface water-focused measures because it reflects the overall trends in water quality in lakes and streams.

Measure Points of Contact

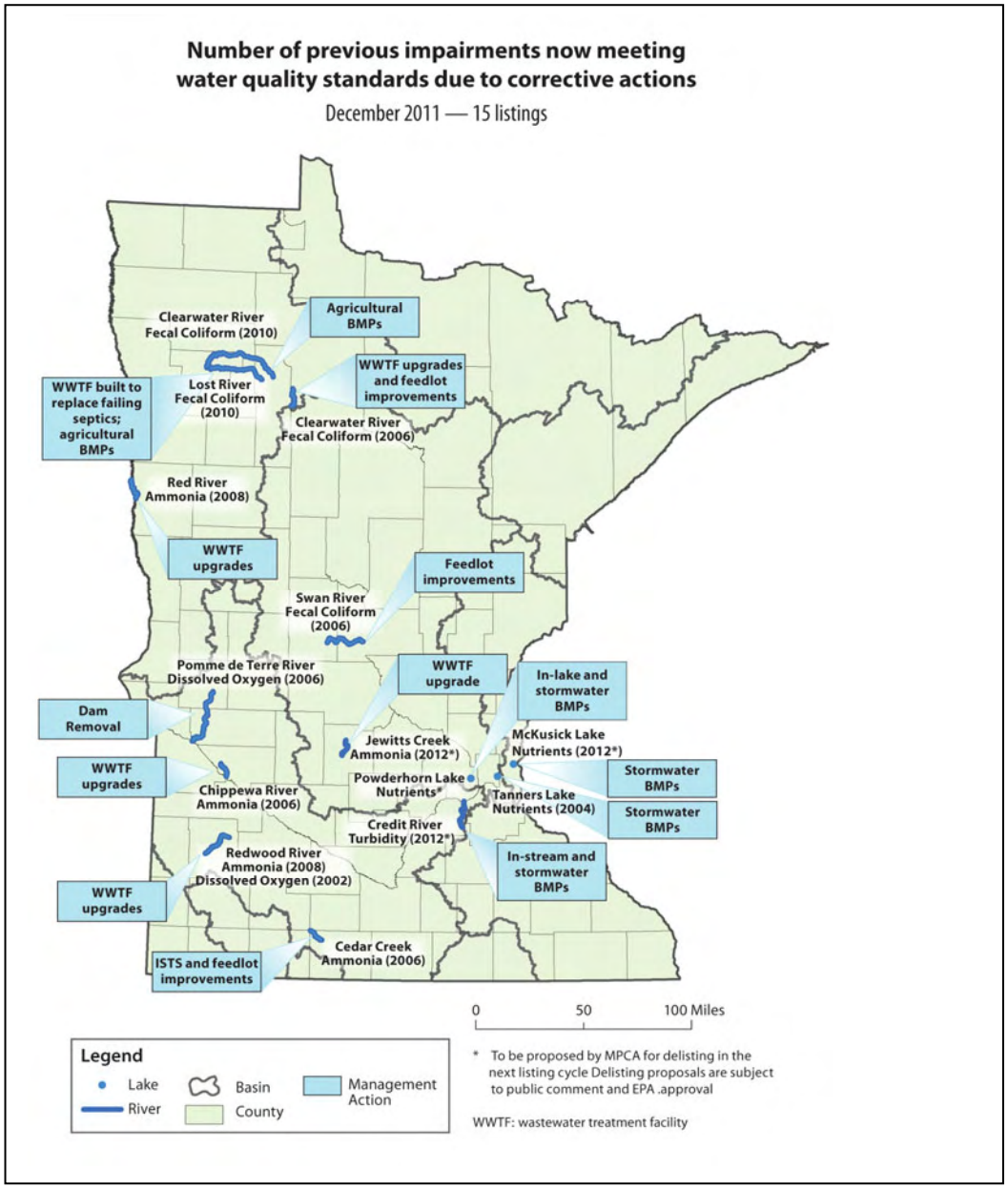
EDWOM 2a): Lake chemistry, Citizen Monitoring Programs: Dana Vanderbosch, Minnesota Pollution Control Agency, dana.vanderbosch@state.mn.us

EDWOM 2b): Wetland and stream biological monitoring (fish, invertebrate), stream chemistry monitoring: Scott Niemela, MPCA, scott.niemela@state.mn.us

EDWOM 2c): Pollutant load monitoring: Steve Thompson, MPCA, stephen.c.thompson@state.mn.us

Number of previous impairments now meeting water-quality standards due to corrective actions

Measure Background



Measure Description

The measure will identify waters restored due to a management action (best management practice installation, wastewater upgrade, etc.) taken to fix a pollution problem, rather than a delisting that's due to better monitoring data or other reasons unrelated to actual restoration activities.

Associated Terms and Phrases

- Water quality standards identify allowable concentrations (per Minnesota regulations) of specific pollutants in water, established to protect its beneficial uses such as recreation, aquatic life, drinking water, fish consumption and others.
- A lake or stream is considered impaired if monitoring data reveals that it is not meeting a water quality standard. Each state updates a list of these impaired waters is updated every two years. As of the 2010 draft list, 3,049 impairments have been identified and approximately 20% of Minnesota's waters have been assessed.

Target

Ultimately, the goal is for all impaired waters in Minnesota (just over 3,000 impairments identified thus far) to be restored. However, achieving this goal is unlikely due to lack of adequate economic resources, extremely degraded water quality in some cases, and other constraints.

Baseline

The baseline year for this measure is 2002, which is the year that the first water body was removed from the impaired waters list ("delisted") due to a management action that resulted in it again meeting water quality standards. [Another possible baseline year could be 1998, which was the date of the first impaired waters list.]

Geographical Coverage

This measure is statewide.

Data and Methodology

Methodology for Measure Calculation

The MPCA recommends "Delistings" (i.e., removal from the impaired waters list) to the U.S. EPA through the impaired waters list approval process. Delistings are determined according to the MPCA's assessment and delisting methodology.

Data Source

The data for the measure is maintained (see below) by the MPCA's Environmental Outcomes Division's Delisting Committee through its delisting review process.

Data Collection Period

1998 to present.

Data Collection Methodology and Frequency

Water quality monitoring data is assessed by the MPCA every two years and then documented in two places:

1. Data and decisions reached is documented in a spreadsheet maintained by the MPCA's Delisting Committee

2. Summary data listed below is also located in a spreadsheet maintained by the MPCA's regional division.

Supporting Data Set

As of 2-10-12:

Credit R. turbidity (Upper Mississippi, Twin Cities)	1	2012*	In-stream and stormwater BMPs
Jewitts Creek, ammonia (Upper Mississippi)	1	2012*	WWTF upgrade
McKusick Lake eutrophication (St. Croix Basin)	1	2012*	Stormwater BMPs
Powderhorn Lake. eutrophication (Upper Mississippi, Twin Cities)	1	2012*	In-lake and stormwater BMPs
Lost R. (Anderson L. to Hill R.) E.coli (Red)	1	2010	WWTF built to replace failing septics; agricultural BMPs
Clearwater R. (Ruffy Bk to Lost R) E. coli (Red River Basin)	1	2010	Erosion buffer and drainage BMPs
Red R. (at Moorhead) ammonia (Red River Basin)	1	2008	WWTF upgrades
Redwood R. ammonia (MN River Basin)	1	2008	WWTF upgrades
Swan R. fecal coliform (Upper Miss.)	1	2006	Feedlot improvements
Clearwater R. (trout stream portion) fecal coliform (Red River Basin)	1	2006	WWTF upgrades and feedlot improvements
Pomme de Terre R. dissolved oxygen (MN River Basin)	1	2006	Dam removal
Chippewa R. ammonia (MN River Basin)	1	2006	WWTF upgrades
Cedar Cr. Ammonia (MN River Basin)	1	2006	ISTS and feedlot improvements
Tanners Lake eutrophication (Upper Miss. Basin)	1	2004	Stormwater BMPs
Redwood R. dissolved oxygen (MN River Basin)	1	2002	WWTF upgrades
TOTAL	**15**		

* To be proposed by MPCA for delisting in the next listing cycle.

Delisting proposals are subject to public comment and EPA approval.

Caveats and Limitations

Implementation actions may be funded from a variety of state, local or federal sources so it is difficult to attribute a restoration to a single funding source such as the Clean Water Fund.

Future Improvements

No future improvements are anticipated at this time.

Financial Considerations

Contributing Agencies and Funding Sources

Not applicable.

Communication Strategy

Target Audience

All audiences

Associated Messages

This measure is important to convey because it is the achievement of one of our most important environmental goals – the restoration of impaired waters due to implementation activities often led by local government and supported by local, state and federal funding.

Outreach Format

This measure will be included on the MPCA web page and linked to other state sites.

Other Measure Connections

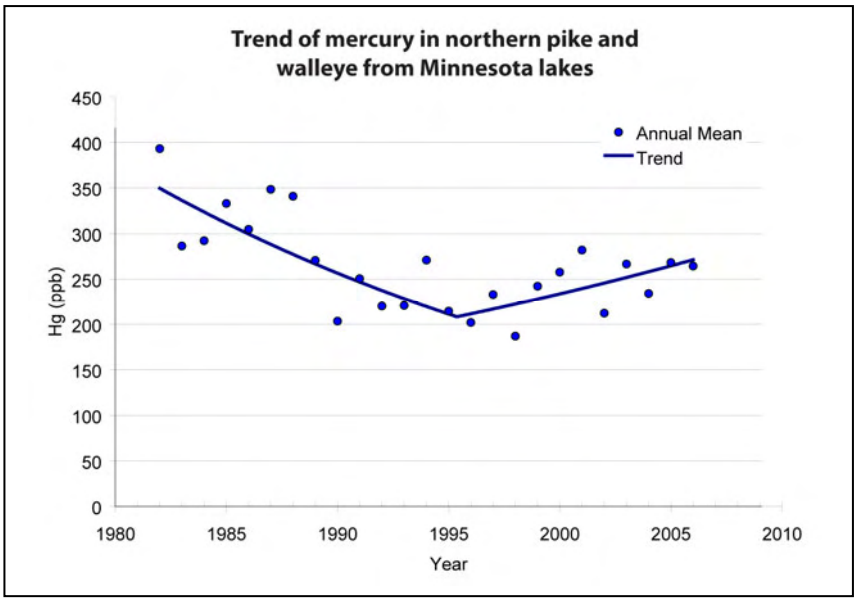
Depending on the cause of the impairment and the activities required for restoration, other measure connections will vary widely. In general, measures related to monitoring, funding and point/nonpoint source implementation activities will be most relevant.

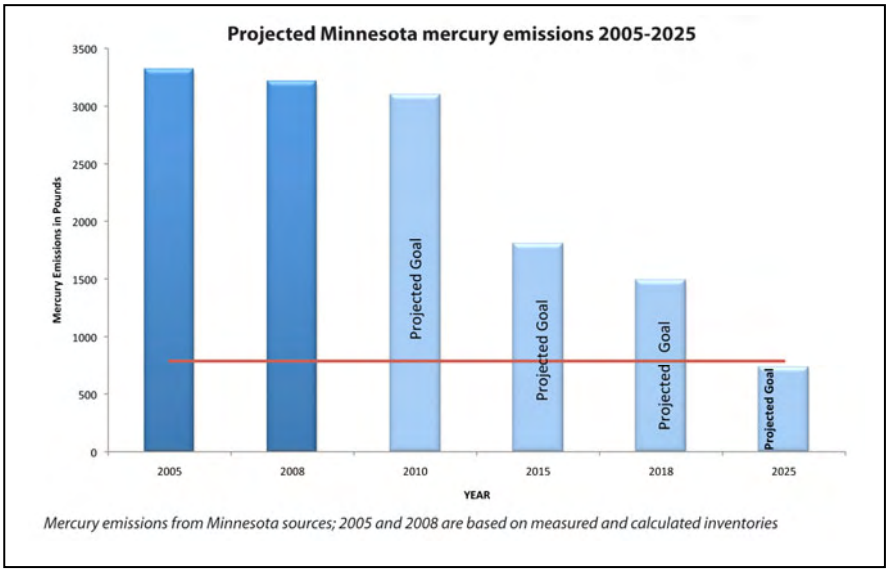
Measure Points of Contact

Jeff Risberg, Minnesota Pollution Control Agency, Jeff.risberg@state.mn.us

Trends of mercury in fish and Minnesota mercury emissions

Measure Background





Measure Description

Many Minnesota lakes and rivers contain mercury which bioaccumulates in aquatic food chains and may pose a risk to humans as well as wildlife that eat fish from those waters. Because air pollution is the primary source of mercury, reducing mercury in fish likely requires large reductions in mercury emissions from sources in Minnesota and throughout the world. To evaluate if Minnesota waters are

getting cleaner, we can track Minnesota mercury emission levels over time through periodic emissions inventories and measure how fish mercury levels respond. Because of the large variation in mercury concentrations from year to year within and among lakes/rivers, long-term trends of mercury in fish are necessary to see if pollution control efforts are sufficient.

Associated Terms and Phrases

Bioaccumulates: Increased concentration of a substance in an organism with time. Bioaccumulation will occur in an organism when the rate of the substance intake is faster than the rate at which the organism is able to eliminate it. The concept of bioaccumulation is often used in reference to the concentrating of toxic substances such as pesticides, heavy metals, or certain other industrial chemicals in living organisms where bioaccumulation increases the risk of toxicity for organisms at the top of food chains.

Food chains: A relationship between the organisms in a particular ecological community whereby organisms at each trophic level (i.e., each step in the food chain) are consumed by organisms of a higher trophic level.

