



1. DETERMINE THE STREAM-REACH BOUNDARY. 2. NEAR THE LOWER END OF THE REACH (IN THE DEEPEST PORTION OF THE RUN), COLLECT WATER SAMPLES AND ANALYZE USING THE CHEMICAL TESTS YOU HAVE AVAILABLE. YOU MAY USE YOUR COLLECTION CONTAINER TO OBSERVE WATERCOLOR AND CLARITY AND TO DETERMINE WATER ODORS. 3. MEASURE THE WIDTH-DEPTH AND VELOCITY, AND ESTIMATE THE WATER LEVEL. 4. USING A **KICK-NET**, COLLECT A MINIMUM OF THREE BENTHIC MACROINVERTEBRATE SAMPLES FROM THE BEST RIFFLES OR RUNS WITHIN YOUR STREAM REACH. USE THE TALLY SHEET ON PAGE FOUR TO RECORD INFORMATION ABOUT YOUR COLLECTIONS. 5. EVALUATE THE PHYSICAL AND HABITAT CONDITIONS, AND RECORD INFORMATION ABOUT KNOWN LAND USE ACTIVITIES. 6. SKETCH YOUR REACH OR SUBMIT PHOTOGRAPHS WITH THE SURVEY, AND ADD ANY OTHER COMMENTS THAT YOU FEEL ARE IMPORTANT. **NOTE: A SCIENTIFIC COLLECTION PERMIT FROM WVDNR IS REQUIRED FOR ALL BENTHIC SURVEYS.**

Stream name _____ Survey date _____
 Watershed _____ County _____
 Latitude _____ Longitude _____ Directions _____
 Start/end times _____
 Survey completed by _____ Station code _____
 Affiliation _____ E-mail _____
 Mailing address _____ Phone number _____

WATER CHEMISTRY: Use the boxes below to record the results of your water chemistry analysis; attach additional sheets if necessary.

	Result	units		Result	units		Result	units
Temperature (C/F)			Conductivity			Alkalinity		
Dissolved oxygen			Nitrates			Iron		
pH			Turbidity			Fecal/E-coli		

Additional tests (describe and record results) _____

PHYSICAL CONDITIONS: Use the check boxes below to describe the conditions that closely resemble those of your stream. The extra lines are provided to write in any additional comments. You may see more than one type of condition; if so, be sure to indicate these on your survey (check all that apply). If multiple conditions are observed, always indicate the most dominant condition. Note: If the condition you observe is not listed, describe it in the comment section.

Water clarity	Water color	Water/Sediment odor	Surface foam
		Water	Sediment
Clear	None	None	None
Murky	Brown	Fishy	Slight
Milky	Black	Musky	Moderate
Muddy	Orange/red	Rotten egg	High
Other (describe)	Gray/White	Sewage	
	Green	Chemical	

Algae color	Algae abundance	Algae growth habit	Streambed color
Light green	None	Even coating	Brown
Dark green	Scattered	Hairy	Black
Brown	Moderate	Matted	Green
Other (describe)	Heavy	Floating	White/gray
			Orange/red

Physical condition comments: _____

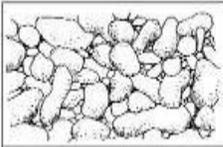
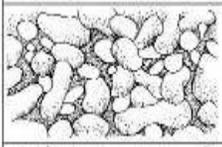
Weather (today and past 48-hours) _____

Indicate the % of your reach that is shaded	> 80	80 - 60	60 - 40	< 40
	Excellent	Good	Fair	Poor

WIDTH AND DEPTH MEASUREMENTS: Record the wetted width and average depth from at least two of the channel's habitats (RUN, RIFFLE or POOL). Determine the average depth from a minimum of five measurements (one should always be from the deepest part of the channel). The width should be measured from the widest section of the feature.

- 1. Riffle Wetted Width ^(feet) _____ Depth ^(feet) _____
- 2. Run Wetted Width ^(feet) _____ Depth ^(feet) _____
- 3. Pool Wetted Width ^(feet) _____ Depth ^(feet) _____

HABITAT CONDITIONS: Rate the habitat conditions by choosing the best description, and then, choose a score from the range within the description. Note: Bank stability and riparian buffer width are assessed on both the **LEFT** and **RIGHT** side of the stream. The **LEFT** and **RIGHT** sides are determined by looking downstream.

