Citizens' Environmental
Monitoring Program

Water Quality Monitor Training

COOK INLETKEEPER®

PROTECTING ALASKA'S COOK INLET WATERSHED AND THE LIFE IT SUSTAINS

Training Objectives

Day 1

What

Why

Days 2 & 3

How

WATERKEEPER® ALLIANCE

CLEAN WATER STRONG COMMUNITIES

- **The concept of a "waterkeeper"**
- **Waterkeeper Alliance**

- **Cook Inletkeeper began in 1995**

Vision:

Cook Inletkeeper works to guarantee clean water for:

Abundant Fish and Wildlife
Strong Communities
Lasting Jobs
Renewable Energy
Public Property Rights

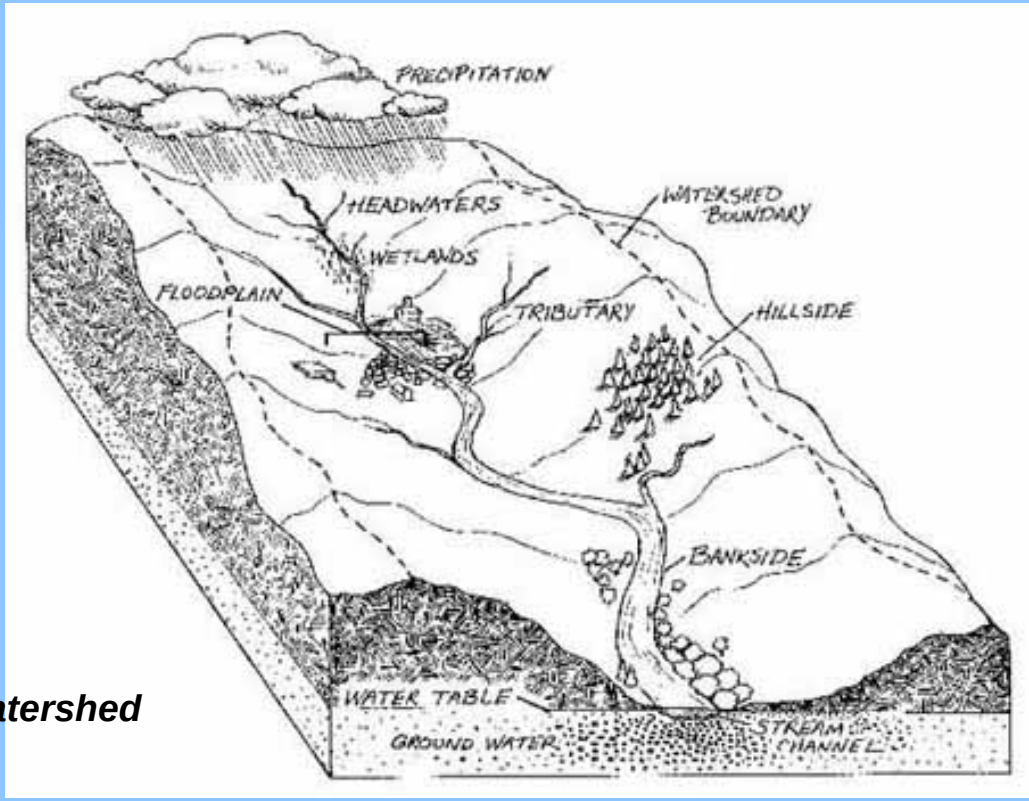
Mission:

To protect
Alaska's Cook Inlet watershed
and
the life it sustains

COOK INLETKEEPER®

Watersheds

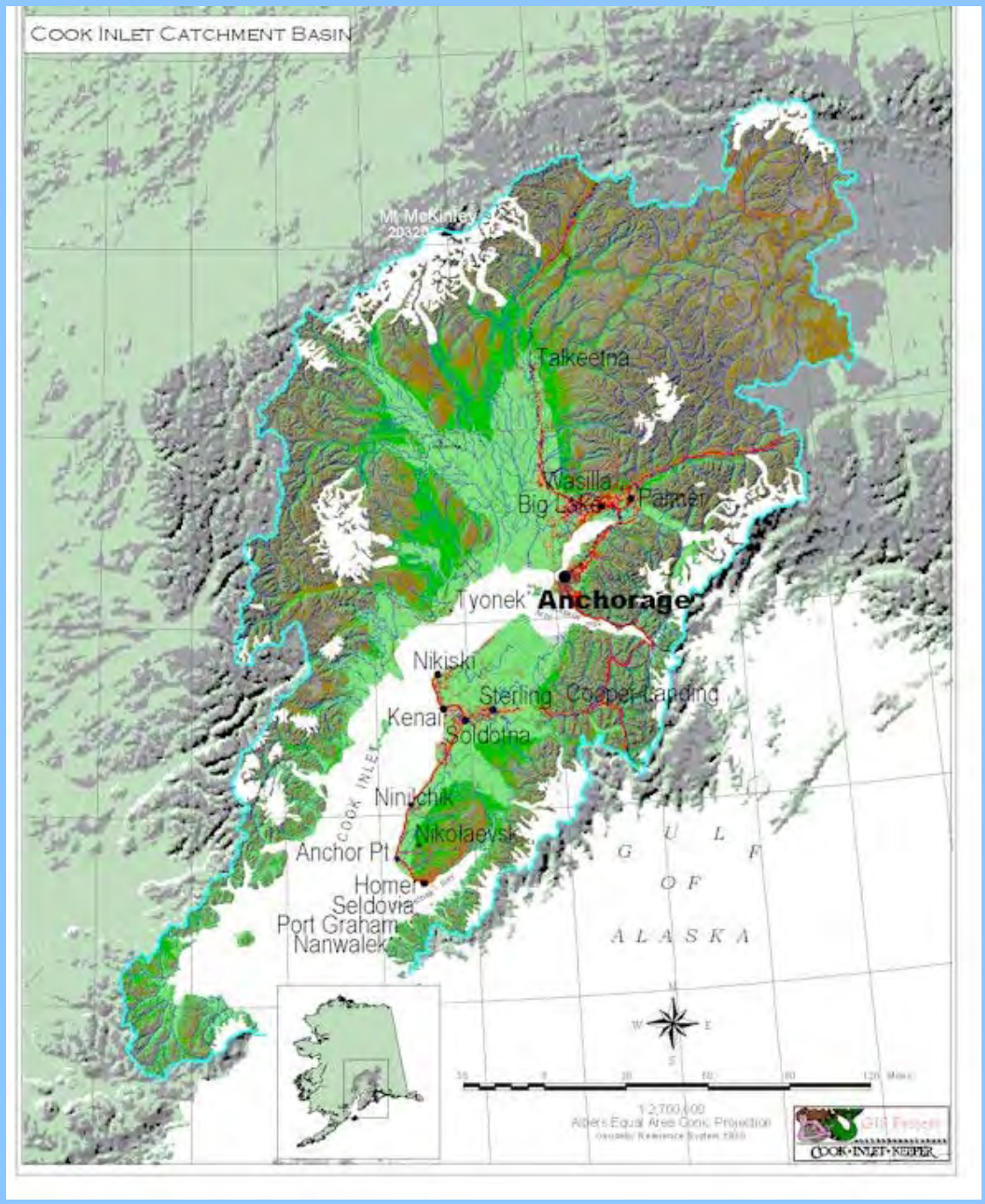
A watershed is the area of land from which runoff (from rain, snow, and springs) drains to a stream, river, lake, or other body of water. Its boundaries can be identified by locating the highest points of lands around the water body.



Cross section of a watershed

The Cook Inlet Watershed

The Cook Inlet watershed covers over 39,000 square miles of Southcentral Alaska. Melting snow and ice from mount McKinley, the Chugach Mountains and the Aleutian Range drains into rivers such as the Susitna, Matanuska and Kenai, which feed the productive waters of Cook Inlet.