Mercury Emissions: The primary source of mercury pollution is from atmospheric deposition. Human sources contributed 60-70% of the atmospheric mercury and the other third is from natural sources. Energy production—primarily burning of coal—contributes about 50% of the human-sourced mercury. The other 50% is from volatilization of mercury in products, mining operations, and other manufacturing operations that release mercury during the processing of raw materials. Mercury emitted into the atmosphere can become a global pollutant, which is why mercury deposition and fish mercury concentrations have not declined despite large reductions in North American mercury emissions from human sources.

Methylmercury: Organically bound form of mercury – as opposed to ionic or reduced free-metal state. The Minnesota fish contaminants program tests for total mercury, which includes methyl, ionic, and free-metal forms. In practice, this is nearly the same as testing specifically for methyl mercury, as over 90% of mercury contained in fish muscle tissue has been shown to be in the methyl mercury form.

Statewide Mercury TMDL: When a waterway is impaired (i.e., exceeding a water quality standard) a total maximum daily load (TMDL) is prepared, which identifies the pollutant sources and the load reduction required to meet the water quality standard. Because the primary source of mercury to waterways in Minnesota is atmospheric deposition, which is fairly uniform throughout the state, a statewide TMDL was prepared for mercury. The EPA approved the TMDL in 2007 which sets mercury reduction targets that Minnesota is currently working to achieve.

Target

The mercury emissions target for Minnesota, established in the Statewide Mercury TMDL, is 789 pounds of mercury per year. The Statewide Mercury TMDL Plan sets out strategies and a timeline to achieve this goal by 2025.

The target for mercury in fish concentrations is for all fish to have mercury concentrations below 0.2 parts per million, which is the state water quality standard for mercury in fish. Mercury in fish is

expected to decrease as mercury deposition is decreased, although the lag time between source reduction and reductions in the fish is unknown. Because Minnesota receives 90% of its mercury pollution from outside the state, achieving a decline will likely require reducing pollution from both in-state and out-of-state sources. Other factors, such as the presence of wetlands, land-use practices, and climate, also influence the amount of mercury pollution that is converted to methylmercury and accumulates in aquatic foodchains. As more is learned about how these factors alter how much mercury accumulates (bioaccumulates) in fish, the target for mercury in fish concentrations may need to be revised.

Baseline

The Minnesota mercury emissions inventory uses 2005 as the baseline year; the mercury in fish trend analysis uses 1982 as the baseline year. The reduction goals in the Statewide Mercury TMDL used 1990 as a baseline year.

Geographical Coverage

Minnesota has adopted a statewide strategy to address mercury pollution, outlined in the Statewide Mercury TMDL; Minnesota emissions inventory data and fish mercury levels are reported on a statewide basis to match the framework of the strategy.

Data and Methodology

Methodology for Measure Calculation

The trends of mercury in fish rely on northern pike and walleye as the indicator fish species. Because mercury concentrations increase with the age and size of a fish, the two species are standardized to specific total length (55 cm for northern pike and 40 cm for walleye). Consequently, each lake or river with one or both of these species will have a standardized length fish mercury concentration assigned to it and that value is used in the trend analysis. The length standardization methodology is described in a 2009 paper authored by B. A. Monson, *Trend Reversal of Mercury Concentrations in Piscivorous Fish from Minnesota Lakes: 1982-2006*, published in Environmental Science & Technology, vol. 43, pp. 1750-1755.

Data Source

The DNR, Division of Ecological and Water Resources, maintains the primary fish contaminant database (ALLFISHM1.mdb). The Minnesota Department of Agriculture (MDA) currently provides the fish mercury analytical services and maintains the associated analytical and quality assurance records.

Mercury emissions in Minnesota are inventoried at least every five years by the MPCA. The emissions estimates for each source are either measured directly or calculated. As measurement technology improves, more of the emissions are being measured rather than calculated.

Data Collection Period

Fish contaminant data has been collected from 1967 to the present year of 2011. Data has been collected in each of these years, though the amount of data has varied from year to year.

Minnesota's mercury emissions have been estimated every five years since 1990.

Data Collection Methodology and Frequency

The DNR, Division of Ecological and Water Resources, maintains a methods document that outlines the procedures used to collect, store, and process fish for mercury tissue analysis.

The data for mercury emissions is either measured directly or calculated. Direct measurements are increasingly done by the emissions sources, such as coal-fired power plants. Emission calculations follow a procedure developed by the U.S. EPA. The calculations are essentially the mercury concentration per unit of production multiplied by the total production volume.

Supporting Data Set

The fish-mercury trend for 1982-2006 is based on 1700 standardized length fish mercury concentrations from 845 lakes. The tabular data is available on request from Bruce Monson, MPCA.

The mercury emissions inventory is available at http://www.pca.state.mn.us/index.php/view-document.html?gid=292.

Caveats and Limitations

Caveats and limitations associated with the sample collection and sample processing are outlined in the methods document maintained by the DNR, Division of Ecological and Water Resources.

The standardized length fish mercury concentration is based on the available northern pike and walleye collected from each lake. The relationship between mercury concentration and fish length can vary from year to year within a lake, as well as among lakes and rivers. Consequently, each standardized mercury concentration has some uncertainty (i.e., confidence interval) associated with it, but that uncertainty is not explicitly included in the trend analysis; assumptions are made that the uncertainty fits within a normal distribution.

For the mercury emissions inventory, there is uncertainty in measured values and in the calculated emissions. The confidence in the calculations is qualitatively assessed based on the quality of the information available to make the calculations. For example, there is high confidence in the mercury emissions from coal-fired power plants, but very low confidence in the mercury emissions from solid waste collection and processing.

Future Improvements

As mentioned above, more mercury emissions are being measured, which will improve the confidence in those estimates. Calculations of standardized length fish mercury concentrations are not expected to change; however, new statistical methods may be applied to the trend analysis if they provide improved inference about the changes in mercury concentrations.

Financial Considerations

Contributing Agencies and Funding Sources

Not applicable

Communication Strategy

Target Audience

In addition to businesses and organizations in Minnesota whose air emissions of mercury are covered by the Statewide Mercury TMDL Plan, Minnesota residents and visitors who consume fish caught from Minnesota waters and individuals interested in the health of Minnesota's fish-eating wildlife, will be particularly interested in this measure.

Associated Messages

The measure directly links efforts to reduce the release of an air pollutant, mercury, and a specific environmental outcome, reducing mercury in fish. It helps show whether a specific pollution-reduction effort is having the desired environmental affect. In addition, because Minnesota receives 90% of its mercury pollution from outside of the state, the measure also shows the extent to which in-state reductions in mercury air emissions are sufficient.

Outreach Format

In addition to help conveying success in meeting Clean Water goals, this measure will complement MPCA's current effort to provide information to those businesses with air emissions permits for mercury or businesses whose air emissions of mercury may be regulated in the future, as well as organizations/individuals interested in air emissions permitting.

Other Measure Connections

Not applicable

Measure Points of Contact

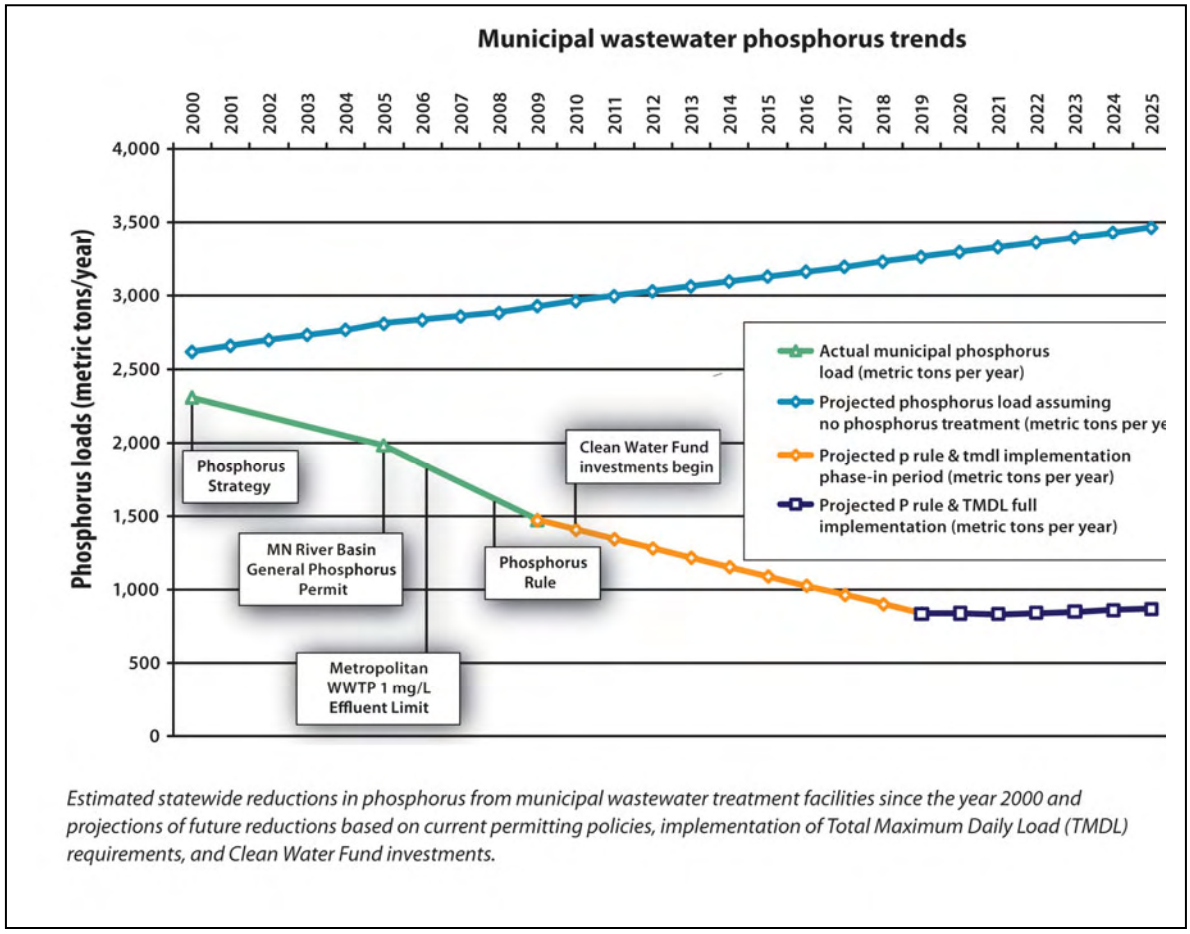
- David Wright, Minnesota Department of Natural Resources, David.I.Wright@state.mn.us
- Paul Hoff, Minnesota Pollution Control Agency, paul.hoff@state.mn.us
- Frank Kohlasch, Minnesota Pollution Control Agency, frank.kohlasch@state.mn.us

Municipal Wastewater Phosphorus Trends

Measure Background

Visual Depiction

This graph represents estimated statewide municipal wastewater treatment facility phosphorus reductions since the year 2000, projects future reductions based on the implementation of current permitting policies and contrasts them to anticipated increases in phosphorus loading that would have resulted from the perpetuation of previous permitting policies.



Estimated statewide reductions in phosphorus from municipal wastewater treatment facilities since the year 2000 and projections of future reductions based on current permitting policies, implementation of Total Maximum Daily Load (TMDL) requirements, and Clean Water Fund investments.

Measure Description

Statewide municipal wastewater treatment facility phosphorus trends and projections assume a 1% per year population growth rate:

- The **red line** assumes pre-2000 business as usual with effluent phosphorus concentrations of 4 mg/L.
- The **yellow line** represents DMR data reported for 2000, 2005 and 2009.
- The **blue line** (Projected Phosphorus Rule & TMDL Implementation Phase-In Period) simply joins the actual to the projected loads assuming a 10-year period.

- The **green line** represents full implementation of the phosphorus rule and continued phosphorus concentration declines from small municipal WWTPs.

Actual wastewater loads based on discharge monitoring report data. Projected phosphorus rule and TMDL implementation phase-in period assumes a 10-year period to achieve full implementation. TMDL requirements and operational margins of safety will likely reduce future phosphorus loads beyond projected values.

Associated Terms and Phrases

- The Phosphorus Strategy was a permitting approach adopted by the MPCA in 2000. It established policies to assign 1 mg/L effluent phosphorus permit limits for municipal wastewater treatment facilities that had the potential to discharge annual phosphorus loads in excess of 1,800 lbs/year to specific watersheds and waterbodies. Municipal wastewater treatment facilities that were not assigned effluent phosphorus limits were required to monitor influent and effluent phosphorus and develop phosphorus management plans.

- The Minnesota River Basin General Phosphorus permit was issued in 2005 to implement the wasteload allocations established by the Lower Minnesota River Dissolved Oxygen TMDL. It established baseline load and pollutant load reduction requirements for the 39 largest continuously discharging municipal and industrial wastewater dischargers in the 8 major watersheds of the Minnesota River basin.

- The Metropolitan WWTP is the largest wastewater treatment facility in Minnesota with an average annual design flow or 251 mgd.

- The "phosphorus rule" refers to Minnesota Rules Chapter 7053.0255. It codifies the phosphorus strategy but extends its requirements to all Minnesota watersheds.

Target

No target has been determined at this time.

Baseline

Baseline year: 2000

Baseline load: 2,305 MT/y

Geographical Coverage

Statewide

Data and Methodology

Methodology for Measure Calculation

- The projections are based on a 1 % per year population growth estimate.
- All municipal ("city") populations are used to calculate municipal flow. All rural ("township") populations are assumed to be outside municipal service boundaries.