		Optimal	Suboptimal	Marginal	Poor
Embeddedness EVALUATED IN RIFFLES					
		Fine sediments surrounds <10% of the spaces between the gravel, cobble and boulders.	Fine sediment surrounds 10-30% of the spaces between the gravel, cobble and boulders.	Fine sediment surrounds 30-60% of the spaces between the gravel, cobble and boulders.	Fine sediment surrounds > 60% of the spaces between the gravel, cobble and boulders.
		20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Sediment deposition		Little or no formation of depositional features; < 20% of the reach affected. See below for examples	Some increase in depositional features; 20-40% of the reach affected.	Moderate amounts of depositional features; 40-60% of the reach affected.	Heavy amounts of deposition; > 60% of the reach affected.
		20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

The next two conditions are evaluated on both the left and the right sides of the stream.

		Optimal	Suboptimal	Marginal	Poor
Bank stability		Banks are stable; no evidence of erosion or bank failure; little or no potential for future problems; < 10% of the reach affected.	Banks are moderately stable; infrequent areas of erosion occur, mostly shown by banks healed over or a few bare spots; 10-30 % of the reach affected.	Banks are moderately unstable; 30-50% of the reach has some areas of erosion; high potential for erosion during flooding events.	Banks are unstable; many have eroded areas (bare soils) along straight sections or bends; obvious bank collapse or failure; > 50% affected.
	Left <input type="text"/> Right <input type="text"/>	10 9 8	7 6	5 4 3	2 1
Riparian buffer width		Mainly undisturbed vegetation > 60 ft; no evidence of human impacts such as parking lots, road beds, clear-cuts, mowed areas, crops, lawns etc.	Zone of undisturbed vegetation 40-60 ft; some areas of disturbance evident.	Zone of undisturbed vegetation 20-40 ft; disturbed areas common throughout the reach.	Zone of undisturbed vegetation < 20 ft; disturbed areas common throughout the entire reach.
	Left <input type="text"/> Right <input type="text"/>	10 9 8	7 6	5 4 3	2 1

Totals		> 70	70 - 55	54 - 40	< 40
		Optimal	Suboptimal	Marginal	Poor

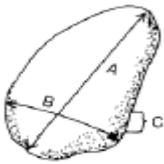
Habitat condition comments: _____

SEDIMENT DEPOSITION may cause the formation of islands, point bars (areas of increased deposition usually at the beginning of a meander that increase in size as the channel is diverted toward the outer bank) or shoals, or result in the filling of runs and pools. Usually deposition is evident in areas that are obstructed by natural or manmade debris and areas where the stream flow decreases, such as bends.

STREAMBED COMPOSITION: You should always collect information about the composition of your reach. You can either estimate the proportions or you use a **PEBBLE COUNT** for a more accurate measure of composition. At a minimum you should estimate composition of the riffles within your reach. The size categories are determined by the (B) axis measured in millimeters. Use the table below to record your data. Did you estimate or count?

Silt/clay < 0.06	Sand 0.06 – 2	Gravel 2 - 24 25 - 64	Cobble 65 - 255	Boulder 256 - 1096	Bedrock > 1096	Woody debris
Very small; having a smooth slick feel	Very small; having a grainy feel	Pea to tennis ball Fine Coarse	Tennis ball to basketball	Basketball to car size	Usually larger than a car; solid surface	Includes sticks, leaves etc

Riffle only Entire reach Estimates should be made from riffles only



- (A) Long axis (**Length**)
- (B) Intermediate axis (**Width**)
- (C) Short axis (**Height**)

Pebble counts require two people, one in the stream and one on shore. The person in the stream walks upstream from bank to bank using a zigzag pattern. After each step the person reaches down without looking, picks up the first particle touched, and measures the intermediate axis with a ruler. The on-shore partner records the measurement. The process continues until **100** pebbles have been measured or the reach has been walked. For a quick estimate, the coordinator recommends that **50** be collected from the entire reach and **20** if collecting from riffles only. You should divide the gravel category into fine and coarse to get a more accurate measure. Note: Pebble counts are not required; they are optional and should only be completed once each year or less frequently.

LAND USE: Indicate the land uses that you believe may be having an impact on your stream station. Use the letters (**S**) streamside, (**M**) within ¼ mile and (**W**) somewhere in the watershed, to indicate the approximate location of the disturbance and the numbers (**1**) slight, (**2**) moderate or (**3**) high, to represent the level of disturbance.

