Minnesota Watershed Budgets - By the Numbers

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- USGS: Jim Stark, Mindy Erickson
- Met Council: Kent Johnson, Lanya Ross
- MN IT: Wade Gillingham, Jim Porter
- NOAA: Diane Cooper

Today's talk

- Describe multi-Agency vision, planning and progress for monitoring major watersheds for near-real time numeric budgets for:
  - Water quality
  - Water quantity
  - Flux of contaminants through watersheds
- Data storage and management systems

MPCA Water Monitoring Section

- Stream and wetland biological monitoring
- Lake monitoring
- Stream chemistry Monitoring
- Watershed Pollutant Load Monitoring Network
- Ambient Groundwater Monitoring Network
- Groundwater/surface water interactions and BMPs
- Business lead for environmental data systems

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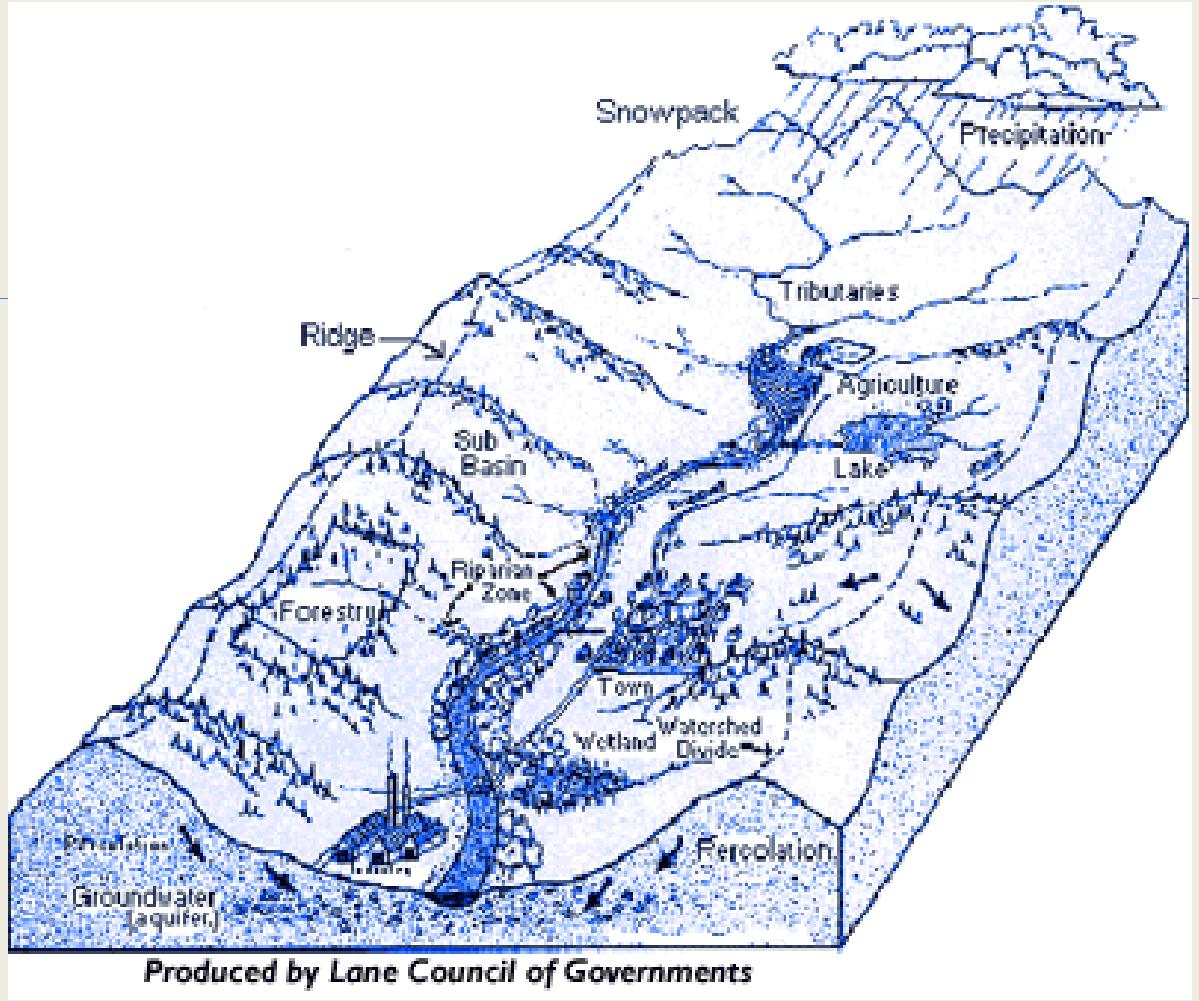
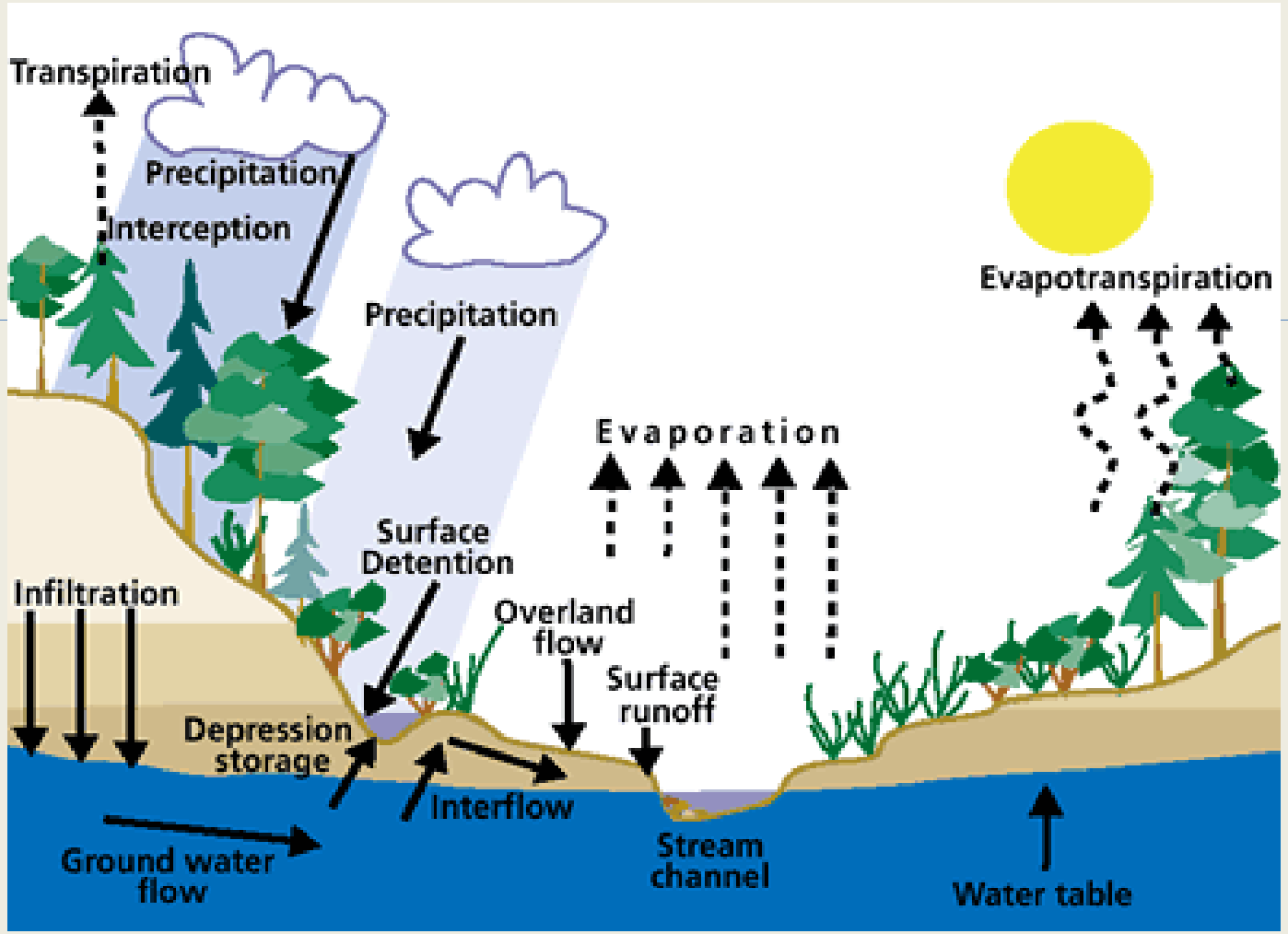
MPCA Water Monitoring Section