CEMP: Citizens' Environmental Monitoring Program

- Goals and Objectives:
  - Inventory baseline water quality in the waters of Cook Inlet Basin
  - Detect and report significant changes and track water quality trends
  - Raise public awareness of the importance of water quality through hands on involvement

Citizen Involvement

Over 500 citizens trained

CEMP Partnership

Homer Soil and Water Conservation District

USGS science for a changing world

United States Environmental Protection Agency

KENAI WATERSHED FORUM

Alaska Department of Fish and Game

Alaska Department of Environmental Conservation

Wasilla Soil & Water Conservation District

Anchorage Waterways Council

UAA University of Alaska Anchorage

Upper Susitna Soil & Water Conservation District

Resurrection Bay Conservation Alliance

Cook Inletkeeper

Matanuska - Susitna Borough

CEMP Partnership

CEMP Monitoring Partners:

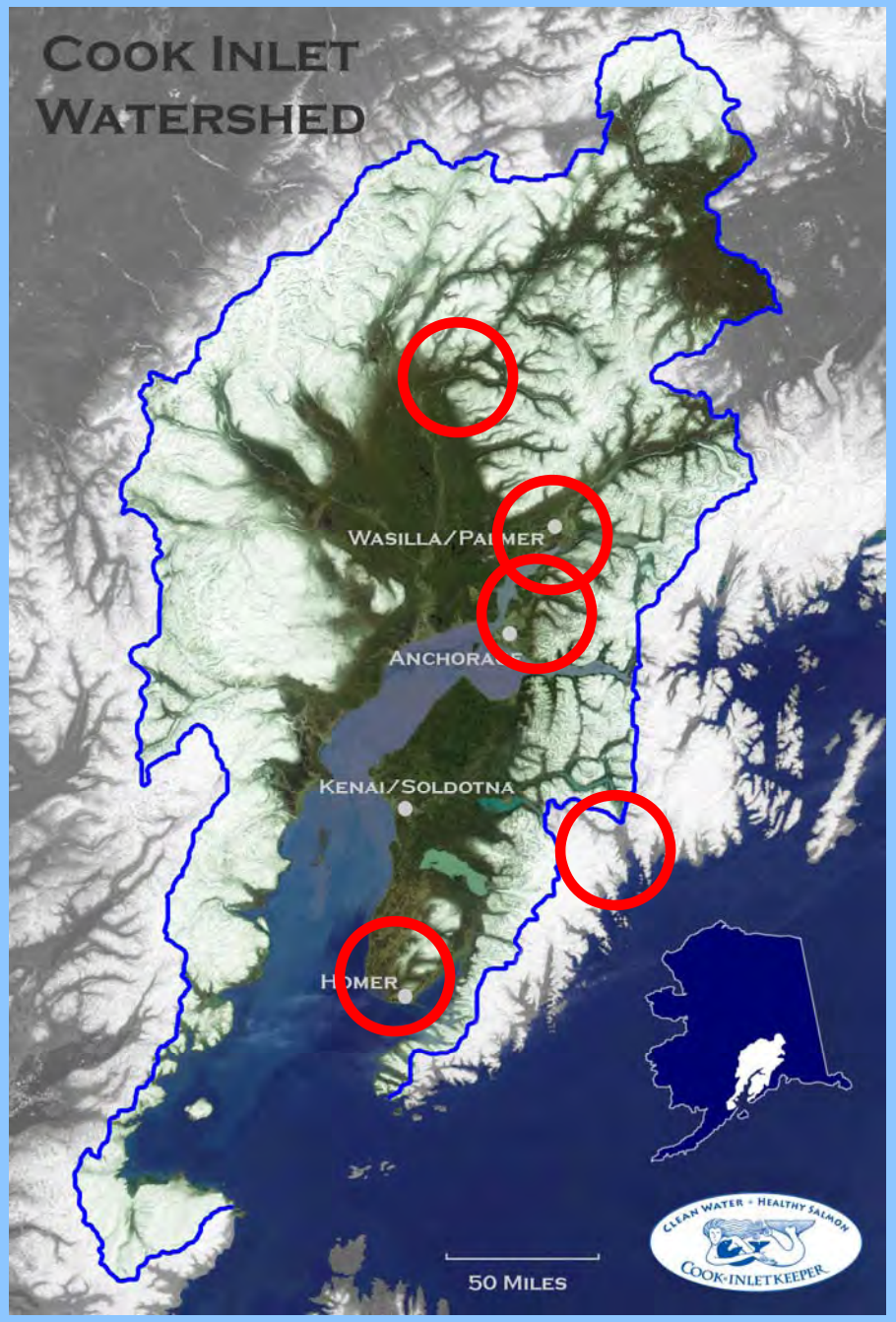
Resurrection Bay Conservation Alliance, Anchorage Waterways Council, Mat-Su Lake Monitoring, Wasilla SWCD, Upper Susitna SWCD

CEMP Outreach Partners:

Homer SWCD, Kenai Watershed Forum

CEMP Technical Partners:

UAA Environment and Natural Resources Institute (ENRI)



Baseline Data: A long term success story!

Baseline Reports

Filling in the gaps:

- Water quality monitoring
- Bioassessments
- Habitat Assessments
- GIS Analysis
- Invasive plant surveys
- Temperature monitoring

2010 CEMP Strategic Monitoring Plan (based off of data through 2009)	GOAL	Bridge Creek	Ruby Creek	Two Moose Creek	Beaver Creek	U T
Water Quality						
Years Monitored	>5	10	13	7	8	
Site Visits	>80	61	74	40	107	
Years w/ >12 visits	5	2	2	0	7	
Months w/ > 5 visits	12	5	10	6	11	
Number of summer visits	40	33	34	26	58	
enough WQ data for baseline?		no	no	no	yes	
Standard Deviation						
Annual temperature	4.60	4.62	3.75	4.15	5.06	
Summer temperature (June-Aug)	2.00	2.94	2.49	1.79	3.16	
Dissolved Oxygen (mg/L)	0.10	0.05	0.08	0.11	0.11	
pH (Hanna)	0.49	0.36	0.37	0.43	0.38	
good enough for trend analysis?		n/a	n/a	n/a	yes	
CEMP Priority						
High, Medium, Low		Medium	High	High	High	M
continue monitoring in 2010?		yes	yes	yes	no	
Temperature Monitoring						
Years monitored (May-Oct)	3	0	5	5	1	
Start Year		no	yes	yes		
Close-out Year						
Bioassessment						
Number of visits	6	0	13	11	12	
Begin Sampling						
End Sampling						
Habitat Analysis Year						
GIS Analysis Year						
Trend Analysis			X	X	X	
Baseline		x				x
Volunteer(s)		Brown	Milburn	York	Wagners	U
Other Relevent Sites (within watershed)		KB-490				
Proposed Baseline Report Year		2013	2013	2013	2010	
Re-assessment Year						

Bioassessment = BUGS!

