AQUATIC INVERTEBRATE ASSEMBLAGES AND BIOLOGICAL ASSESSMENT OF STREAM SITES IN THE CITY OF BELLEVUE, WASHINGTON:

2014

Report to the City of Bellevue, Washington
Utilities Department
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INTRODUCTION

This report summarizes and interprets aquatic macroinvertebrate data collected in August 2014 at stream sites in the City of Bellevue, King County, Washington. As with the projects completed in prior years, the objectives of this study include using the invertebrate biota to detect impairment to biological health, using 2 assessment tools: the B-IBI (Benthic Index of Biological Integrity: Puget Sound Stream Benthos: http://pugetsoundstreambenthos.org, accessed May 2015), and a predictive model (RIVPACS – the River InVertebrate Prediction and Classification System). The 10 B-IBI metrics and index scores were calibrated for streams of the Pacific Northwest and obtained from the Puget Sound Stream Benthos website, using the revised version based on continuous scoring (0-100). The RIVPACS model was developed by the Washington Department of Ecology (WDOE). RIVPACS compares the occurrence of taxa at a site with the taxa expected at a similar site with minimal human influence, and yields a score that summarizes the comparison. These assessment tools provide a summary score of biological condition, and the B-IBI can be translated into biological health condition classes (i.e., excellent, good, fair, poor, and very poor) based on ranking criteria used by King County and other agencies and organizations in the Puget Sound region.

In addition, this report identifies probable stressors that may account for diminished stream health in site-specific narrative summaries. These summaries are based on the demonstrated and expected associations between patterns of response of B-IBI metrics and other metric expressions, as well as the taxonomic and functional composition of the benthic assemblages. The analysis examines common stressors associated with urbanization: water quality degradation (including metals contamination), changes to natural thermal regimes, loss and impairment of instream habitats due to sediment deposition and altered flow regimes, and disturbance to reach-scale and in-stream habitat features such as stream banks, channel morphology, and riparian zone integrity.

METHODS

Sampling

The City of Bellevue provided oversight for the collection of 9 aquatic invertebrate samples from 4 sites. Three replicate samples were collected at Unnamed Tributary (Vasa) and at Lewis I-90. Single collections were made at the other 3 sites. Samples were processed and invertebrates identified by Rhithron Associates, Missoula, Montana.

Sample processing

In the laboratory, standard sorting protocols were applied to achieve representative subsamples of aquatic organisms. Caton sub-sampling devices (Caton 1991), divided into 30 grids, each approximately 5 cm by 6 cm were used. Each individual sample was thoroughly mixed in its jar(s), poured out and evenly spread into the Caton tray, and individual grids were randomly

selected. The contents of each grid were examined under stereoscopic microscopes using 10x30x magnification. All aquatic invertebrates from each selected grid were sorted from the substrate, and placed in ethanol for subsequent identification. The final selected grid was completely sorted of all organisms. All unsorted sample fractions were retained and stored at the Rhithron laboratory.

Organisms were individually examined by certified taxonomists, using 10x – 80x stereoscopic dissecting scopes (Leica S8E and S6E) and identified to target taxonomic levels consistent with protocols for Puget Sound Lowlands streams, using appropriate published taxonomic references and keys. Midges (Diptera: Chironomidae) were identified to genus/species group/species and Oligochaetes were identified to genus/species. Identification, counts, life stages, and information about the condition of specimens were recorded on bench sheets. To obtain accuracy in richness measures, organisms that could not be identified to the target level specified were designated as "not unique" if other specimens from the same group could be taken to target levels. Organisms designated as "unique" were those that could be definitively distinguished from other organisms in the sample. Identified organisms were preserved in 95% ethanol in labeled vials, and archived at the Rhithron laboratory.

Midges and worms were carefully morphotyped using 10x – 80x stereoscopic dissecting microscopes (Leica S8E and S6E) and representative specimens were slide mounted and examined at 200x – 1000x magnification using an Olympus BX 51 compound microscope with Hoffman contrast. Slide mounted organisms were archived at the Rhithron laboratory.