- 92% of the flow and load are assumed to be from cities with populations ≥ 2000.
- Loads from municipalities with populations ≥ 2000 are estimated based on flow projections and a 1 mg/L concentration. Loads from municipalities with populations < 2000 are estimated based on flow projections and effluent concentrations that decline gradually based on the reductions shown in the 2000 to 2009 effluent data. They bottom out at 1 mg/L around 2020.
- TMDLs and operational margins of safety push actual future loads below the projections.

About the graph:

The **red line** assumes pre-2000 business as usual with effluent phosphorus concentrations of 4 mg/L

The **yellow line** represents DMR data reported for 2000, 2005 and 2009.

The **blue line** (Projected Rule & TMDL Implementation Phase-In Period) simply joins the actual to the projected loads assuming a 10-year period.

The **green line** represents full implementation of the P rule and continued phosphorus concentration declines from small municipal WWTPs.

Actual wastewater loads based on discharge monitoring report data.

Projected P Rule & TMDL Implementation Phase-In Period assumes a 10-year period to achieve full implementation.

The year 2000 discrepancy between "Actual Municipal Phosphorus Load" and "Projected Phosphorus Load Assuming Non Phosphorus Treatment" reflects pre-2000 implementation of phosphorus effluent limits.

Data Source

WQ Delta database discharge monitoring report data and State demographic center population estimates.

Data Collection Period

2000, 2005, 2009

Data Collection Methodology and Frequency

Supporting Data Set

	Domestic						
	Flow (MG/y)	Conc. (mg/L)	TP Load (MT/y)	Project TP Load @ 2000 Conc (MT/y)	No of Permits		No. of Permits with P Limits
2000	178,106	3.42	2,305	2,305	511		80
2005	210,756	2.49	1,985	2,727	552		100
2009	160,932	2.41	1,471	2,082	573		119

Year	City Population	City > 2000 Population	City > 2000 Pop as % of Tot. City Pop	City < 2000 Pop as % of Tot. City Pop	Actual Municipal Wastewater Flow (MG/y)	Actual Municipal Phosphorus Load (MT/y)	Projected Average Municipal Wastewater Flow (MG/y)	Projected Phosphorus Load Assuming No Phosphorus Treatement (MT/year)	City > 2000 Projected P Rule Implementation Load (MT/year)	City < 2000 Projected P Load (MT/year)	Projected P Rule & TMDL Implementation Phase-In Period MT/year)	Projected P Rule & TMDL Full Implementation (MT/year)
2000	4,257,328	3,900,753	92%	8%	178,106	2,305	172,848	2,617	599	187		
2001	4,324,100	3,964,161	92%	8%			175,558	2,658	609	183		
2002	4,387,230	4,022,758	92%	8%			178,122	2,697	618	175		
2003	4,444,786	4,077,722	92%	8%			180,458	2,732	627	174		
2004	4,500,777	4,129,621	92%	8%			182,732	2,767	635	169		
2005	4,567,652	4,191,489	92%	8%	210,756	1,985	185,447	2,808	644	165		
2006	4,607,356	4,220,005	92%	8%			187,059	2,832	648	164		
2007	4,648,222	4,259,669	92%	8%			188,718	2,857	655	157		
2008	4,686,816	4,294,835	92%	8%			190,285	2,881	660	152		
2009	4,762,705	4,365,483	92%	8%	160,932	1,471	193,366	2,928	671	147	1,471	
2010	4,816,929	4,415,002	92%	8%			195,567	2,961	678	142	1,407	
2011	4,871,153	4,464,520	92%	8%			197,769	2,994	686	137	1,344	
2012	4,925,377	4,514,039	92%	8%			199,970	3,028	694	131	1,280	
2013	4,979,601	4,563,557	92%	8%			202,172	3,061	701	125	1,216	
2014	5,033,825	4,613,076	92%	8%			204,373	3,094	709	120	1,153	
2015	5,088,048	4,662,594	92%	8%			206,575	3,128	717	114	1,089	
2016	5,142,272	4,712,113	92%	8%			208,776	3,161	724	107	1,026	
2017	5,196,496	4,761,631	92%	8%			210,978	3,194	732	101	962	
2018	5,250,720	4,811,150	92%	8%			213,179	3,228	739	95	898	
2019	5,304,944	4,860,669	92%	8%			215,381	3,261	747	88	835	835
2020	5,359,168	4,910,187	92%	8%			217,582	3,294	755	81		836
2021	5,413,392	4,959,706	92%	8%			219,784	3,328	762	70		832
2022	5,467,616	5,009,224	92%	8%			221,985	3,361	770	70		840
2023	5,521,840	5,058,743	92%	8%			224,187	3,394	777	71		849
2024	5,576,064	5,108,261	92%	8%			226,388	3,428	785	72		857
2025	5,630,288	5,157,780	92%	8%			228,590	3,461	793	73		865

Caveats and Limitations

The projections are based on a **1 % per year population** growth estimate.

All municipal ("city") populations are used to calculate municipal flow. All rural ("township") populations are assumed to be outside municipal service boundaries.

92% of the flow and load are assumed to be from cities with populations ≥ 2000.

Loads from municipalities with populations ≥ 2000 are estimated based on flow projections and a 1 mg/L concentration. Loads from municipalities with populations < 2000 are estimated based on flow projections and effluent concentrations that decline gradually based on the reductions shown in the 2000 to 2009 effluent data. They bottom out at 1 mg/L around 2020.

TMDLs and operational margins of safety push actual future loads below the projections.

Projected P Rule & TMDL Implementation Phase-In Period assumes a 10-year period to achieve full implementation.

The year 2000 discrepancy between "Actual Municipal Phosphorus Load" and "Projected Phosphorus Load Assuming Non Phosphorus Treatment" reflects pre-2000 implementation of phosphorus effluent limits.

Future Improvements

Increased frequency of phosphorus monitoring in industrial permits should allow for future estimates and projections to include industrial wastewater loads.

Financial Considerations

Contributing Agencies and Funding Sources

Not applicable.

Communication Strategy

Target Audience

The primary audience would be regulated municipalities and permitting authorities. However, this measure is of interest to anyone interested in the effectiveness of wastewater programs.

Associated Messages

This measure is important to communicate to a variety of audiences to help understand the long term trends in wastewater control measure effectiveness.

Other Measure Connections

This measure links to other outcome-related measures on environmental trends, as well as financial measures showing inputs and activities related to wastewater funding.

Measure Points of Contact

Marco Graziani, Minnesota Pollution Control Agency

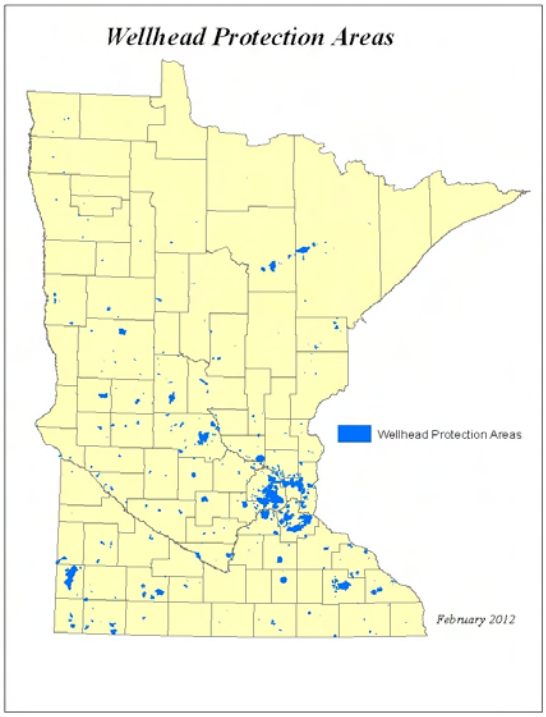
Marco.Graziani@state.mn.us

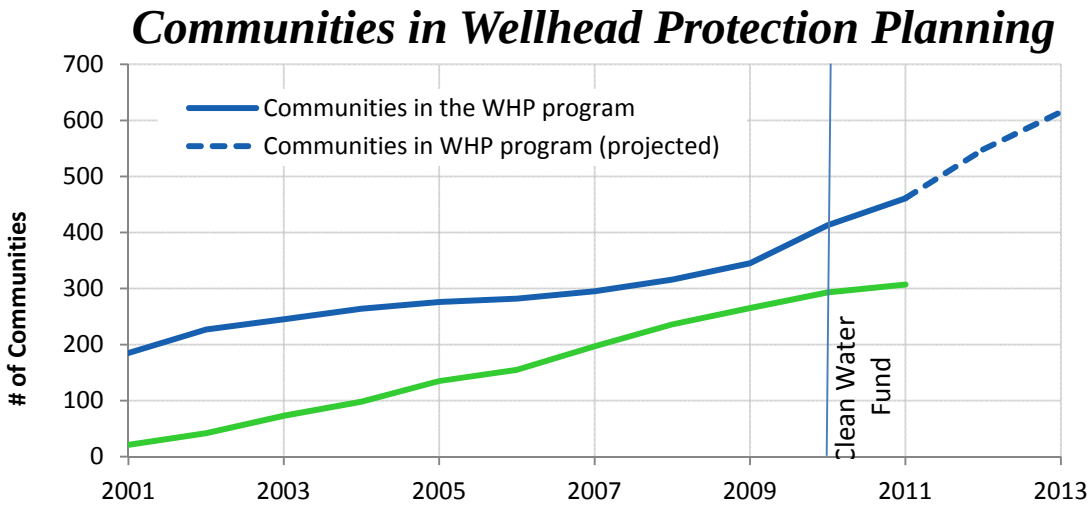
Drinking Water Protection Measures

Number of Public Water Supply Systems Assisted with Developing and Implementing Source Water Protection Plans

Measure Background

Visual Depiction





Measure Description

Source water protection planning and implementation help the public water supply systems (PWS) protect the source of the drinking water supply by identifying:

1) the area that supplies water to the PWS well or wells,
2) vulnerability of that area, and
3) appropriate land and water resource management strategies for protecting the source of drinking water.

The goal is to have every community public water supply system engaged in source water protection by 2020. This measure was developed to track the rate of progress toward that goal.

Communities develop source water protection plans for water supplies as legally required in Minnesota, and assistance is available from several partners. The Minnesota Department of Health (MDH) is the primary agency responsible for source water protection; they review and approve source water protection plans. However, the Minnesota Department of Agriculture (MDA), Minnesota Department of Natural Resources (DNR), Minnesota Pollution Control Agency (MPCA), Metropolitan Council, Board of Water and Soil Resources , federal agencies, overlapping watershed districts, and neighboring communities all provide vital information and management tools.

Associated Terms and Phrases

Drinking Water Supply Management Area (DWSMA). The area delineated using identifiable land marks that reflects the scientifically calculated wellhead protection area boundaries as closely as possible (Minnesota Rules, part 4720.5100, subpart 13).

Drinking Water Supply Management Area Vulnerability. An assessment of the likelihood that the aquifer within the DWSMA is subject to impacts from land and water uses within the wellhead protection area. It is based upon criteria that are specified under Minnesota Rules, part 4720.5210, subpart 3.

Inner Wellhead Management Zone (IWMZ). The land that is within 200 feet of a public water supply well (Minnesota Rules, part 4720.5100, subpart 19). The public water supplier must manage the IWMZ to help protect it from sources of pathogen or chemical contamination that may cause an acute health effect.

Source Water Protection. Source water protection prevents contaminants from entering a public water supply at levels that could negatively impact human health. Source water protection activities have many benefits:

- Human health is protected
- Costs are reduced; the cost of pollution prevention is less than the cost of remediation
- Risk is reduced; property owners are less likely to become responsible parties to contaminating a source of public drinking water
- Sustainable water supplies are ensured for future generations' health and economic needs

Surface Water Intake Protection. A method of prevention contamination of the surface water (rivers or lakes) used to supply drinking water by managing potential contamination sources. The development of surface water intake protection plans is voluntary in Minnesota. However, plans seeking the endorsement of the state must follow the guidance provided by MDH.

Wellhead Protection. A method of preventing well contamination by effectively managing potential contamination sources in all or a portion of the well's recharge area. Wellhead protection is a legal requirement that was adopted by the state in December 1997. Procedures and time frames for wellhead planning are described in Minnesota Rules Parts 4720.5100 to 4720.5590, and apply to community and noncommunity public water supply systems that rely on groundwater for their source of drinking water.

Wellhead Protection Area (WHPA). The surface and subsurface area surrounding a well or well field that supplies a public water supply system, through which contaminants are likely to move toward and reach the well or well field (Minnesota Statutes, part 103I.005, subdivision 24).

Well Vulnerability. An assessment of the likelihood that a well is at risk to human-caused contamination, either due to its construction or indicated by criteria that are specified under Minnesota Rules, part 4720.5550, subpart 2.

Target

All community public water suppliers that use groundwater will have a wellhead protection plan in place by 2020.

Baseline

Data from 2001 through June 30, 2009 provides a context for this measure.

Geographical Coverage

Statewide

Data and Methodology

Methodology for Measure Calculation

For this first report, data from the MDH Source Water Protection Tracker database was used to provide the number of new communities entering the wellhead protection program, technical assistance provided by the four planners supported by the Clean Water Fund, and new wellhead protection plans that were approved.

Data Source

Source Water Protection Tracker and Minnesota Drinking Water Information System, two databases that are maintained by the Minnesota Department of Health.

Data Collection Period

1998 to 2011

Data Collection Methodology and Frequency

Data is continually entered by Minnesota Department of Health and Minnesota Rural Water staff as rule requirements are met and assistance is provided to public water suppliers and the general public.