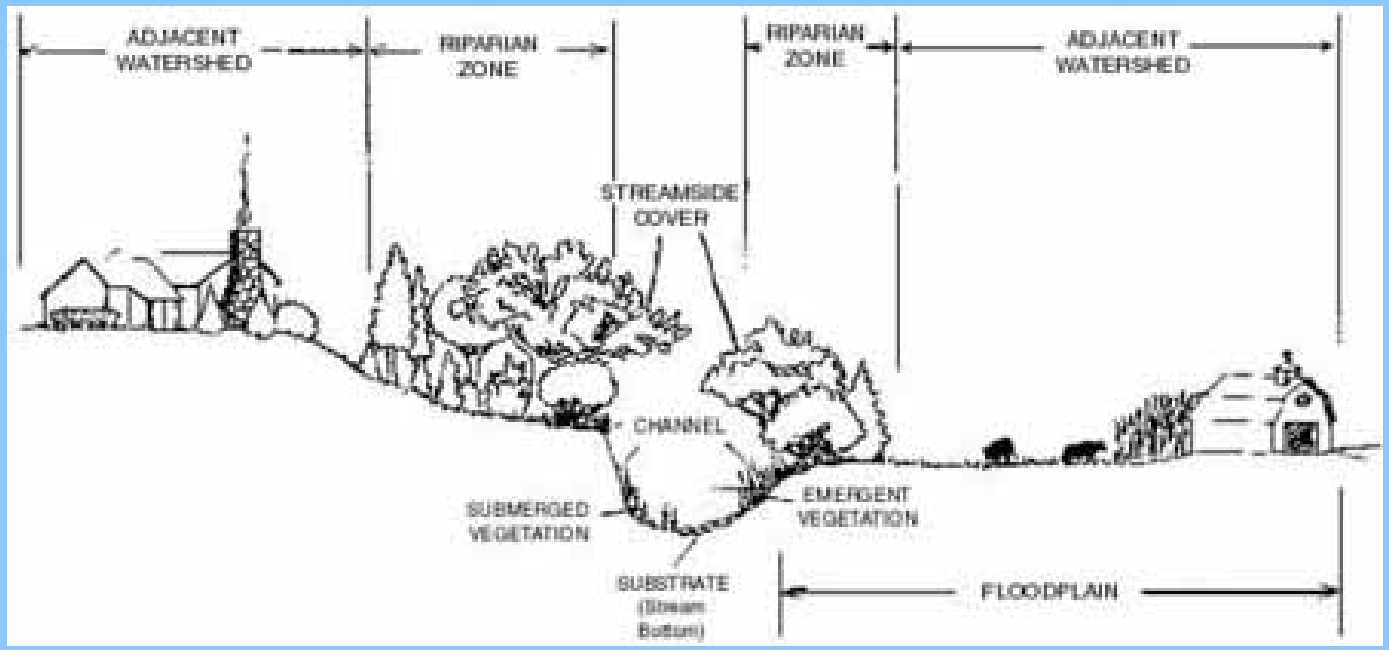
We monitor 5 sites twice a year – once in June and again in August!

The Living Stream Environment

Components of the stream system

<u>A healthy stream is a busy place.</u>

- Wildlife and birds
- Vegetation
- Fish
- Insects and other macro invertebrates



<u>Human activities shape and alter many of these stream characteristics</u>

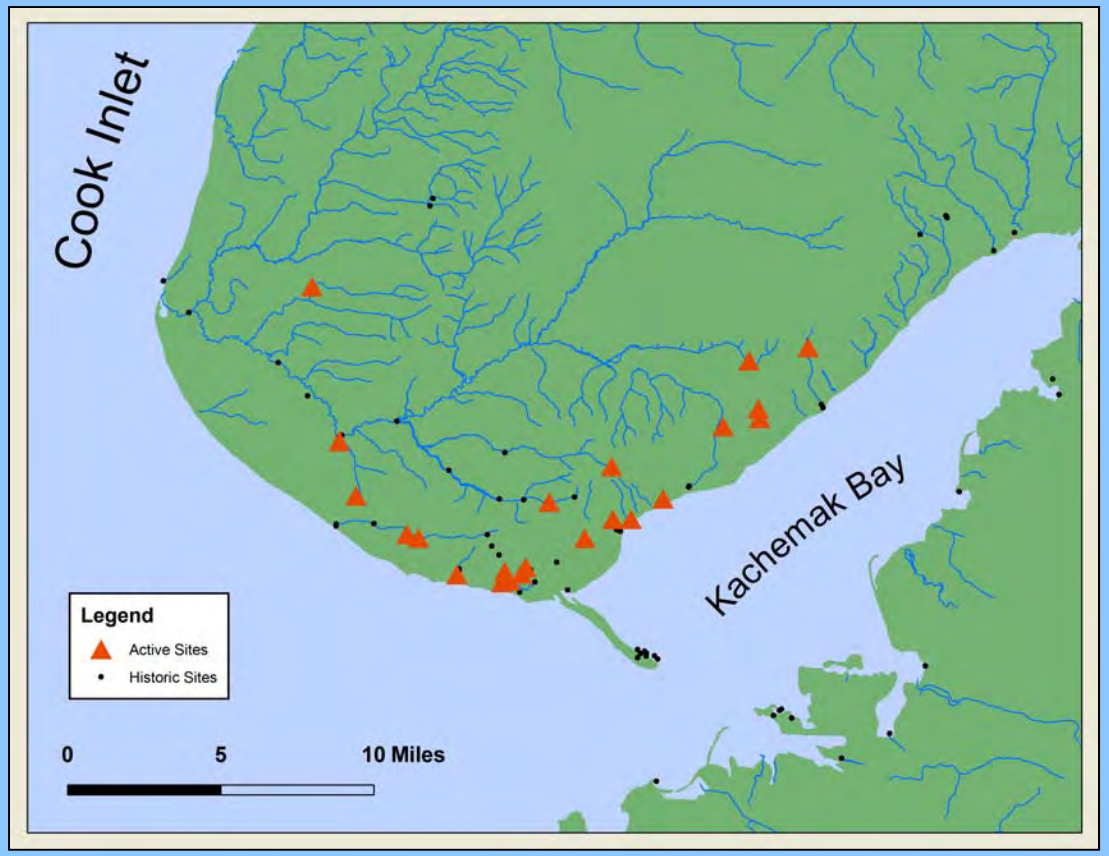
Homes, farms, other developments

Septic systems/outhouses, rural runoff, increase in impervious surfaces

Towns and cities – urban runoff

Logging, mining, gravel extraction activities

CEMP Monitoring Sites



Anchor River watershed:

Beaver Creek
Ruby Creek
Two Moose
Bridge Creek

Kachemak Bay watershed:

Woodard Creek
Bidarka Creek
Mariner Creek
Palmer Creek/Beluga Slough
Fritz Creek
McNeil Canyon
Rice Creek
Miller Creek
Diamond Creek

Site Selection

- Representative
- Safely and reasonably accessible
- Prioritization based on uses, database needs, and potential threats

Two Moose Creek

Ruby Creek

“No Name” Creek

Beaver Creek

Bridge Creek

Lower and Upper Diamond Creek

Bidarka Creek

Upper and Lower Woodard Creek

Palmer Creek

Miller Creek

Upper and Lower Fritz Creek

Rice Creek

McNeil Creek

What is Water Quality?

Pollution is broadly divided into two classes according to its source:

Point source

Nonpoint

<u>Common sources of pollution to streams include:</u>

Agricultural

Municipal dischargers

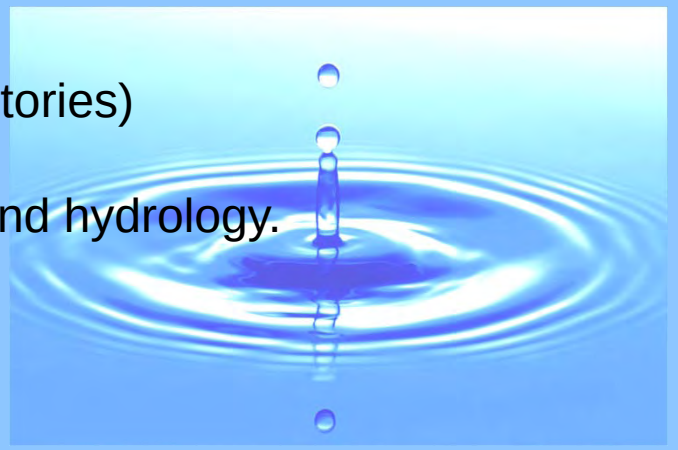
Urban runoff

Mining

industrial dischargers (factories)

forestry activities

modifications to stream habitat and hydrology.



What We Monitor

- **Chemical**
- **Biological**
- **Physical**

WHY DO WE MONITOR WATER QUALITY?

The Need for Monitoring

- The federal Clean Water Act of 1972
- The single largest factor limiting our ability to make intelligent policy decisions is not having sufficient information (i.e. hard data).
- Growth in population and its associated pressures on water quality and natural resources
- The federal and state agencies charged with monitoring and protecting water quality have found it increasingly difficult to fulfill their mandates.

Water quality monitoring can be used for many purposes:

To identify whether waters are meeting designated uses.
To identify specific pollutants and sources of pollution.
To determine trends.
To screen for impairment.