- **Watershed Pollutant Load Monitoring Network/ DNR Stream Gaging Network and grantee network**
- **Ambient Groundwater Monitoring Network/ DNR Observation Well Network**
- **Groundwater/surface water interactions/ TMDLs**
- **Groundwater BMPs/ feedlots, storm water, landfills, remediation**
- **Business lead for environmental data systems/ MN IT**

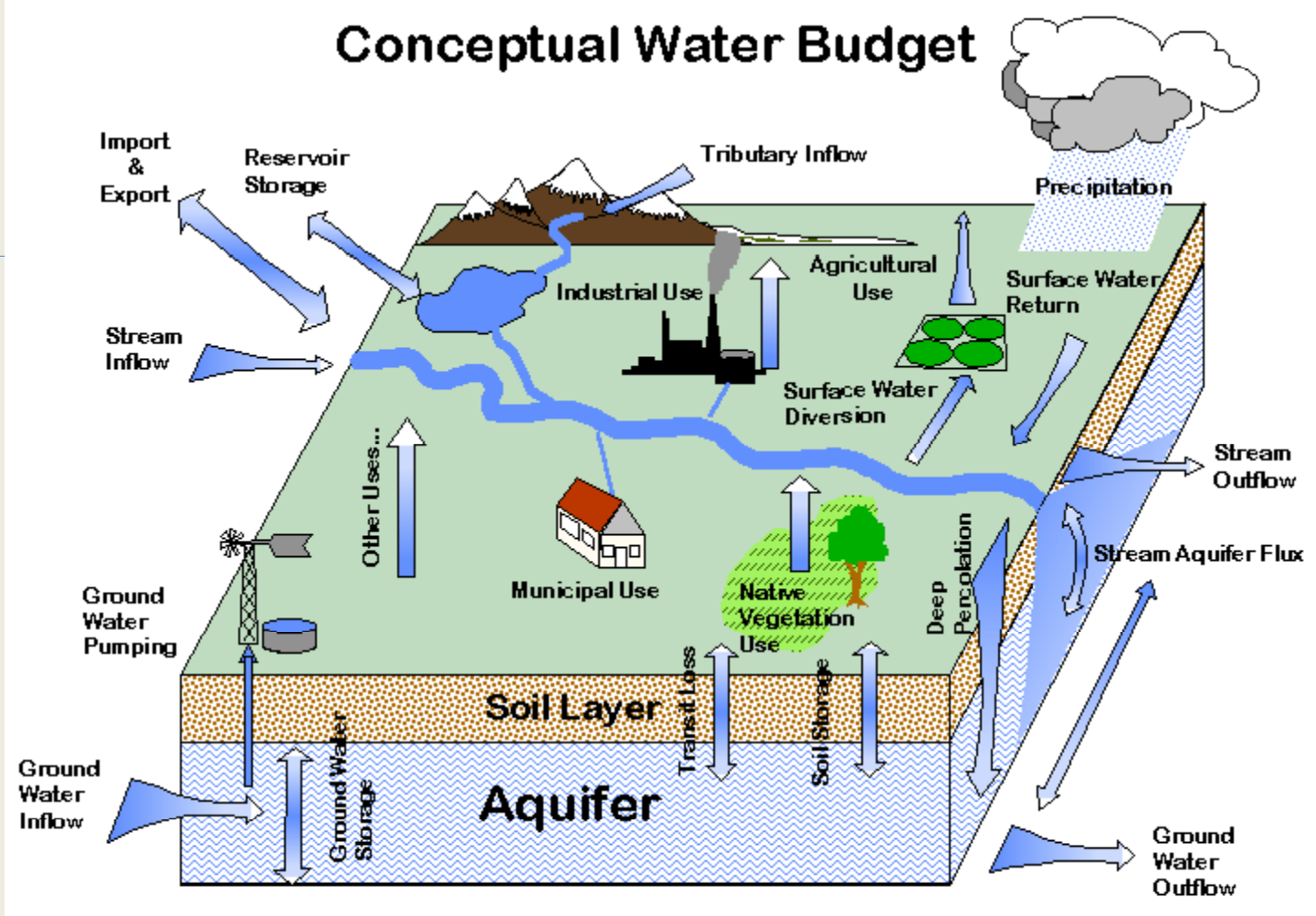
What is a watershed?



