Chapter 1: Locally-led Volunteer Water Monitoring
Locally-Led Volunteer Water Monitoring: Mission

To protect and improve Iowa’s water quality by raising citizen awareness about Iowa’s watersheds, supporting and encouraging the growth and networking of Iowa’s volunteer water monitoring communities, and promoting water monitoring activities as a means of assessing and understanding Iowa’s aquatic resources.
About Locally-Led Volunteer Water Monitoring

Citizen-based

This is YOUR program
About Locally-Led Volunteer Water Monitoring

Focuses on

SOLUTIONS

NOT problems
About Locally-Led Volunteer Water Monitoring

Focuses on

RESULTS

NOT regulation
About Locally-Led Volunteer Water Monitoring

Flexible

You decide where, when, what, and why
About Locally-Led Volunteer Water Monitoring

Focuses on

Watersheds
Watersheds

What’s your watershed address?

(What’s a watershed...?)

Mississippi River Watershed = United States
Upper Mississippi River Watershed = Iowa
Des Moines River Watershed = Central Iowa
Middle Des Moines River Watershed = Des Moines
Saylor Creek = State Capital
What can be Monitored?

- Physical Parameters
  - Water clarity
  - Flow
  - Habitat
- Chemical Parameters
  - Nitrogen
  - Phosphorus
  - Dissolved oxygen
  - Chloride
  - pH
- Biological Parameters
  - Aquatic macroinvertebrates
  - Others

Photo from University of Iowa Hygienic Lab
Monitoring Safety

• Have a “Buddy” or a team
• Let someone know where you are going & how long you will be gone
• Use caution when entering the water and walking down steep slopes
• Watch for High Flows!
• Only sample during daylight hours
• Wear waders or “river shoes”
• Watch for poison ivy, ticks, etc.
• Dress for the weather
• Wash up when you are done!
Other Volunteer Activities
Chapter 1: Water Quality in Iowa
The Hydrologic Cycle in Iowa

- Sunlight
- Water vapor
- Rain
- Evaporation and transpiration
- Stream
- Runoff
- Water table
- Tile drain
- Groundwater flow
Iowa’s Water

• Rivers & Streams
  – 72,000 miles!!
    • 26,600 miles are Perennial
    • 42,957 miles are Intermittent
    • 1,418 miles are Drainage Ditches
    • 660 miles are our large border Rivers
Iowa’s Water

- 125,000 acres Lakes, Reservoirs & Ponds
- 50,500 acres of marshes
Water Quality Monitoring

*What is it? Why is it important?*
What is Water Quality??

Biological

Physical parameters
e.g., temp, pH, DO,
suspended solids

Toxic Pollutants
acute and chronic

Algal biomass
and aquatic plants

Non-toxic Pollutants
e.g., sediment, nutrients

Physical

Fish and benthic macroinvertebrate communities

Rotax.

Hydrology

alterations of timing/amount

The quality of the water resource

Synthetics
Pesticides, antibiotics, industrial compounds, etc.

Habitat
In-stream and riparian
Water Quality in Iowa

Point (●) Source Pollution

Photo by Dave Ratliff

USGS photo
Water Quality in Iowa

Nonpoint (●) Source Pollution

Sediment

NRCS photos
Water Quality in Iowa

Nonpoint (○) Source Pollution

Nutrients – they are essential for life, but it is possible to have too much of a good thing.
Why is Water Quality Important?

• Monitoring is the only way we will know the status of our water & how it has changed over time

How to Monitor Water Quality?

• Step Right In! The Basics:
  – Collect from the middle of the stream flow
  – Move slowly to avoid stirring sediments
  – Face upstream
Understanding Test Results

• Concentration: weight or mass of the measured chemical per volume of water

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Chapter 3: Getting Started with Volunteer Monitoring
Parts of the Plan

• *Why do you want to monitor?*
• *Where are you going to go?*
• *When are you going to go?*
• *Who will do the monitoring?*
• *What are you going to test for?*
• *How will the data be used?*
Why do you want to monitor?

