Appendix B.

Stream and River Monitoring Data Sheets

MiCorps Site ID#:________________

Michigan Clean Water Corps

Site Sketch

Stream Name:______________________________ Location:________________________

Date:___________________ Drawn by:______________________________________

Draw a bird's-eye view of the study site. Include enough detail that you can easily find the site again! Include the following items in the sketch:

- Direction of water flow
- Which way is north
- Large wood in the water
- Vegetation
- Bank features
- Areas of erosion
- Riffles
- Pools
- Location of road
- Trees
- Fences
- Parking lots
- Buildings
- Any other notable features

0 feet

150 ft

300 ft

Datasheet version 6/22/05

STREAM HABITAT ASSESSMENT

Michigan Clean Water Corps

I. Stream, Team, Location Information

Site ID:__________________ Date:___________________ Time:____________________

Location:____

Name(s):____

II. Stream and Riparian Habitat

A. General Information *Circle one or more answers as appropriate*							Notes and Observations: Give further explanation when needed.
1	Average Stream Width (ft)	< 10	10-25	25-50	>50		
2	Average Stream Depth (ft)	<1	1-3	>3	>5		
3	Has this stream been channelized? (Stream shape constrained through human activity- look for signs of dredging, armored banks, straightened channels)	Yes, currently	Yes, sometime in the past	No	Don't know		
4	Estimate of current stream flow	Dry or Intermittent	Stagnant	Low	Medium	High	
5	Highest water mark (in feet above the current level)	<1	1-3	3-5	5-10	>10	
6	Which of these habitat types are present?	Riffles	Deep Pools	Large woody debris	Large rocks	Undercut bank	
		Overhanging vegetation	Rooted Aquatic Plants	Other:	Other:	Other:	
7	Estimate of turbidity	Clear	Slightly Turbid (can partially see to bottom)		Turbid (cannot see to bottom)		
8	Is there a sheen or oil slick visible on the surface of the water?	No	Yes				
9	If yes to #8, does the sheen break up when poked with a stick?	Yes (sheen is most likely natural)		No (sheen could be artifical)			
10	Is there foam present on the surface of the water?	No	Yes				
11	Is yes to #10, does the foam feel gritty or soapy?	Gritty (foam is most likely natural)		Soapy (foam could be artifical)			
The following are optional measurements not currently funded by MiCorps							
8	Water Temperature						
9	Dissolved Oxygen						
10	pH						
11	Water Velocity						

MiCorps Site ID#:___________ Date:_________________

Michigan Clean Water Corps

II. Stream and Riparian Habitat (continued)

D. Plant Community

Estimate the percentage of the stream covered by overhanging vegetation ________%

Using the given scale, estimate the relative abundance of the following:

Plants in the stream:		*Plants on the bank/riparian zone:*	
Algae on Surfaces of Rocks or Plants	Filamentous Algae (Streamers)	Shrubs	Trees
Macrophytes (Standing, Floating Plants)	**0= Absent 1= Rare 2= Common 3= Abundant 4= Dominant**	Grasses	**0= Absent 1= Rare 2= Common 3= Abundant 4= Dominant**
Identified species (optional)		Identified species (optional)	

E. Riparian Zone

The riparian zone is the vegetated area that surrounds the stream. Right/Left banks are identified by looking downstream.

1. Left Bank

Circle those land-use types that you can see from this stream reach.

Wetlands Forest Residential Lawn Park Shrub, Old Field Agriculture

Construction Commercial Industrial Highways Golf Course Other___________

2. Right Bank

Circle those land-use types that you can see from this stream reach.

Wetlands Forest Residential Lawn Park Shrub, Old Field Agriculture

Construction Commercial Industrial Highways Golf Course Other___________

3. Summarize the size and quality of the riparian zone along each bank separately on a scale of 1 through 10, by circling a value below.

Excellent	Good	Marginal	Poor
Width of riparian zone >150 feet, dominated by vegetation, including trees, understory shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.	Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.	Width of riparian zone ,10 feet; little or no riparian vegetation due to human activities.
LEFT BANK 10 - 9	LEFT BANK 8 - 7 - 6	LEFT BANK 5 - 4 - 3	LEFT BANK 2 - 1 - 0
RIGHT BANK 10 - 9	RIGHT BANK 8 - 7 - 6	RIGHT BANK 5 - 4 - 3	RIGHT BANK 2 - 1 - 0

MiCorps Site ID#:___________ Date:_________________

Michigan Clean Water Corps

III. Sources of Degradation

1. In what ways is this stream degraded, if any?

2. Does a team need to come out and collect trash?

3. Based on what you can see from this location, what are the potential causes and level of severity of this degradation? Only judge what you can see from the site.

(Severity: S – slight; M – moderate; H – high) (Indicate all that apply)							
Crop Related Sources	S	M	H	Land Disposal	S	M	H
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry)	S	M	H
Highway/Road/Bridge Maintenance and Runoff	S	M	H	Resource Extraction (Mining)	S	M	H
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H
Dredging	S	M	H	• Golf Courses	S	M	H
Removal of Riparian Vegetation	S	M	H	• Marinas/Recreational Boating (water releases)	S	M	H
Bank and Shoreline Erosion/ Modification/Destruction	S	M	H	• Marinas/Recreational Boating (bank or shoreline erosion)	S	M	H
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H
Invasive Species	S	M	H	Industrial Point Source	S	M	H
Construction: Highway, Road, Bridge, Culvert	S	M	H	Municipal Point Source	S	M	H
Construction: Land Development	S	M	H	Natural Sources	S	M	H
Urban Runoff	S	M	H	Source(s) Unknown	S	M	H

Additional comments:

MiCorps Site ID#:___________ Date:_________________

Michigan Clean Water Corps

IV. Optional quantitative measurements

A. Transects and Pebble Counts

To take quantitative stream habitat measurements, conduct 5-10 transects of your stream reach. Required equipment: tape measure long enough to stretch across the stream, and graduated rod or stick to measure water depth. Data sheet is on the next page.

Directions:
1) Determine stream width.
2) Use the rod to measure depth (D) and substrate (S) at more than 10 but less than 20 regular intervals along the entire transect. (For streams less than 10 feet wide, measure every ½ foot, for streams about 10 feet wide, measure every foot, etc.)
3) At every depth measurement, identify the <u>single</u> piece of substrate that the rod lands on (can be arbitrary).
4). For every measurement, enter the reading on the tape measure, the depth, and the substrate on the data sheet on the next page.

Data use: The depth and tape measure reading can be used to produce stream cross-section profiles. The pebble count can be used to give a more accurate percentage breakdown of the stream substrate than simply making an eyeball estimate (see Section II-B).

B. Bank Height

Vertical banks higher than 3 feet are usually unstable, while banks less than 1 foot, especially with overhang, provide good habitat for fish. While doing the transects, measure the bank heights and record the angle of the bank (right, acute, or obtuse) as indicated on the data sheet. Left/right banks are identified by looking downstream.

Data use: Calculate the percentage of banks with right, obtuse, and acute angles. Right angles indicate higher erosive potential, while acute angles improve the habitat structure of a stream.

V. Final Check

This data sheet was checked for completeness by: ________________________________

Name of person who entered data into data exchange: ____________________________

Date of data entry:____

VI. Credits

This habitat assessment was created for the MiCorps Volunteer Stream Monitoring Program from a combination of habitat assessments from the Huron River Watershed Council, the Friends of the Rouge River, and the Michigan Department of Environmental Quality. Version 1.0, June 2009.

MiCorps Site ID#:___________ Date:_________________

Michigan Clean Water Corps

STREAM TRANSECT DATASHEET

B: Boulder -- more than 10"
C: Cobble -- 2.5 - 10"
G: Gravel – 0.1 – 2.5"
S: Sand -- fine particles, gritty

F: Fines: Silt/Detritus/Muck
H: Hardpan/Bedrock
A: Artificial
O: Other (specify)

T= Reading on tape
D = Depth
S = Substrate

	EXAMPLE			Transect #			Transect #			Transect#		
Stream Width	13.3 feet											
	T	D	S	T	D	S	T	D	S	T	D	S
Beginning Water's Edge:	1.5											
1	2.5	0.4	G									
2	3.5	0.4	G									
3	4.5	0.4	G									
4	5.5	0.2	C									
5	6.5	0	S									
6	7.5	0.6	S									
7	8.5	0.7	G									
8	9.5	0.7	G									
9	10.5	0.6	C									
10	11.5	0.7	B									
11	12.5	0.4	G									
12	13.5	0.3	F									
13	14.5	0.2	F									
14												
15												
16												
17												
18												
19												
Ending Water's Edge	14.8											
Bank Side	L	R		L	R		L	R		L	R	
Bank Height	1.7 feet	0.5 feet										
Does the bank have an undercut?	N	Y										
If so, how wide is it?		1 ft										
Bank Angles: Sketch												

