Calculation of Metrics

1. Density- Is the relative abundance of animals in a sample.

Calculation: Number of animals in subsample / proportion of sample processed.

Example : 300 animals picked / 0.25 (or one quarter of sample picked) = 1200 animals/sample

2. Richness- Species richness is the number of species in a sample unit.

Calculation: Richness is the total number of distinct taxa identified in a sample. Note immature larva identified to family or genus are not considered a distinct new taxa if a genus or species identification is determined within its group.

Example :

Taxon	# orgs Rep 1	# orgs Rep 2
Ephemerellidae Ephemerella sp	2	0
Ephemerellidae Ephemerella dorothea	3	4
Ephemerellidae Ephemerella invaria	0	2
Richness =	1	2
Mean Richness =	1.5	

 3. EPT Index- The EPT index is a subset of the above richness measure. It is the number of species in the sample in the generally more environmentally sensitive orders Ephemeroptera, Plecoptera, and Trichoptera.

Calculation: The number of distinct taxa identified in a sample from the insect orders Ephemeroptera, Plecoptera, Trichoptera. Note same rules apply as above for richness in determining number of distinct taxa.

4. EPT/EPT & Chironomidae - Is a measure of the ratio of the abundance of the intolerant EPT orders to the generally tolerant Diptera family Chironomidae.

Calculation: The number (abundance) of animals from the orders Ephemeroptera, Trichoptera and Plecoptera, divided by the above plus the number of Chironomidae.

5. % Oligochaeta - Is a measure of the percent of the macroinvertebrate community made up of the Order Oligochaeta.

Calculation: The number (abundance) of Oligochaeta divided by the total number of animals in sample.

6. Percent Model Affinity of Orders - (PMA-O) Is a measure of order level similarity to a model based on the reference streams Novak and Bode (1992).

Calculation: Determine the percent composition for each major group - Coleoptera, Diptera, Ephemeroptera, Plecoptera, Trichoptera, Oligochaeta, Other. Compare to the "Model" for the appropriate stream community (see below), then add up the lower of the two values for each of the groups (assessment site vs Model), this is the PMA-O for the assessment site.

PMA-O = min (X_a or X_r)

Where: X_a = the percent composition of order X from the assessment site;

X_r = the percent composition of order X from the appropriate reference condition;

Example:

Percent Composition Major Grps	Assessment Site % Comp	Model for MMC (Medium Mt)
Coleoptera	20	**6**
Diptera	55	**18**
Ephemeroptera	**10**	34
Plecoptera	**2**	8
Trichoptera	**3**	33
Oligocheata	10	**0.5**
Other	**0**	0.5
PMA-Orders =	39.5 rounded = 40.0	

7. Hilsenhoff Biotic Index - BI (0-10) - Is a measure of the macroinvertebrate assemblage tolerance toward organic (nutrient) enrichment Hilsenhoff (1987). In many ways this index is both an indicator taxa metric and functional group metric, since those taxa which become more dominant in moderately enriched streams are those which are taking advantage of shifts in the available food base in the stream.

Calculation : Multiply the number of individuals of a taxon by its assigned tolerance value, see VTDEC BI values, modified from Hilsenhoff 1987, and Bode 1996. Total all these products, and divide by the total number of individuals <u>of each taxon assigned a tolerance value</u>. This is the Bio Index value.

$$HBI = \sum_{i=1}^{i} \frac{n_i\, a_i}{N}$$

Where: n is the number of individuals of the "i"th taxon;

a is the index value of that taxon;

N is the total number of individuals in the sample assigned a Bio Index Value

Example :

Taxon	Count	BI Tolerance Value	Subtotal Ct × BI
Ephemerllidae imm	(10)	NA	NA
Ephemerella sp	**10**	4	**40**
Ephemerella needhami	**10**	1	**10**
Plecoptera Leuctridae imm	**20**	0	**0**
Diptera Cricotopus bisinctus	**5**	6	**30**
Trichoptera Symphitopsyche alhedra	**10**	3	**30**
Trichoptera Symphitopsyche sp	**5**	5	**25**
Totals	***60***		***145***
Site Bio Index Value	145/60 = ***2.42***		

8. Pinkham – Pearson Coefficient of Similarity – Functional Groups – (PPCS-F) - Is a measure of functional feeding group similarity to a model based on the reference streams. It is similar in concept to the **PMA-O** in that a site is compared to a model of the composition of the functional feeding groups as opposed to order level taxonomic changes. Also the Pinkham Pearson Coefficient of Similarity (Pinkham1976) was used as the similarity index. By replacing functional feeding groups with families, the formula can easily be recalculated to yield a Pinkham Pearson Coefficient of Similarity – Families (PPCS-Fam). This would provide a family-level comparison between a pair of sites.

Calculation: At the assessment site determine the percent composition of the six major functional groups (Collector Gatherer, Collector Filterer, Predator, Shredder-Detritus, Shredder-Herbivore, Scraper) as assigned by VTDEC after Merrit and Cummins 1996, Bode 1996. For each functional group determine the product (min/max) between the assessment site vs the Model for the stream community sampled. Add these products and divide by six (# of functional grps). This is the PPCS-F.

$$PPCS\text{-}F = 1/k \sum_{i=1}^{k} \frac{\min(x_i a, x_i b)}{\max(x_i a, x_i b)}$$

Where: k = the number of comparisons between stations (6)

x_i = the number of individuals in functional group i

a, b = site a, site b

Example :

Functional Group	Assessment Site % Comp	"Model" for MMC	Product (min/max)
Collector Gatherer	68	32	0.47
Collector Filterer	10	30	0.33
Predator	2	13	0.15
Shredder - Detritus	0	4	0.00
Shredder - Herbaceous	16	1	0.06
Scraper	2	13	0.15
PPCS-F =			**0.19**