- Citizen engagement and outreach?
- Establish or track project goals?
- Educate landowners?
- Track pollution?
- Discover problems?
Where are you going to go?

• Guidelines for site selection
  – Ease of access and safety
  – Representative area of the water body
  – Position in watershed
  – Proximity to area of interest
  – Historical dataset
Who will Monitor?

- **Coordination required**
  - Staff
  - Volunteers
  - Landowners

- **Safety**

- **Training**

- **Value of “snapshots”**
Monitoring Frequency

*I know where to go and what to do...now when do I go there?*

- Time of Year
- Frequency
- Time of Day
- Weather Conditions
Important Questions

How will the data I collect be used?

- Local project goals are first priority
- Coordinator as data organizer
- Part of historic dataset
- Opening data to others
Examples of Monitoring Plans

- Paired
- Nested
- Single Station
- Upstream/Downstream
Example: *Paired Watershed*

Adapted from North Carolina State University

Site may be compared based on:
- Control/variable experiment
- Different land uses/landforms
- Other activities
Example: Single Station
Adapted from North Carolina State University

Site may be tested before and after changes in:
- Land use
- Season
- Other activities
Example: *Upstream/Downstream*

Adapted from North Carolina State University

Sites isolate specific areas to measure:

- Differences above and below a specific location
- Impacts of sub-watershed activity & improvements
Important Considerations

Do I have to monitor for everything?

• **Monitored parameters**
  – Align parameters with project goals
  – Some things are better tested in labs that may add cost
  – Use of indicators can save money
  – Comfort level of coordinator and samplers
What if I don’t know what or where?

• Iowa DNR technical assistance
• Look to other programs
• Connect with a local conservation professional
• Connect with a local educator

• Many online resources
What if my site is dry?

- Zeroes are important data points
- Goals: a new site may be more indicative of water body
  - Remember: where are you in the watershed?
- Change should be documented regardless
Chapter 4: Watershed Mapping

State-Funded Watershed Initiatives

Watershed Project Areas
- Prioritized Water Quality Initiative Watersheds (WQI - 9)
- WQI Demonstration Projects (18 Projects/60 HUC12 Watersheds)
- Watershed Management Authorities (WMA - 17)
- DNR/EPA Section 319 Projects (14 Projects)
- WRBR (25 Projects/23 HUC12 Watersheds)
- Water Protection Fund Watersheds (WPF - 15 Projects)
- Watershed Protection Fund Watersheds (WSPF - 15 Projects)
- Counties with WPF & WSPF Urban Conservation Projects (3)
Watersheds

If you want to know what’s in here

Look up here
Defining Your Location

• Location
  – What is the exact location to monitor – and why?
  – Can I map the location? (paper, electronic)
• Importance of watershed position
  – What does this area mean to the water quality at the site?
Hydrologic Unit Codes (HUC)

– Unique identification number for each watershed
– Is an indication of watershed scale (the greater #, the smaller the watershed)
  • 8-digit HUC
  • 10-digit HUC
  • 12-digit HUC
Get to know your watershed

Watershed Tours
- Aerial/satellite imagery
- Topographic maps
- Windshield survey
- Walking survey

DNR GIS Resources

Other Resources

Reach out to local mapping resources in your region for more advanced analysis
Chapter 5: Habitat Assessment
Habitat Assessment
Habitat Assessment

- Conduct once a year preferably in the summer
- May be helpful after a major land use change
- Observations & documentation
- Pictures help tell the story:

View to the North

View to the South

Photos by Ed Engle
Stream Transect & Reach

- Observations and parameters measured throughout most stream assessments are done at two scales; the **stream transect** and the **stream reach**
Transect

A stream transect is the exact location across the stream that you are going to monitor.

Your transect should “represent” your stream.