Source	Common Associated Indicators
Cropland	**Turbidity**, phosphorus, nitrates, **temperature, conductivity**
Forestry harvest	**Turbidity, temperature, conductivity**
Grazing land	**Fecal bacteria, turbidity**, phosphorus, nitrates, **temperature**
Industrial discharge	**Temperature, conductivity**, toxics, **pH**
Mining	**pH**, alkalinity, **conductivity**
Septic systems	**Fecal bacteria**, nitrates, phosphorus, **dissolved oxygen**/ biochemical oxygen demand, **conductivity, temperature**
Sewage treatment plants	**Dissolved oxygen** and biochemical oxygen demand, **turbidity, conductivity**, phosphorus, nitrates, **fecal bacteria, temperature**, **pH**
Construction	**Turbidity, temperature, dissolved oxygen** and biochemical oxygen demand, **conductivity**, and toxics
Urban runoff	**Turbidity**, phosphorus, nitrates, **temperature, conductivity, dissolved oxygen** and biochemical oxygen demand

Some Types of Water Quality Monitoring

- **Baseline Monitoring**
- **Compliance and Enforcement Monitoring**

Sampling Schedule

- Samples are to be taken on the second and last Sundays May - August and on the last Sunday September - April for a total of 16 x per year.
- 2:00 PM.
- The quality of the data collected by our program depends on regular and consistent monitoring

Safety

The following are some basic common sense safety rules. At the site:

Always let someone else know where you are, when you intend to return

Complete a volunteer form.

If you drive, park in a safe location. Be sure your car doesn't pose a hazard to other drivers.

Never cross private property without the permission of the landowner.

Watch for wildlife and insects. Know what to do if you get bitten or stung.

Never drink the water in a stream. After monitoring, wash your hands with antibacterial soap.

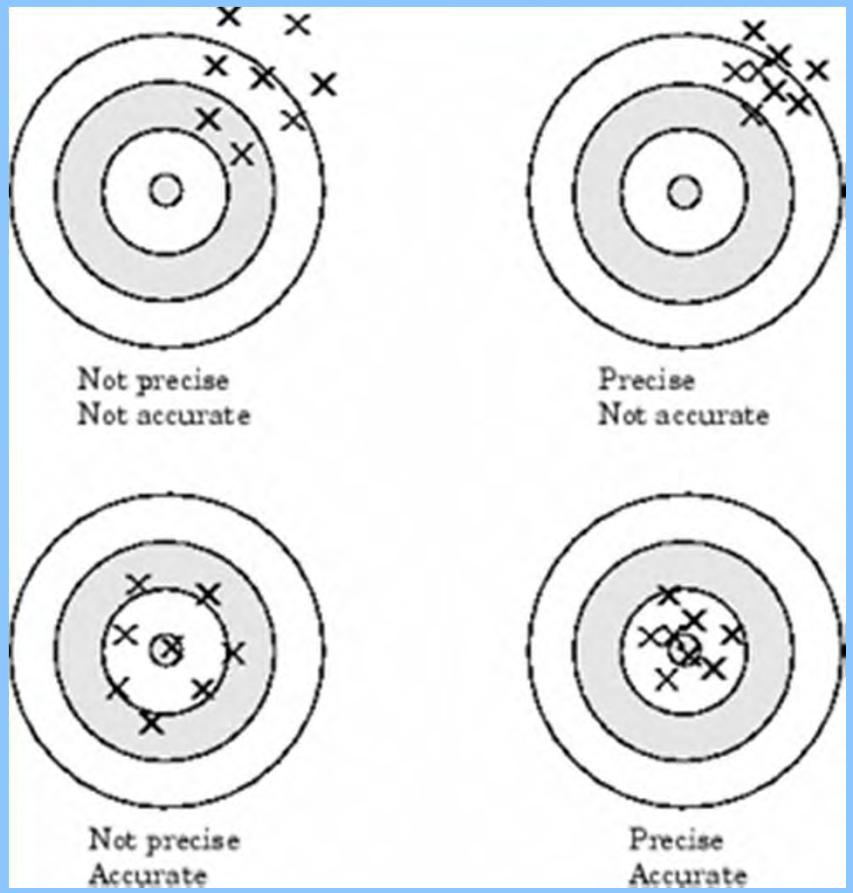
If the water appears to be severely polluted, contact the Monitoring Coordinator.

Disturb streamside vegetation as little as possible.

If at any time you feel uncomfortable about the condition of the stream or your surroundings, stop monitoring and leave the site at once. Your safety is more important than the data!

Quality Control & Assurance

- **Precision & Accuracy**
- **Training & Recertification**
  - **DQO**
- **Site visits & Split samples**
- **Data Management**



(www.mathworks.com)

Quality Assurance Plans

- Quality Management Plan
  - Guiding Umbrella Document for CEMP Partnership
    - Standard Operating Procedures (SOPs)
- Quality Assurance Project Plan(s) (QAPP)
  - Field Procedures Manual
  - Standard Operating Procedures (SOPs)
- Data Management
  - Access Database
  - Quarterly newsletters & Annual report

What and Why

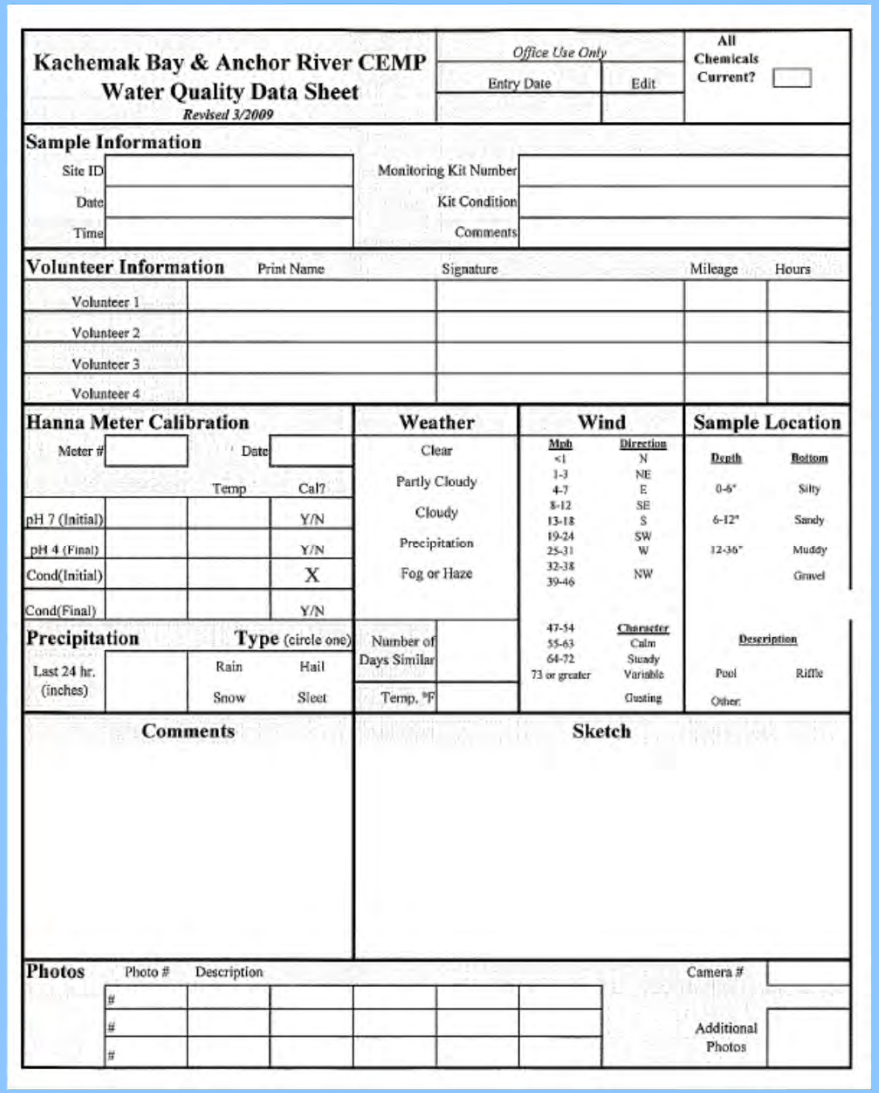
Field Observations

- Air Temperature
- Wind & Weather
- Water Surface & Substrate
- Comments & Observations
- Photos & Sketches