What is a Watershed Budget?



Watershed Budgets including human activities



Implementing a Groundwater Sustainability Process for Minnesota

James Stark, Melinda Erickson and Tim Cowdery-USGS

What does the Sustainability Framework Tell US?

- Top priority is to preserve a sustainable and clean water supply
- More than supply for the public, agriculture, power generation and industry: it includes recreational and ecological needs
- **Calls for water budgets, and using them to improve the water-appropriation**
- Presents the need for integrated policy and management that recognizes interconnected nature of GW/SW and ecological needs

Other uses/benefits

- Organizing principal for water monitoring (GW & Surface Waters)
- Data integration and data management – multiple use of monitoring data
- Calibrate watershed predictive models
- Watershed pollutant loads - TMDLs
- Waste water and storm water monitoring
- Water management (drought and flood)

What makes watershed budgets possible now?

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Enhanced data management systems:

- MN Hydrology Time-Series Data System (Hydstra)
  - Flow
- MN Water Quality Data System (EQuIS, Storet)
  - Water chemistry

Paradigm shifts for MPCA monitoring

- No longer have monitoring data collected solely for one project.
- Transparency and public access to data.
- All data accessible through web-based, shared, consolidated, or linked data systems.
- Allow for multiple uses of monitoring data.
- Quality control and data governance.

Hydrology Time-Series Data System

Hydrology Time-Series Data

- **Flow (derived)**
- **Stage**
- **Precipitation**
- **Continuous Chemistry Data (SONDE)**

time series - is a sequence of data points measured at a set interval.

A data logger set to 15 minute sampling interval will store 35,000 records in a year

Other Data

- Loads (derived)
- Discharge Measurements
- Chemistry Data (linked to Water Quality Data System)

Current users of Hydrology Time-Series Data System

- DNR Waters
- DNR Fisheries & Eco Services
- MPCA Surface Water Hydrologists

Future users of Hydrology Time-Series Data System

- Enterprise data system (will be available to public or non profit entities)
- GW observation well network (transducers) – DNR
- Storm water discharge data
- Municipal waste water discharge
- Other State environmental “continuous series” data

MN Water Quality Data System (EQuIS)

- Data system for storing monitoring locations, chemistry data, and metadata
- EDGE for field data capture, Sample Planning Module
- Chemistry data imported directly from labs into Water Quality Data System
- County Well Index (CWI) – unique number and other conventions

Current Users of MN Water Quality Data System (EQuIS)

- Current:
  - MPCA surface water quality monitoring
  - MPCA Ambient GW Monitoring Network
  - MDA Ambient GW Monitoring Network
  - MPCA Closed Landfill program

Future Users of MN Water Quality Data System (EQuIS)

- MPCA –
  - Superfund, Brownfield programs, Petroleum Remediation, Feedlots, Landfills, Hazardous waste programs
- DNR –
  - Observation well network (metadata)
- Other state agencies or Local Units of Govt.