Photo by Dave Ratliff
Stream Reach

- The stream reach is one set of riffle, run, and pool habitat OR

- A set distance from your transect.

  - We recommend 25 meters upstream and 25 meters downstream of the transect.
Habitat Type - Estimated at Stream Transect

Stream habitats are divided into three main types: riffles, runs, and pools.

A variety of habitats within a stream usually enhances the diversity of aquatic life that you may find there.

Figure adapted from: Volunteer Stream Monitoring: A Methods Manual. EPA 841-B-97-002
Habitats Influence Water Quality

- Physical features
- Water quality parameters
- Biological parameters
Riffle

- Swift moving current and water that is normally "bubbling" due to a rocky streambed
- Promotes relatively high dissolved oxygen levels, high numbers of invertebrates, and specific fish

Photo by Ben Petty

Photo by Dale Lindquist
Run

- Moderate current, medium depth, and a smooth water surface
Pool

- Slow current
- Usually found at stream channel bends, upstream of riffles, or on the downstream side of obstructions (scours)
- Great areas for fish such as bass, catfish, northern pike and trout.
Streambed Substrate

Estimated at Stream Transect

What’s on the bottom of the stream?

Bedrock, boulders, cobbles, gravel, sand, mud/silt, other…

Photo by Dave Ratliff

Photo by Troy Martens

Photo by Jacklyn Gautsch

Photo by Terry Moran

Photo by Dave Ratliff
Streambed Substrate

- Important to habitat quality and aquatic life
- Natural **geology** is responsible for the original substrate, human activities that increase erosion can cover the existing substrate with a layer of sand or silt.
  - Embeddedness
  - Reduces biodiversity by destroying aquatic habitats
Microhabitats

*Found in Stream Reach*

- Microhabitats ensure stream diversity by supporting a variety of aquatic life.
  - Algae Mats
  - Logjams
  - Rootwads
  - Fallen Trees
  - Silt/Muck
  - Sand
  - Junk
  - Leaf Packs
  - Rocks
  - Weed Beds / Aquatic Vegetation
  - Undercut Banks
  - Rip Rap
  - Overhanging Vegetation

Basically, ANYTHING – natural or unnatural
Stream Banks

Conditions at Stream Transect

A stable stream bank is a sign of a stable stream.

Upstream

Downstream
What influences streambank stability?

- Channelization
- Soil Types
- Stream Bank Vegetation
- Livestock
- Tiles or Storm Drain Outlets
Cut Bank – Eroding

Photo by Gary Shaner

Photo by Gary Shaner

Photo by Tom Griep

Photo by Steve Veysey

Photo by Byron Bohnen

Photo by Byron Bohnen
Cut Bank – Vegetated

Photo by Greg Hoversten

Photo by Greg Hoversten

Photo by Gary Shaner

Photo by Mark Brecht
Sloping Bank

Photo by Dave Ratliff

Photo by Troy Martens

Photo by Greg Hoversten

Photo by Tom Isenhart

IOWA DEPARTMENT OF NATURAL RESOURCES
CHUCK GIPP, DIRECTOR
Sand/Gravel Bar

Photo by Troy Martens

Photo by Troy Martens

Photo by Mark Brecht

Photo by Gary Shaner
Rip Rap

Photo by Tom Davis

Photo by Dave Ratliff

Photo by Del Holland

Photo by Dave Ratliff

Photo by Del Holland
Constructed Bank (i.e., Drainage Ditch)

Photo by Greg Hoversten

Drainage Ditch, North-Central Iowa, NRCS photo

Photo by Pam Simmons

Photo by Pam Simmons

Drainage Ditch, North-Central Iowa, NRCS photo

Photo by Pam Simmons
Canopy Cover

Estimated at Stream Transect

- The canopy can help protect the stream from extreme fluctuations in water temperature

Stable/lower temperature required by some species like trout
Riparian Zone
*Estimated at Stream Transect*