Supporting Data Set

Currently there are 929 community public water supplies with groundwater as a source. Of these, 227 have approved plans and 283 are in the process of developing a first plan or amending an existing plan.

Public water supplies given assistance by the four new planners supported by the Clean Water Fund for FY 10 and 11:

Barrett	Grand Meadow	North Branch	Sargeant
Battle Lake	Green Isle	Northfield	Sargent's Landscape Nursery
Battle Lake Mobile Home Park	Green Lake Sanitary Sewer & Water Dist.	Oak Park Heights	Sartell
Bayport	Hancock	Oakdale	Savage
Bejou	Harmony	Olivia	Shakopee
Blomkest	Harris	Olmsted County Waste-to-Energy	Shoreview
Bloomington	Hastings	Orono	Shorewood
Braham	Hazelden Foundation	Osakis	Spring Park
Brandon	Henning	Owatonna	St. John's Lutheran School
Browns Valley	Hi View Park	Parkers Prairie	Stillwater
Brownsdale	Hutchinson	Paynesville	Sun Valley Mobile Home Park
Buffalo	K & K Fabrication, Inc.	Pelican Rapids	Sunray Water Company, LLC
Burnsville	Kandiyohi	Perham	Taylors Falls
Caledonia	Kandiyohi Power Cooperative	Pine Hill Mobile Home Park	Tonka Bay
Chisago City	Kellogg	Pine Island	Twin Fawn Mobile Home Park
Chokio	Kittson-Marshall Rural Water System	Plainview	Twin Pine Mobile Home Park
Cold Spring Brewing Company	Lafayette	Plummer	Utica
Crookston	Lake City	Prinsburg	Vadnais Heights
Dalton	Lake Lillian	Prior Lake	Valley Mobile Home Park
Danube	Lakeland Municipal Water	Racine	Vermillion
Detroit Lakes	Lakeville	Ramsey	Viking Industries
Dexter	LeCenter	Randolph	Village of Bay Crest

Dumont	LeRoy	Raymond	Wabasha
Eden Valley	Lewiston	Red Lake Falls	Waltham
Elgin	Light of Christ Lutheran/Headstart	Renville	Watertown
Elizabeth	Lindstrom	Richmond	
Elkton	Litchfield	Rochester	

Community public water supplies that entered the wellhead protection program in FY 10 and 11.

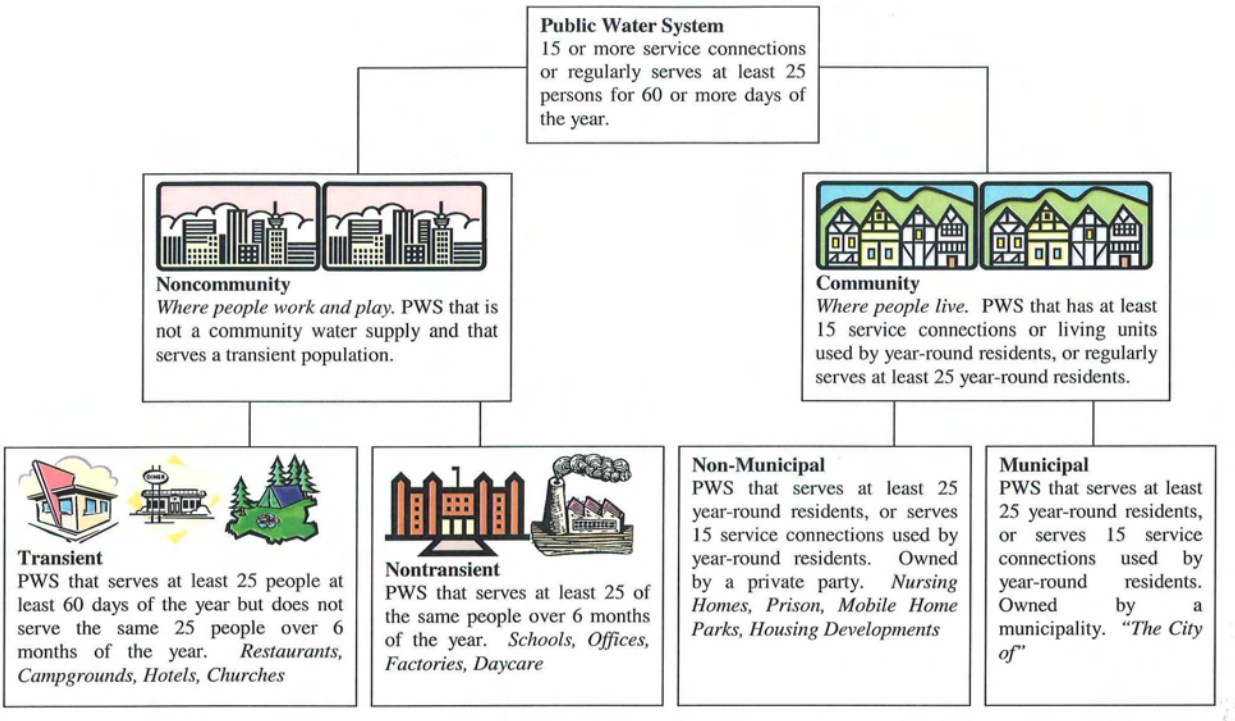
Albany	**Easton**	**Mankato**	**Sebeka**
Atwater	Elkton	Maple Plain	Sherburn
Austin	Elmore	Meadowlands	Shorewood
Avon	Excelsior	Medina	Spring Park
Battle Lake Mobile Home Park	Forbes Mobile Home Park	Menahga	Sun Valley Mobile Home Park
Blackduck	Freeport	Minnesota Lake	Sunray Water Company, LLC
Blomkest	Frost	Minnetonka Beach	Tonka Bay
Bowlus	Grand Meadow	Mora	Trommald
Bricelyn	Green Lake Sanitary Sewer & Water Dist.	Mounds View	Twin Pine Mobile Home Park
Buckman	Hazelden Foundation	North Branch	Village of Bay Crest
Calumet	Hi View Park	Olivia	Walters
Ceylon	Huntley Well Corporation	Orono	Waltham
Chisago City	Iron Junction	Orr	Waterville
Chokio	Isanti	Pine Hill Mobile Home Park	Wayzata
Cook	Jackson	Prinsburg	Welcome
Cuyuna	Kandiyohi	Racine	Wells
Dalton	Kiester	Raymond	Winnebago
Danube	Kilkenny	Rich Prairie Sewer and Water District	Wyoming
Deerwood	Kinney	Riverton	
Delavan	Lake Lillian	Saint Charles	
Dunnell	Mahtomedi	Sargeant	

Caveats and Limitations

Community public water supply systems include municipal and non-municipal systems (See figure below). Twenty-three of the community systems rely on surface water and are not regulated by the wellhead protection rule. The remainder of the state's approximately 7,300 public water supply systems are non-community systems, which include both transient and non-transient public water supply systems. All of these must manage an inner wellhead management zone that consists of an area defined by a 200 foot radius around a public water supply well. This measure does not include Minnesota residents that rely on private wells or surface water supplies. Also, wellhead protection plans are required to be amended every 10 years, which limits the number of new community PWS that can be brought into the wellhead protection program (assuming that MDH staff numbers remain stable.)

Clean Water, Land and Legacy amendment funding also provides grants to all types of public water supply systems in Minnesota that rely on groundwater to assist in the implementation of approved wellhead protection plans.

Figure 2.1 Water System Categories And Definitions



Future Improvements

The Source Water Protection Tracker database is currently being modified to allow measurement of interactions between MDH planning staff and local governments/PWS who are responsible for and the development and implementation of their wellhead protection plan.

Financial Considerations

Contributing Agencies and Funding Sources

US Environmental Protection Agency

Clean Water, Land and Legacy Amendment appropriation ($1,200,000 for 2010 and $1,215,000 for 2011). This supports part of the planning and technical assistance activities for wellhead protection and allows more public water supplies to be brought into the planning process than would otherwise be possible with established funding.

Communication Strategy

Target Audience

City and county governments, watershed districts and management organizations, land use planning and zoning staff, water planning staff, environmental non-government organizations, the Legislature, state agency partners and the general public.

Associated Messages

1. Source water protection prevents contaminants from entering a public water supply at levels that could negatively impact human health.
2. The goal is to have every community water supply in Minnesota engaged in source water protection by the year 2020.
3. Currently, 452 of the 929 community water supplies that use groundwater wells are engaged in efforts to protect their wells (wellhead protection).

Other Measure Connections

As both groundwater and surface water are used as sources for drinking water, other measures that concern water quantity and quality are related to this measure.

Measure Points of Contact

Bruce Olsen, Minnesota Department of Health, bruce.olsen@state.mn.us

Number of local government partners participating in Clean Water funded groundwater nitrate monitoring and reduction activities

Measure Background

Nitrate is a water soluble molecule that is made up of nitrogen and oxygen. It is naturally occurring in the environment; however at elevated levels it can have negative effects on human health. Nitrate is one of most common contaminants in Minnesota's groundwater and may exceed the drinking water standard in vulnerable aquifers. There is significant local variability in nitrate monitoring results; some areas of the state have shown little change while other areas have shown increasing nitrate trends. The most vulnerable areas of the state are the Central Sands region of central Minnesota and the Karst region located in southeast Minnesota.

Groundwater funding from Minnesota's Clean Water Fund is being used for activities that help identify potential sources of nitrate contamination and evaluate and implement practices to reduce nitrate in groundwater. Many of MDA's activities are focused in regions of the state most vulnerable to contamination. There are several activities currently underway (number of local partners in parentheses*):

- Rosholt Farm: A public-private partnership to improve nitrogen fertilizer efficiency and protect groundwater (2)
- Dakota county: Validating nitrogen recommendations and water quality impacts under irrigated agriculture (1)
- Irrigators Workshops and Adaptive Management Program in Central Minnesota (1)
- Central Sands Private Drinking Water Well Monitoring Network (14)

* The total number of partnerships recorded is lower than the sum of the numbers in the parentheses because we do not double count counties that are participating in more than one project.

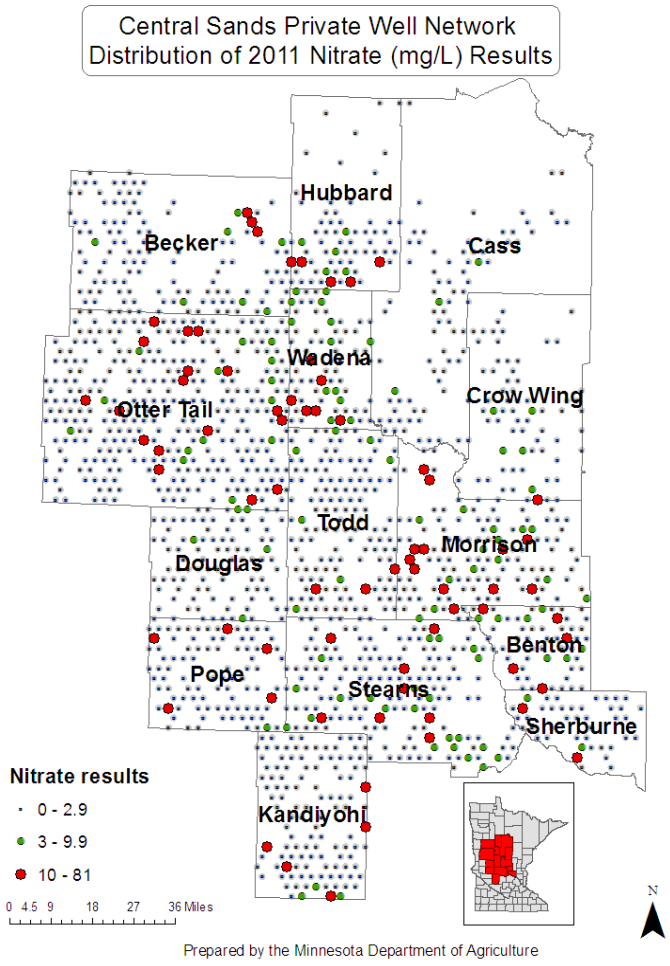
MDA also works on statewide efforts to better understand nitrogen fertilizer use and to promote proper nitrogen management. Additionally, MDA works with local partner on hosting free nitrate testing clinics. All activities reported in this measure are supported by the Clean Water Fund, in the category of Groundwater and Drinking water Protection. All 2010-11 projects will continue in 2012-13. New projects will depend upon results from existing projects as well as future CWF appropriations.

Visual Depiction

Visual depictions will vary depending on the specific activity or project being explained.

For example, the following map will be used to display results from the Central Sands Private Well Monitoring Network.

Tables, graphs and charts will be used to present results for the Rosholt Farm and Dakota County projects. Other visuals may include: pictures of local partners (in the field and hosting events) and short "success stories" written for newsletters or sent out as postcards.



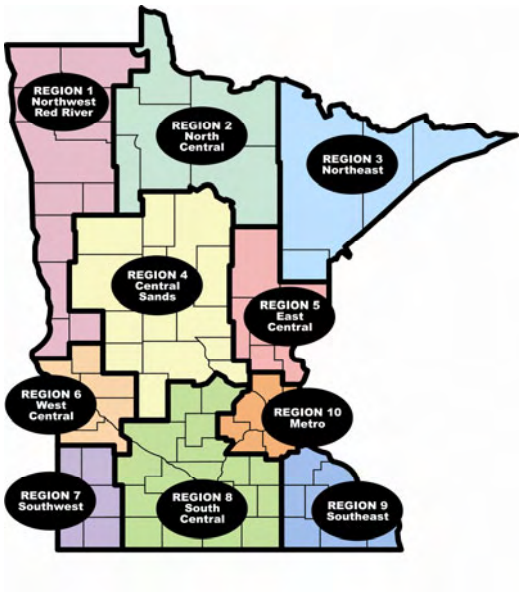
Measure Description

This measure counts the number of local government partners participating in Clean Water funded nitrate monitoring and reduction activities. In general, local partners include Soil and Water Conservation Districts (SWCDs) and Watershed Districts.

