

SMART Monitoring Program
Water Quality Screening Chart

Indicator Group		Excellent	Good	Fair	Poor
Biology¹					
Plankton		No Blooms	Infrequent Blooms	Periodic Blooms	Frequent/Prolonged Blooms
Periphyton	Chlorophyll a	$\leq 2 \mu\text{g} / \text{cm}^2$ ave. $\leq 7 \mu\text{g} / \text{cm}^2$ max.		$\leq 6 \mu\text{g} / \text{cm}^2$ ave. $\leq 20 \mu\text{g} / \text{cm}^2$ max. >40 % cover in riffle by green macroalgae	$>6 \mu\text{g} / \text{cm}^2$ ave. $>20 \mu\text{g} / \text{cm}^2$ max. >40 % cover in riffle by green macroalgae
Macrophyton		Non-natives absent		Non-natives present	Non-natives Dominant
Macroinvertebrates	% Reference RBP III	Non Impacted $\geq 83\%$	Slightly Impacted 54-79%	Moderately Impacted 21-50%	Severely Impacted <17%
Fish (Rivers)	Taxa Composition Cold Water Fishery	Dominated by intolerant fluvial fishes	Dominated by intolerant or moderately tolerant fluvial fishes and cold water species well represented (>10%).	Cold water species not well represented (<10%).	Absence of cold water species.
	Taxa Composition Warm Water Fishery	Dominated by intolerant or moderately tolerant fluvial fishes	Dominated by intolerant or moderately tolerant fluvial fishes.	Dominated by tolerant fluvial species, or by macrohabitat generalist species.	General absence (<10%) by fluvial species.
	Target Fish Community	The most dominant species identified in an applicable TFC are present and dominant		The most dominant species identified in an applicable TFC are missing, or if present are low in numbers or proportion.	

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Habitat¹					
RBP II, III, IV	% Reference	≥ 90%	75-88%	60-73%	< 58%
Substrate/Cover	Composition	> 50%	25-49%	10-24%	< 10%
	Embedded	0-25%	25-50%	50-75%	> 75%
Geomorphology	Alterations	None	< 40%	40-80%	> 80%
	Deposition	< 5%	5-30%	30-50%	> 50%
Riparian Zone	Width	> 60 ft.	40-60 ft.	20-40 ft./gaps	< 20 ft.
	Bank Erosion	< 5%	5-30%	30-60%	> 60%
Flow⁷					
Volume	Net Loss	None	< 7Q10	≥ 7Q10	≥ 0.5 ABF
Channel Status	% Full	100%	75-100%	25-75%	< 25%
Flow Pattern	Δ Reference Stream				
	Low flow duration	< 5%	< 10%	< 15%	< 20%
	Seasonal base flows	< 10%	< 15%	< 20%	< 25%
	High flow pulse frequency	< 10%	< 20%	< 30%	< 50%
	Small flood magnitude	< 10%	< 25%	< 40%	< 50%
	Large flood magnitude	< 15%	< 25%	< 40%	< 50%