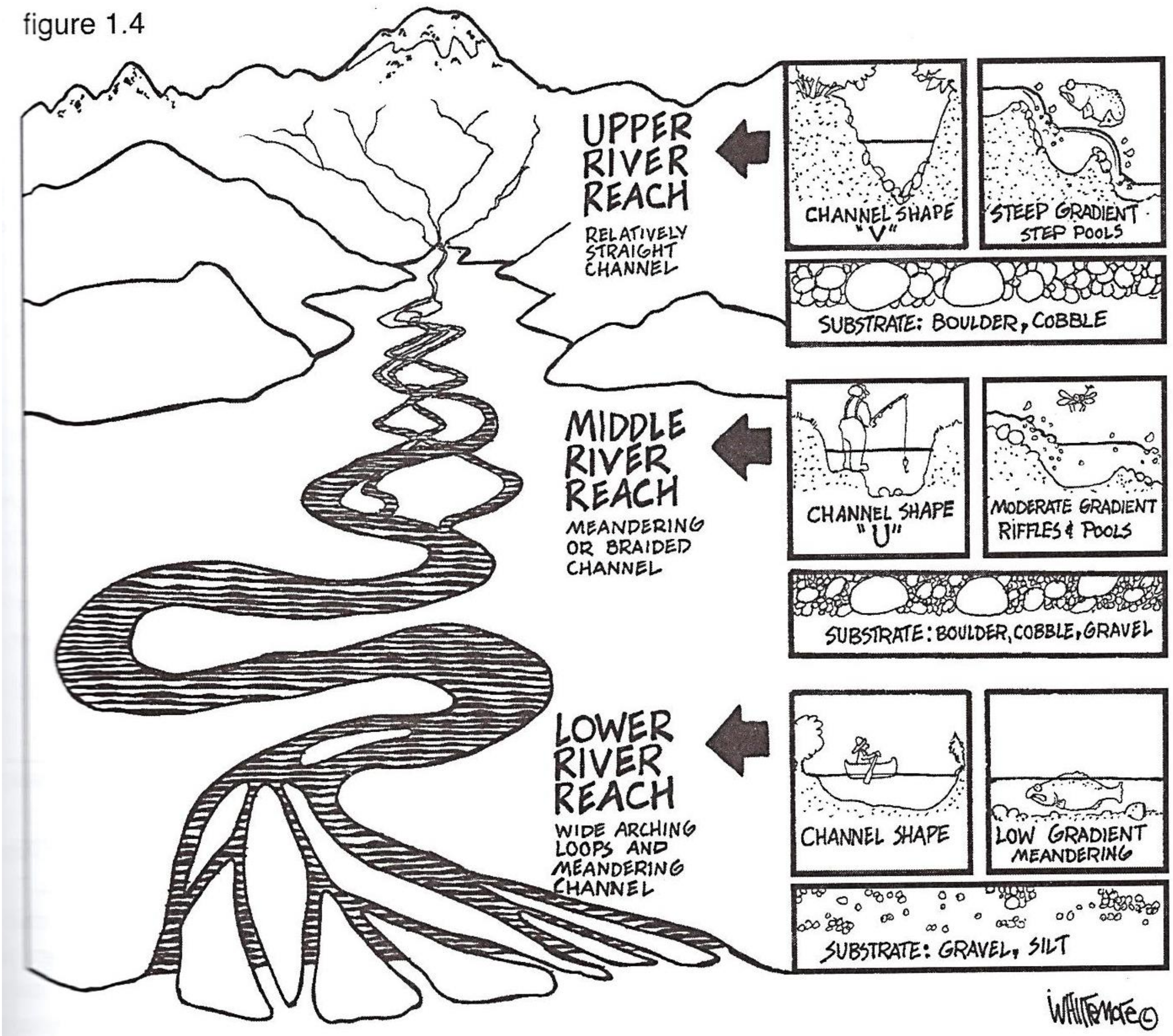
Sketch examples:

Undercut (Acute) Obtuse Right

River System

Source: Streamkeepers Field Guide

figure 1.4



Rain Gauge Journal

Date	Time(s)	Reading(s)	24 Hour Total Rainfall (inches)	Comments

DATA SHEET 5 FLOW - METHOD I

(for streams greater than 3 feet wide)

Name__________________ **Group**________________ **Date**________ **Time**__________

Stream Name____________ **Reach Name/#**______________ **Site Name**______________

Site Location: Latitude___ °___ '___ " N River mile:________
Longitude___ °___ '___ " W Transect #:________

Driving/Hiking directions:____

Site Description: (e.g. transect #, landmarks, etc.) ______________________________

Weather Conditions: ❒ Clear ❒ Cloudy ❒ Rain ❒ Other ________________
Air Temperature: ______°___ (F or C)

Amount of precipitation in last storm___________ Time elapsed since last storm________

Other recent weather information____

Velocity Float Trials:

Trial #	Time
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

Distance: [ ]

[/] = [ ]

total time/# of trials   avg. time

Cross Sectional Area:

Record depths at one-foot intervals Depth = D

Cross Section 1				Cross Section 2				Cross Section 3			
#	D	#	D	#	D	#	D	#	D	#	D
1		11		1		11		1		11	
2		12		2		12		2		12	
3		13		3		13		3		13	
4		14		4		14		4		14	
5		15		5		15		5		15	
6		16		6		16		6		16	
7		17		7		17		7		17	
8		18		8		18		8		18	
9		19		9		19		9		19	
10		20		10		20		10		20	

([ ] + [ ] + [ ]) / 3 =

sum   sum   sum

Average Cross Sectional Area = [ ] ft²

(Multiply sums by 2 if depths were measured in 2 ft.intervals)

Average Surface Velocity = [/] = [ ] X (0.8) = **Average Corrected Velocity** = [ ]

distance/avg. time   feet/sec.   velocity correction factor

Flow = [ ] **ft./sec. X** [ ] **ft.²** = [ ] **CFS**

Avg. Corrected Velocity   Avg.Cross Sectional Area   (cubic feet/second)

DATA SHEET 5 FLOW - METHOD II (PAGE 2 OF 3)

(for streams up to three feet wide)

Name__________________ **Group**_______________ **Date**________ **Time**_________

Stream Name___________ **Reach Name/#**__________ **Site Name**______________

Site Location: Latitude___ °___ '___ " N River mile:_______
Longitude___ °___ '___ " W Transect #:_______

Site Description: (e.g. transect #, landmarks, etc.)________________________________
Driving/Hiking Directions____

Weather Conditions: ❐ Clear ❐ Cloudy ❐ Rain ❐ Other ________________
Air Temperature: _____°___ (C or F)
Amount of precipitation in last storm_________ Time elapsed since last storm__________
Other recent weather information____

Velocity Float Trials:

trial #	time
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Distance [ ]

[/] = [ ]
sum/# of trials avg time

Average Surface Velocity = [/] = ______
distance/avg. time feet/sec.

Average Corrected Velocity = ______ X (0.8) = [ ]
feet/sec velocity correction factor feet/sec

Use Average Corrected Velocity to calculate Flow, using formula on page 3 bottom of following page.

DATA SHEET 5 FLOW - METHOD II (CONTINUED) (PAGE 3 OF 3)

Cross Sectional Area

Use Average Cross Sectional Area to calculate Flow, using formula on bottom of this page.

Cross Section 1

1	
2	
3	

avg. depth = ______ / 3 = ______
sum feet

Area$_1$ = ______ x ______ = ______ ft^2
avg. depth width

Cross Section 2

1	
2	
3	

avg. depth = ______ / 3 = ______
sum feet

Area$_2$ = ______ x ______ = ______ ft^2
avg. depth width

Cross Section 3

1	
2	
3	

avg. depth = ______ / 3 = ______
sum feet

Area$_3$ = ______ x ______ = ______ ft^2
avg. depth width

Average Cross Sectional Area =

______ **Area$_1$**

\+

______ **Area$_2$**

\+

______ **Area$_3$** /3

= ______ **feet^2**

Flow = ______ X ______ = ______
Avg. Corrected Velocity | Avg.Cross Sectional Area | **CFS** (cubic feet/second)

Turbidity Tube

1. Collect a surface water sample.

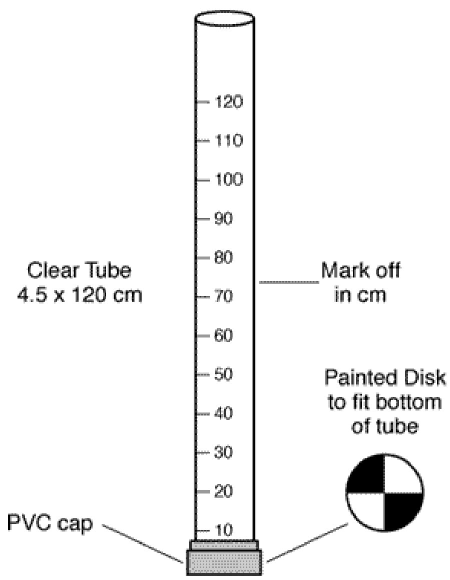
2. Stand with your back to the sun so that the transparency tube is shaded. Pour sample water slowly into the tube using a cup. Look straight down into the tube with your eye closed to the tube opening. Stop adding water when you cannot see the pattern at the bottom of the tube.

4. Rotate the tube slowly as you look to make sure you cannot see any of the pattern.

5. Record the depth of water in the turbidity tube to the nearest cm. Note: If you can still see the disk on the bottom of the tube after the tube is filled, record the depth as >120 cm.