- Area of land that is in “natural” vegetation directly adjacent to the stream banks
- This zone is extremely important to the health and protection of the stream
  - Trees help stabilize the bank during flood events and may provide habitat for both aquatic and terrestrial organisms
  - Shrubs, grasses, and other plants can slow and filter runoff water before it enters the stream
• It may be important to document the land uses in the watershed that might influence water quality
Human Use

Recorded at Stream Reach
Human Use

Recorded at Stream Reach
Perennial or Intermittent

**Recorded at Stream Reach**

- **Perennial Streams**
  - Water flowing in a channel year-round......**EXCEPT** during periods of extreme drought

- **Intermittent Streams**
  - Contain water only part of the year
  - If the stream regularly dries up between July & September (typical dry times in Iowa)

- **Losing Streams**
  - Found in the karst topography of Northeast Iowa
  - Sinkholes can appear and fill “fast” (for geology)
Pictures

- These are extremely useful for tracking changes over time.
  - Take photos looking upstream & downstream every year.

Photo by Dave Ratliff
Chapter 6: Chemical Assessment
Chemical Assessment

- Most complicated, but easiest to do
- Extreme natural variations
- What is normal?
Chemical Assessment

- Check expiration dates
- Face upstream at transect
- Monitor from area of greatest flow, but err on the side of safety
pH

- Water’s acid/base content
- Measured on scale from 0 to 14
- pH affected by
  - Acids in rain
  - Types of soils/bedrock in area
- Low pH can be harmful to aquatic life
- Low pH can cause ammonia and heavy metals to be more soluble
pH scale

Increasing acidity

Neutral

Increasing alkalinity

6.5-9.0 acceptable levels for aquatic life in Iowa

Typical levels in Iowa:
8.0-8.4 (rivers)
8.2-8.8 (lakes)

0 - battery acid
1 - lemon juice, vinegar
2 - tomato juice
3 - milk
4 - pure water
5 - human blood
6 - sea water
7 - baking soda
8 - ammonia solution
9 - bleach, oven cleaner
14 -

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CHUCK GIPP, DIRECTOR
Measuring: pH

**DIRECTIONS:**
1. Dip a strip into water and remove immediately.
2. Hold the strip level for **15 seconds**. Do not shake excess water from the test strip.
3. Compare the pH test pad to the color chart above. Estimate results if the color on the test pad falls between two color blocks.

pH results may be incorrectly low if alkalinity is less than 80 ppm.

**IMPORTANT: KEEP CAP ON TIGHT BETWEEN USES. STORE AT ROOM TEMPERATURE.**
Typical range for pH = 8.0 to 8.4 (rivers); 8.2 to 8.7 (lakes)

Iowa average = 8.2 (rivers); 8.5 (lakes)

Iowa’s water quality standard - pH shall not be less than 6.5 nor greater than 9.0
Dissolved Oxygen

• Necessary for aquatic life
• Affected by:
  – Water temperature
  – Season
  – Time of day
  – Stream flow
  – Aquatic plants
  – Dissolved or suspended solids
  – Human impacts

Photos by IOWATER volunteer

Photo by NRCS
Dissolved Oxygen

Dissolved Oxygen Concentration

Dawn Dusk Dawn

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Dissolved Oxygen
Blue line = Coldwater aquatic life criteria (7 mg/L)

Green line = Warm water aquatic life criteria (5 mg/L)

Red line = Hypoxic condition (2 mg/L & lower)

Pink line = Medians
Dissolved Oxygen

- Dissolved Oxygen levels of 5 mg/L or less can be a concern
Nitrate-N and Nitrite-N

- Nitrogen is an essential plant nutrient
- Excess levels can cause nutrient enrichment
- Nitrate and nitrite are two forms of nitrogen
  - Nitrate is very water soluble and is more common
  - Nitrite is less stable and quickly converts
- Sources include:
  - Soil organic matter
  - Animal wastes
  - Decomposing plants
  - Sewage
  - Fertilizers
- Levels higher in late spring/early summer
Nitrogen

DIRECTIONS:
1. Dip a strip into water for 1 second (or pass under gentle water stream) and remove. Do not shake excess water from the test strip.
2. Hold the strip level, with pad side up, for 30 seconds. Compare the NITRITE test pad to the color chart above.
3. At 60 seconds, compare the NITRATE test pad to the color chart. Estimate results if the color on the test pad falls between two color blocks.