Associated Terms and Phrases

Central Sands: A region in central Minnesota that is characterized by course-textured sandy soils, often referred to as glacial outwash. There are 14 counties located in this region.

Nitrate: Nitrate (NO_3^-) is a water soluble molecule that is made up of nitrogen and oxygen. It is naturally occurring in the environment and can be taken up and used by plants. Nitrate is a negatively charged ion and does not adhere to soil particles. As a result, it can be leached and easily lost from the soil profile. One source of nitrate in the environment is agricultural fertilizer.



Nitrate Testing Clinics: "Walk-in" style clinic that offers free water testing. The goal is to increase awareness about nitrate in drinking water and to educate private well owners that it is a personal responsibility to test well water.

Target

MDA's goal is to continue to develop effective partnerships with counties. There is no specific numeric target for this measure.

Nitrate Clinics: MDA's goal is to increase the number of nitrate clinics held each year. The hope is to support every county that would like to host a clinic and ensure that all counties that have a chronic problem with nitrate are hosting annual clinics.

Baseline

The baseline year for this measure is 2010. This year marked the beginning of Clean Water funding and the first year of each of the nitrate monitoring and reduction activities.

Geographical Coverage

Many of these projects are targeted in areas of the state most vulnerable to groundwater contamination (Region 4 and Region 9 on the map). Dakota County is located in Region 10. Nitrate clinics are held statewide.

Data and Methodology

Methodology for Measure Calculation

Data for this measure will be collected from the contract and work plan for each individual project. The number of local partners will be calculated according to the number of partners identified in the formal contract (i.e. Joint Powers Agreement) and each partner that has a formal role in executing work described in the approved work plan.

Data Source

The MDA is the lead agency for this measure. All information is stored in contracts and work plans maintained by all staff and supervisors involved in the projects. MDA's Finance and Budget Division also retains all original contract information.

Data Collection Period

Data collection begins on the date a contract is executed. Data collection began July 1, 2009 and will continue for 25 year duration of the Clean Water Fund.

Data Collection Methodology and Frequency

Data will be collected at the time when contracts are executed and whenever any modifications are made to work plans. Updates will occur annually.

Supporting Data Set

There is no formal data set for this measure. Rather, MDA staff count the number of local partners participating in nitrate monitoring and reduction activities (supported by the Groundwater and Drinking Water appropriation in the Clean Water Fund).

Caveats and Limitations

This measure only accounts for formal partnerships with local government units. It does not account for partnerships with local co-ops, the University of Minnesota or other non-government units.

This measure records partnership supported by the Groundwater and Drinking Water appropriation in the Clean Water Fund. It does not account for partnerships on projects in other appropriation categories such as Implementation or Monitoring/Assessment.

Future Improvements
None identified at this time.

Financial Considerations

Contributing Agencies and Funding Sources
Minnesota Department of Agriculture is the only agency contributing data. Clean Water funding supports the partnerships identified in this measure.

Communication Strategy

Target Audience
State agencies, local government units, agricultural co-ops, farmers, researcher and the general public.

Associated Messages
State agencies work closely with local governments (LGUs) on all nitrate monitoring and reduction activities. Working with local government helps ensure that Clean Water funds are spent on priority projects that are relevant and important to community members. LGU's add value by providing expertise and knowledge of local issues.

Outreach Format
Newsletters, web pages, factsheets, Power Point presentations and reports are used to communicate information about nitrate monitoring and reduction projects.

- Quarterly updates are written for each project
- One page factsheets are available for each project
- Updates to web pages are made biannually or whenever significant activities occur
- Project staff prepare presentations for meetings and annual field days

Other Measure Connections
EDWOM 3: Changes over time in pesticides, nitrate and other key water quality parameters in groundwater

FM4: Total dollars awarded in grants and contracts to non-state agency partners

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Measure Points of Contact

- Bruce Montgomery, Minnesota Department of Agriculture, bruce.montgomery@state.mn.us
- Margaret Wagner, Minnesota Department of Agriculture, margaret.wagner@state.mn.us

Number of New Health-Based Guidance Values for Contaminants of Emerging Concern

Measure Background

Visual Depiction

Illustration of the molecular structure of compounds and pictures of consumer products or pharmaceuticals.

Measure Description

Active research combined with our increasing ability to measure minute amounts of chemicals in water raises concerns about people's exposure to very low levels of chemicals over a long period of time, especially during vulnerable periods like fetal development. This measure tracks the number of contaminants of emerging concern for which the Minnesota Department of Health (MDH) has conducted toxicity and exposure evaluations resulting in health-based guidance values for drinking water.

Associated Terms and Phrases

Contaminant of Emerging Concern. A chemical substance that has been released to, found in, or has the potential to enter Minnesota waters (groundwater and surface water), characterized by:

- a perceived or real threat to public health;
- Minnesota drinking water health-based standards that currently do not exist or need to be updated to reflect new toxicity or occurrence information;
- insufficient or limited toxicological information or toxicity information that is evolving or being re-evaluated; or,
- significant new source, pathway, or detection limit information.

Health Based Values (HBV). Concentrations of chemicals in drinking water at which no adverse health effects would be expected among the general population, including sensitive populations such as pregnant women and infants.

Health Risk Limits (HRLs). HBVs which are promulgated through a formal rulemaking process authorized in the 1989 Groundwater Protection Act (GWPA). Per the GWPA, MDH's authority to promulgate HRLs is limited to chemicals that have been detected in groundwater in Minnesota.

Risk Assessment Advice (RAA). May be based on more limited toxicity data than HBVs or HRLs, or may use new risk assessment methods that are not included in the HRL rules. RAA may include a numerical value or may be qualitative in nature.

Target

Guidance for three chemicals were developed in FY2010, an additional seven were completed in FY 2012, for a total of ten health-based guidance developed in the 2010-2011 biennium.

Baseline

While historically MDH developed guidance for contaminants found in groundwater when there was no preexisting standard, this is a new effort to provide guidance in anticipation of future occurrence in Minnesota drinking water, including surface water and groundwater. Funding from the Clean Water amendment provides additional staff and resources to support this effort.

Geographical Coverage

This activity is relevant to the entire state.

MDH Health-Based Guidance Values
(parts per billion in water)

Chemical Name	MDH Guidance
Acetaminophen (pharmaceutical)	200 ppb
6-Acetyl-1,1,2,4,4,7-hexamethyltetraline (AHTN) (fragrance)	20 ppb
Carbamazepine (pharmaceutical)	40 ppb
N,N-Diethyl-meta-toluamide (DEET) (insect repellant)	200 ppb
1,4-Dioxane (solvent)	1 ppb
Metribuzin degradates (DA, DK, DADK) (pesticide)	10 ppb
Pyraclostrobin (pesticide)	100 ppb
Tris(2-Chloroethyl) phosphate (TCEP) (flame retardant)	5 ppb
1,2,3-Trichloropropane (1,2,3-TCP) (industrial chemical)	0.003 ppb
Triclosan (anti-bacterial)	50 ppb

Data and Methodology

Methodology for Measure Calculation

Health risk assessment methodology used to develop guidance is consistent with the methodology promulgated as part of the HRL rule (Minnesota Administrative Rules, Parts 4717.7810 through 4717.7900).

Data Source

Information on the process used and contaminants assessed is available in periodic reports for the public authored by the Health Risk Assessment Unit's Contaminants of Emerging Concern staff, including quarterly reports, an interim biennium report, and a final biennium report. Numerous data sources are used to develop health based guidance, depending on the availability of applicable toxicological studies.

Data Collection Period

July 2009-June 2011

Data Collection Methodology and Frequency

Occurrence information is found in ongoing groundwater and surface water monitoring conducted by the Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Agriculture (MDA). Additionally, the United States Geological Survey (USGS), American Water Works Association (AWWA), and academic institutions conduct monitoring for various research projects. Toxicological studies are available from various data sources.

Supporting Data Set
Available in worksheets online on the program website for each contaminant assessed.

Caveats and Limitations
The Clean Water Fund Land and Legacy amendment funding is restricted to evaluating health based guidance for contaminants that have the potential to impact drinking water. For some contaminants, the route of exposure of greatest concern may be something other than drinking water such as use of a consumer product that contains the chemical. Additionally, for some contaminants of emerging concern there may not be sufficient published and peer reviewed toxicological data available to develop numeric health-based guidance. In these instances, it is anticipated that qualitative guidance will be provided as applicable and available.

Future Improvements
The work of the program continues to evolve and improve. Two task groups and an advisory forum have been convened and have provided advice and input on the work of the program. The task groups are temporary in nature but forums will be held annually/semiannually. Additionally, the work of the program is supported by contracted research and grants.

Financial Considerations

Contributing Agencies and Funding Sources
This effort is entirely supported by Clean Water amendment funding, with some in-kind contributions.

Communication Strategy

Target Audience
Audiences include the legislature, the public, and environmental and health professionals (state, local and federal agencies, academic institutions, nonprofit organizations, private industry, general practitioners, and public health nurses).

Associated Messages
The exposure and toxicity information generated from this measure can be used to inform consumer activity as well as the environmental monitoring activities of government entities and academic institutions. The human health-based guidance and risk assessment advice for drinking water provided through this measure clarifies the potential risk from exposure to contaminants of emerging concern.

Outreach Format
Information regarding this measure is communicated via a program website, factsheets (including contaminant specific factsheets), quarterly reports, biannual reports, an email list serve, an advisory forum, and presentations at conferences and other events.

Other Measure Connections

This measure does not specifically link to other measure but is an integral component of drinking water protection efforts. Monitoring activities conducted by MPCA include contaminants of emerging concern.

Measure Points of Contact

Michele Ross, Minnesota Department of Health, michele.ross@state.mn.us

Changes over time in pesticides, nitrate and other key water quality parameters in groundwater

Measure Background

Reporting on this measure will be the responsibility of both the Minnesota Department of Agriculture (MDA) and the Minnesota Pollution Control Agency (MPCA). Each agency has a unique groundwater monitoring program, which is designed for a specific purpose and to meet specific objectives. The agencies also have a monitoring agreement to coordinate monitoring activities. Whenever possible, data will be colligated between the two programs. However, there will be many instances when MDA and MPCA data will be reported separately.

In general, the MDA's pesticide monitoring program analyzes samples for pesticides that are widely used and/or pose the greatest risk to groundwater or surface water. The MDA follows a pesticide selection process which prioritizes the specific compounds to be tested. Common compounds include pesticides applied in agricultural settings and those applied to lawns and gardens. The MDA's water quality monitoring program is designed specifically to evaluate pesticides, however, analysis of nutrients and sediment is also conducted. The MDA has also initiated an extensive program for monitoring nitrate concentration trends in private drinking water wells. For this measure, the MDA will begin reporting on pesticide trends in fall of 2011 and nitrate trends in the fall of 2012.

The MPCA manages a network of groundwater monitoring wells that measure ambient (or background) conditions for non-agricultural parameters, and is focused on two aquifers that are vulnerable to anthropogenic contamination—the sand and gravel and Prairie du Chien-Jordan aquifers. A network of wells screened near the water table in the sand and gravel aquifers are monitored as an Early Warning Network. The Early Warning Network was designed using a random stratified approach to determine the effects of land use (sewered residential, residential areas on subsurface sewage treatment systems, commercial/industrial, and undeveloped) and the composition of these aquifers (these aquifers vary in composition depending upon which glacial advance deposited the sediments) on groundwater quality. The MPCA portion of this measure will report on the changes in nitrate, chloride, volatile organic compounds, and emerging contaminants of vulnerable aquifers.

There are some important differences between the monitoring programs at the MDA and MPCA. The MPCA's network deliberately focuses on urban and undeveloped parts of the State since their role is the provide information on non-agricultural chemicals. The MDA program is designed to evaluate the impact to groundwater from the normal use of pesticides and fertilizer, with an emphasis on the impacts from agricultural crops such as corn in areas vulnerable to groundwater contamination. The MDA has been collecting groundwater monitoring data, primarily for pesticides, for this purpose since 1987. The MDA currently has groundwater quality trend data extending over 20 years, which is exceedingly rare, and publishes an annual report which summarizes this data. This data is important for evaluating the long term effects of agricultural practices on groundwater quality.

Due to the large amount of data that will available and the many water quality parameters that could be reported on, it is possible that sub-measures may eventually be developed. Possible sub-measures are:

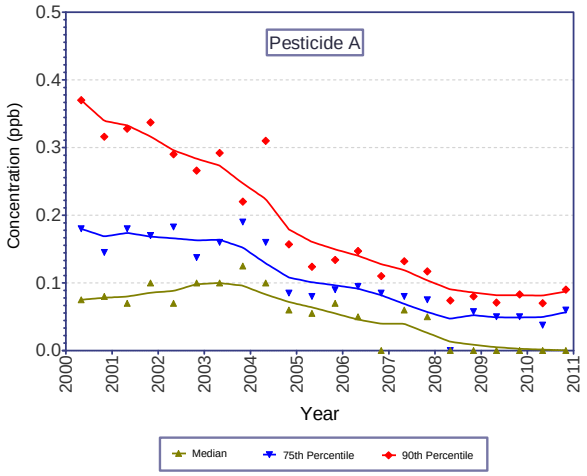
EDWOM3a) Trends in the concentration and detection of common detection pesticides in groundwater, EDWOM3b) Trends in concentration of nitrate-nitrogen in groundwater and EDWOM3c) Changes in chloride, volatile organic compounds, and emerging contaminants of vulnerable aquifers.