6. Pour the water from the tube back into the sample bucket or mix up the remaining sample.

7. Repeat the measurement two more times with different observers using the same sample).



Site:	
Date:	
Time:	
Trial	**Water Depth**
1	
2	
3	
Average	

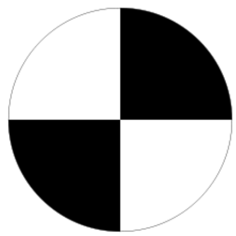
Source: Global Learning and Observations to Benefit the Environment (GLOBE)

Constructing a Turbidity Tube

To make a turbidity tube:

1. Obtain a 3-4-foot clear tube such as a fluorescent light protector and a flat surface PVC cap that will fit on the tube.

2. In the inside of the cap, draw the following pattern with black and white water proof paint. Or alternatively, create a waterproof disk that is placed on the bottom of the PVC cap.



3. Put a PVC cap over one end of the 3-4-foot clear tube. The cap should fit tightly so water cannot leak out. The cap may need to be sealed.

4. Use a marker and meter stick to make a scale on the side of the tube, beginning with 0 cm at the top of the disk to 120 cm at the top of the tube.

Total Suspended Solids (TSS)

Total suspended solids (**TSS**) include all particles suspended in water which will not pass through a filter. Suspended solids are present in sanitary wastewater and many types of industrial wastewater. There are also nonpoint sources of suspended solids, such as soil erosion from agricultural and construction sites.

As levels of TSS increase, a water body begins to lose its ability to support a diversity of aquatic life.

- Suspended solids absorb heat from sunlight, which increases water temperature and subsequently decreases levels of dissolved oxygen (warmer water holds less oxygen than cooler water). Some cold water species, such as trout and stoneflies, are especially sensitive to changes in dissolved oxygen.
- Photosynthesis also decreases, since less light penetrates the water. As less oxygen is produced by plants and algae, there is a further drop in dissolved oxygen levels. TSS can also destroy fish habitat because suspended solids settle to the bottom and can eventually blanket the river bed.
- Suspended solids can smother the eggs of fish and aquatic insects, and can suffocate newly-hatched insect larvae. Suspended solids can also harm fish directly by clogging gills, reducing growth rates, and lowering resistance to disease. Changes to the aquatic environment may result in a diminished food sources, and increased difficulties in finding food. Natural movements and migrations of aquatic populations may be disrupted.

For point sources, adequate treatment is necessary to insure that suspended solids are not present at levels of concern in waters of the state. Treatment typically consists of settling prior to discharge of the wastewater. Settling allows solids to sink to the bottom, where they can be removed.

For nonpoint sources, control measures should be implemented to reduce loadings of suspended solids to streams, rivers and lakes. Farming practices such as no-till minimize soil erosion and help protect water quality. For construction sites, controls such as silt fences and sedimentation basins are designed to prevent eroding soils from reaching surface waters. In urban areas, storm water retention ponds or a regular schedule of street sweeping may be effective in reducing the quantity of suspended solids in storm water run-off.

Water Quality Standards for Total Suspended Solids
Rule 50 of the Michigan Water Quality Standards (Part 4 of Act 451) states that waters of the state shall not have any of the following unnatural physical properties in quantities which are or may become injurious to any designated use: turbidity, color, oil films, floating solids, foam, settleable solids, suspended solids, and deposits. This kind of rule, which does not establish a numeric level, is known as a "narrative standard."

Most people consider water with a TSS concentration less than 20 mg/l to be clear. Water with TSS levels between 40 and 80 mg/l tends to appear cloudy, while water with concentrations over 150 mg/l usually appears dirty. The nature of the particles that comprise the suspended solids may cause these numbers to vary. As articulated in the Lower Grand River Watershed Management Plan, an informal MDEQ target is 80 mg/L TSS for wet weather events. Plaster Creek has a goal for TSS of 30 mg/L instead of 80 mg/L.

Source: http://www.michigan.gov/documents/deq/wb-npdes-TotalSuspendedSolids_247238_7.pdf

Formula for determining suspended solids:

$$TSS\ (mg/L) = ([A-B]*1000)/C$$

Where A = End weight of the filter, g

B = Initial weight of the filter, g

C = Volume of water filtered, L

Preparing your filters

1. Rinse three filters with 20-30 mL DI to remove any solids that may remain from the manufacturing process. Place the filters in separate, labeled aluminum weight pans, dry them in a 103C oven for 30 minutes, place them (filter and pan) in a desiccator, and obtain a constant weight by repeating the oven and desiccation steps.

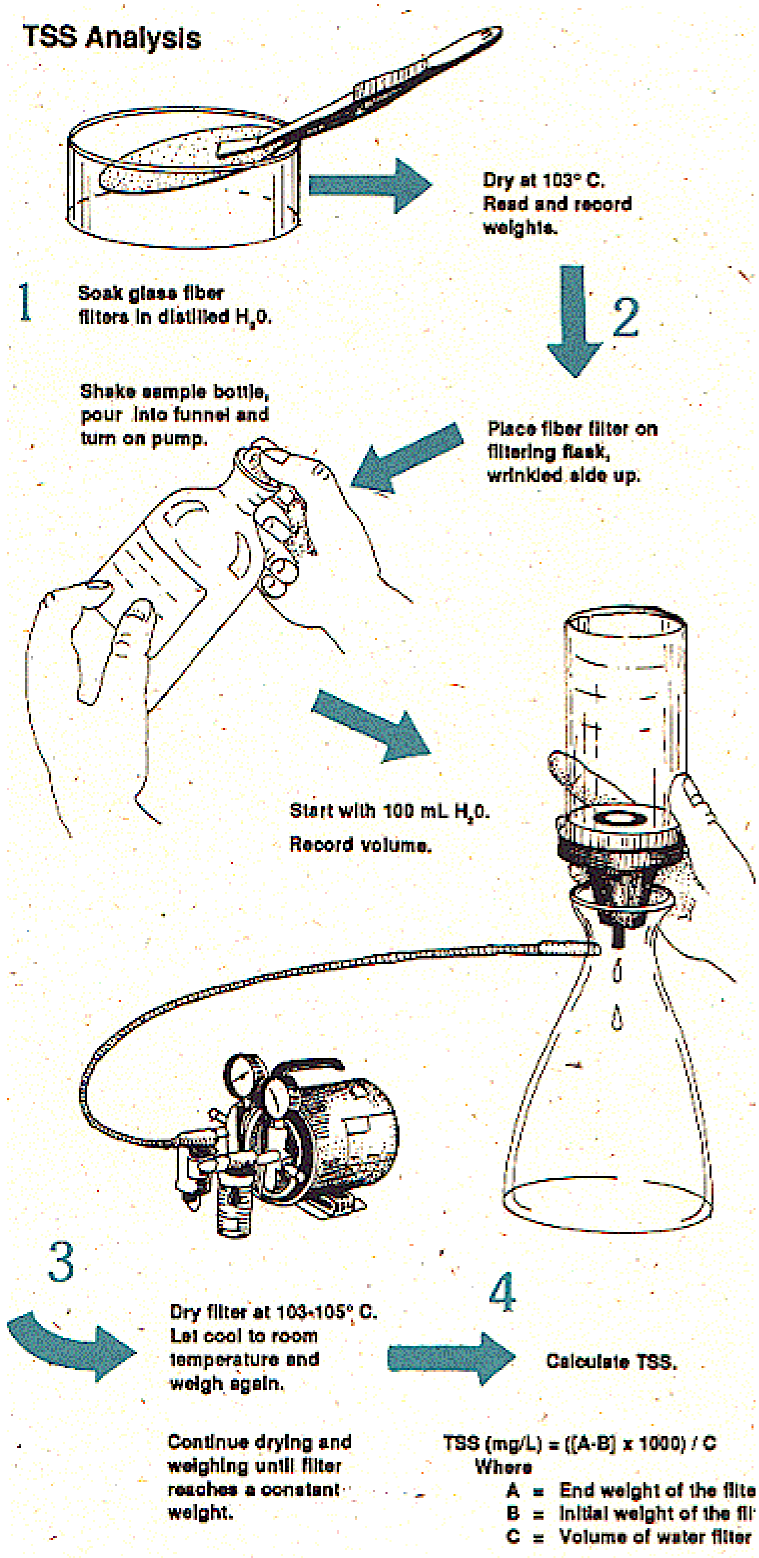
Obtaining the TSS measurement

2. Filter 100.mL of sample through each pre-weighed filter.

3. Place each paper in its aluminum weight pan in the 103 C oven for 1 hour. Cool the filter and pan in a desiccator and obtain a constant weight by repeating the drying and desiccation steps.

Hints for success:

- Always, ALWAYS completely mix your sample before removing any solution/ suspension. The soil/sediment particles will settle and bias your results if you do not completely mix the sample every time you remove an aliquot.
- Perform all measurements in triplicate.
- Carefully clean all containers and pre
- Wash all filters with DI water prior to use.
As the procedure notes, you must heat filters to the maximum temperature that you will use experimentally, before filtering. Also as noted in the procedures, you must obtain a constant weight (generally within 0.5 mg) before you end each experiment.



