Appendix E

Useful Tools for Monitoring

Tools/examples included (in order):

- Conversion factors
- Example of monitoring checklist
- Example field data sheets for stream, lake and biological monitoring.

Conversions

As you enter and assess your data, it is sometimes necessary to transform the data from one unit to another. For example, you may take Secchi disk measurements in feet and later find that you need to translate them to meters to match data someone else has collected. The table below provides conversions for common units used in water quality monitoring and analysis.

To convert unit "X"	To unit "Y"	Multiply "X" value by
acres	hectares	0.4047
acre-feet	gallons	3.259×10^5
cubic feet/ second (cfs)	Gallons/ minute	448.831
feet	meters	0.3048
gallons	liters	3.785
inches	centimeters	2.54
pounds	grams	453.5924
temp. in degrees Fahrenheit (˚F)	temp. in degrees Celsius (˚C)	First subtract 32, then multiply by 5/9
milligrams/liter (mg/L) or parts per million (ppm)	micrograms/ liter (µg/L) or parts per billion (ppb)	1000

Conversion Examples:

All summer you record Secchi disk measurements in feet. You later learn that the county also has transparency data for the lake from previous years, but the measurements are in meters. To change your measurements from feet to meters, use the following equation:

Measurement in feet x conversion factor = Measurement in meters

Conversion factor (from table) = 0.3048

Your laboratory reports results in mg/L (ppm), but you'd like to compare those results to reference values, which are reported in µg/L (ppb). To change your measurements, use the following equation:

Result in mg/L x conversion factor = Result in µg/L

Conversion factor (from table) = 1000

Note: To perform the conversion in the reverse direction, multiply by (1/(the conversion factor)). For example, to convert from hectares to acres, multiply the value in hectares by (1/0.4047).

Note: Keep in mind when converting between units that it is important not to report excess decimal places. Use the following rule of thumb: Look at all the values that were used in the calculation, and find the *measured* value with the fewest decimal places. The final answer should have that same number of decimal places. For example, if you measured Secchi disk transparency to the nearest tenth of a foot, after converting from feet to meters the final value should not have more than one decimal place (even though there are 4 decimal places in the conversion factor).

4.6 feet x 0.3048 (conversion factor) = 1.40208, which should be recorded as *1.4 meters.*

Monitoring checklist

The following example of a sampling checklist for lake monitoring is from *Vermont Lay Monitoring Program Manual,* 2000.

Lake sampling equipment checklist (for supplemental monitors)

(▲ denotes items supplied by monitor, other supplies provided by the Water Quality Division)

1. ▲boat
2. ▲anchor with line
3. Secchi disk with measured line
4. lake map with station locations
5. data sheets
6. pencil (**not** a pen)
7. rubber hose with measured line and weights
8. plastic bucket with lid
9. 2- 500mL plastic chlorophyll sample bottles (one labeled “A” and one labeled “B”)
10. filtering apparatus
11. hand vacuum pump with tubing
12. small chlorophyll filter papers (2 per week)
13. large filter papers (1 per week)
14. 1- 100 mL plastic graduated cylinder
15. paper clips
16. tweezers
17. glass jar or “Ziploc” baggie covered with black tape (for storage of frozen chlorophyll filters)
18. glass phosphorus test tubes (1 per week)

Field data sheets

The following pages contain example data sheets used for field data collection. Feel free to duplicate any of these data sheets and use them if they fit with your monitoring effort, or revise as needed for your project goals and objectives.

Vermont
Lay Monitoring Program
Department of Environmental Conservation
(802) 241-3777

1. **Lake** _____ **Town** _____

Monitor(s) _____

Day of the week: M T W Th F S Su

Sky Conditions: Clear Hazy Partly Cloudy Overcast

Wave Conditions: Calm Rippled Choppy Rough

} Circle one

2. **Station 1**

Lake Code	Date	Time	Hose Depth	Secchi Disc Transparency
_____	___ ___ ___ Month Day Year	___ ___ ___ ___ 2400 hours	___ ___ . ___ meters	___ ___ . ___ B meters

circle "B" if Secchi hits bottom

Station 2

Lake Code	Date	Time	Secchi Disc Transparency
_____	___ ___ ___ Month Day Year	___ ___ ___ ___ 2400 hours	___ ___ . ___ B meters

circle "B" if Secchi hits bottom

3. **Check (✓) to indicate if both chlorophyll and phosphorus samples were taken:**

Chlorophyll (from bottle "A")	____
Duplicate Chlorophyll (from bottle "B")	____
Phosphorus (from bottle "B")	____

4. **Total Sampling Time** (*include boat and lab time*): _____ hours and _____ minutes

5. **Weekly Gas Estimate** *(how much it costs in gas to collect the samples, include driving as well as boating costs)*
_____

6. **Have you noticed any adult zebra mussels** on submerged objects (i.e. docks, moorings, rocky areas, etc.) in the lake this week?