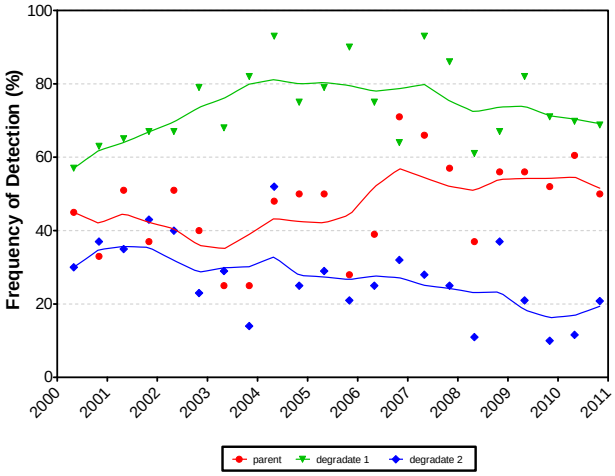
Visual Depiction

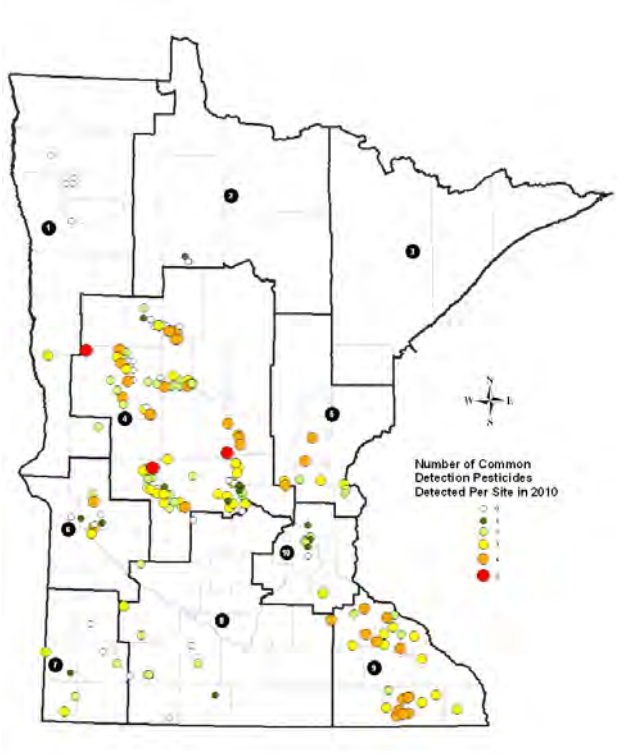
Below are examples of the graphical and tabular representation of data for this measure.

Example graphics for common detection pesticides in groundwater over time.

Each pesticide that is in Common Detection will have similar graphs and tables prepared for the analysis of trends over time.

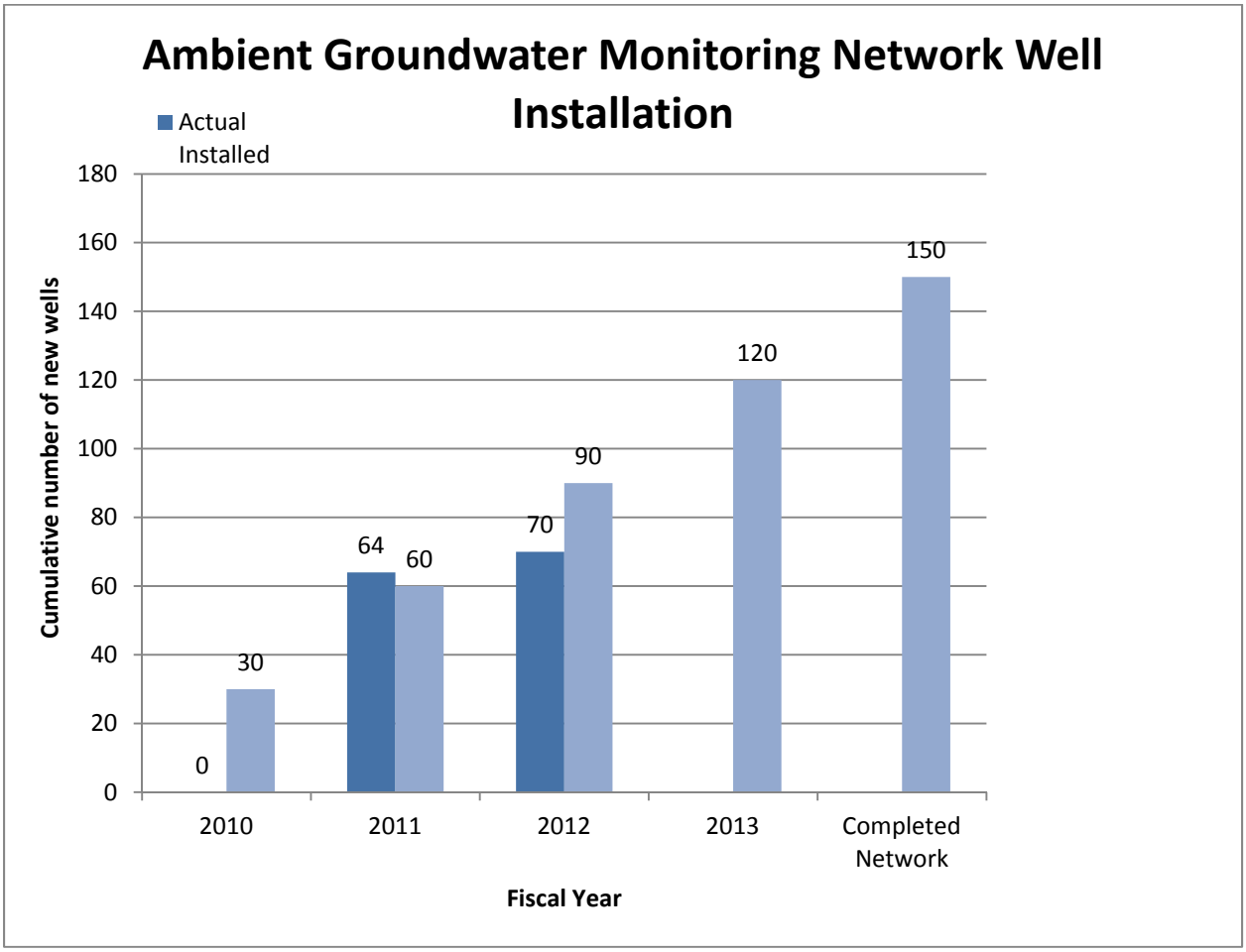




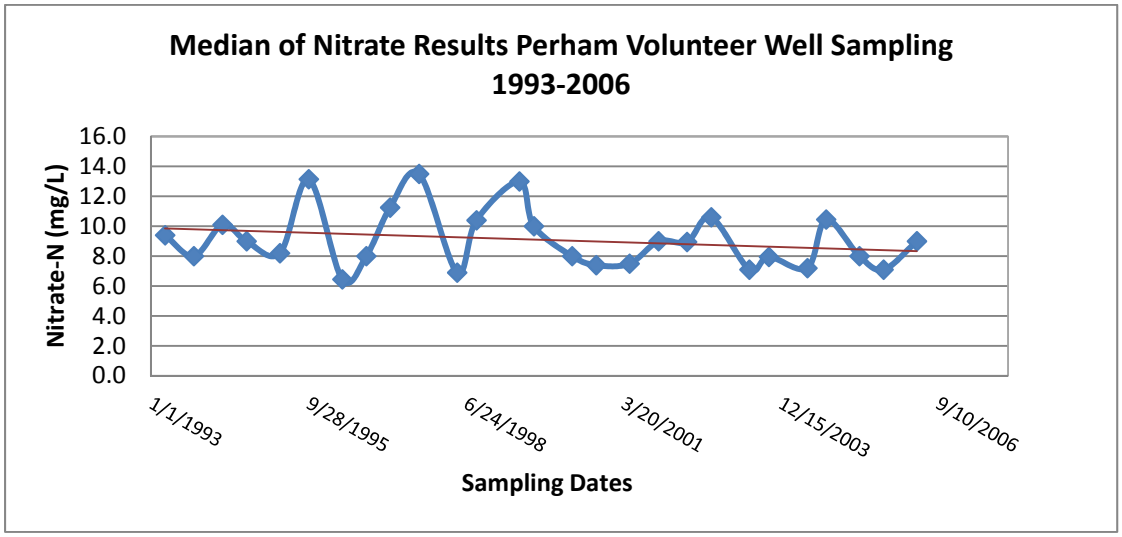


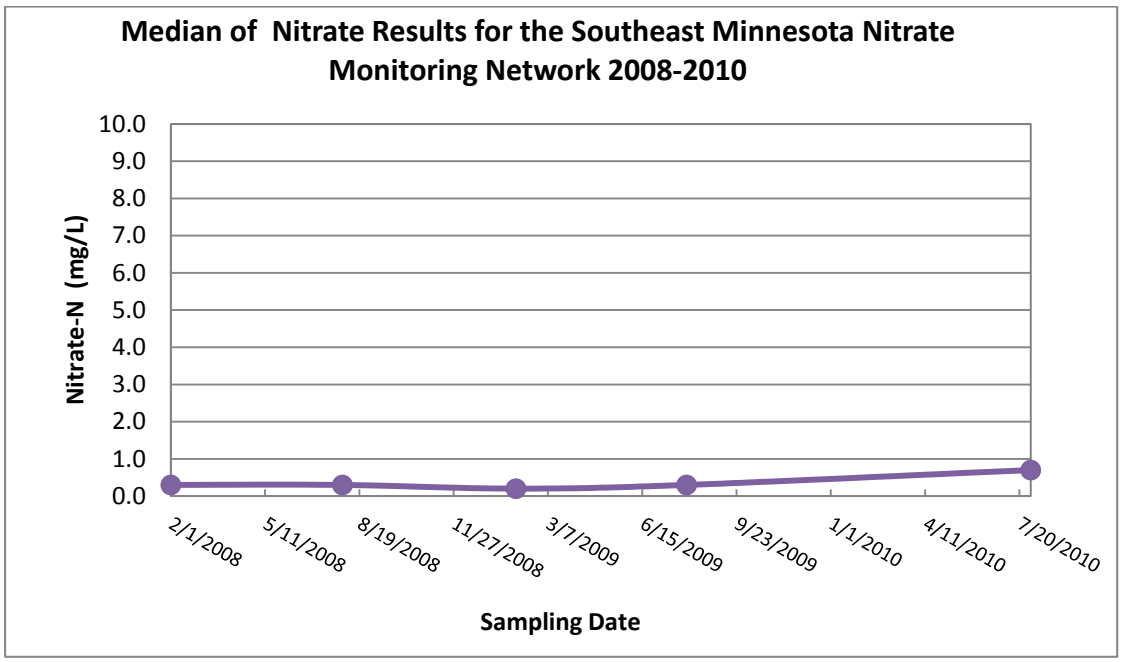
An example of results of trend analysis of a pesticide in groundwater.

Parameter	M-K stat	Statistically Significant at $\alpha = 0.05$	Kendall Tau	Slope estimate
Parent Median	76	Yes	0.33	0
Parent 75th %-ile	-110	Yes	-0.48	-0.001
Parent 90th %-ile	-137	Yes	-0.59	-0.003
Parent Detection Frequency	72	Yes	0.31	1.55
Degradate 1 Median	-134	Yes	-0.58	-0.002
Degradate 1 75th %-ile	-162	Yes	-0.70	-0.004
Degradate 1 90th %-ile	-183	Yes	-0.79	-0.007
Degradate 1 Detection Frequency	48	No	0.21	0.75
Degradate 2 Median	-5	No	-0.02	0
Degradate 2 75th %-ile	-73	Yes	-0.32	0
Degradate 2 90th %-ile	-130	Yes	-0.56	-0.009
Degradate 2 Detection Frequency	-99	Yes	-0.43	-1.84


Ambient Groundwater Monitoring Network Well Installation
Actual Installed
Cumulative number of new wells
180
160
140
120
100
80
60
40
20
0
0
30
64
60
70
90
120
150
2010
2011
2012
2013
Completed Network
Fiscal Year

An example graph for nitrate concentrations in groundwater over time.





Reporting ambient groundwater trends for nitrate, chloride, volatile organic compounds and emerging contaminants will begin in 2014.

Measure Description

Pesticides

This measure consists of graphics and tables displaying pesticide concentration and detection over time. Coupled with trend calculations the graphics provide a rapid determination of tendency in groundwater monitoring results for pesticides. This measure is intended for pesticides that have been detected frequently enough to be designated as commonly detected in Minnesota groundwater. As of February

2011, acetochlor, alachlor, atrazine, metolachlor and metribuzin have been placed in Common Detection in Minnesota groundwater. Specific pesticides in Common Detection status may change over time.

The pesticide portion of this measure does not evaluate the condition of drinking water but only the shallowest groundwater at the edges of fields in highly sensitive geological areas.

Nitrate

This measure consists of graphics and tables displaying nitrate concentrations over time. This measure will include multiple types of nitrate data. Data collected statewide as part of MDA's water quality monitoring program and also data from more intensive sampling in areas where private well networks are established.

Background on Private Well Networks

- The current Central Sands private well monitoring network began nitrate sampling in spring of 2011. The initial sampling set the stage for a long-term monitoring network. The private well network is designed to complement the MDA monitoring well data. The MDA monitoring wells sample at the most vulnerable parts of the aquifer on the edge of fields. The Central Sands private well monitoring project emphasizes sampling groundwater that people are drinking.
- The South East Minnesota volunteer monitoring network has completed five rounds of sampling since 2008. Approximately 400 to 500 wells are sampled each round (sampling event).