Source: Washington Department of Ecology, http://www.ecy.wa.gov/programs/wq/plants/management/joysmanual/4tss.html

Water Temperature

1. Collect your water sample in a bucket.

2. Attach a rubber band attached to a string to the thermometer. Slip the rubber band around your wrist so that the thermometer is not accidentally lost or dropped into the water.

3. Check the alcohol column on your thermometer to make sure there are no air bubbles trapped in the liquid.

4. Put the bulb end of the thermometer into the sample water to a depth of 10 cm.

5. Leave the thermometer in the water for three minutes.

6. Read the temperature without removing the bulb of the thermometer from the water.

7. Let the thermometer stay in the water sample for one more minute.

8. Read the temperature again. If the temperature has not changed, go to Step 9. If the temperature has changed since the last reading, repeat Step 7 until it stays the same.

9. Record the temperature on a data sheet.

10. Have two other students repeat the measurement with new water samples.

11. Calculate the average of the three measurements. All temperatures should be within 1.0˚ C of the average. If not, repeat the measurement.

Site:	
Date:	
Time:	
Trial	**Water Temperature ^{0}C**
1	
2	
3	
Average	

Instrument Maintenance

Alcohol-filled Thermometers

1. For safety, use an alcohol thermometer with plastic or metal casing or a probe.
2. Make sure that the string and rubber band attached to the thermometer is secure.
2. Store the thermometer upright in a beaker or other holder. Storing the thermometer on its end prevents the alcohol column from separating.
3. Make sure that the alcohol column is continuous and has not become separated.

Source: Global Learning and Observations to Benefit the Environment (GLOBE)

Stream Crossing Data Sheet

Site ID: ______

General Information

Stream Name: ______ Road Name: ______

Name of Observer(s): ______ Date: ______

GPS Waypoint: ______ GPS Lat/Long: ______

County: ______ Township: ______ Range: ______ Sec: ______

Adjacent Landowner Information: ______ Additional Comments: ______

Crossing Information

Crossing Type: Culvert(s) no.: ______ Bridge Ford Dam Other: ______

Structure Shape: Round Square/Rectangle Open Bottom Square/Rectangle Pipe Arch Open Bottom Arch Ellipse

Inlet Type: Projecting Mitered Headwall Apron Wingwall 10-30° or 30-70° Trash Rack Other

Outlet Type: At Stream Grade Cascade over Riprap Freefall into Pool Freefall onto Riprap Outlet Apron Other

Structure Material: Metal Concrete Plastic Wood

Substrate in Structure: None Sand Gravel Rock Mixture

General Condition: New Good Fair Poor

Plugged: ______ % Inlet Outlet In Pipe

Crushed: ______ % Inlet Outlet In Pipe

Rusted Through? Yes No Structure Interior: Smooth Corrugated

Multiple Culverts/Spans

Number the culverts/spans left to right, facing downstream. Include #s in site sketch on back page

Culvert/ Span #	Width (ft)	Length (ft)	Height (ft)	Material

Structure Length (ft):[1] ______ Structure Width (ft):[1] ______ Structure Height (ft):[1] ______

Structure Water Depth (ft):[1] inlet ______ outlet ______ Perch Height (ft):[1] ______ or NA

Embedded Depth of Structure (ft):[1] inlet ______ outlet ______

Structure Water Velocity (ft/sec):[1] inlet ______ outlet ______

Structure Water Velocity Measured: At Surface or ______ ft Below Surface Measured With: Meter or Float Test

Stream Information

Stream Flow: None < ½ Bankfull < Bankfull = Bankfull > Bankfull

Scour Pool (if present) Length: ____ Width: ____ Depth: ____ Upstream Pond (if present) Length: ____ Width: ____

Riffle Information (measured in a riffle outside of zone of influence of crossing)

Water Depth (ft): ______ Bankfull Width (ft): ______ Wetted Width (ft): ______ Water Velocity (ft/sec): ______

Dominant Substrate: Cobble Gravel Sand Organics Clay Bedrock Silt Measured With: Meter or Float Test

Road Information

Type: Federal State County Town Tribal Private Other:

Road Surface: Paved Gravel Sand Native Surface Condition: Good Fair Poor

Road Width at Culvert (ft): ______ Location of Low Point: At Stream Other Runoff Path: Roadway Ditch

Embankment: Upstream Fill Depth (ft): ______ Slope: Vertical 1:1.5 1:2 >1:2

Downstream Fill Depth (ft): ______ Slope: Vertical 1:1.5 1:2 >1:2

Left Approach: Length (ft): ______ Slope: 0% 1-5% 6-10% >10% Ditch Vegetation: None Partial Heavy

Right Approach: Length (ft): ______ Slope: 0% 1-5% 6-10% >10% Ditch Vegetation: None Partial Heavy

[1] - Fill out for primary culvert (culvert #1). If multiple culverts are used, number each and use embedded table.

Form Date: February 28, 2011

Source: Michigan Department of Natural Resources

Erosion Information

Use a new row for each distinct gully/erosion location. Note prominent streambank erosion within 50 feet of crossing.

Location of Erosion Ditch, approach, or streambank Left or right facing downstream	**Erosion Dimensions (ft)**			**Eroded Material Reaching Stream?**		**Material Eroded** Sand, Silt, Clay, Gravel, Loam, Sandy Loam or Gravelly Loam.
	Length	**Width**	**Depth**			
				Yes	**No**	
				Yes	**No**	
				Yes	**No**	
				Yes	**No**	
				Yes	**No**	

If there is erosion occurring, can corrective actions, such as road drainage measures, be installed to address the problem? **Y N**

Extent of Erosion: Minor Moderate Severe Stabilized

Erosion Notes:

Photos – enter photo number in blank corresponding to location

❑ Site ID ____ ❑ Upstream Conditions ____ ❑ Downstream Conditions ____

❑ Inlet ____ ❑ Outlet ____ ❑ Road Approach – Left ____ ❑ Road Approach – Right ____

Summary Information

Would you consider this a priority site? Fish Passage Erosion Why?

Would you recommend a future visit to this site? Yes No **Why?**

Were any non-native invasive species observed at the site? Yes No **If yes, what species were observed?**

Site Sketch

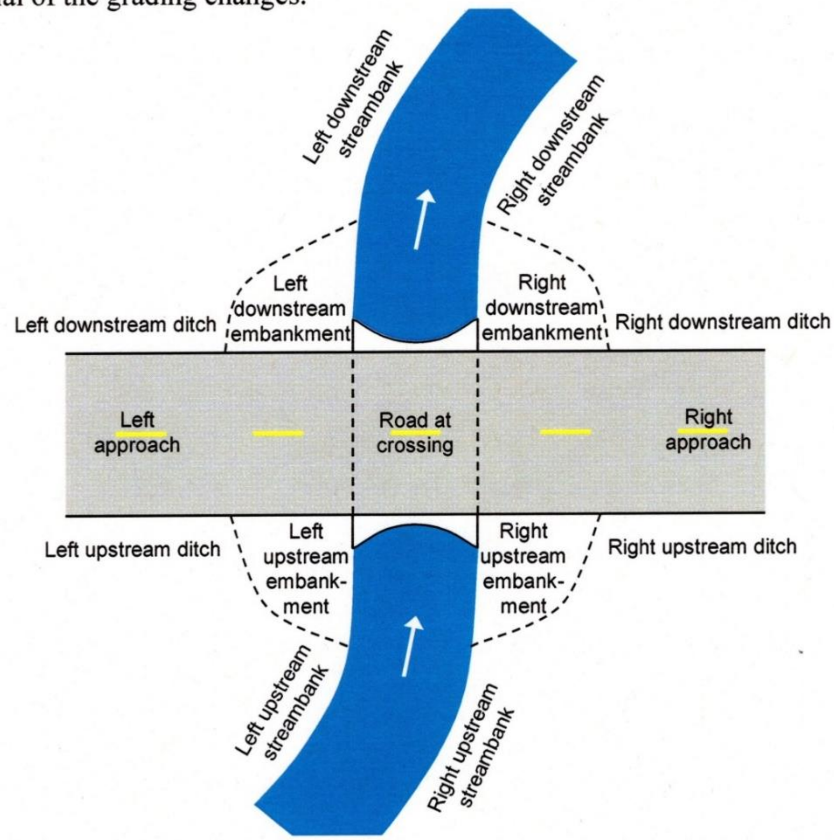
Draw an overhead sketch of crossing. Be sure to mark North on the map and to indicate the direction of flow. Include major features documented on form, such as erosion sites, multiple culverts, scour pool, impounded water, etc.

Source: Michigan Department of Natural Resources

Form Date: February 28, 2011

Erosion Information

Location of Erosion: Record the location of each distinct eroding area using the terms in the diagram below. Left and right are facing downstream. The road approach extends to where it no longer slopes toward the crossing. Road shoulders are considered part of the road or approach, not the ditch. The boundary between an embankment and a ditch is generally where the slope and/or material of the grading changes.



Erosion Dimensions: Measure the length, width and depth of eroded areas to the nearest 0.1 foot.

Eroded Material Reaching Stream: For each eroded area, circle "Yes" or "No" to indicate whether the eroded material appears to be reaching the stream.