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Chemistry^{2,3,4}					
Dissolved Oxygen	Cold Water (Fall 10/1-11/30)	≥ 8 mg/l (≥ 11mg/l)	6-8 mg/l (9-11 mg/l)	5-6 mg/l (8-9 mg/l)	< 5mg/l (< 8 mg/l)
	Warm Water (Spring 3/1-6/30)	≥ 6 mg/l (≥ 6.5 mg/l)	5-6 mg/l (5.5-6.5 mg/l)	4-5 mg/l (5.0-5.5 mg/l)	< 4 mg/l (< 5 mg/l)
	Winter 12/1-2/28	91-110% saturation	71-90% saturation	50-70% saturation	< 50% saturation
pH	Standard Units	6.5-8.0 Δ 0.5	6.5-8.5 Δ 0.5	6.0-9.0 Δ 1.0	< 6.0 or > 9.0 Δ 1.5
Temperature	Cold Water	< 15°C (59°F)	15-20°C (59-68°F)	> 20-23.8°C (68-75°F)	> 23.8°C (75°F)
	Warm Water	< 23.8°C (75°F)	24-26.6°C (75-80°F)	> 26.6-28.3°C (80-83°F)	> 28.3°C (83°F)
Conductivity	Umho/cm	≤ 120	80% > 120	50% > 240	20% > 360
Suspended Solids		1-10 mg/l	10-25 mg/l	25-80 mg/l	> 80 mg/l
Nutrients					
Total Phosphorus as P	Lakes -low	< 10 ug/l	10-15 ug/l	15-25 ug/l	> 25 ug/l
	med	<15 ug/l	15-25 ug/l	25-50 ug/l	> 50 ug/l
	high	< 25 ug/l	25-50 ug/l	50-75 ug/l	> 75 ug/l
	Rivers VIII	< 10 ug/l	10-15 ug/l	15-25 ug/l	> 25 ug/l
	XIV	< 25ug/l	25-50 ug/l	50-75 ug/l	> 75 ug/l
Total Nitrogen as N	Lakes-low	< 0.3 mg/l	0.3-0.6 mg/l	0.6-0.9 mg/l	> 0.9 mg/l
	med	< 0.4 mg/l	0.4-0.7 mg/l	0.7-1.0 mg/l	> 1.0 mg/l
	high	< 0.6 mg/l	0.6-0.9 mg/l	0.9-1.2 mg/l	>1.2 mg/l
	Rivers VIII	< 0.3 mg/l	0.3-0.6 mg/l	0.6-0.9 mg/l	> 0.9 mg/l
	XIV	< 0.6 mg/l	0.6-0.9 mg/l	0.9-1.2 mg/l	> 1.2 mg/l

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Toxics⁵					
Ambient Toxicity	% Survival	100%	75-100%	50-75%	< 50%
Effluent Toxicity		LC 50 >Permit Limit = "Concern"			
Specific Chemicals	US EPA Criteria		< Chronic Level	≥ Chronic Level	≥ Acute Level
Chlorine			11 ug/L	11-19 ug/L	19 ug/L
Ammonia -N	Lakes (average)	< 0.15 mg/l	0.15-0.3 mg/l	0.3-0.5 mg/l	> 0.5 mg/l
	Rivers (average)	< 0.3 mg/l	0.3 – 0.5 mg/l	0.5-1.0 mg/l	> 1.0 mg/l
Sediments⁸					
Mercury	mg/kg		≤ 0.18	0.19-0.35	≥ 0.36
Other Metals		< TEC	TEC- PEC	> PEC	≥ 2 X PEC
Total PCB's	ug/kg		≤ 60	61-120	≥120
Pesticides			≤ TEC	>TEC	≥ 2 X TEC
PAH's			≤ TEC	>TEC	≥ 2 X TEC
Nutrients	TOC (%)	0.1	1	2-10	10
	TKN (ppm)	55	550	551-4,800	4,800
	TP (ppm)	60	600	601-2,000	2,000
Toxicity Test		100%	75-100%	50-75%	< 50%
Bioaccumulation			None Evident	Limited Advisory	Full Advisory
Fish Tissue					
Advisories		Data below advisory levels		Limited Advisory- targeted population and /or species: P1 (all species) P1 (species) P2 (species) P3 (species)	Full Advisory- general population, all species: P4, P5, P6

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Bacteria⁶					
Fecal Coliform* /100ml	Geometric mean	≤ 20	≤ 200	≤ 1,000	> 1,000
	Maximum	≤ 40	≤ 400	≤ 2,000	> 2,000
E. coli*/100ml	Geometric mean	≤ 12	≤ 126	≤ 630	> 630
	Maximum	≤ 24	≤ 235	≤ 1,260	> 1,260
Enterococci*/100ml (marine water)	Geometric mean	≤4	≤ 35	≤ 175	> 175
	Maximum	≤10	≤104	≤ 350	> 350
Aesthetics					
Oil and Grease		None Objectionable		Visible sheen, deposits or odors	
Taste and Odor		None Objectionable		Offensive odors (rotten egg, sewage, chemical, musty)	
Clarity	Rivers	> 4 feet	4-3 feet	3-2 feet	< 2 feet
	Lakes	>15 feet	10-15 feet	4-10 feet	< 4 feet
Turbidity	Weekly Average	0-1 NTU	1-5 NTU	5-10 NTU	> 10 NTU
Color	PCU	0-30	30-50	50-70	> 70
Nuisance Vegetation	Plants	< 50% coverage		50-75% coverage	> 75% coverage
Nuisance Vegetation	Periphyton	<40 % cover in riffle by green macroalgae		>40 % cover in riffle by green macroalgae	
Trash/Debris		None Objectionable		Nuisance trash, debris, scum or other matter	