Chloride, Volatile Organic Compounds and Emerging contaminants

This measure consists of graphics and statistics displaying trends in chloride concentrations, VOC, emerging contaminants, and other emerging contaminant detections over time.

Associated Terms and Phrases

Common detection refers to common detection as defined in Minnesota Statutes Section 103H and further described within the Minnesota Pesticide Management Plan.

Emerging contaminants is any synthetic, naturally-occurring chemical or microorganism that is not commonly monitored in the environment but has the potential to enter the environment and cause known or suspected adverse ecological and/or human-health effects. In some cases, the release of emerging contaminants has occurred for a long time but may not have been detected until new laboratory methods were developed.

Groundwater quality refers to the chemical condition of water beneath the ground surface regardless of the use of the water. This measure does not refer to, or necessarily reflect, the general condition of drinking water in the state or any sub-state region.

Pesticides in groundwater refers to pesticides that are present in groundwater as a result of routine application and not some unusual or unique circumstance.

Pesticide Monitoring Region (PMR) refers to an area of the state that contains similar land and water features and similar types of pesticide use practices. By dividing the state into regions, the MDA can provide information about the effects of pesticides in each unique area of the state. A map of the 10 PMRs is located in the "Geographical Coverage" section of this measure.

Private Well Monitoring Network refer to a group of private well owners that agree to collect well water samples and submit them for nitrate analysis . The monitoring network is statistically designed for an unbiased sample collection. The **Central Sands Private Well Monitoring Network** is distributed across 14 counties in central MN. Selection of individual wells was random, and results from this program can be used to make conclusions about nitrate trends in drinking water across the region.

Trend refers to a change, either an increase or decrease, in the frequency of detection or concentration of pesticides, nitrate or other water quality parameters in groundwater.

Volatile organic compounds are organic chemicals that have a low boiling point and evaporate readily.

Target

Groundwater is not assessed as impaired/unimpaired as is surface water since there currently are no water quality standards for this media. The purpose of the health-based guidance set by the Minnesota Department of Health for groundwater is to protect human health from contaminants in drinking water. The target is decreasing detection frequencies and/or concentrations of common detection pesticides, nitrate, chloride, and VOCs. For example, subsequent targets may be to decrease common detection pesticide concentration and frequency of detection over time or stabilize and decrease nitrate concentration trends. Subsequent actions and targets will be based on the trends found by these analyses.

Baseline

Pesticides

The baseline year for MDA's groundwater reporting is 2000 for Pesticide Monitoring Region (PMR) 4, 2000 for PMR 9, 2006 for PMRs 1, 6, 7 and 2007 for PMR 5.

Nitrate

Central Sands Private Well Monitoring Network: baseline nitrate data collection began in spring 2011 in this region.

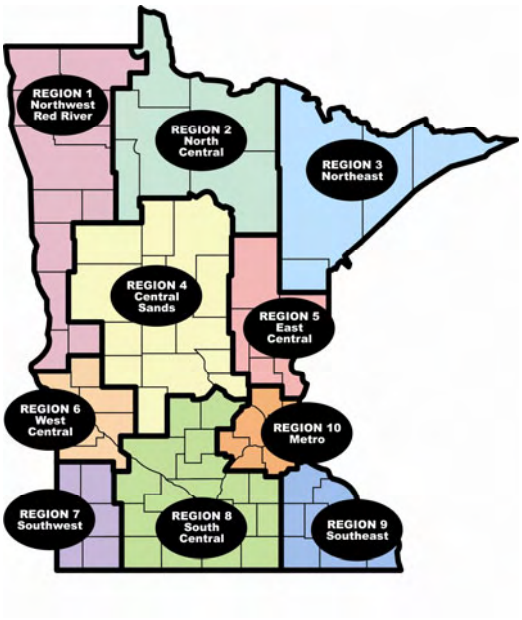
The baseline for MPCA's ambient nitrate groundwater reporting is 2004, when the vulnerable aquifer network was started. That network is currently being redesigned and will not be fully in place until 2014. The available 2004-2014 data will yield limited baseline information.

Chloride, Volatile Organic Compounds and Emerging contaminants

The baseline for MPCA's ambient groundwater reporting is 2004, when the vulnerable aquifer network was started. That network is currently being redesigned and will not be fully in place until 2014. The available 2004-2014 data will yield limited baseline information.

Geographical Coverage

The MDA has established 10 Pesticide Monitoring Regions to provide a framework for conducting groundwater and surface water monitoring. The MDA's water quality monitoring efforts are statewide.



The MPCA's ambient groundwater network is also on a statewide scale.

The general geographic coverage for nitrate would be both statewide and focused on MDA's Pesticide Monitoring Regions. Local implementation projects could be based on county or counties. For example, the Central Sands project includes 14 counties.

Data and Methodology

Data Collection Methodology

Pesticides

Annual production of graphs of common detection pesticide median, 75th percentile and 90th percentile concentrations over time will be generated. Graphs will be accompanied by a table of the results of calculations of general monotonic trend for each summary statistic. Trends will be calculated by use of the Mann-Kendall test or other appropriate statistical method. Magnitude of any trends present will be estimated using the Thiel-Sen method. Statistical methods may change in response to newly developed techniques or new applications of previously existing methods.

Nitrate

Trends in nitrate concentration (both MDA and MPCA) will be calculated by use of non-parametric tests or other appropriate statistical methods. For the MPCA's nitrate data, Mann-Kendall or Regional Kendall test are the most appropriate to use to determine concentration trends.

MDA monitoring unit sample collection: MDA staff collects samples two to four times annually.

Central Sands Private Well Network: Volunteers will initially collect samples at least annually; however the frequency is yet to be determined.

South East Minnesota Volunteer Nitrate Monitoring Network: Volunteers will collect the samples at least annually.

Chloride, Volatile Organic Compounds and Endocrine Disruption Compounds

The key parameters to be tracked by MPCA will be calculated by non-parametric statistics, the Mann-Kendall or Regional Kendall test are the most appropriate to use to determine chloride concentration trends. Logistic regression is likely the most appropriate statistical test to use to determine whether the detections of VOCs or EDCs and other emerging contaminants have changed over time.

Data Source

MDA's results are generated by the MDA analytical laboratory on groundwater samples collected by the MDA water quality monitoring program and maintained in a joint MDA/MPCA data base, called EQuIS.

All MPCA ambient groundwater data are stored in a series of Microsoft Access databases. These data will begin to be migrated into the EQuIS water quality database in 2011. The data migration is expected to be completed in 2012.

Private Well monitoring networks

Currently there is no data set for the Central Sands private well monitoring network. The first round of sampling began in spring 2011 and samples are still being analyzed.

Data Collection Period

Pesticides

The MDA's pesticide monitoring began January 2000 and is intended to be maintained in perpetuity.

Nitrate

The MDA groundwater monitoring program has been sampling nitrate since 1986 in edge of field conditions, which do not reflect general drinking water conditions. This is intended to continue in perpetuity.

Central Sands Private Well Monitoring Project: Began in March 2010 and will continue for at least a period of 20 years.

South East Minnesota Volunteer nitrate monitoring Network started in 2008 and there is no set end date.

The MPCA's groundwater monitoring network began in 2004 and there is no set end date.

Chloride, Volatile Organic Compounds and Endocrine Disruption Compounds

The MPCA's groundwater monitoring network began in 2004 and there is no set end date.

Data Collection Frequency

MDA's samples are collected two to four times annually from specifically designed and installed monitoring wells, naturally occurring springs and private drinking water wells. Sampling frequency depends on site location and hydrogeologic conditions.

The MPCA's groundwater monitoring wells are sampled annually.

Supporting Data Set

Pesticides

As of January 2011 MDA's groundwater pesticide data set consists of nearly 200,000 records of analyses conducted on approximately 2,500 groundwater samples.

Nitrate

The MDA has been monitoring well nitrate results starting in 1986. From 1986 to 1999, DNR and USGS observation wells were used for the monitoring program. A newly designed monitoring well network in the Central Sands region was completed and sampling commenced by early 2000. These monitoring wells are edge of field conditions and do not reflect general drinking water conditions.
Nitrate Clinics: From 1993-2006 MDA and its local partners held walk-in style nitrate clinics. These clinics were funded in part with Legislative Commission on Minnesota Resources (1997-1999), EPA 319 (1997-2000) and the MDA Fertilizer Account. These clinics were mainly designed as a public education tool and were not scientifically or statistically designed.

The MPCA presents no supporting data, as we have not yet begun to report on this measure.

Caveats and Limitations

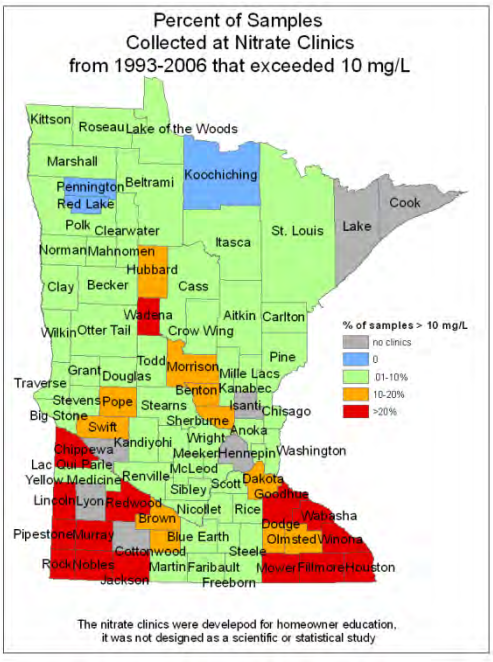
Pesticides

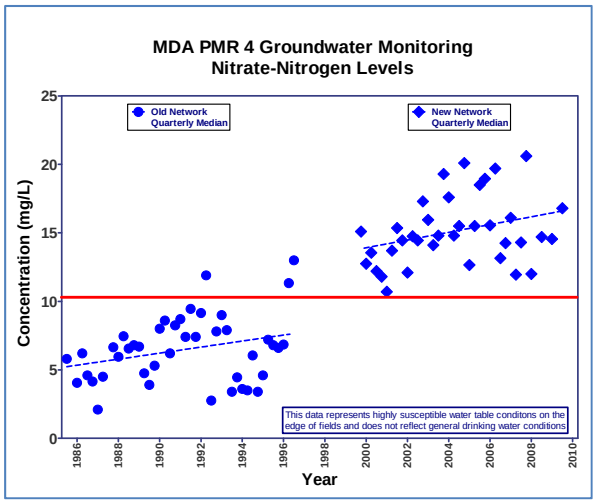
Data on pesticides in groundwater is considered messy data. In the context of the data set used for this measure the data is censored, contains multiple detection limits, missing values and unquantifiable detections. The data over time is typically non-linear, contains multiple peaks and has inconsistent variability over time making analysis of results quite difficult. As a result of the messy data, graphical representations of the data will frequently display trends long before statistical analysis is capable of confirming a trend is present.

Nitrate

The data collected with the monitoring wells was designed to monitor pesticides at the most vulnerable parts of the aquifers, on the edge of fields. However, nitrate has been sampled along with the pesticide data.

The Central Sands private well monitoring networks have been designed to sample the groundwater that people are drinking and may not be representative of all groundwater resources in the area. The nitrate clinics were not statistically or scientifically designed and were used for educational purposes only. The nitrate clinic data may be a high estimate; it is not representative of all private well drinking water.





Chloride, Volatile Organic Compounds and Endocrine Disruption Compounds

The suite of VOCs and emerging contaminants analyzed in the groundwater is censored at a variety of method reporting limits. These data will need to be re-censored at a common reporting limit to most accurately describe the most-frequently detected chemicals in the groundwater. Emerging contaminant concentrations below the method reporting limit are reported by the laboratory since the qualitative identification is done using mass spectrometry. These concentrations and those with matrix interferences or not meeting quality-assurance criteria are qualified. The emerging contaminants data often is affected by contamination from the laboratory and field. These data must be reviewed prior to analysis to ensure the reported concentrations are not an artifact of field or laboratory contamination.

Future Improvements

Laboratory capacity and capability is always the limiting factor in groundwater characterization regarding pesticide impacts. Analysis for pesticides in water is very expensive, collection of the samples is time consuming and analysis of the data is quite difficult. Measures to improve laboratory capacity and capability are continuously being sought and are normally very expensive, sometimes prohibitively so. The design and operation of the monitoring network(s) are continuously reviewed for improvements in efficiency, scientific and technical validity, and for newly emerging methods or insights from other organizations conducting similar work in other locations. The entire state cannot be comprehensively monitored at one time resulting in the need to stage various aspects of a complete monitoring system. Staging of program components is typically done as funding becomes available and may be short-term or one-time in nature and is used to begin, refine or extend a program element. Short term funding generally has very limited usefulness for trend monitoring in groundwater as trends are usually not evident for 5 years or more.

Develop more private well networks throughout the state in order to develop long-term trends.

Financial Considerations

Contributing Agencies and Funding Sources

Substantial funding for groundwater pesticide work comes from non-clean water funds. This also includes limited funds from the EPA.

Funding for water quality monitoring has come through the MDA, MDH and MPCA.

MDA is the lead agency in the Central Sands Private Well monitoring project and funded by the Clean Water Fund. It is also a local implementation project and partners with the 14 counties of the Central Sands region.