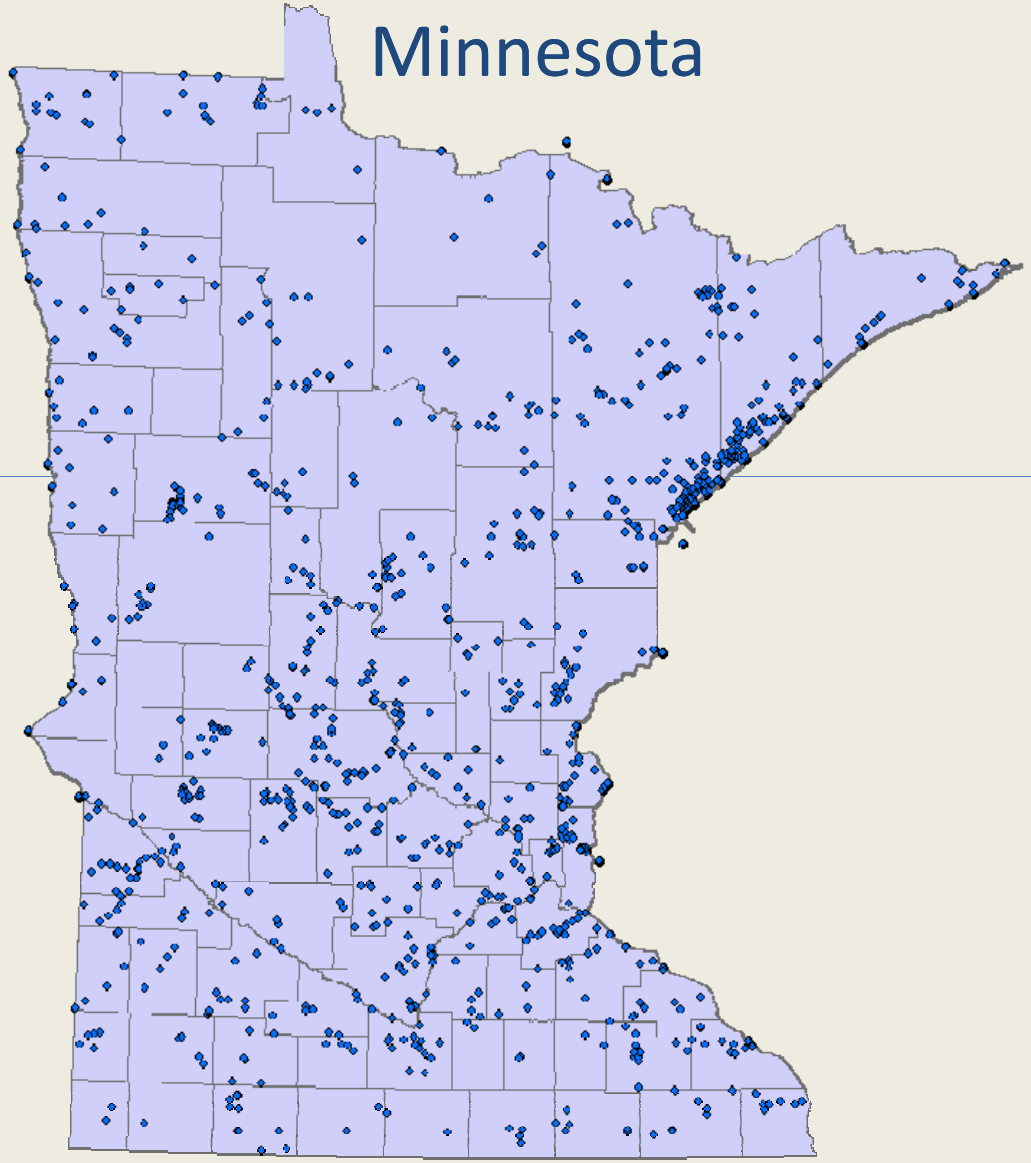
What makes watershed budgets possible now?

Enhanced stream monitoring and groundwater monitoring networks

Stream monitoring and groundwater monitoring networks

- **Stream gaging network (DNR)**
- Watershed Pollutant Load Monitoring Network (MPCA, Met Council, others)
- Groundwater Observation Well Network (DNR)
- Ambient Groundwater Monitoring networks (MPCA, MDA)