*** When “good” criteria are met during dry weather conditions but not during wet weather conditions the waterbody is assessed as “fair”.**

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Notes on SMART Water Quality Screening Criteria:

The purpose of this chart is to aid in the review of data for the SMART Water Quality Report Card. The Report Card uses a simple color-coded system to report water quality in one of four status categories: excellent, good, fair or poor. Since many constituents do not have numerical criteria it can be difficult to assign them to a particular status level. This chart uses the existing database and best professional judgment to determine an expected range of values for each status category. The values are primarily for rivers although some lake values are included. These can be used to screen large data sets and quickly flag areas for more extensive review. It is important to note that these values are not enforceable water quality standards, nor are they intended to replace scientific judgments or site-specific considerations.

1. In the **Biology and Habitat Indicator Groups**, RBP II, III, IV and V refer to the US EPA Rapid Bioassessment Protocols as modified by MassDEP.
2. For applying **Dissolved Oxygen** values in cold water fisheries use fall values during the period of 10/1-11/30. In warm water fisheries use spring values during the period 3/1-6/30. In all cases use winter values during the period 12/1-2/28.
3. **Nutrient** data should be used in context with other pertinent data (diurnal dissolved oxygen, diurnal pH, Plankton, Periphyton, Macrophyton and turbidity) to determine if a water quality problem exists. Lake nutrient regions –the Nashua, Suasco, and Blackstone SMART stations are in the high nutrient region, the Millers, Chicopee, and F&Q are in the intermediate region. River ecoregions –the Millers SMART stations are in EPA ecoregion VIII, the Blackstone, Nashua, Suasco, Chicopee, and F&Q stations are in EPA ecoregion XIV.
4. For large data sets in the **Chemistry and Nutrient Indicators Groups**, where you determine that an occasional high or low value will cause no serious harm, the prescribed values should not be exceeded in greater than 20% of the values of any 20 consecutive samples nor in three consecutive samples.
5. The term **Ambient Toxicity** refers to a standard toxicity test (standard organisms and duration) run with ambient water, not effluent.
6. For **Bacteria** data the **Geometric Mean** is the nth root of the product of five or more samples. Use the **Maximum** value for data sets with fewer than five samples.
7. For **Flow** data, the **Net Loss** is a value calculated from a water budget on a defined drainage area. The net loss is the sum of the water losses minus the sum of water gains (from water withdrawals, water distribution systems, wastewater collection systems and wastewater discharges). The **7Q10** is the lowest flow to be expected for 7 consecutive days during a 10-year period. The **ABF** is the aquatic base flow (usually the August median flow).
8. **Sediments**-TEC= threshold effects concentration, PEC = probable effects concentration, in accordance with the freshwater sediment screening benchmarks for the Massachusetts Contingency Plan (MassDEP).
9. **Fish Tissue**- advice codes in the Freshwater Fish Consumption Advisory List, Ma. Dept. of Public Health, Center for Environmental Health.

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The **Flow Duration Curve Zones** are used to characterize the river regime during various sampling events and identify possible sources of pollution. The flow duration is the historical probability that a particular flow rate is equaled or exceeded for a particular location. USGS has these statistics available for most of their gage sites. When using exposure indicators, the more flow regimes that are included the better (more complete) is the data set for capturing the variability at a site.

Contributing Source Area	Flow Duration Curve Zone				
	Flood Flow 0-10%	High Flow 10-40%	Average Flow 40-60%	Dry Flow 60-90%	Low Flow 90-100%
Point Source				Medium	High
On-site wastewater systems			High	Medium	
Riparian Areas		High	High	High	
Stormwater: Impervious areas		High	High	High	
Combined sewer overflows	High	High	High		
Stormwater: Upland	High	High	Medium		
Bank erosion	High	Medium			