Note: The Nitrate Test actually measures the sum of both nitrate nitrogen and nitrite nitrogen present in the sample.

IMPORTANT: KEEP CAP ON TIGHT BETWEEN USES. STORE AT ROOM TEMPERATURE.

Hach Company, P.O. Box 389, Loveland, CO 80539 U.S.A.
(800) 227-4224 Outside U.S.A. (970) 669-3056
Typical range for Nitrate + Nitrite-N = 2.6 to 7.9 mg/L (rivers); 0.05 to 0.4 mg/L (lakes)

Iowa average = 5.4 mg/L (rivers); 0.19 mg/L (lakes)

Iowa’s drinking water quality standard – 10 mg/L

Pink lines represent the medians 2000 - 2014
Nitrite/Nitrate Nitrogen

- Pads must be read at specified times
- Colors should be estimated to nearest color standard

Levels of concern
- Nitrite – 0.3 and greater
- Nitrate – 20 & 50 mg/L
Landforms of Iowa:
- Alluvial Plains
- Des Moines Lobe
- East-Central Iowa Drift Plain
- Iowan Surface
- Loess Hills
- Northwest Iowa Plains
- Paleozoic Plateau
- Southern Iowa Drift Plain

Rivers:
- Nitrate+Nitrite-N (mg/L)
  - 0.07 - 0.5
  - 0.51 - 5
  - 5.1 - 11

Ambient Monthly Lake Monitoring Sites 2000 - 2008 (Average)
Phosphorus

- An essential nutrient for plants and animals
- Sources include:
  - Human, animal, or industrial wastes
  - Certain soils and rocks
- Excess phosphorus in water can cause excess plant growth
  - Most common is algae blooms
  - Factoid: 1 lb of phosphorus = 500 lbs of algae
  - Cyclical death of algae and other aquatic plants = decomp = deoxygenation and fish kill potential
  - Some algae harmful to human and animal health
Phosphate

- Phosphate values of 0.6 mg/L & greater are of concern
Typical range for total phosphorus = 0.11 to 0.32 mg/L (rivers); 0.05 to 0.13 mg/L (lakes)

Iowa average = 0.19 mg/L (streams); 0.08 mg/L (lakes)
Phosphorus

- Filtering can help reduce problems with off-color samples by reducing suspended solids
Chloride

• Found in salts
• Easily dissolves in water
• Sources include:
  – Human or animal wastes
  – Inputs from fertilizers
  – Road salt runoff
• Can harm aquatic invertebrates at high levels
• Standards often criticized
**DIRECTIONS:**
1. Remove a titrator from bottle and replace cap immediately.
2. Insert lower end of titrator into solution. Do not allow solution to reach yellow completion band at top of titrator.
3. Allow solution to completely saturate wick of titrator. Reaction is complete when yellow band turns dark.
4. Note where the tip of the white chloride peak falls on the numbered Quantab® scale. This represents the Quantab® unit value.
5. Refer to the table below to convert Quantab® units into salt concentration.

**NOTE:** Filtration of the sample solution may be needed to prevent obstruction of the titrator.

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<th>Quantab Units</th>
<th>%NaCl</th>
<th>ppm(mg/L)</th>
<th>Quantab Units</th>
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**Important:** Keep Cap on Tight Between Uses.

**STORE AT TEMPERATURES NOT TO EXCEED 86°F (30°C).**

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*Quantab® is manufactured by Environmental Test Systems, Elkton, Maryland.