Water Quality Parameters

- *Color*
- Turbidity (Clarity)
- Water Temperature
- pH
- Conductivity
- Dissolved Oxygen
- Coliform Bacteria

Recording your data



Kachemak Bay & Anchor River CEMP
Water Quality Data Sheet
Revised 3/2009

Office Use Only — Entry Date | Edit

All Chemicals Current? ☐

Sample Information

Site ID | Monitoring Kit Number
Date | Kit Condition
Time | Comments

Volunteer Information

	Print Name	Signature	Mileage	Hours
Volunteer 1				
Volunteer 2				
Volunteer 3				
Volunteer 4				

Hanna Meter Calibration

Meter # | Date

	Temp	Cal?
pH 7 (Initial)		Y/N
pH 4 (Final)		Y/N
Cond(Initial)		X
Cond(Final)		Y/N

Weather

Clear | Partly Cloudy | Cloudy | Precipitation | Fog or Haze

Wind

Mph	Direction
<1	N
1-3	NE
4-7	E
8-12	SE
13-18	S
19-24	SW
25-31	W
32-38	NW
39-46	
47-54	
55-63	
64-72	
73 or greater	

Character: Calm | Steady | Variable | Gusting

Sample Location

Depth	Bottom
0-6"	Silty
6-12"	Sandy
12-36"	Muddy
	Gravel

Description: Pool | Riffle | Other:

Precipitation — Type (circle one): Rain | Hail | Snow | Sleet

Last 24 hr. (inches) | Number of Days Similar | Temp. °F

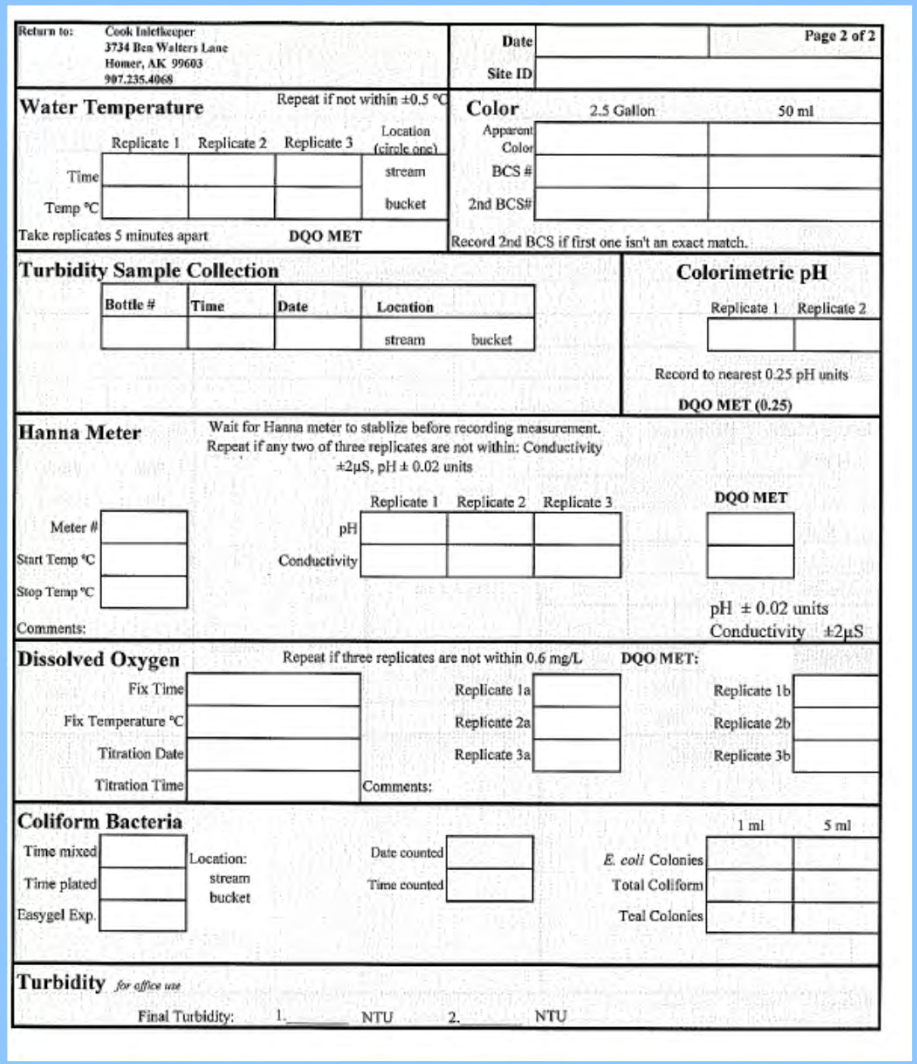
Comments

Sketch

Photos — Photo # | Description | Camera #

#
#
#

Additional Photos



Return to: Cook Inletkeeper, 3734 Ben Walters Lane, Homer, AK 99603, 907.235.4068

Date | Site ID | Page 2 of 2

Water Temperature — Repeat if not within ±0.5 °C

	Replicate 1	Replicate 2	Replicate 3	Location (circle one)
Time				stream
Temp °C				bucket

Take replicates 5 minutes apart — DQO MET

Color

	2.5 Gallon	50 ml
Apparent Color		
BCS #		
2nd BCS#		

Record 2nd BCS if first one isn't an exact match.

Turbidity Sample Collection

Bottle #	Time	Date	Location
			stream bucket

Colorimetric pH

Replicate 1	Replicate 2

Record to nearest 0.25 pH units

DQO MET (0.25)

Hanna Meter

Wait for Hanna meter to stablize before recording measurement.
Repeat if any two of three replicates are not within: Conductivity ±2µS, pH ± 0.02 units

Meter # | Start Temp °C | Stop Temp °C

	Replicate 1	Replicate 2	Replicate 3	DQO MET
pH				
Conductivity				

pH ± 0.02 units
Conductivity ±2µS

Comments:

Dissolved Oxygen — Repeat if three replicates are not within 0.6 mg/L — DQO MET:

Fix Time | Fix Temperature °C | Titration Date | Titration Time

Replicate 1a | Replicate 2a | Replicate 3a
Replicate 1b | Replicate 2b | Replicate 3b

Comments:

Coliform Bacteria

Time mixed | Time plated | Easygel Exp.