Material Eroded: Indicate soil type(s) which best describes the eroded sediment. Options include: "Sand", "Silt", "Clay", "Gravel", "Loam", "Sandy Loam", and "Gravelly Loam".

If there is erosion occurring, can corrective actions be installed? Circle "Yes" or "No" to indicate whether there are any corrective actions that can be installed to address the erosion problems. In the "Erosion Notes" section, provide more detail on the correction action options.

Extent of Erosion: Circle the word that best describes the overall extent of erosion near the crossing.

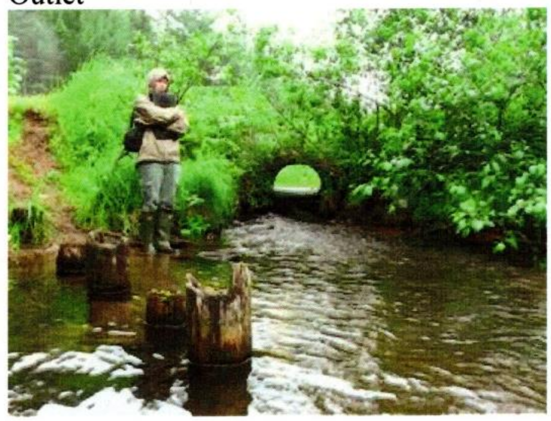
Source: Michigan Department of Natural Resources

Photos

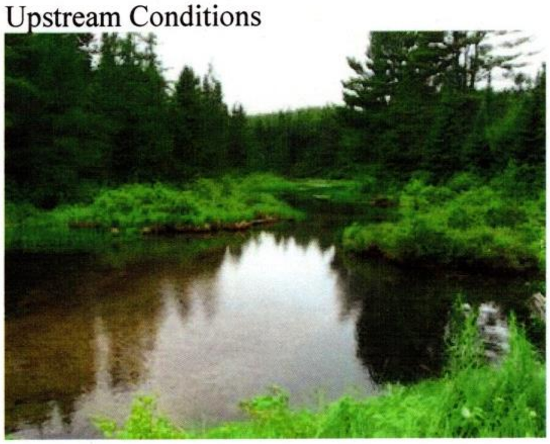
Take digital photos of the inlet, outlet, road approaches (left and right), upstream conditions, downstream conditions, and any other important site characteristics. Example Photos:

Inlet

Outlet

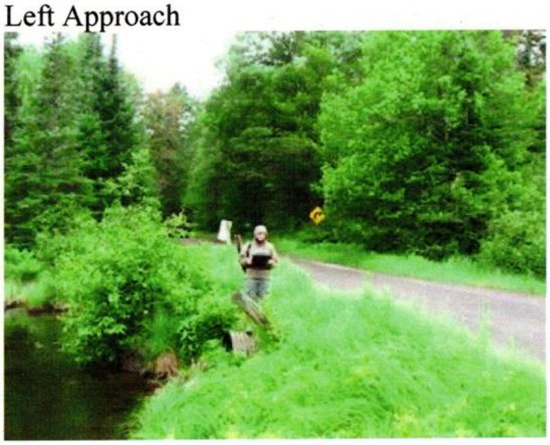


Upstream Conditions

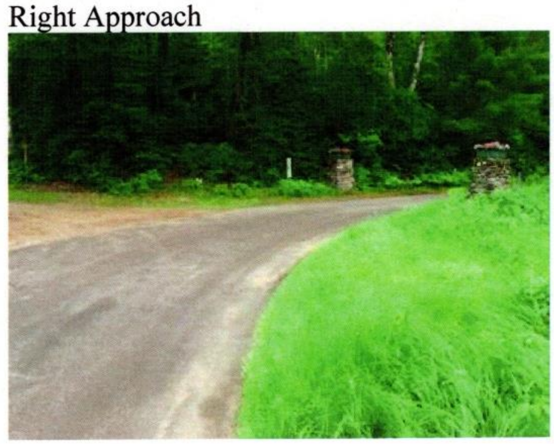


Downstream Conditions

Left Approach



Right Approach

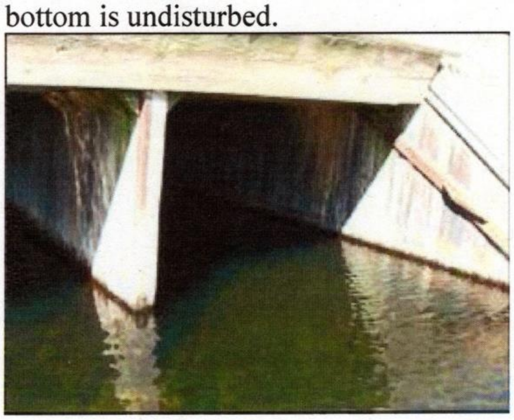


Structure Shape: Circle the term that best describes the shape of the structure.

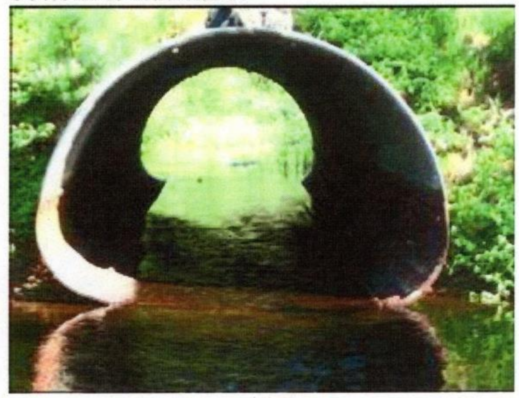
Round

Square/Rectangle – typically concrete, with floor (may be covered with natural stream substrate).

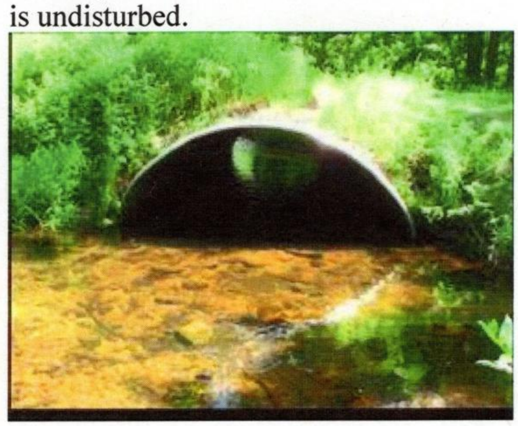
Open Bottom Square/Rectangle – the walls of the crossing are buried and the stream bottom is undisturbed.



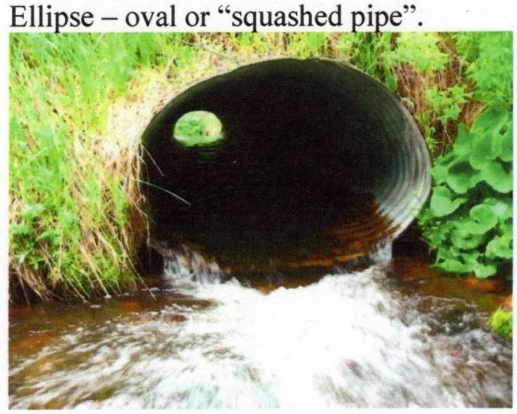
Pipe Arch – similar to a round pipe, but bottom is flattened.



Open Bottom Arch – the walls of the crossing are buried and the stream bottom is undisturbed.



Ellipse – oval or "squashed pipe".



MiCorps Site ID#:________________

Michigan Clean Water Corps

Stream Macroinvertebrate Datasheet

Stream Name: ____

Location:________________________________ (Circle one: *Upstream* or *Downstream* of road?)

Date:______________________ Collection Start Time:______________ (AM/PM)

Major Watershed:__________________ HUC Code (if known):__________________

Latitude:______________________ Longitude:______________________

Monitoring Team:

Name of Person Completing Datasheet:______________________________

Collector:____

Other Team Members:________________________________

Stream Conditions: Average Water Depth:______________ feet

Is the substrate covered with excessive silt? ____ No ____ Yes (describe:______________)

Substrate Embeddedness in Riffles: ____ 0-25% ____ 25-50% _____ > 50% ____ Unsure

Did you observe any fish or wildlife? ( ) Yes ( ) No If so, please describe:________________

Macroinvertebrate Collection: Check the habitats that were sampled. Include as many as possible.

____ Riffles
____ Cobbles
____ Aquatic Plants
____ Runs
____ Stream Margins
____ Leaf Packs
____ Pools
____ Undercut banks/Overhanging Vegetation
____ Submerged Wood
____ Other (describe:________ ________________)

Did you see, but not collect, any **live crayfish**? (___ Yes ___ No), or **large clams**? (___ Yes ___ No)

remember to include them in the assessment on the other side!

Collection Finish Time:____________(AM/PM)

Datasheet checked for completeness by:______________________________ Datasheet version 10/08/05

Data entered into MiCorps database by:______________________________ Date:______________

MiCorps Site ID#:________________

Michigan Clean Water Corps

IDENTIFICATION AND ASSESSMENT

Use letter codes [**R** (rare) = 1-10, **C** (common) = 11 or more] to record the approximate numbers of organisms in each taxa found in the stream reach.