DNR, USGS, Met Council & MPCA Stream Gaging in Minnesota



Stream monitoring and groundwater monitoring networks

Enhanced state-wide groundwater and stream monitoring networks

- Stream gaging network (DNR)
- **Watershed Pollutant Load Monitoring Network (MPCA, Met Council, others)**
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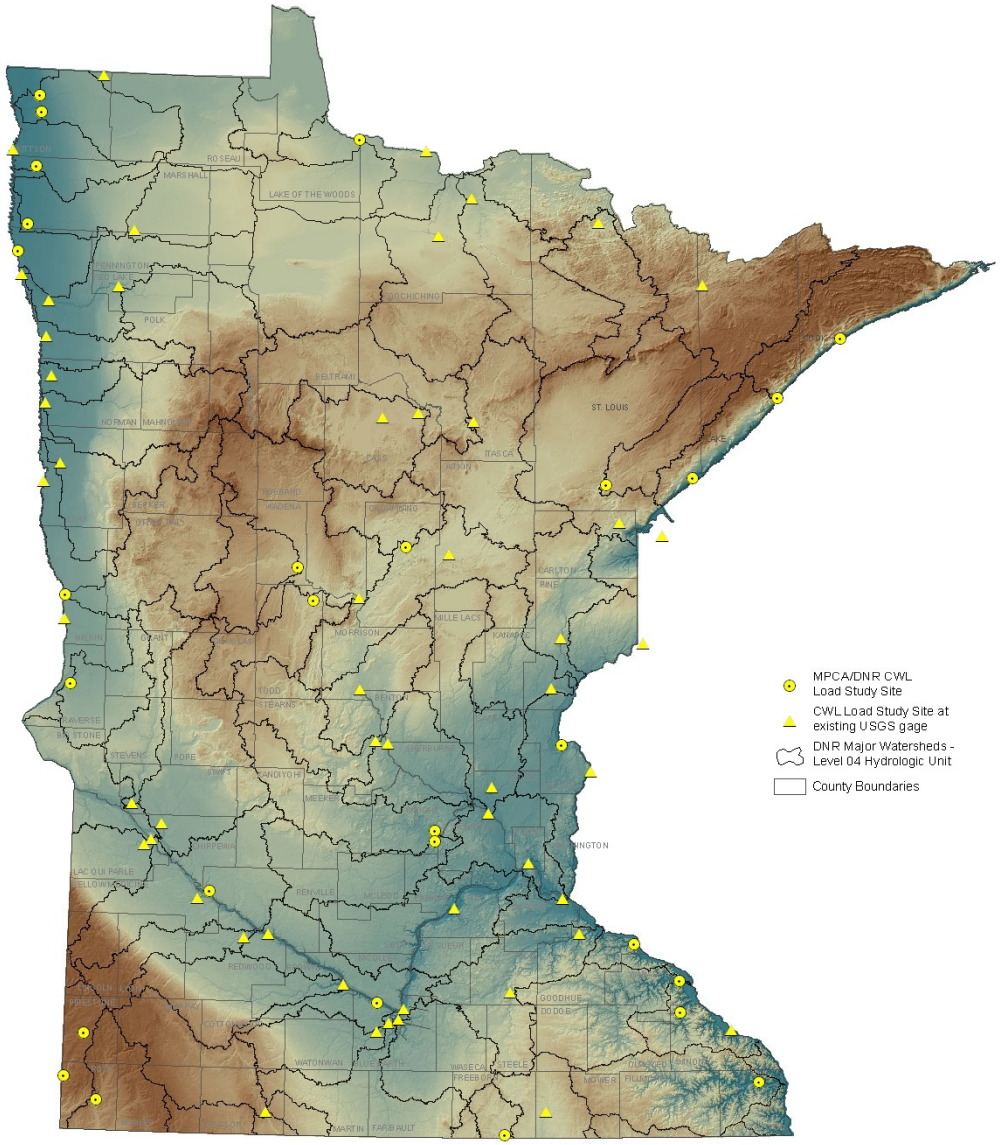
Watershed Pollutant Load Monitoring Network

- Current: long-term, event-based, year-round monitoring at major watershed outlets (8 digit HUCs)
- All gaging stations have telemetry
- By 2015: additional 150 additional long-term stream gaging and load monitoring at subwatershed sites (10-12 digit HUCs).
- Next phase: automatic samplers