Location: stream bucket

Date counted | Time counted

	1 ml	5 ml
E. coli Colonies		
Total Coliform		
Teal Colonies		

Turbidity *for office use*

Final Turbidity: 1._____ NTU 2._____ NTU

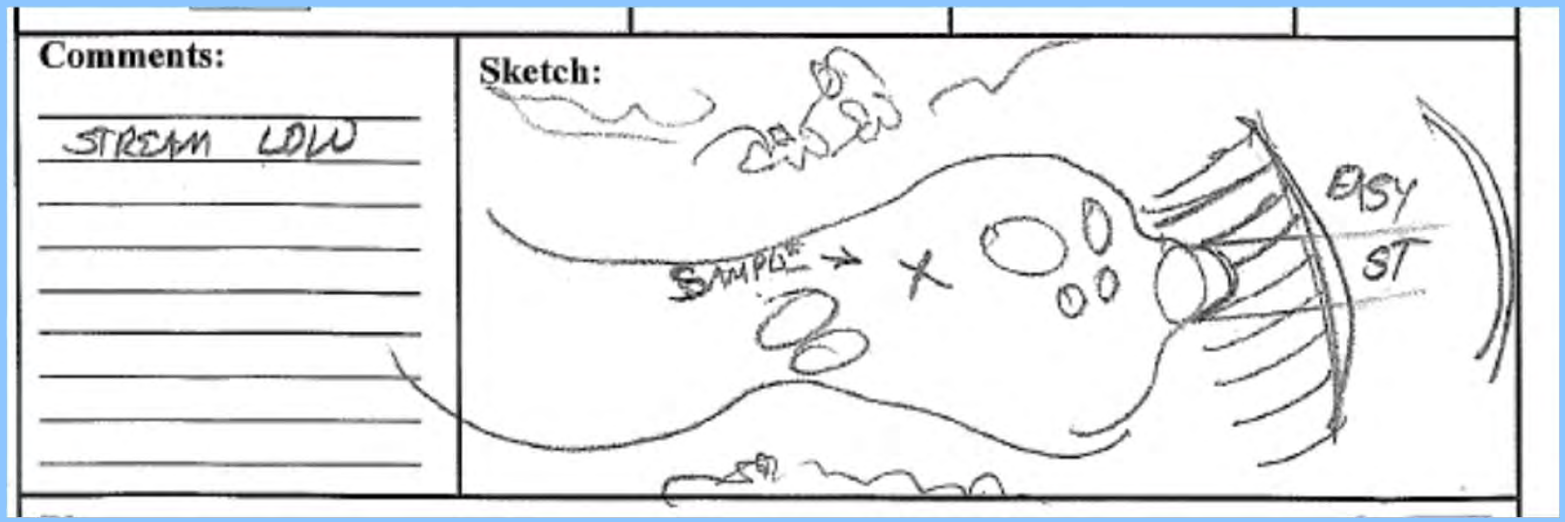
Field Observations

- Air Temperature
- Wind & Weather
- Water Surface & Substrate

Weather		Wind		Sample Location	
Clear		Mph	Direction	Depth	Bottom
Partly Cloudy		<1	N	0-6"	Silty
Cloudy		1-3	NE	6-12"	Sandy
Precipitation		4-7	E	12-36"	Muddy
Fog or Haze		8-12	SE		Gravel
		13-18	S		
		19-24	SW		
		25-31	W		
		32-38	NW		
		39-46			
Number of Days Similar		47-54	Character	Description	
		55-63	Calm		
		64-72	Steady		
		73 or greater	Variable	Pool	Riffle
Temp. °F			Gusting	Other:	

Precipitation		Type (circle one)	
Last 24 hr. (inches)		Rain	Hail
		Snow	Sleet

Comments & Sketches…



Site Photos

- New system this year – quarterly photos
- Inletkeeper has a Flickr site for storage

Water Quality Parameters

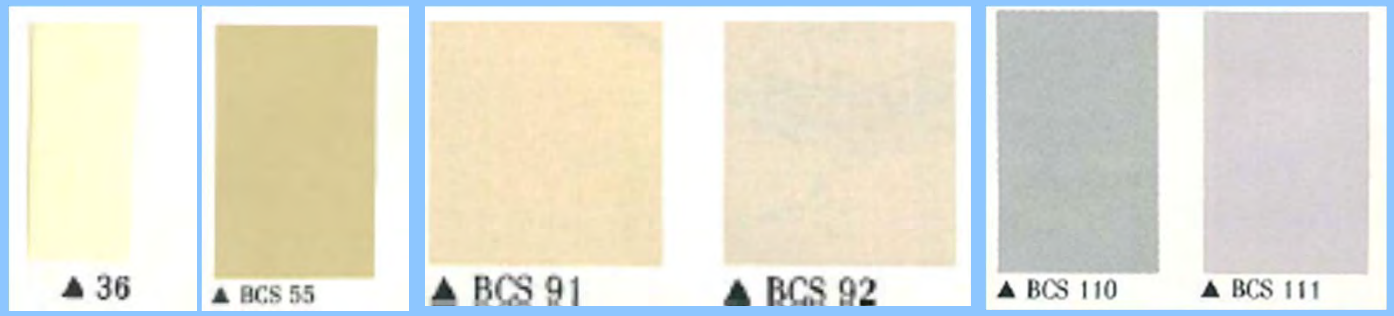
- Color
- Turbidity (Clarity)
- Water Temperature
- pH
- Conductivity
- Dissolved Oxygen
- Coliform Bacteria

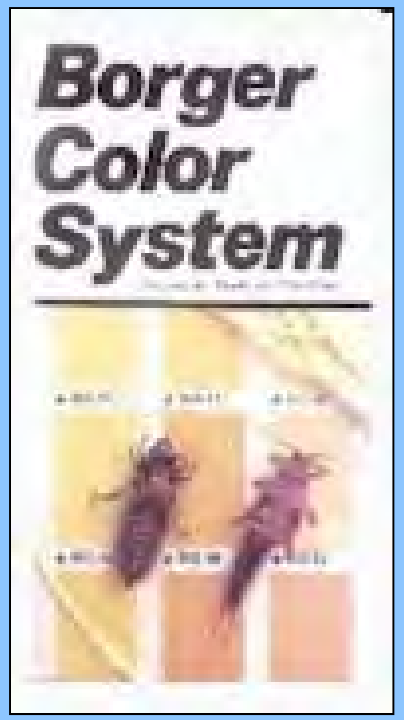
Color

- Apparent color results from dissolved substances and suspended matter
- General but useful!
- CEMP utilizes your descriptive observations of apparent color as well as the BCS#(s)

Color	2.5 Gallon	50 ml
Apparent Color		
BCS #		
2nd BCS#		

Record 2nd BCS if first one isn't an exact match.





Turbidity (clarity)

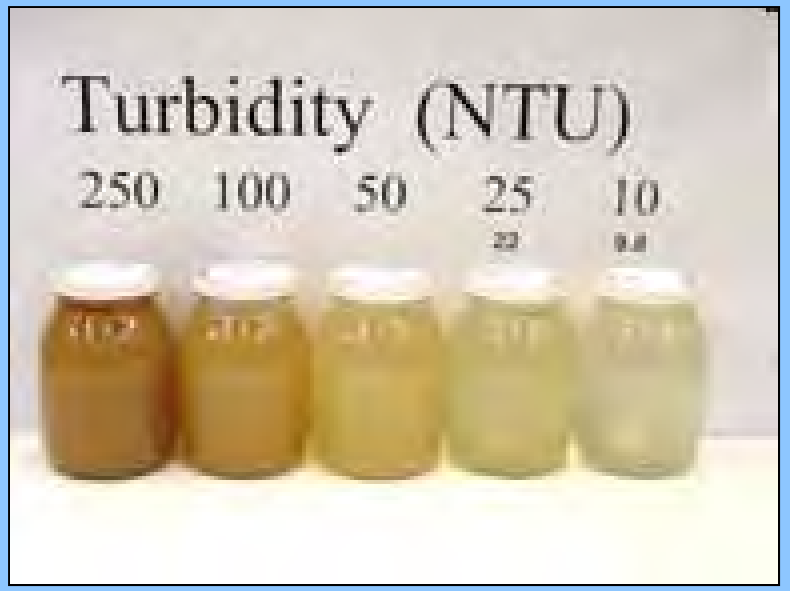
- Turbidity is a measure of how much material suspended in the water decreases the passage of light through it
- Many affects on overall stream health

Turbidity Sample Collection

Bottle #	Time	Date	Location
			stream bucket

Turbidity *for office use*

Final Turbidity: 1._____ NTU 2._____ NTU



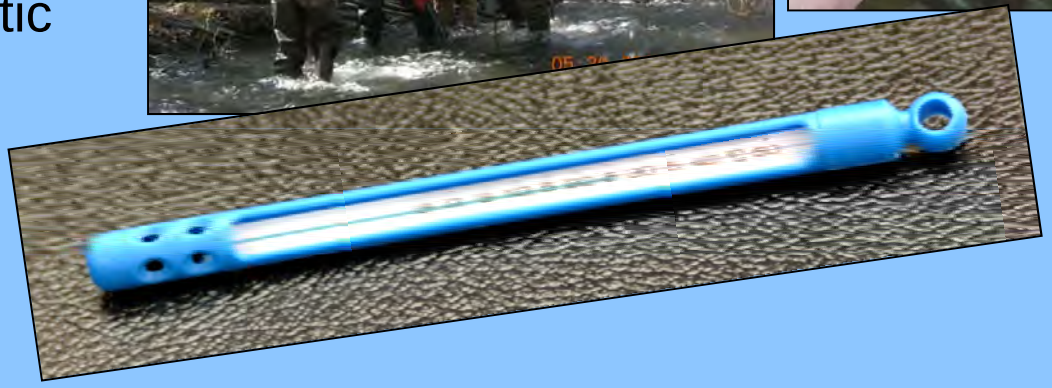
Water Temperature

- Many factors influence water temperature
  - Air temperature
  - Stream flow
  - Riparian vegetation
  - Human inputs
- Affects
  - Rate of photosynthesis
  - Organisms metabolic processes
  - Distribution of aquatic life
  - Dissolved oxygen