*** Do NOT count empty shells, pupae, or terrestrial macroinvertebrates***

Group 1: Sensitive

____ Caddisfly larvae (Trichoptera)
EXCEPT Net-spinning caddis
____ Hellgrammites (Megaloptera)
____ Mayfly nymphs (Ephemeroptera)
____ Gilled (right-handed) snails (Gastropoda)
____ Stonefly nymphs (Plecoptera)
____ Water penny (Coleoptera)
____ Water snipe fly (Diptera)

Group 2: Somewhat-Sensitive

____ Alderfly larvae (Megaloptera)
____ Beetle adults (Coleoptera)
____ Beetle larvae (Coleoptera)
____ Black fly larvae (Diptera)
____ Clams (Pelecypoda)
____ Crane fly larvae (Diptera)
____ Crayfish (Decapoda)
____ Damselfly nymphs (Odonata)
____ Dragonfly nymphs (Odonata)
____ Net-spinning caddisfly larvae (Hydropsychidae; Trichoptera)
____ Scuds (Amphipoda)
____ Sowbugs (Isopoda)

Group 3: Tolerant

____ Aquatic worms (Oligochaeta)
____ Leeches (Hirudinea)
____ Midge larvae (Diptera)
____ Pouch snails (Gastropoda)
____ True bugs (Hemiptera)
____ Other true flies (Diptera)

STREAM QUALITY SCORE

Group 1:
____ # of R's * 5.0 = ____
____ # of C's * 5.3 = ____
Group 1 Total = ______

Group 2:
____ # of R's * 3.0 = ____
____ # of C's * 3.2 = ____
Group 2 Total = ______

Group 3:
____ # of R's * 1.1 = ____
____ # of C's * 1.0 = ____
Group 3 Total = ______

Total Stream Quality Score = _______
(Sum of totals for groups 1-3; round to nearest whole number)

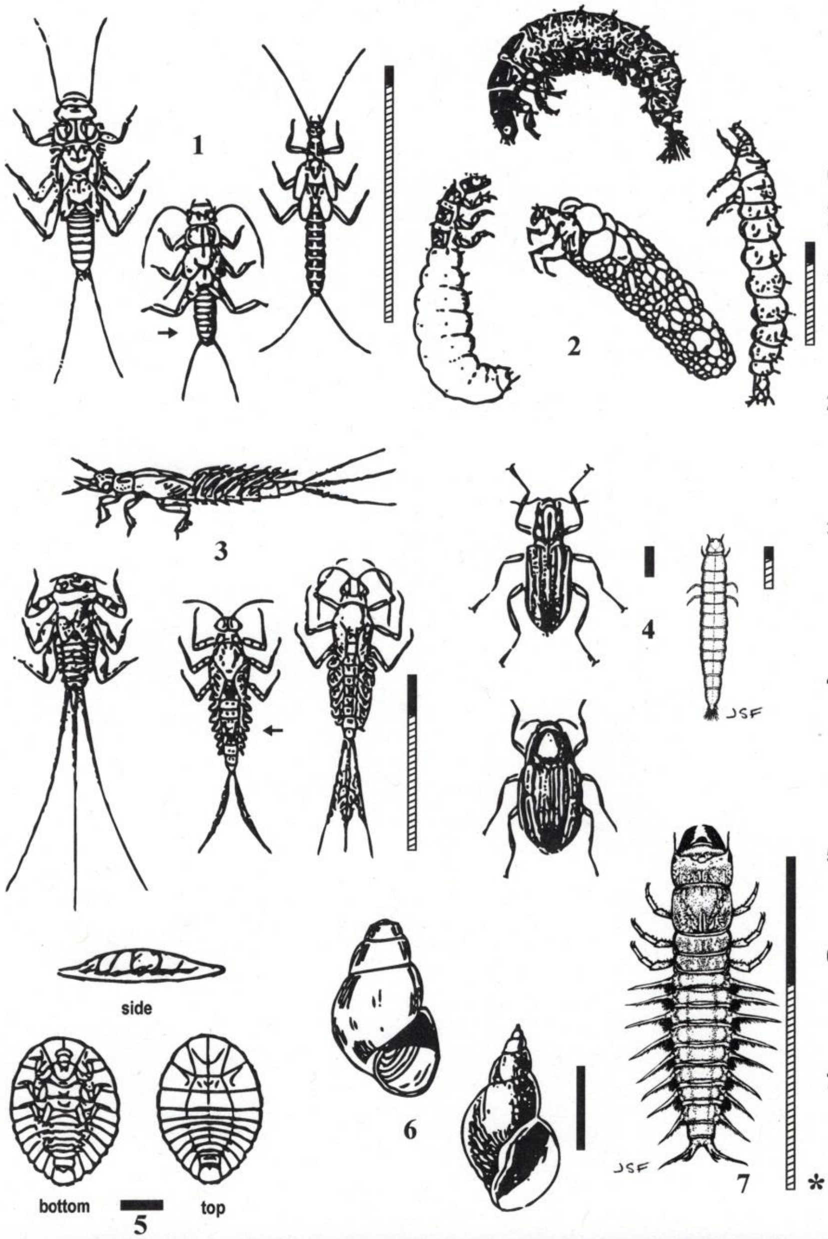
Check one:
____ Excellent (>48)
____ Good (34-48)
____ Fair (19-33)
____ Poor (<19)

Identifications made by:____

Rate your confidence in these identifications: Quite confident 5 4 3 2 1 Not very confident

Datasheet checked for completeness by:_______________________________ Datasheet version 10/08/05
Data entered into MiCorps database by:_______________________________ Date:____________

Stream Insects & Crustaceans



GROUP ONE TAXA

Pollution sensitive organisms found in good quality water.

1 Stonefly nymph: *Order Plecoptera.* 1/8" - 1 1/2"; 6 legs with hooked tips; 2 hairlike tails. Smooth (no gills) on abdomen (see arrow). May have gills on thorax under the legs.

2 Caddisfly larva: *Order Trichoptera.* Up to 1"; 6 legs on thorax; 2 hooks at end of abdomen. May be in a stick, rock, or leaf case with its head sticking out. May have fluffy gill tufts on lower half.

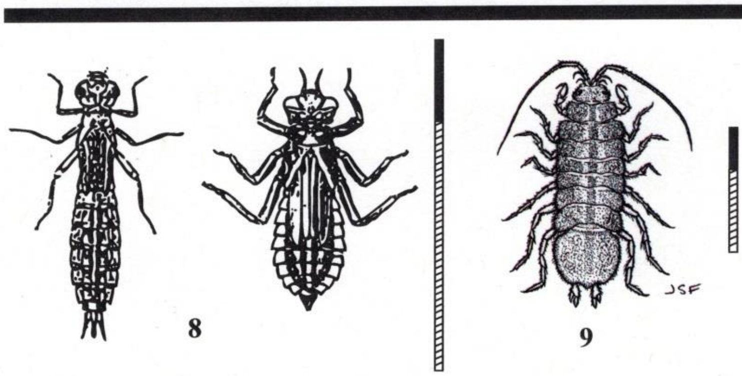
3 Mayfly nymph: *Order Ephemeroptera.* 1/4" - 1"; moving, platelike, or feathery gills on abdomen (see arrow); 6 large hooked legs; antennae; 2 or 3 long, hairlike tails. Tails may be webbed together.

4 Riffle Beetle: *Order Coleoptera.* Adult: Tiny, 6-legged beetle; crawls slowly on the bottom. Larva: Entire length of body covered with hard plates; 6 legs on thorax; uniform brown or black color. Combine number of adults & larvae when reporting total counts.

5 Water Penny larva: *Order Coleoptera.* 1/4"; flat saucer-shaped body, like a penny; segmented with 6 tiny legs underneath. Immature beetle.

6 Gilled Snail: *Class Gastropoda.* Shell opening covered by thin plate called operculum. When pointed up and opening facing you, the shell opens to right. Do not count empty shells.

7 Dobsonfly larva (hellgrammite): *Family Corydalidae.* 3/4" - 4"; dark-colored; 6 legs, large pinching jaws; eight pairs lateral filaments on lower half of body with paired cottonlike gill tufts along underside of lateral filaments; short antennae; 2 pairs of hooks at back end.