Active construction		Pastureland		Single-family residences	
Mountaintop mining		Cropland		Sub-urban developments	
Deep mining		Intensive feedlots		Parking lots, strip-malls etc.	
Abandoned mining		Unpaved Roads		Paved Roads	
Logging		Trash dumps		Bridges	
Oil and gas wells		Landfills		Other (describe)	
Recreation (parks, trails etc.)		Industrial areas			

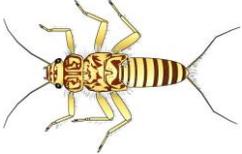
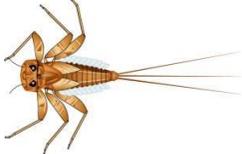
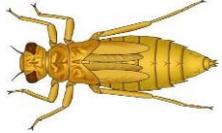
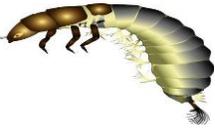
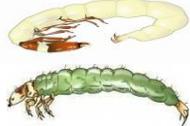
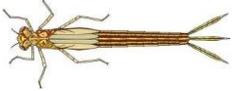
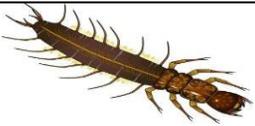
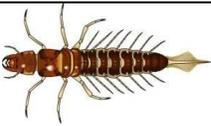
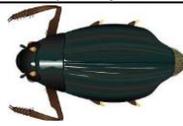
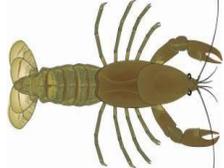
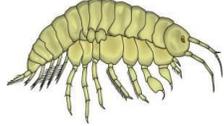
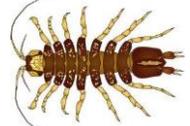
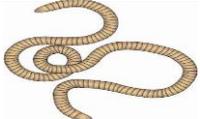
Pipes? Yes No

Describe the types of pipes observed and indicate if there is any discharge from the pipes. Also describe the colors and odors of the discharge, and provide any other land-use comments _____

PHOTOGRAPH AND SKETCH THE STUDY REACH: Use the space below to draw a **bird's eye view** your study reach. Indicate the direction of flow, sample locations and important features of the reach. Choose at least two locations from which to take your photos and submit your photos with your survey data sheet.

LEVEL-ONE SURVEY DATA SHEET

BENTHIC MACROINVERTEBRATES: Use the table below to record information about your collections. Record their abundance using these codes: (A) > 50, (C) 5 – 50 and (R) < 5 and also record the number of different kinds. The # of kind's box indicates groups in which multiple kinds (FAMILIES) are possible. Note: Always record the # OF KINDS when necessary. Illustrations courtesy of the [Cacapon Institute](#); Jennifer Gillies, artist

 Stoneflies	<input type="text"/>	 Mayflies	<input type="text"/>	 Caddisflies	<input type="text"/>	<input type="text"/>	Case-builders
 Dragonflies	<input type="text"/>	 Common netspinner	<input type="text"/>	 Caddisflies	<input type="text"/>	<input type="text"/>	Net-spinners Free-living
 Damselflies	<input type="text"/>	 Riffle beetle	<input type="text"/>	 Water penny	<input type="text"/>	<input type="text"/>	
 Fishfly/Hellgrammite	<input type="text"/>	 Alderfly	<input type="text"/>	 Other Beetles/Bugs	<input type="text"/>	<input type="text"/>	Beetles True bugs
 Midges	<input type="text"/>	 Black fly	<input type="text"/>	 Crane fly	<input type="text"/>	<input type="text"/>	
 Watersnipe fly	<input type="text"/>	 Other True flies	<input type="text"/>	 Crayfish	<input type="text"/>	<input type="text"/>	
 Clams	<input type="text"/>	 Mussel	<input type="text"/>	 Scud/Sideswimmer	<input type="text"/>	<input type="text"/>	
 Operculate snails	<input type="text"/>	 Non-operculate snails	<input type="text"/>	 Aquatic sowbug	<input type="text"/>	<input type="text"/>	
 Aquatic worm	<input type="text"/>	 Leech	<input type="text"/>	 Flatworm	<input type="text"/>	<input type="text"/>	

Other aquatic life observed or collected: _____

STREAM SCORE

After the sorting and identifications is complete, the macroinvertebrates are assessed using four **metrics**. First, transform your abundance rating into numbers using this code (**A = 6; C = 3; R = 1**) and follow the instructions below to complete all calculations. **Note:** The **SHADING** indicates that multiple kinds are possible within the group.

- Biotic Index:** Multiply the abundance number by the tolerance value to calculate the tolerance score. Add the entire tolerance score column and the abundance column. Divide the tolerance total by the abundance total.
- Total Taxa:** Calculate the total number of kinds.
- EPT Taxa:** Calculate the total number of kinds from the stoneflies, mayflies, and all caddisflies.