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*Iowa Department of Natural Resources*

*Chuck Gipp, Director*
Typical range for chloride = 16 to 29 mg/L (rivers)

Iowa average = 22 mg/L (rivers)
Chloride

• Quantab values that fall below table on bottle should be recorded as <25 mg/L

• If you find your chloride strips are inadequate (chloride > 600 mg/L), contact IOWATER for high range chloride strips

• Chloride values of 100 mg/L & greater are of concern
Chapter 7: Physical Assessment
Physical Assessment

- Recommended Frequency – Monthly
Weather

- Sunny
- Partly Sunny
- Cloudy
- Rain/Snow
- Windy
- Calm
Water Color

Milky
Gray
Green
Oily
Brown
Oily Sheen

If oily sheens are present, conduct a simple test to determine whether or not the sheens are natural:

Poke the sheen with a stick
- If the sheen swirls back together immediately, it's petroleum.
- If the sheen breaks apart and does not flow back together, it is from bacteria or plant or animal decomposition.

Photos by Evan De Groot
Water Odor

- Manure or Sewage – urban or animal waste
- Rotten egg – low oxygen levels (decomposition)
- Petroleum – a direct pollution source
- Fishy – Stressed biological life (for lakes monitoring)
Air Temperature

• Make sure thermometer is dry
• Keep thermometer out of direct sunlight

Water Temperature

• Let thermometer stabilize (at least 2 minutes)
Precipitation
Over the past 24 hours

• Rain decreases **point source** pollution concentrations because of dilution
• Rain increases **non-point** pollution effects because of surface run-off

• Use your favorite weather site or:
  – http://mesonet.agron.iastate.edu/climate/
Transparency

- Measured in centimeters

How far can you see through the water?

- Transparency is a measure of how *clear* the water is.
- Turbidity is a measure of how *dirty* the water is.
Stream Width & Depth

Facing UPSTREAM

Maximum Stream Depth

Stream Width (W)

Left Bank

Right Bank

1 m

Measured in METERS

Depth (D)

from top of water to bottom

Measured in METERS

string

stake
Stream Velocity

• Stream velocity is best with (expensive) equipment
• Approximations can be made with floating objects

• For many sites, see: http://rivergages.mvr.usace.army.mil/
Stream Flow (Discharge)

- **Strong** influence on water quality.
- Calculated from depth, width & velocity
- Estimated as:
  - High
  - Normal
  - Low
  - Not sure
Chapter 8: Standing Waters Assessment
Standing Water Assessment
Introduction to Lakes

- The Iowa DNR has cataloged 5,432 “standing waters” in Iowa
  - Lakes and ponds
    - 115 Significant publicly owned lakes
    - 67 “meandered” lakes
  - Reservoirs and Impoundments
    - 4 Flood control reservoirs
  - Wetlands
- Total acres: 161,366
**Seasonal Turnover**

**Winter**
No circulation of water.

**32°F**

**Spring**
Lake turnover occurs. Oxygen and nutrients are circulated vertically throughout the lake.

**39 - 50°F**
Summer
Thermocline develops and vertical mixing is prohibited.

Autumn
Lake turnover occurs. Oxygen and nutrients are circulated vertically throughout the lake.
Site selection

• Most representative location
  – Deepest point
    • In circular natural lakes – the center
    • In man-made reservoirs – near the dam

• If I don’t have a boat what do I do?
  – Docks, bridges, jetties, shoreline
  – May be more applicable to your project needs and areas of concern (beach?)
Site selection

Natural Lake
- Shoreline
- Sample Sites

Impoundment Lake
- Inlet
- Sampling Sites
- Outlet
- Dam
- 2 m
- 1 m
- 3 m
Point Sampling and Sampling Frequency

• Sampling from a specific depth
  – Elbow depth (Approx. ½ meter)
• Monthly sampling is recommended
  – From ice-out to freeze-over, between 10 AM and 3 PM
  – Be consistent – If you can only sample every other month or quarterly then stick with it
Secchi Disk Depth

Lower the disc into the water on shaded the side until you can just make out the black & white Secchi pattern.
Mark that depth with a clothes pin.
Secchi Disk Depth

Lower the disc further until you can no longer see it.
Bring the disc up slowly until you can again just make out the black & white Secchi pattern.