7. **Signature:** _____

8. **Comments:**

VTDEC Aquatic Plant Survey Field Sheet

Lake _____ Town_____

Crew_____ Conditions_____

Date_____ _____

Area #	Plant species	Plant abundance and notes, include GPS location if warranted
		u s o c a va
		u s o c a va
		u s o c a va
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		u s o c a va
		u = uncommon (< 1% cover) s = scattered (1-5% cover) o = occasional (5-25% cover) c = common (25-50% cover) a = abundant (50-75% cover) va = very abundant (75-100% cover)

VTDEC BASS Lab

LOTIC BENTHOS FIELD SHEET

Site Location

River (site) _____ River Mile _____ Storet ID_____ Lab ID _____

Town _____ Latitude _____ Longitude _____ Elevation _____ft

Drainage Area _____Km^2 Stream Order _____ Ecoregion _____

Site Description_____

_____

Sampling Information

Date _____ Time _____ Personnel (circle sampler)_____

Gear: _____ Effort time (min)____ Area (m^2)_____ Mesh (um)_____
Quantitative: Y / N Composite / rep:_____ Weather_____Air Temp_____ f
Antecedent (3 weeks) Flow/Weather _____ Present Flow: H - M - L Water Temp____c

% Substrate Composition

Bedrock _____ Coarse Gravel >.5-2.5" _____ Silt _____Snags/debris dams #____/___m

Boulder >10" _____ Gravel >.05-.5" _____ CPOM _____

Cobble 2.5-10" _____ Sand .002-.05" _____ Clay _____

Embeddedness: 0-5% Excel (5) 5-25% V Good (4) 25-50% Good (3) 50-75% Fair (2) > 75% Poor (1)

Other Substrate observations: Sediment Deposits/Odors: Sludge, Sawdust, paper fiber, sand, sewage, oil:_____
_____

% Canopy: 100 90 80 70 60 50 40 30 20 10 0 Overhead = Open or Closed

Bank: Stability EX , G , F , P Vegetation (both sides) %: Softwood ____ Hardwood _____ Brush_____ Grass_____
Other____

Riparian Width(facing upstream) ft L____ R____ **Surrounding Land Use:**_____
_____

Periphyton Cover For each type 0-100%

Diatom _____% Filamentous green _____% and length _____" Blue Green _____% Moss _____% Green_____% Other _____

General Water Type

Riffle _____ Winder _____ Other _____ Warm _____ Cold _____ Mixed _____

Width _____(m)Depth _____(m) Velocity: ____ ft/sec, Vel .RANGE <.4 ft/sec (S) .4-2 ft/sec (M) >2 ft/sec (F)

Channelized: Y / N Upstream Dam: Y ____mi / N Other modifications:_____

pH____ Alk _____ Cond____Color _____ _____

Other _____

Site Sketch and Observations

River (Site) _____ Personnel _____ Date_____

Pebble Count Field Form

Particle	Millimeters	Inches	Transect 1 (100 pebbles)	Tot #	Item %	Cum %
Sand	0062 - 2.00	0.002 -0.08				
Gravel	2 - 16	0.08 - 0.63				
Coarse Gravel	16 - 64	0.63 - 2.5				
Cobble	64 - 256	2.5 - 10.1				
Boulder	>256	>10.1				
Bedrock						
			TOTALS			

Particle	Millimeters	Inches	Transect 2 (100 pebbles)	Tot #	Item %	Cum %
Sand	0062 - 2.00	0.002 -0.08				
Gravel	2 - 16	0.08 - 0.63				
Coarse Gravel	16 - 64	0.63 - 2.5				
Cobble	64 - 256	2.5 - 10.1				
Boulder	>256	>10.1				
Bedrock						
			TOTALS			

Observations:

Field sheets on this page and page 97 were taken from U.S. EPA document number EPA 841B-97-003, *Volunteer Stream Monitoring: A Methods Manual*.

PHYSICAL CHARACTERIZATION

In-Stream Characteristics

1. Check which stream habitats are present: Page 73

(You can check more than 1 habitat)

θ Pool(s) θ Riffle(s) θ Run(s)

2. Nature of particles in the stream bottom at site Page 73

	Percent
Silt/Clay/Mud	______
Sand (up to 0.1" in diam.)	______
Gravel (0.1 - 2" in diam.)	______
Cobbles (2 - 10" in diam.)	______
Boulders (over 10" in diam.)	______
Bedrock (solid)	______
TOTAL	*100%*

3. Pick the category that best describes the extent to which gravel, cobbles, and boulders on the stream bottom are embedded (sunk) in silt, sand, or mud. Page 74

θ Somewhat/not embedded (0-25%) θ Mostly embedded (75%)

θ Halfway embedded (50%) θ Completely embedded (100%)