Water Temperature Repeat if not within ±0.5 °C

	Replicate 1	Replicate 2	Replicate 3	Location (circle one)
Time				stream
Temp °C				bucket

Take replicates 5 minutes apart **DQO MET**



pH

- A measure of how acidic or basic/alkaline a solution is
- pH ranges from 0 (acidic) to 14 (basic) and is on a *logarithmic* scale
- 6 – 8 is the pH range of most streams
- Changes in pH may be from:
  - Leaching of bedrock/soils
  - Human discharges
  - Aerosols, dusts, gasses from the air
  - Plant photosynthesis

Colorimetric pH

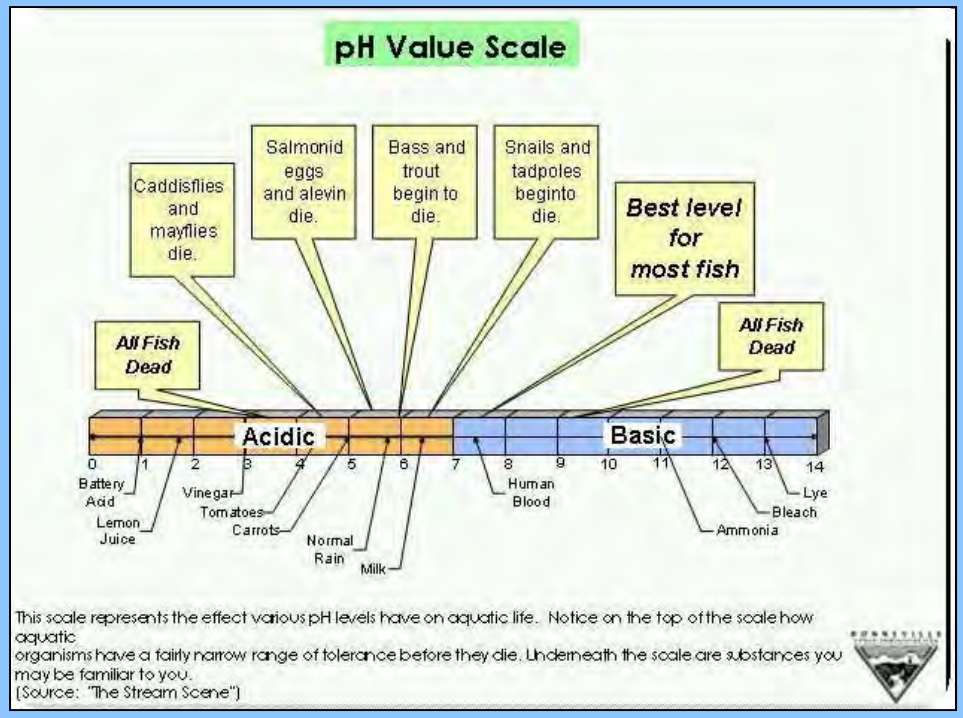
	Replicate 1	Replicate 2

Record to nearest 0.25 pH units

DQO MET (0.25)

Wait for Hanna meter to stablize before recording measurement. Repeat if any two of three replicates are not within: Conductivity ±2µS, pH ± 0.02 units

	Replicate 1	Replicate 2	Replicate 3	DQO MET
pH				



Conductivity

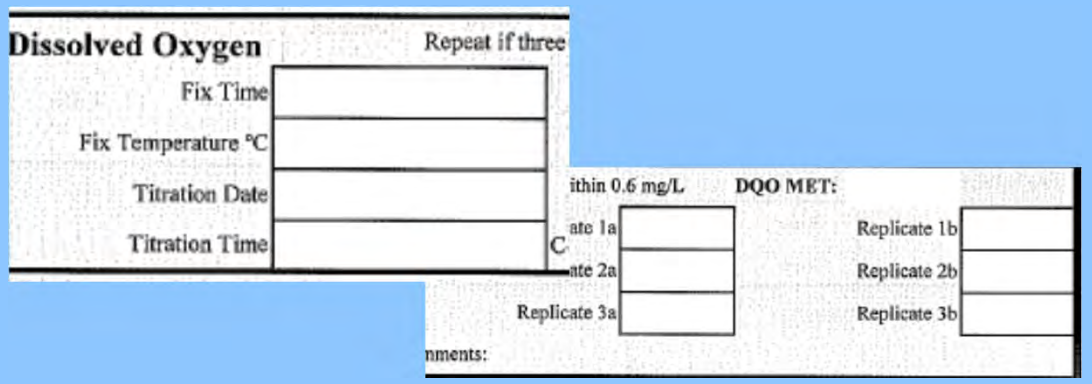
- The conductance of water (µS/cm) = total dissolved solids
- Chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium, iron, aluminum
- Geology & human inputs will change conductivity

Hanna Meter				DQO MET
Conductivity				

pH ± 0.02 units
Conductivity ±2µS

Dissolved Oxygen

- One of the most important indicators!
- Concentration (mg/l) of oxygen dissolved in the water
- Saturation & biological oxygen demand
- Influences on DO:
  - Temperature
  - Wind & waves
  - Aquatic plants
  - Urban, agricultural, organic waste discharges
  - Dams



Coliform Bacteria

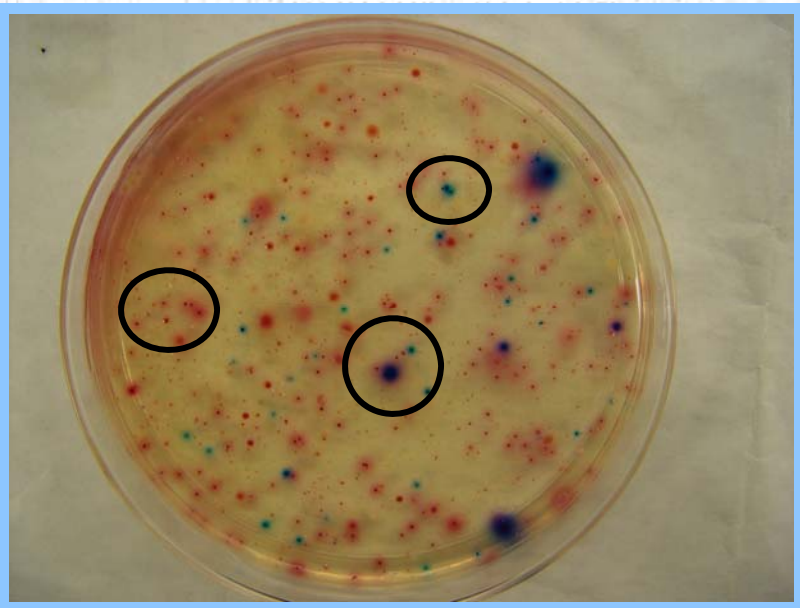
- *Indicator* bacteria of sewage pollution
  - Fecal coliform
  - *E. coli*
- Easier & far cheaper to monitor than pathogenic bacteria
- Urbanization, development, and increased population can all increase bacteria levels

Coliform Bacteria

Time mixed		Location: stream bucket
Time plated		
Easygel Exp.		