Major Watershed Pollutant Load Monitoring Program

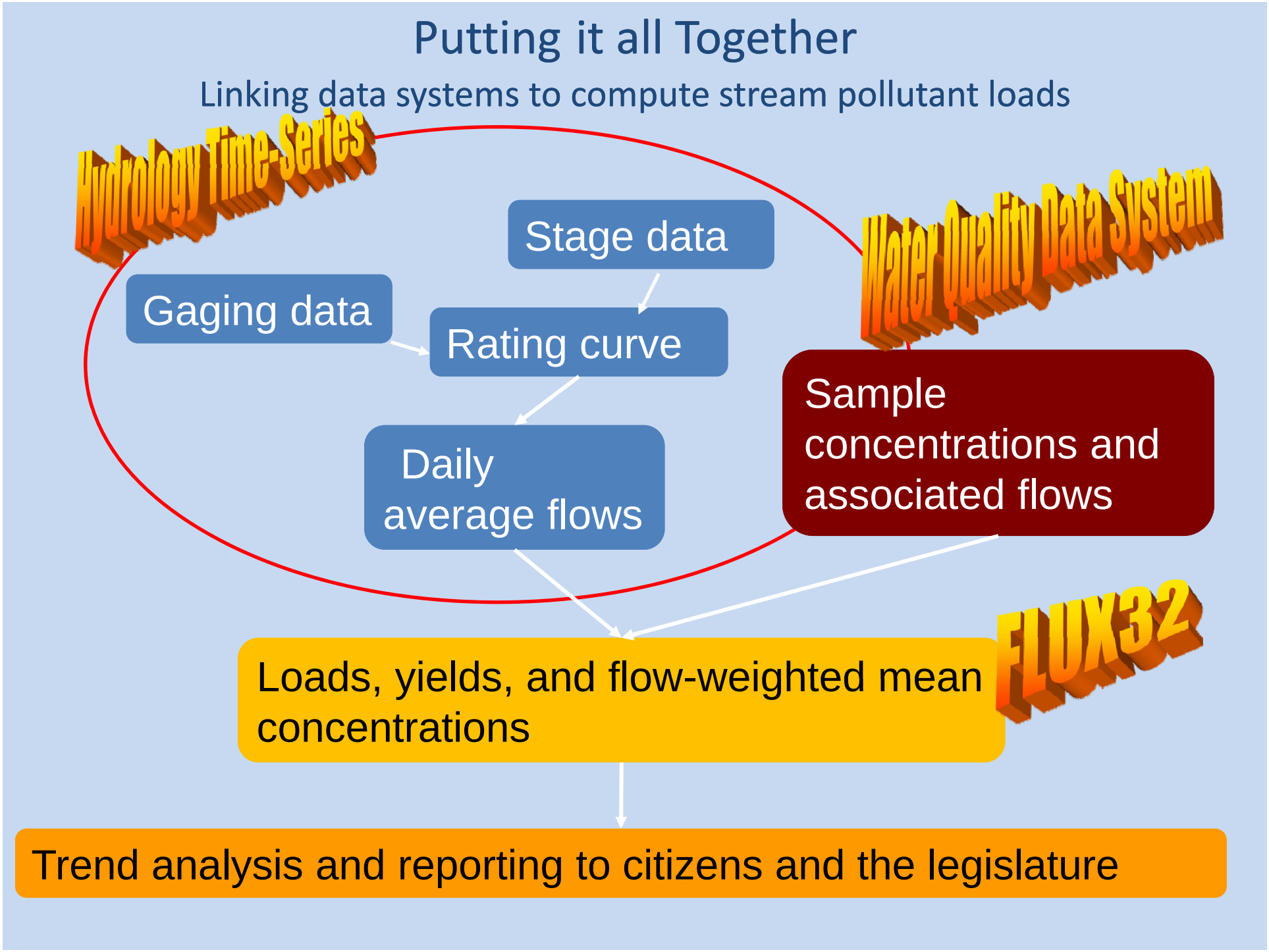


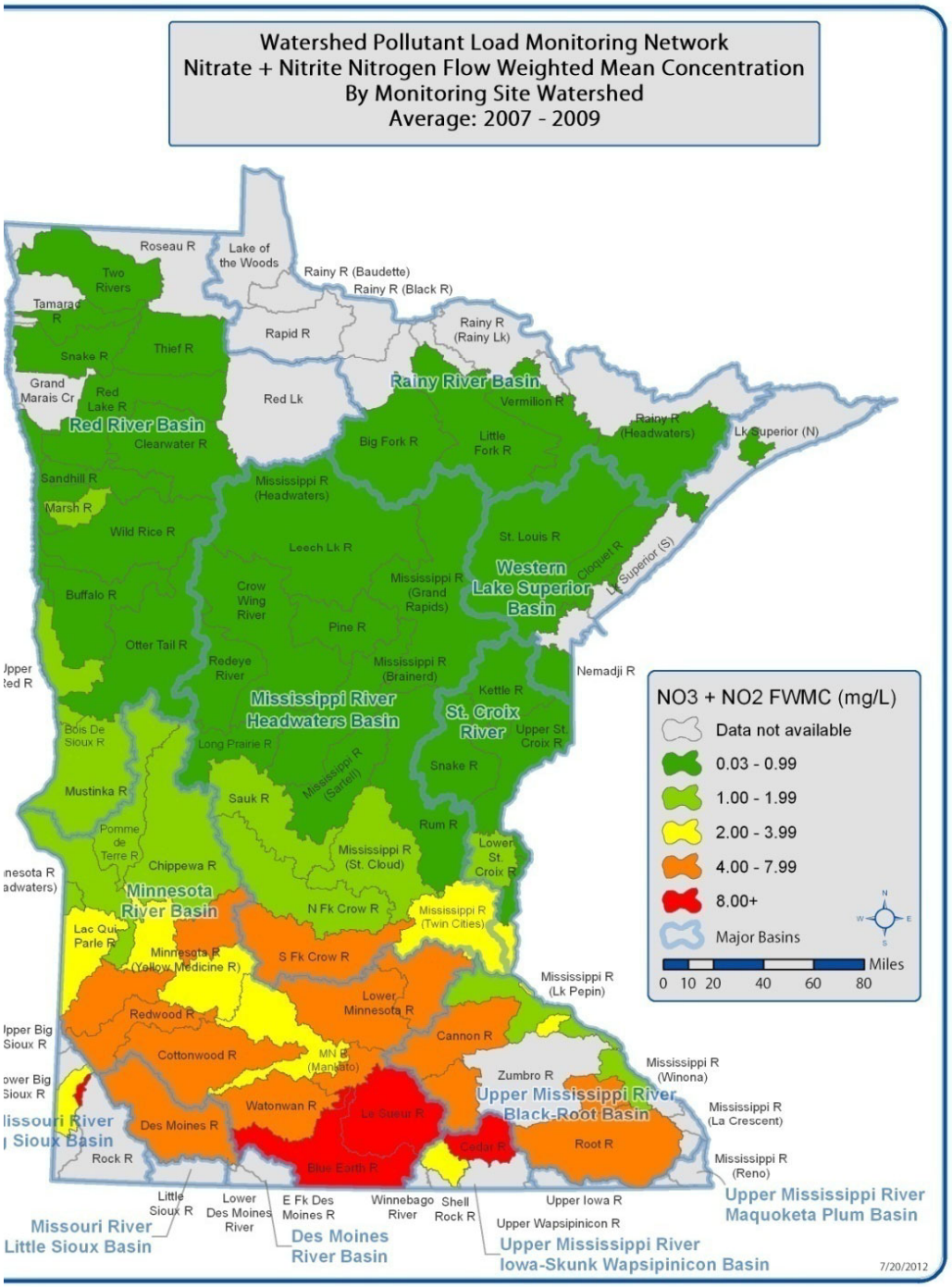
Map generated with data from DNR/MPCA Cooperative Stream Gaging Program:
www.mndnr.gov/waters/csg