4. Streambed sinks beneath your feet in: Page 74

θ No spots θ A few spots θ Many spots

5. Presence of logs or large woody debris in stream: Page 74

θ None θ Occasional θ Plentiful

6. Presence of naturally-occurring organic material (i.e., leaves and twigs, etc.) in stream: Page 74

θ None θ Occasional θ Plentiful

7. Water appearance: Page 74

θ Clear θ Turbid θ Orange

θ Milky θ Dark brown θ Greenish

θ Foamy θ Oily sheen θ Other ______________

8. Water odor: Page 74

θ Sewage θ Fishy θ None

θ Chlorine θ Rotten eggs θ Other ______________

9. Water temperature: Page 74

_________ °C *or* _________ °F

Streambank and Channel Characteristics

10. (a) Approximate depth of run(s): Page 75

θ < 1 ft θ 1-2 ft θ > 2 ft

(b) Approximate depth of pool(s):

θ < 1 ft θ 1-2 ft θ > 2 ft

11. Approximate width of stream channel: Page 75

_________ feet θ measured θ estimated

12. Stream velocity: _________ ft/sec. Page 75

13. Looking upstream (100 yds.), pick the description that best fits the shape of the stream bank and the channel. Page 75

(a) Stream bank:

Left		Right
θ	Vertical/undercut	θ
θ	Steeply sloping (> 30°)	θ
θ	Gradual/no slope (< 30°)	θ

(b) Extent of artificial bank modifications:

Left		Right
θ	Bank 0-25% covered	θ
θ	Bank 25-50% covered	θ
θ	Bank 50-75% covered	θ
θ	Bank 75-100% covered	θ

(c) Shape of the channel:

θ Narrow, deep θ Wide, deep

θ Narrow, shallow θ Wide, shallow

14. Looking upstream (100 yds.), describe the streamside cover Page 76

(a) Along water's edge and stream bank only:

Left *(Percent)*		Right *(Percent)*
______	Trees	______
______	Bushes, shrubs	______
______	Tall grasses, ferns, etc.	______
______	Lawn	______
______	Boulders/rocks	______
______	Gravel/sand	______
______	Bare soil	______
______	Pavement, structures	______
TOTALS *100%*		*100%*

(b) From the top of the streambank out to 25 yards.

Left *(Percent)*		Right *(Percent)*
_____	Trees	_____
_____	Bushes, shrubs	_____
_____	Tall grasses, ferns, etc.	_____
_____	Lawn	_____
_____	Boulders/rocks	_____
_____	Gravel/sand	_____
_____	Bare soil	_____
_____	Pavement, structures	_____
TOTALS *100%*		*100%*

15. Pick the category that best describes the extent to which vegetation shades the stream at your site. Page 77

θ 0% θ 25% θ 50% θ 75% θ 100%

16. Looking upstream, note general conditions. Page 77
Check "1" if present, "2" if severe problem is clearly evident.

Left			Right	
1	**2**	**Stream Banks**	**1**	**2**
θ	θ	Natural streamside plant cover degraded	θ	θ
θ	θ	Banks collapsed/eroded	θ	θ
θ	θ	Garbage/junk adjacent to the stream	θ	θ
θ	θ	Foam or sheen on bank	θ	θ
1	**2**	**Stream Channel**	**1**	**2**
θ	θ	Mud, silt, or sand in or entering the stream	θ	θ
θ	θ	Garbage/junk in the stream	θ	θ
1	**2**	**Other**	**1**	**2**
θ	θ	Yard waste on bank (grass, clippings, etc.)	θ	θ
θ	θ	Livestock in or with unrestricted access to stream	θ	θ
θ	θ	Actively discharging pipe(s)	θ	θ
θ	θ	Other pipe(s) entering the stream	θ	θ
θ	θ	Ditches entering the stream	θ	θ

Local Watershed Characteristics

(within about 1/4 mile of the site; adjacent and upstream)

17. Land uses in the local watershed can potentially have an impact on a stream. Check "1" if present, "2" if clearly having an impact on the stream. Page 78

1	2	**Residential**
θ	θ	Single-family housing
θ	θ	Multifamily housing
θ	θ	Lawns
θ	θ	Commercial/institutional
1	**2**	**Roads, etc.**
θ	θ	Paved roads or bridges
θ	θ	Unpaved roads
1	**2**	**Construction underway on:**
θ	θ	Housing development
θ	θ	Commercial development
θ	θ	Road bridge construction/repair
1	**2**	**Agricultural**
θ	θ	Grazing land
θ	θ	Feeding lots or animal holding areas
θ	θ	Cropland
θ	θ	Inactive agricultural land/fields
1	**2**	**Recreation**
θ	θ	Power boating
θ	θ	Golfing
θ	θ	Camping
θ	θ	Swimming/fishing/canoeing
θ	θ	Hiking/paths
1	**2**	**Other**
θ	θ	Mining or gravel pits
θ	θ	Logging
θ	θ	Industry
θ	θ	Oil and gas drilling
θ	θ	Trash dump
θ	θ	Landfills