Date counted		
Time counted		

	1 ml	5 ml
E. coli Colonies		
Total Coliform		
Teal Colonies		



Volunteer Monitor Responsibilities

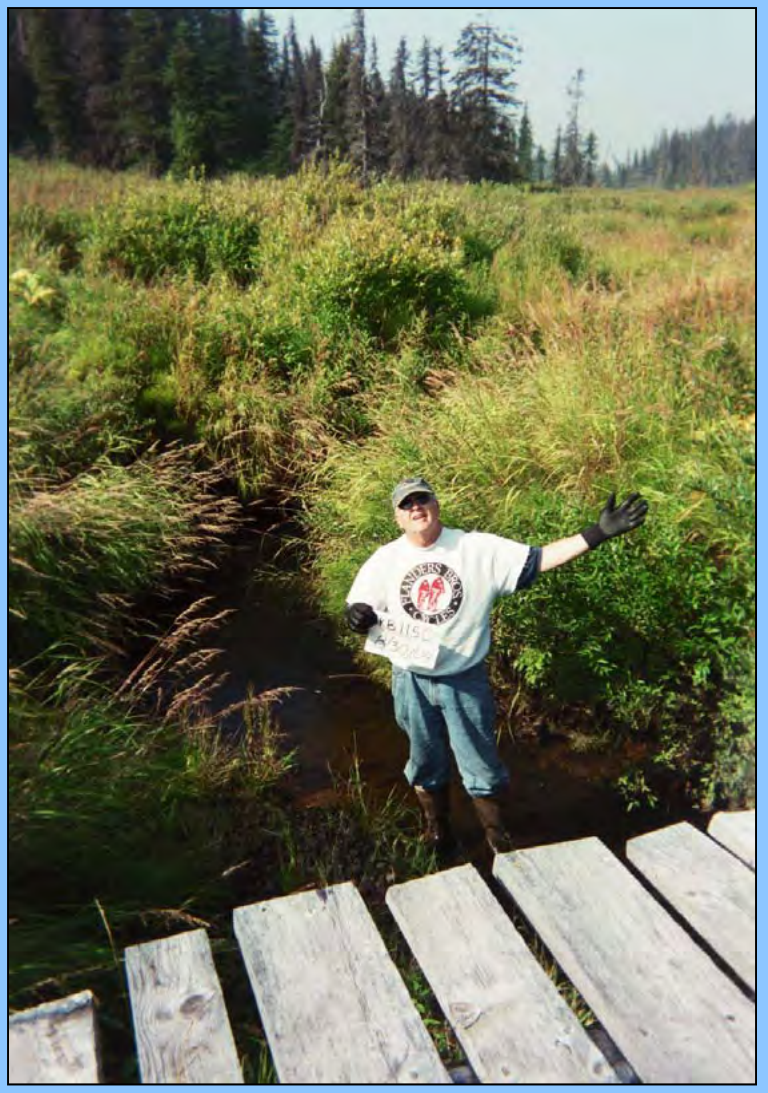
TRAINING

SAFETY

MONITORING SCHEDULE

FIELD PROCEDURES

DATA MANAGEMENT



Volunteer Monitor Responsibilities (Cont.)

RESPONSE

KIT MANAGEMENT

CHEMICAL WASTE MANAGEMENT

PERFORMANCE STANDARD

REPLICATE ANALYSIS

Monitoring Kits

When using chemicals:

Know your equipment, sampling instructions, and procedures before going out into the field.

Prepare labels and clean equipment before you get started.

Keep all equipment and chemicals away from small children. Many of the chemicals used in monitoring are poisonous.

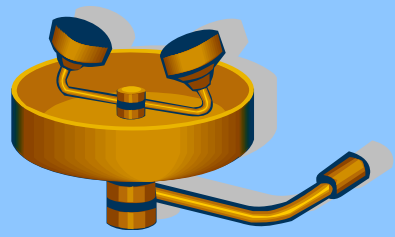
Avoid contact between chemical reagents and skin, eye, nose, and mouth.

Never use your fingers to stopper a sample bottle (e.g., when you are shaking a solution).

Wear safety goggles when performing any chemical test or handling preservatives.

Know chemical cleanup and disposal procedures.

Wipe up all spills when they occur.



Return all unused chemicals to your program coordinator for safe disposal.

Close all containers tightly after use. Do not switch caps.

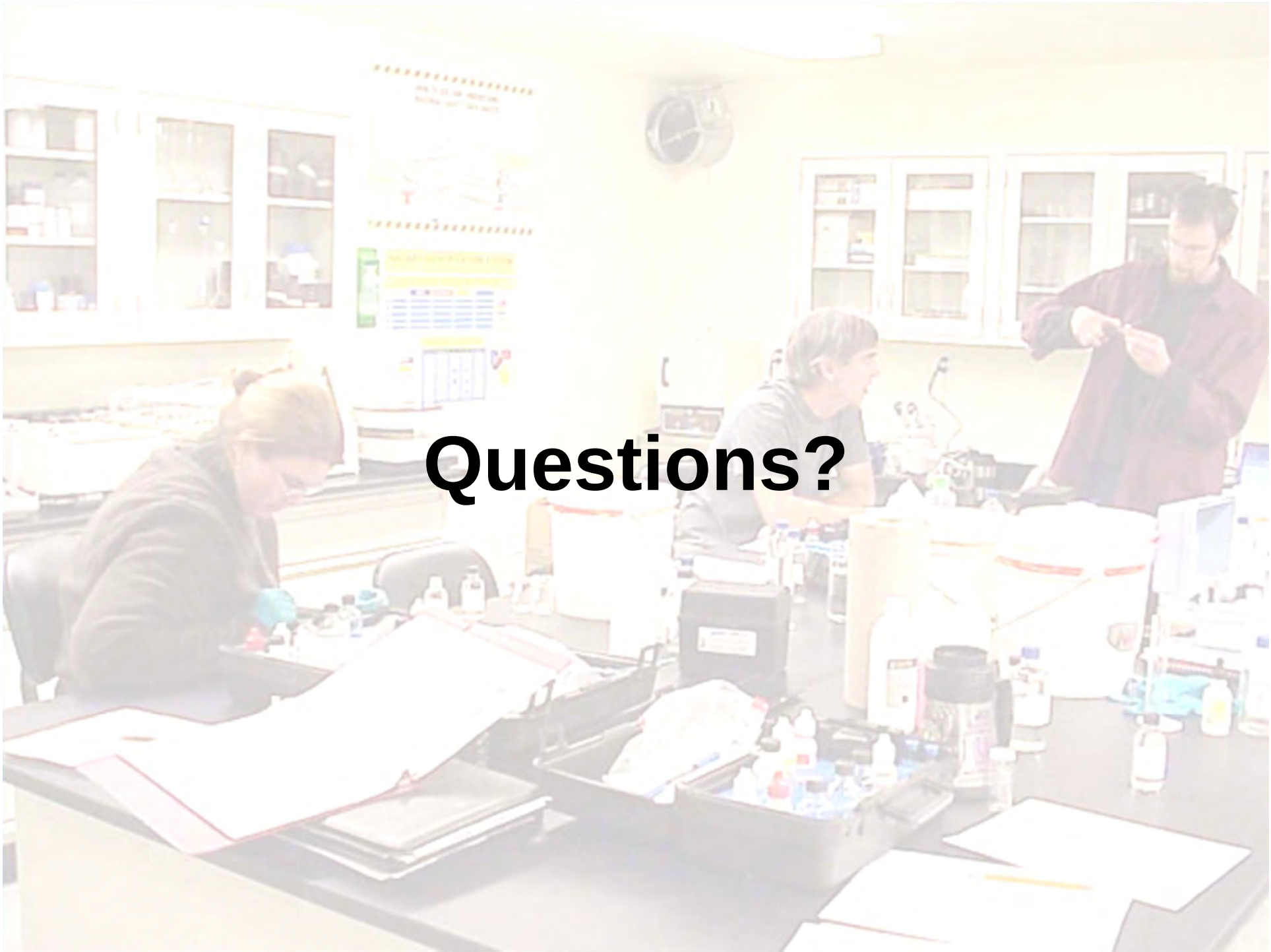
Know how to use and store chemicals.

Do not expose chemicals or equipment to temperature extremes or longterm direct sunshine.

Basic Equipment for Field Sampling

Listed below is some basic equipment appropriate for any volunteer field activity.

- Boots or waders
- "Field Clothes" - long sleeves and pants are best
- Rubber gloves
- Insect repellent/sunscreen
- Drinking water
- Clipboard
- Several pencils
- Tape measure
- Thermometer
- Field data sheet
- Camera and film, to document particular conditions


Questions?