GROUP TWO TAXA

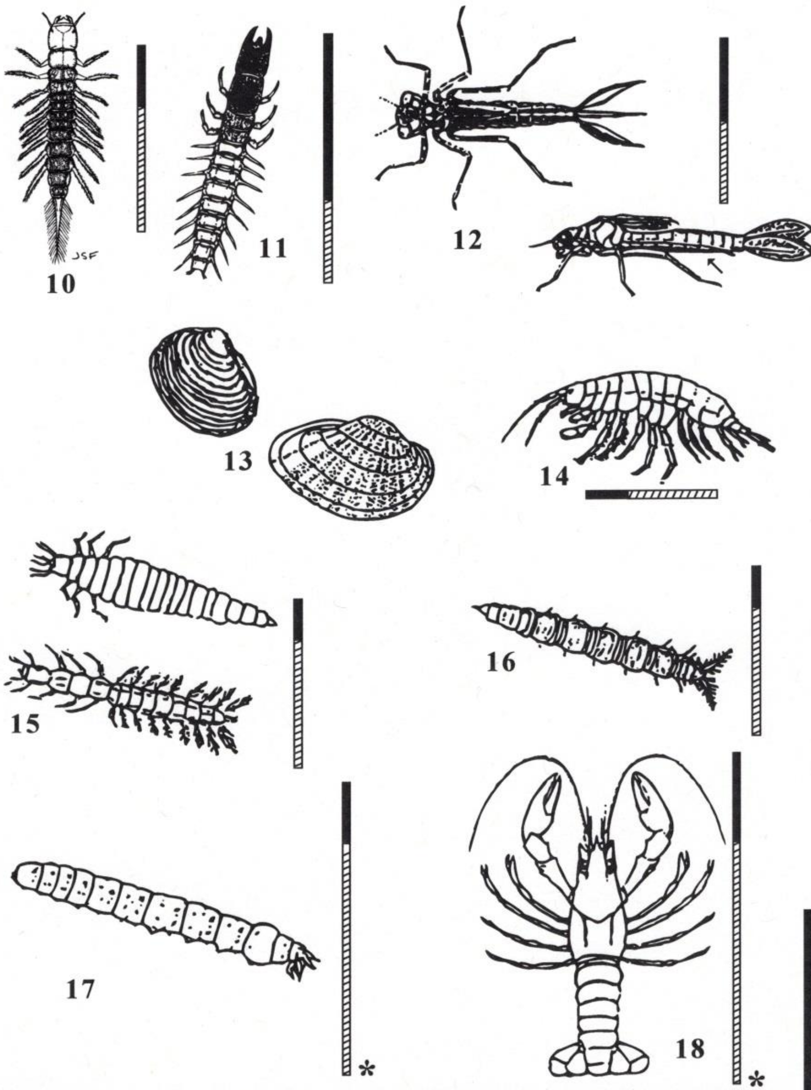
Somewhat pollution tolerant organisms can be in good or fair quality water.

8 Dragonfly nymph: *Suborder Anisoptera.* 1/2" - 2"; large eyes, 6 hooked legs. Wide oval to round abdomen, masklike lower lip.

9 Sowbug: *Order Isopoda.* 1/4" - 3/4"; gray oblong body wider than it is high, more than 6 legs, long antennae, looks like a 'roly poly.'

*** May be larger.**
~Solid bar indicates approx. minimum size. Combined solid and striped bar is approx. maximum size.~

Save Our Streams



GROUP TWO TAXA continued

10 Alderfly larva: *Family Sialidae.* 3/8"- 1"; looks like small hellgrammite but has 1 long, thin, branched tail at end of abdomen (no hooks). No gill tuft underneath the lateral filaments on abdomen.

11 Fishfly larva: *Family Corydalidae.* Up to 1 1/2"; lateral filaments on abdomen. Looks like small hellgrammite but often a lighter reddish-tan color, or with yellowish streaks. No gill tufts underneath.

12 Damselfly nymph: *Suborder Zygoptera.* 1/2"- 1"; large eyes; 6 thin hooked legs; 3 broad oar-shaped tails (gills); body positioned like a tripod. Smooth (no gills) on sides of lower half of body (see arrow).

13 Clam/Mussel: *Class Bivalvia.* Do not count empty shells.

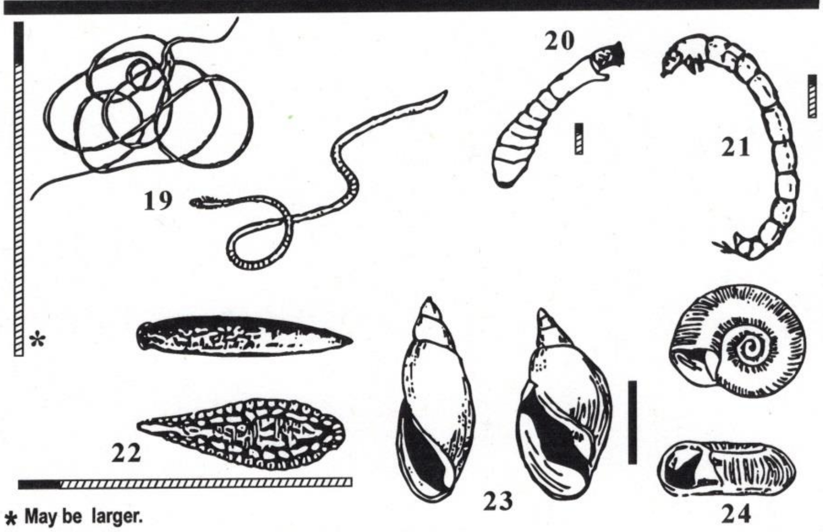
14 Scud: *Order Amphipoda.* 1/4"- 3/4"; white to gray, body higher than it is wide; swims sideways; more than 6 legs; resembles small shrimp.

15 Other Beetle larva: *Order Coleoptera.* 1/4" - 1"; light-colored; 6 legs on upper half of body; feelers; antennae; obvious mouthparts. Diverse group.

16 Watersnipe Fly larva: *Family Athericidae (Atherix).* 1/4" - 1"; pale to green; tapered body; many caterpillar-like legs; conical head; two feathery 'horns' at back end.

17 Crane Fly larva: *Suborder Nematocera.* 1/3" - 4"; milky, green, or light brown; plump caterpillar-like segmented body. May have enlarged lobe or fleshy fingerlike extensions at the end of the abdomen.

18 Crayfish: *Order Decapoda.* Up to 6"; 2 large claws, 8 walking legs, resembles small lobster.



GROUP THREE TAXA

Pollution tolerant organisms can be in any quality of water.

19 Aquatic Worm/Horsehair Worm: *Class Oligochaeta/ Phylum Nematomorpha.* Aquatic worm: 1/4"- 2"; can be very tiny, thin wormlike body. Horsehair Worm: 4"-27"; slender, can be tangled.

20 Black Fly larva: *Family Simulidae.* 1/8"- 3/8"; one end of body wider. Black head, suction pad on end.

21 Midge Fly larva: *Suborder Nematocera.* Less than 1/4"; distinct head; wormlike segmented body; pair of tiny prolegs under head and tip of abdomen.

22 Leech: *Order Hirudinea.* 1/4" - 6"; flattened muscular body, ends with suction pads.

23 Pouch Snail and Pond Snails: *Class Gastropoda.* No operculum. Breathe air. Shell usually opens on left. Do not count empty shells.

24 Other snails: *Class Gastropoda.* No operculum. Breathe air. Snail shell coils in one plane. Do not count empty shells.

*** May be larger.**

~Solid bar indicates approx. minimum size. Combined solid and striped bar is approx. maximum size.~

01/10
STR 250

6.2 Presenting the Data

When presenting numerical data, one of your chief goals should be to maintain the attention and interest of your audience. This is very difficult using tables filled with numbers. Most people will not be interested in the absolute values of each parameter at each sampling site. Rather, they will want to know the bottom line for each site (e.g., is it good or bad) and seasonal and year to year trends.

Graphs and charts, therefore, are typically the best way to present volunteer data. Take care, however, that your graphs "fit" your audience and are neither too technical nor too simplistic.

Graphs and Charts

Graphs can be used to display the summarized results of large data sets and to simplify complicated issues and findings. The three basic types of graphs that are typically used to present volunteer monitoring data are:

- Bar graph
- Line graph
- Pie chart

Bar and line graphs are typically used to show results, such as bioassessment scores, along a vertical or yaxis for a corresponding variable (such as sampling date or site) which is marked along the horizontal or xaxis. These types of graphs can also have two vertical axes, one on each side, with two sets of results shown in relation to each other and to the variable along the xaxis.

Habitat scores as a percent of reference condition at sites #1 and #2 for 1992-1994

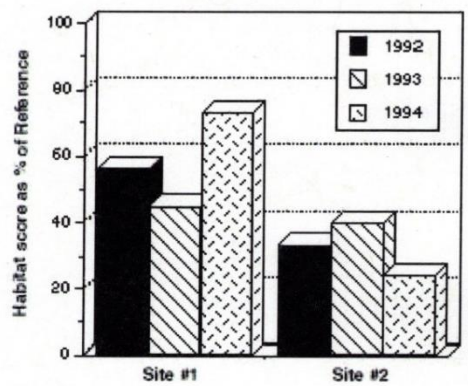


Figure 6.1

Example of a bar graph displaying biological data

Bar Graph

A bar graph uses columns with heights that represent the value of the data point for the parameter being plotted. Fig. 6.1 is an example using fictional data from Volunteer Creek.

Line Graph

A line graph is constructed by connecting the data points with a line. It can be effectively used for depicting changes over time or space. This type of graph places more emphasis on trends and the relationship among data points and less emphasis on any p articular data point.

Fig. 6.2 is an example of a line graph again using fictional data from Volunteer Creek.

Pie Chart

Pie charts are used to compare categories within the data set to the whole. The proportion of each category is represented by the size of the wedge. Pie charts are popular due to their simplicity and clarity. (See Fig. 6.3)

Graphing Tips

Regardless of which graphic style you choose, follow these rules to ensure you use them most effectively.