The final step is to determine a **point value** for each metric. These points are added together to determine your overall **stream score** and integrity rating. **Note: Don't forget to record the number of kinds.**

BENTHIC MACROINVERTEBRATES	Abundance	Tolerance Value	Tolerance Score	Number of Kinds
Stoneflies (Order Plecoptera)		2		
Mayflies (Order Ephemeroptera)		3		
Case-building caddisflies (Order Trichoptera)		3		
Net-spinning caddisflies (Order Trichoptera)		4		
Common netspinner (Family Hydropsychidae)		5		
Free-living caddisfly (Family Rhyacophilidae)		3		
Dragonflies (Sub-order Anisoptera)		4		
Damselflies (Sub-order Zygoptera)		7		
Riffle beetle (Family Elmidae)		4		
Water penny (Family Psephenidae)		3		
Other Beetles (Order Coleoptera)		6		
True Bugs (Order Hemiptera)		8		
Hellgrammite (Family Corydalidae)		3		
Alderfly (Family Sialidae)		6		
Non-biting midge (Family Chironomidae)		9		
Black fly (Family Simuliidae)		6		
Crane fly (Family Tipulidae)		4		
Watersnipe fly (Family Athericidae)		3		
Other True flies (Order Diptera)		7		
Water mite (Order Hydrachnida)		6		
Crayfish (Family Cambaridae)		5		
Sideswimmer (Family Gammaridae)		5		
Aquatic sowbug (Family Asellidae)		7		
Operculate snails (Sub-class Prosobranchia)		5		
Non-operculate snails (Sub-class Pulmonata)		7		
Clams (Order Veneroida)		6		
Mussel (Family Unionidae)		4		
Aquatic worm (Class Oligochaeta)		10		
Leech (Class Hirudinea)		10		
Flatworm (Class Turbellaria)		7		
Other invertebrates (describe)	Total Abundance		Total Tolerance	Total Taxa (# OF KINDS)

Metrics	Results	Points	10	8	6	4	2
1. Total Taxa			> 18	18 - 15	14 - 11	10 - 7	< 7
2. EPT Taxa			> 10	10 - 8	7 - 5	4 - 2	< 2
3. Biotic Index			< 3.5	3.5 - 4.3	4.4 - 5.6	5.7 - 6.5	> 6.5

Integrity Rating Scale

STREAM SCORE		> 24	24 - 19	18 - 13	< 13
		Optimal	Suboptimal	Marginal	Poor

DISCHARGE

Determine the discharge by using a flow meter or other methods such as the **FLOAT** or the **VELOCITY HEAD ROD (VHR)** method. The more measurements collected the more accurate your discharge results will be; however, you should collect a minimum of five measurements. Discharge should always be measured from a **RUN**. Stretch your tape measure across the run and select a minimum of five positions along the tape to measure discharge. One measurement should be from the deepest part of the channel and the others should be on either side. If you use the float method move 10-20 feet upstream from the tape and float at least five times back to the tape. The float distance must be timed in seconds.

Discharge method used

Water Level

Float

VHR

Flow meter

Low

Normal

High

Dry

Channel width _____ feet

Tape positions (ft)	Depth (ft)	Velocity (ft/sec)	VHR (Rise-inches)	Float (sec)	Discharge (cfs)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
Totals/Averages					

Cross Sectional Area (CSA) _____ ft²
 (CSA = Average Depth x Width)

Discharge = CSA x Velocity

= _____ x _____
 = _____ cfs (ft³/sec)

If you use a float record your distance below and the number of seconds it took to travel the distance in the column indicated. **Float distance** (feet) _____

VHR rises and velocities

Rise (R)	Velocity	Rise (R)	Velocity
1/4	1.2	3 1/4	4.2
1/2	1.6	3 1/2	4.3
3/4	2.0	3 3/4	4.5
1	2.3	4	4.6
1 1/4	2.6	4 1/4	4.8
1 1/2	2.8	4 1/2	4.9
1 3/4	3.1	4 3/4	5.0
2	3.3	5	5.2
2 1/4	3.5	5 1/4	5.3
2 1/2	3.7	5 1/2	5.4
2 3/4	3.8	5 3/4	5.5
3	4.0	6	5.7

VHR Velocity = $8 \times \sqrt{R}$, where R is rise in feet

Submit a clear copy or the original data sheet to the coordinator at address below. The Coordinator will review your survey and return it with comments or return a summary with comments. **ALWAYS KEEP A COPY FOR YOUR RECORDS.**

West Virginia Dept. of Environmental Protection
 Save Our Streams Program
 601 57th Street, SE
 Charleston, WV 25304

For more information visit the program's website at: <http://www.dep.wv.gov/sos>