Mark this depth with a second clothes pin.
Secchi Disk Depth

The distance between the top of the disc and the average of the two pins is your Secchi depth.
Point Sampling

Lower your sampling cup into the water to elbow depth.

Hold the cup upside down.
Point Sampling

Slowly turn the cup upright to fill it.
Point Sampling

Slowly bring the water sample up to run your tests.

Remember to rinse your sampling cups three times when moving from site to site.

If moving between water bodies, allow all equipment to thoroughly dry to help prevent the movement and spread of aquatic invasive species.
Chapter 9: Data Interpretation
What is normal?

It is hard to know what is “normal” until:

• You can compare to a historical dataset
• You spend additional time monitoring the waterbody

Other things to consider:

Does your sampling take into account varying:

• Hydrology?
• Seasons?
• Weather?
• Other changes?
What is normal?
Level or results of concern

Chemical/Physical Assessments:
Nitrite values of 0.3 or greater (0.3, 1.0, 1.5 & 3.0 mg/L)
Nitrate values of 20 or greater (20 or 50 mg/L)
Phosphate values of 0.6 or greater (0.6, 0.8, 1.0-8.0, 10 mg/L)
Dissolved Oxygen values of 5 or less (1-5 mg/L)
pH values of 6 or less (4, 5, 6)
Chloride values of 100 or greater (100 - >600 mg/L)
How often should you collect data?

- Will depend on your monitoring plan and goals
- Monthly sampling is typical
Factors that Affect Water Quality - Land Use

• Regional Differences

**Northeast** – rugged topography, spring-fed streams, higher transparency, lower nutrients.

**North Central** – flat topography, mainly row crops, tile drainage, higher transparencies, higher nutrients

**West** – loess hills, rolling plains, forest, grassland, and row crops, low transparency

**South** – irregular plains, low hills, forest, pasture, row crops, lower nitrogen, variable water quality
Factors that Affect Water Quality - Precipitation

- Precipitation tends to increase non-point source pollution.
- Precipitation tends to decrease point source pollution.
Factors that Affect Water Quality - Season

- **Dissolved Oxygen**
  - IOWATER Data
  - Ambient Monitoring Data
  - Winter
  - Summer

- **Temperature (F)**
  - IOWATER Data
  - Ambient Monitoring Data

- **Nitrate Nitrogen**
  - IOWATER Data
  - Ambient Monitoring Data
Factors that Affect Water Quality - Time of Day

- Temperature and Dissolved Oxygen vary depending on the time of day.
Factors that Affect Water Quality - Physical Influences

- Canopy Cover
- Shading
- Macrohabitats
Long-term data sets are extremely valuable in determining what is normal for a site and how water quality at a site varies throughout the year.

Montgomery Creek is a warm water stream. Dissolved oxygen results meet the 5 mg/L standard. Data show a seasonal trend.

Nitrate-N shows a seasonal pattern, with higher values during the late spring/early summer months.

Chloride has been detected, but at low concentrations.
North Bear Creek is a coldwater stream which means a dissolved oxygen standard of 7 mg/L applies.

No occurrence of nitrite-N. Nitrate-N tends to be relatively low at 2 to 5 mg/L.

No obvious problem with chloride.

A closer look at temperature may be required for coldwater systems, as sustained temperatures outside of “normal” can damage the ecosystems.
Abnormal Sampling Results
How to differentiate between “normal” and “abnormal”

If you think your results are abnormal
- **RETEST** – double check results
  - And check expiration dates
- Ask someone else to double check results
- Document as thoroughly as possible
  - Data
  - Pictures
  - Observations
- **Contact your local volunteer monitoring leader**