- *Each graph should have a clear purpose.* The graph should be easy to interpret and should relate directly to the content of the text of a document or the script of a presentation.
- *The data points on a graph should be proportional to the actual values so as not to distort the meaning of the graph.* Labeling should be clear and accurate and the data values should be easily interpreted from the scales. Do not overcrowd t he points or values along the axes. If there is a possibility of misinterpretation, accompany the graph with a table of the data.
- *Keep it simple.* The more complex the graph, the greater the possibility for misinterpretation.
- *Limit the number of elements.* Pie charts should be limited to five or six wedges, the bars in a bar graph should fit easily, and the lines in a line graph should be limited to three or less.
- *Consider the proportions of the graph and expand the elements to fill the dimensions, thereby creating a balanced effect.* Often, a horizontal format is more visually appealing and makes labeling easier. Try not to use abbreviations that are not obvious to someone who is unfamiliar with the program.
- *Create titles that are simple, yet adequately describe the information portrayed in the graph.*
- *Use a legend if one is necessary to describe the categories within the graph.* Accompanying captions may also be needed to provide an adequate description of the elements.

June phosphorus concentrations at Sites #1 and #2 from 1991-1997

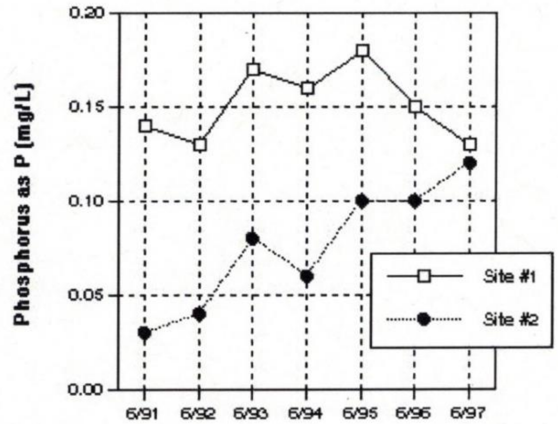


Figure 6.2

Example of a line graph depicting trends in phosphorus data

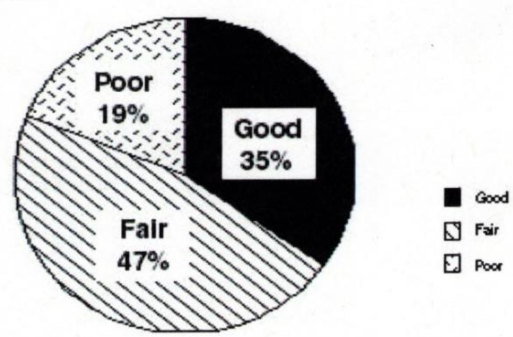
Summary Statistics

Summary statistics can reduce a very large data set to a few numerical values that can then be easily described and analyzed. Such statistics include the mean and standard deviation--two of the most frequently used descriptors of environmental data.

Textbook statistics commonly assume that if a parameter is measured many times under the same conditions, then the measurement values will be randomly distributed around the average with more values clustering near the average than further away. In this i deal situation, a graph of the frequency of each measure plotted against its magnitude should yield a bell-shaped or normal curve. The *mean and the standard deviation* determine the height and breadth of this curve, respectively.

The mean is simply the sum of all the measurement values divided by the number of measurements. This

Summary of water quality ratings for Volunteer Creek



(total no. of stations=52)

Figure 6.3

statistic is a measure of location and in a normal curve marks the highest point at the center of the bell.

Example of a pie chart summarizing water quality ratings

The standard deviation, on the other hand, describes the variability of the data points around the mean. Very similar measurement values will have a small standard deviation while widely scattered data will have a much larger standard deviation.

While both the mean and standard deviation are quite useful in describing stream data, often the actual measures do not fit a normal distribution. Other statistics often come into play to describe the data. Some data are skewed in one direction or the oth er. Other data may have a flattened bell shape.

It is important to note that biological information often does not follow normal, bell-shaped distribution. This is because biological communities are dynamic, complex, and interdependent systems; many factors influence them, and these cannot be statistica lly predicted. For example, bioassessment scores plotted against habitat assessment scores will be at their best when habitat quality is at its best. For data that is non-normally distributed, the mean and the standard deviation are not appropriate summary statistics.

For describing non-normally distributed data, it is best to use statistics that can convey the information for a variety of conditions and which are not overly influenced by the data points at the extremes of the distribution. The median and the interquart ile range are two statistics that are commonly used to describe the central tendency and the spread around the median, respectively. These statistics are derived by placing the data points in order of value from lowest to highest. The median is simply the value that is in the middle of the data set. The interquartile range is the difference between the value at the 75 percent level and the value at the 25 percent level.

The best method for presenting this type of data is called a box and whisker plot. One simple box and whisker plot will graphically display the following information:

- Median
- Variability of the data around the median
- Skew of the data
- Range of the data
- Size of the data set

Statistical software packages for computers will easily construct box and whisker plots. You can construct these plots by following procedure shown below:

1. Order the data from the lowest to the highest.
2. Plot the lowest and highest values on the graph as short horizontal lines. These are the extreme values of the data set and represent the data range.
3. Determine the 75 percent value and the 25 percent value of the data set. These values define the interquartile range and are represented by the location of the top and bottom lines of the box.
4. The horizontal length of the lines that define the top and bottom lines of the box (the box width) can be used as a relative indication of the size of the data set. For example, the box width that describes a data set of 20 values can be displayed twice as wide as a data set of 10 values. Any proportional scheme can be used as long as it is consistently applied.
5. Close the box by drawing vertical lines that connect to the ends of the horizontal lines.
6. Plot the median inside the box.

Fig. 6.4 is an example depicting the extreme values, interquartile range, and median of biosurvey metric scores from 52 sites sampled in Volunteer Creek in June, 1995.

Maps

Displaying the results of your monitoring data on a map can be a very effective way of showing the data and helping people understand what it means. A map shows the location of sample sites in relation to l and features, such as cities, wastewater treatment plants, farmland, and tributaries that may have an effect on water quality. Because a map also displays the stream's relationship to neighborhoods, parks a nd recreational areas, it can help to develop concern for the stream and strengthens interest in protecting it.

Choosing a Map

It is best to have two types of maps. One should be a working map with a lot of detail. The other should be used for display purposes. The working map should include important features such as:

- Stream and its tributaries
- Wetlands
- Lakes and ponds
- Cultural features such as roads
- Rail and power lines; municipal boundaries
- Some indication of land use patterns and vegetation.

The map should be of a scale large enough to add the location of sample sites.

U.S. Geological Survey (USGS) 7.5 minute quads (scale of 1:24,000; 1 in. = 2,000 ft) are available with and without topographic contours (elevation markings). These maps are available for most of the United States.

Box Plot of Total Metric Scores from June, 1995

(No. of sites=52)

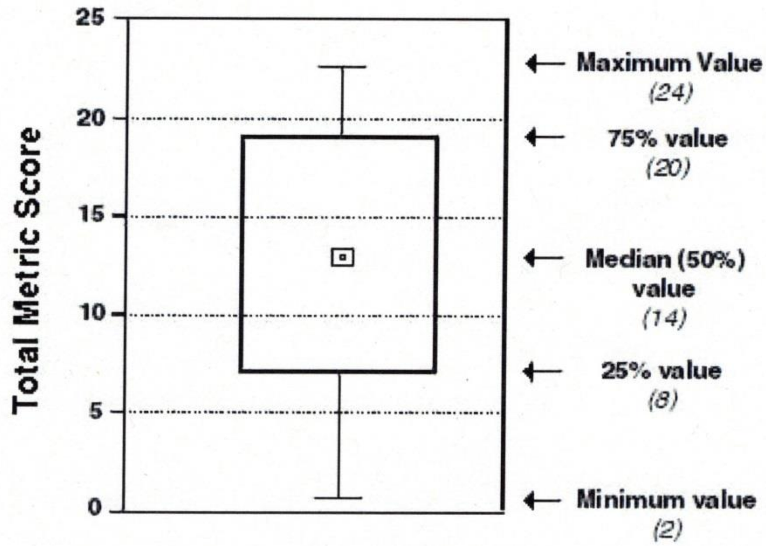


Figure 6.4

Example of a box plot

The USGS maps are particularly useful if your information will be incorporated into a geographic information system (GIS), since many of these systems use the USGS maps as base maps. For your data to be used in a GIS, it is likely that you will have to provide the latitude and longitude of your sample sites, which can be obtained by using the grid markings on the USGS topographic maps. Several different coordinate systems are marked, including standard latitude/longitude and the Universal Transmercator coordinates. For assistance in learning how to use these coordinate markings, talk to the local USGS office or someone in the geography department at a university. It may also be possible for the GIS office you work with you to "digitize" the maps, thus saving you the trouble of trying to calculate the coordinates.

The display map is best used to illustrate your program results at public meetings or in reports. This map should be simpler than the detailed map and show only principal features such as roads, municipal boundaries, and waterways. It should have sufficient detail and scale to show the location of sample sites, and have space for summary information about each of the sample sites. Commercial road atlases and county or town road maps available from state transportation departments are examples of the types of maps that can be used for display purposes (See Fig. 6.5).