May 2011

Putting it all Together

Linking data systems to compute stream pollutant loads

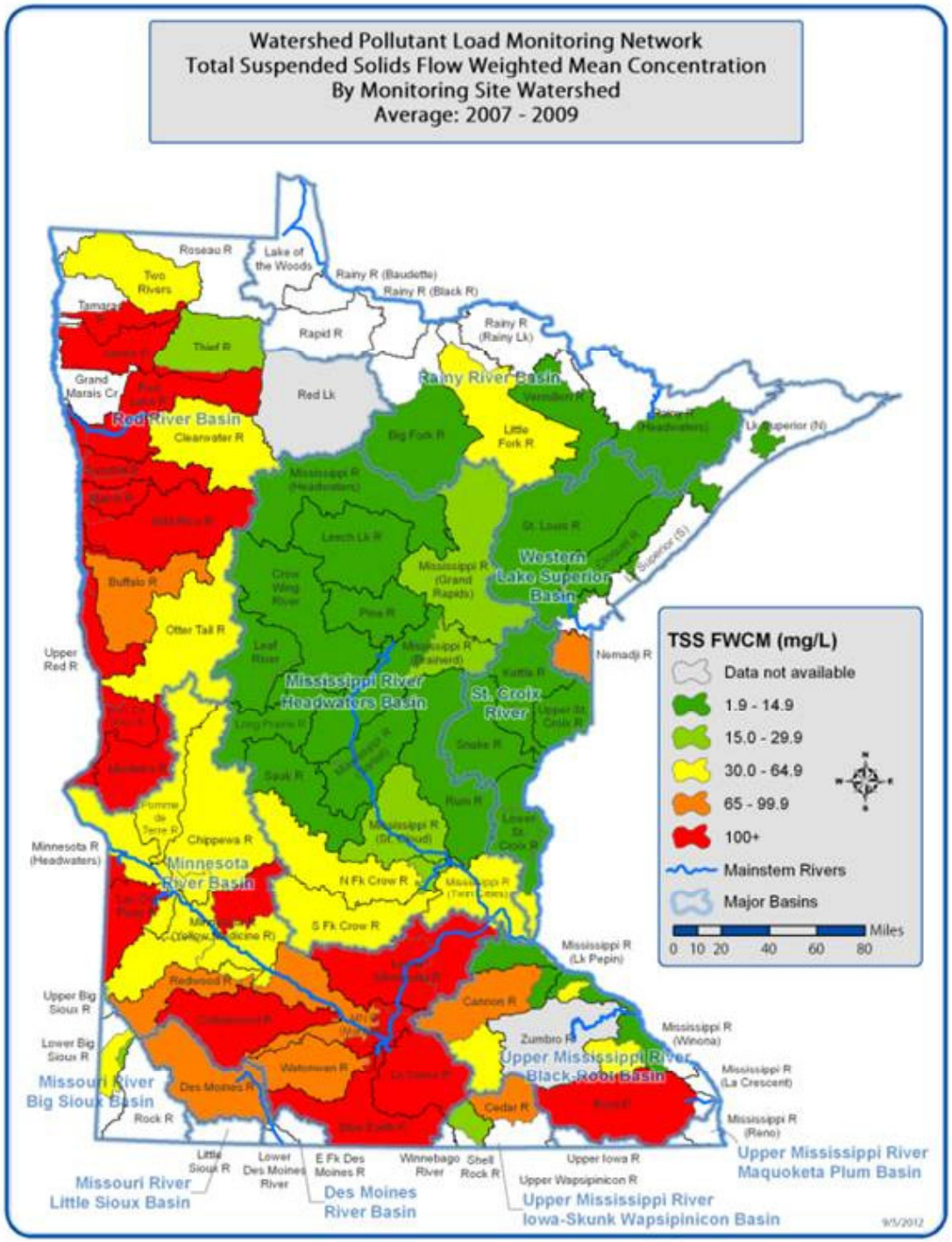




Nitrate + Nitrite Nitrogen

Flow weighted mean conc.

Average: 2007-2009



Total Suspended Solids

Flow weighted mean conc.

Average: 2007-2009

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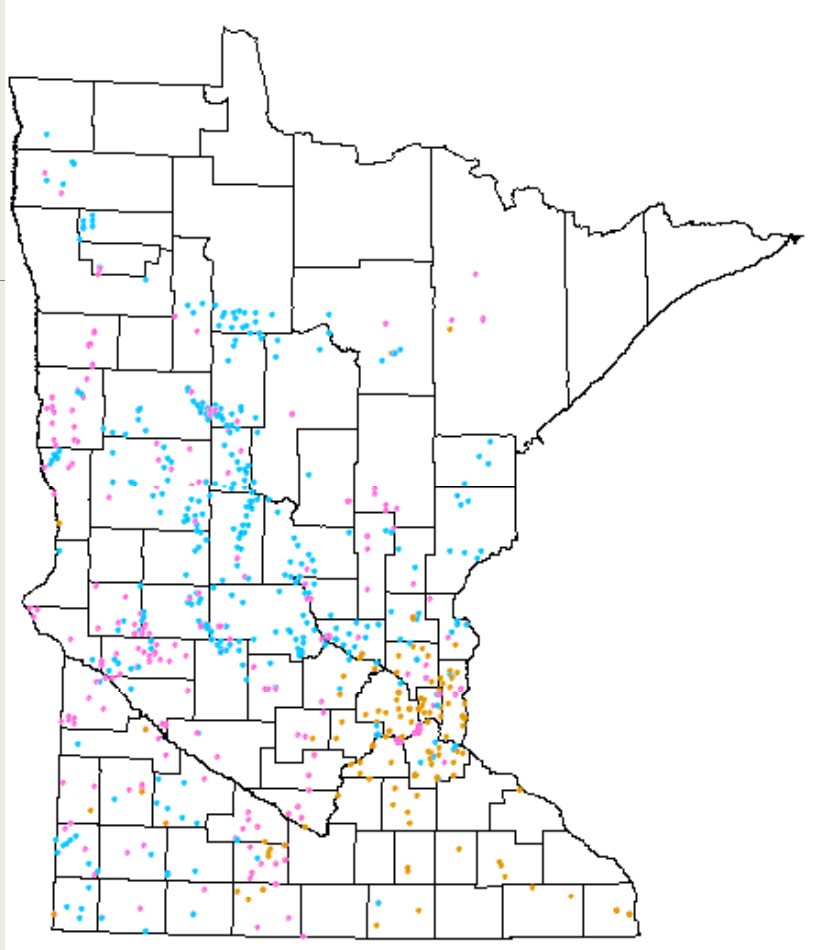
Minnesota DNR Observation Well Network (2010)