Measure Points of Contact

- Heather Johnson, Minnesota Department of Agriculture, heather.johnson@state.mn.us
- Dan Stoddard, Minnesota Department of Agriculture, dan.stoddard@state.mn.us
- Steve Thompson, Minnesota Pollution Control Agency, stephen.c.thompson@state.mn.us

Changes over time in source water quality for community public water supplies

Measure Background

Visual Depiction

Eighty percent of Minnesota residents rely on public water systems instead of private wells. Public water systems supply our homes, schools, hospitals and workplaces.

Measure Description

The Minnesota Department of Health (MDH) is collecting general water chemistry samples from community public water systems from July 1, 2010 through September 30, 2013, and will be publishing an electronic summary of the water quality data (similar to the MDH Public Water Supply Data hardcopy books published in 1989). Systems can use their individual results to develop a more in-depth understanding of the water quality from their unique aquifers and well depths, to assess and maintain water quality at entry points and within the distribution system, and to use as baseline data in evaluating potential contamination events. It is recommended that systems continue to regularly monitor for the water quality parameters reported by MDH.

Associated Terms and Phrases

Ammonia Nitrogen: Ammonia in water can decrease the efficiency of disinfection treatment. Oxidation of ammonia will result in the formation of nitrite.

Arsenic: Arsenic is a semi-metal element in the periodic table. It is odorless and tasteless. It enters drinking water supplies from natural deposits in the earth or from agricultural and industrial practices. The EPA MCL for arsenic is 10 µg/l.

Barium and Strontium: Barium and strontium are minerals that naturally occur in water. They can be used as indicators of a waters source (aquifer).

Bromide and Chloride: The ratio of bromide to chloride in water can be an indicator of potential effects of surface activities on ground water. Absolute values of these two compounds are not as significant as the ratio between the two minerals. Bromide and chloride can also be used to determine a water's source (aquifer).

Calcium and Magnesium: Calcium and Magnesium are indicators of waters hardness. Knowing a water's hardness will help in optimizing the water treatment process.

Carbonate and Bicarbonate Alkalinity: Alkalinity is the measure of the ability of the water to neutralize acid. This can be useful in assessing and optimizing corrosion control treatment.

Community Public Water Supply System: Community public water supplies serve at least 25 persons or 15 service connections year-round, which include municipalities, manufactured mobile home parks, etc. These systems are required to provide a safe and adequate supply of water under the federal Safe Drinking Water Act (SDWA). Currently there are almost 1,000 community water supply systems in Minnesota.

Conductivity: Conductivity measures waters ability to conduct electrical current. Conductivity can be an indicator of water quality and can also help in assessing TDS.

Dissolved Oxygen (DO): High dissolved oxygen concentrations can increase the corrosion process within the distribution system. This can lead to contaminants such as lead and copper being introduced into the water supply and also reduce the lifetime of distribution piping and household plumbing materials.

Entry point: The place where the source water (from a well or surface water) comes into the water treatment plant or water supply system. The term is used to describe where the water sample is collected. Sample results from the entry point provide a picture of the source water. When samples are collected at various points in the treatment process or at the end the water quality is impacted by the various treatment processes.

Fluoride: Fluoride can occur naturally in an aquifer's geology and is commonly added to drinking water to promote dental health of the consumers. The USEPA secondary standard for fluoride is 2 mg/L. Iron and Manganese: Iron and Manganese are metals that are commonly found in water. They are considered secondary contaminants. The USEPA secondary standard for Iron and Manganese are 0.3 mg/L and 0.05 mg/L respectively.

Heterotrophic Plate Count (HPC): HPC is an analytic method used to measure the variety of bacteria that are common in water. Heterotrophic bacteria occur in drinking water even after disinfection. Values greater than 500 CFU/mL may indicate poor microbiological quality. HPC greater than 10,000 CFU/mL can mask total coliform counts.

Metals Scan: The MDH Public Health Lab will do a metals scan that will analyze for 67 different trace metals. This analysis is a rough test of what may or may not be present in the water. The values given are not accurate data, but general indicators of what could be in the water and what is normal in the system to compare against in the event of an emergency.

Nitrite: Nitrites are nitrogen-oxygen chemical units which combine with various organic and inorganic compounds. The USEPA MCL for nitrite is 1 mg/L.

Oxidation Reduction Potential (ORP): Oxidation Reduction Potential, also known as Redox, is the activity or strength of oxidizers and reducers in relation to their concentration. ORP is also affected by pH.

pH: pH is a measure of how acidic or alkaline water is. pH is important in assessing water quality and the speciation of compounds in water. pH can also be an indicator of the corrosiveness of water and plays a key role in assessing corrosion control treatments.

Potassium and Sodium: Potassium and sodium can be naturally occurring in water or the result of chemicals being added to the water during the treatment process. Although potassium and sodium may cause some health effects in susceptible individuals, potassium and sodium intake from drinking-water is well below the level at which adverse health effects may occur.

Sulfate: Sulfate is considered a secondary contaminant by the USEPA. The USEPA secondary standard for sulfate is 250 mg/L at which taste and odor issues can occur.

Temperature: Temperature can affect water chemistry and water quality.

Total Dissolved Solids (TDS): Total dissolved solids are the compounds in water that cannot be removed through conventional filtration. TDS are made up of compounds which dissociate in water to form ions. TDS is considered by USEPA to be a secondary contaminant with a secondary standard of 500 µg/L where taste and laxative properties can occur.

Total Organic Carbon (TOC): Total Organic Carbon is the measure of all organic carbon molecules in water. TOC can react with disinfectants to produce disinfection byproducts in the distribution system.

Total Phosphorus: Total phosphorus is the total measure of phosphorus in water. Phosphorus is often added to drinking water in the form of phosphates to sequester iron and manganese and also as a corrosion control method.

Target

MDH intends to conduct sampling at all of Minnesota's community public water systems (approximately 1,000 systems).

Baseline

Similar parameters were included in the MDH Public Water Supply Data hardcopy books published in 1989. These data, along with the results from this period of sampling (2011-2013), will serve as the baseline data set for future monitoring.

Geographical Coverage

The measure is statewide.

Data and Methodology

Methodology for Measure Calculation

Water quality analysis is being done in the field and at the MDH Public Health Laboratory.

Data Source

The data is held in the Minnesota Drinking Water Information System (MNDWIS) in the MDH Drinking Water Protection Section.

Data Collection Period

Samples are being collected in 2011-2013.

Data Collection Methodology and Frequency

Each community public water supply system's drinking water source(s), water system entry point(s), and water distribution system is sampled by MDH. The MDH provides results for:

- Ammonia Nitrogen
- Total Phosphorus
- Total Organic Carbon
- Total Alkalinity
- Carbonate Alkalinity
- Bicarbonate Alkalinity
- Dissolved Oxygen
- Conductivity
- Total Dissolved Solids
- Oxidation Reduction Potential
- Temperature
- pH

MDH is providing additional results from drinking water sources:

- Arsenic
- Barium
- Bromide and Chloride
- Calcium
- Iron
- Potassium
- Sodium
- Sulfate
- Nitrite
- Magnesium
- Manganese
- Strontium

If water treatment involves more than chemical addition, MDH will also provide results at water system entry points for:

- Calcium
- Iron
- Magnesium
- Manganese
- Nitrate+Nitrite
- Nitrite

Supporting Data Set
The complete data set will be available in 2014.

Caveats and Limitations
Water quality at the source, entry point, and distribution system is variable, and that variability will not captured by the results of the MDH's 2011-2013 study. Additionally, community public water systems are not randomly distributed across the state; the results of this study will not necessarily represent an unbiased snapshot of the state's source water quality.

Future Improvements
It is proposed to conduct rounds of general water chemistry sampling at ten year intervals.

Financial Considerations

Contributing Agencies and Funding Sources
Total general water chemistry sampling costs for 2010 through 2013 is approximately $1 million. Although this measure helps us evaluate the impact of activities supported by the Clean Water Fund, this study is supported by service connection fees and not Clean Water Fund dollars.

Communication Strategy

Target Audience

The target audience for these water quality results includes, but is not limited to, community public water systems, consulting engineers, academia, and the general public.

Associated Messages
MDH recommends systems regularly monitor for the above-listed water quality parameters, and use the data as a tool to assess and maintain water quality throughout the water system. Results will be used as a starting point for evaluating systems needs related to source, treatment, distribution, and storage.

Other Measure Connections

Community public water supply systems in Minnesota rely on both surface water and groundwater sources. The results of this measure may be examined in conjunction with other measures documenting surface water and groundwater quality.

Outreach Format

Information from the study will be provided on the MDH website.

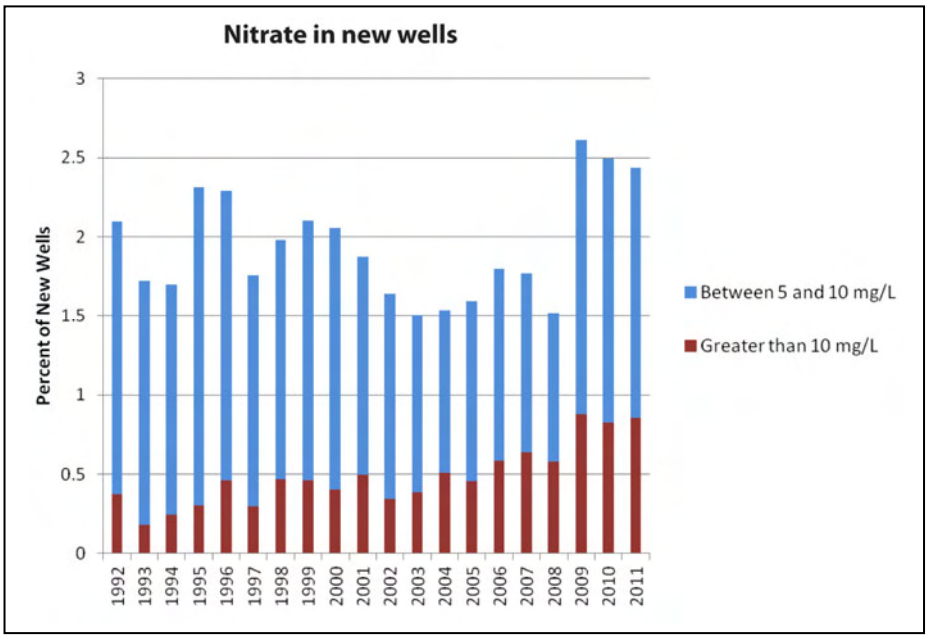
Measure Points of Contact

Karla Peterson, Minnesota Department of Health, karla.peterson@state.mn.us

Nitrate concentrations in newly constructed wells

Measure Background

Visual Depiction



Measure Description

This measure tracks the percentage of newly constructed drinking water supply wells with elevated nitrate concentrations. Natural levels of nitrate are typically quite low. Elevated nitrate concentrations in drinking water wells are associated with sources such as fertilizers, animal wastes or human sewage. Minnesota statute and rules governing the location and construction of wells (Minnesota Statute 103I and Minnesota Rules 4725) are intended to avoid elevated nitrate in groundwater. In addition, activities to manage nitrate sources can result in a reduction of nitrate input into groundwater. Therefore, this is a measure of both the effectiveness of the well code and nitrate management activities.

Associated Terms and Phrases

Nitrate – a compound of nitrogen and oxygen (NO_3) found in nature and in many food items in the human diet.

Methemoglobinemia – a blood disorder found in infants aged less than 6 months of age caused by elevated nitrate contamination in groundwater resulting in decreased oxygen carrying capacity of hemoglobin in babies which can cause death.

Drinking water supply well – A well that provides water used for a potable (drinking, cooking, bathing, washing, etc.) supply. This includes both public and private water supply wells.

Target
A downward trend in the percent of wells with nitrate exceeding the drinking water standard is the target.

Baseline
The historical percentage of wells exceeding the drinking water standard (10ppm) will serve as the baseline.

Geographical Coverage
Statewide

Data and Methodology

Methodology for Measure Calculation
The number of new wells with nitrate above the drinking water standard will be compared to the total number of new wells constructed each year as reported to the Minnesota Department of Health (MDH).

Data Source
Every new drinking water supply well in the state is required to be sampled for nitrate prior to putting the well into service. The results of the analysis are required to be submitted to MDH and to the well owner. This information is entered into MDH's "Wells" database which is managed by the MDH Well Management Section.

Data Collection Period
1992 to present.

Data Collection Methodology and Frequency
After construction of the well a sample is collected and submitted to an MDH certified laboratory for analysis. There is no requirement for follow up sampling. Sample results are required to be submitted to the Health Department. The analysis will be conducted annually for the calendar year.

Supporting Data Set

Percent of New Wells With Elevated Nitrate		
Year	Greater than 10 mg/L	Between 5 and 10 mg/L
1992	0.38	1.72
1993	0.18	1.54
1994	0.24	1.45
1995	0.31	2.01
1996	0.46	1.82
1997	0.30	1.46
1998	0.47	1.51
1999	0.46	1.64
2000	0.40	1.65
2001	0.50	1.38
2002	0.34	1.30
2003	0.38	1.12
2004	0.51	1.03
2005	0.45	1.14
2006	0.59	1.21
2007	0.64	1.13
2008	0.58	0.93
2009	0.88	1.73
2010	0.82	1.67
2011	0.86	1.58

Caveats and Limitations

Well construction is not uniformly distributed across the state. Nitrate concentrations can vary spatially and temporally depending on geology, land use, groundwater flow etc. The number of wells constructed varies from year to year.

Financial Considerations

Contributing Agencies and Funding Sources

The Well Management Section is funded nearly exclusively through fees on the construction and sealing of wells and borings. The funding for this measure will come from these fees. The cost for construction of wells and analysis of nitrate is the responsibility of the well owner.

Measure Points of Contact

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