Groundwater elevations (quantity of groundwater)

- Bedrock MWs
- Buried artesian wells
- Water table wells

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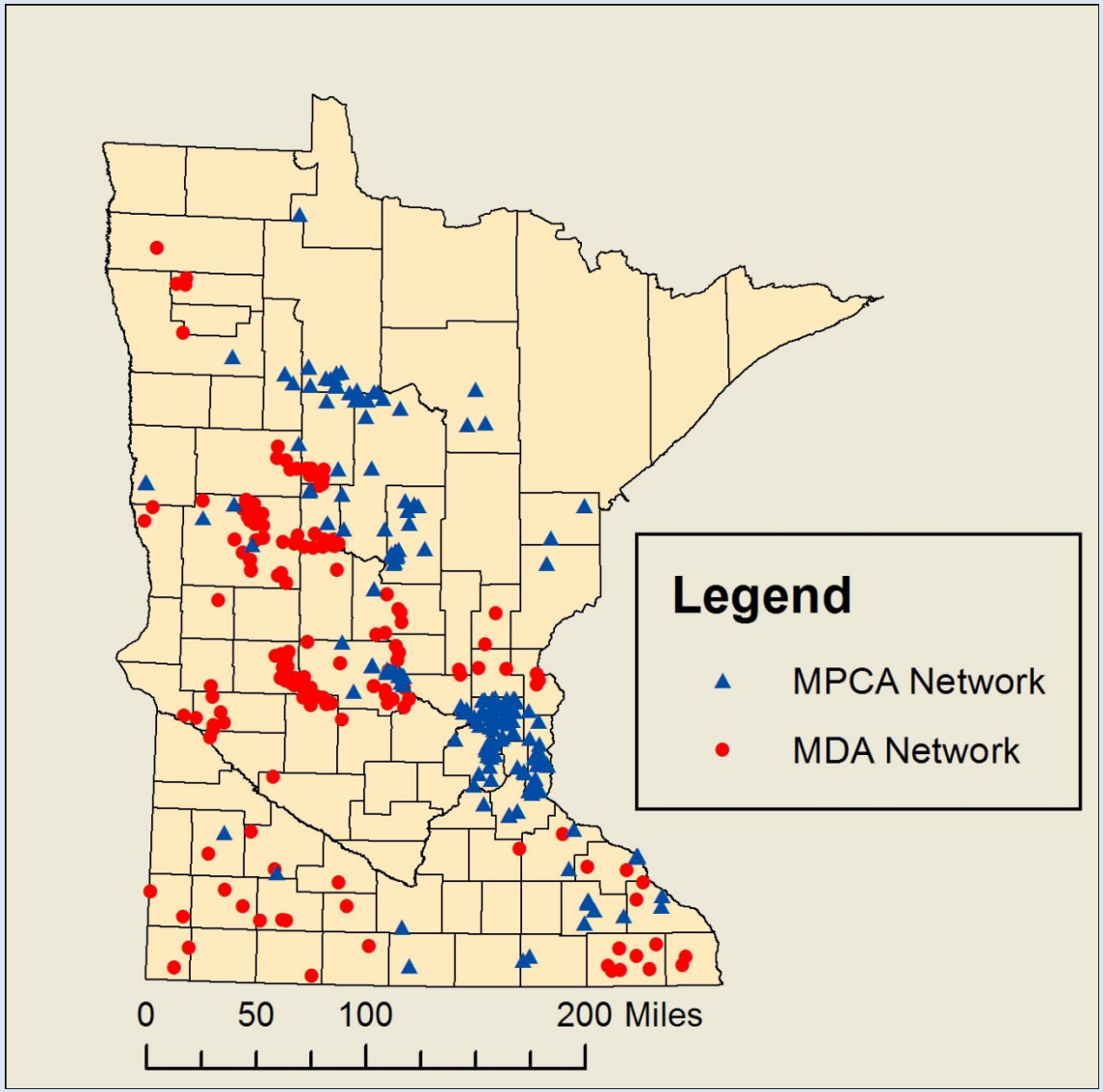
Ambient Groundwater Monitoring Networks in Minnesota



Other Components of Watershed Budget

Precipitation

- Rain gages at stream gaging locations (with telemetry)
- NOAA precipitation gaging network
- Weather radar to fill in gaps and intensity
- Additional rain gages needed

Other Components of Watershed Budget

Groundwater recharge estimation data set MPCA (Andrew Streitz), USGS (Erik Smith)

Synthetic hydrographs –MPCA (Byron Adams), USGS (David Lorenz)

Evapotranspiration

Watershed Budget Uses

- Data available for:
  - Groundwater appropriation permits (irrigation)
  - Groundwater management areas
  - Provide basis for identifying land use-water quality relationships
  - Pollutant allocations by 12 digit HUCs for TMDLs

Watershed Budget Uses

- Compare water quality across the state
- Identify water quality and water quantity trends
- Inform water resource policy discussions
- Watershed investigations and condition reports
- Environmental reviews
- Watershed models
- It’s a tool, not a solution.