Quality assurance (QA)/ quality control (QC) procedures

Quality control procedures for initial sample processing and subsampling involved checking sorting efficiency (*SE*). An independent observer microscopically re-examined 100% of the sorted substrate from a randomly selected sample, representing 11.1% of total samples. All organisms that were missed were counted and this number was added to the total number obtained in the original sort. Sorting efficiency was evaluated by applying the following calculation:

$$SE = [n_1/(n_1 + n_2)] \; X \; 100$$

where: *SE* is the sorting efficiency, expressed as a percentage, n_1 is the total number of specimens in the first sort, and n_2 is the total number of specimens in the second sort. Target efficiency for these samples was 90%.

Quality assurance procedures for taxonomic determinations of invertebrates involved checking accuracy, precision and enumeration. One sample was randomly selected and all organisms re-identified and counted by an independent taxonomist. Taxa lists and enumerations were compared by calculating the Percent Taxonomic Difference (PTD), the Percent Difference in Enumeration (PDE), and a Bray-Curtis similarity statistic (Bray and Curtis 1957) for each selected

sample. Internal data quality targets for these parameters are: PTD ≤5%, PDE ≤5%, and BrayCurtis similarity ≥95%. Routinely, discrepancies between the original identifications and the QC identifications are discussed among the taxonomists, and necessary rectifications to the data are made. Discrepancies that cannot be rectified by discussions are routinely sent out to taxonomic specialists for identification. However, taxonomic certainty for identifications in this project was high, and no external verifications were necessary.

Data analysis

B-IBI metrics and scores were obtained from the Puget Sound Stream Benthos (PSSB) website, using the updated version (accessed in May 2015), scaled continuously between 0 and 100. RIVPACS scores were obtained by entering data into a web-based application maintained by the Utah State University's Western Center for Monitoring and Assessment of Freshwater Ecosystems. Related applications on this website produce a taxa list from each sample by a random re-sampling routine that standardizes sample sizes. Some taxa are excluded from the analysis. Output from the RIVPACS applications provide a RIVPACS score for each replicate.

Metric and taxonomic signals for water quality (including the presence of possible metals contamination), thermal condition, sediment deposition and habitat indicators were investigated and described in narrative interpretations. These interpretations of the taxonomic and functional composition of invertebrate assemblages are based on demonstrated associations between assemblage components and habitat and water quality variables gleaned from the published literature, the writer's own research and professional judgment, and those of other expert sources (e.g. Wisseman 1998). Often canonical procedures are used for stressor identification; however, the substantial data required for such procedures (e.g., surveys of habitat, historical and current data related to water quality, land use, point and non-point source influences, soils, hydrology, geology) were not readily available for this study. Instead, attributes of invertebrate taxa that are well-substantiated in diverse literature, published and unpublished research, and that are generally accepted by regional aquatic ecologists, are combined into descriptions of probable water quality and instream and reach-scale habitat conditions. The approach to this analysis uses some assemblage attributes that are interpreted as evidence of water quality and other attributes that are interpreted as evidence of habitat integrity. To arrive at impairment hypotheses, attributes are considered individually, so information is maximized by not relying on a single cumulative score, which may mask stress on the biota. When replicate samples were collected, data were combined for the narrative analyses.

Mayfly taxa richness, the Hilsenhoff Biotic Index (HBI) value (Hilsenhoff 1987), the richness and abundance of hemoglobin-bearing taxa and the richness of sensitive taxa are often used as indicators of water quality. Mayfly taxa richness has been demonstrated to be significantly correlated with chemical measures of dissolved oxygen, pH, and conductivity (e.g. Bollman 1998, Fore et al. 1996, Wisseman 1996). The HBI has a long history of use and validation (Cairns and Pratt 1993, Smith and Tran 2010, Johnson and Ringler 2014). The index uses the relative abundance of taxa and the tolerance values associated with them to calculate a score

representative of the tolerance of a benthic invertebrate assemblage. Higher HBI scores indicate more tolerant assemblages. In one study, the HBI was demonstrated to be significantly associated with conductivity, pH, water temperature, sediment deposition, and the presence of filamentous algae (Bollman 1998). Nutrient enrichment often results in large crops of filamentous algae (Watson 1988). Thus in these samples, when macroinvertebrates associated or dependent on filamentous algae (e.g. LeSage and Harrison 1980, Anderson 1976) are abundant, the presence of filamentous algae and nutrient enrichment are also suspected. In addition, low oxygen concentrations are often a result of nutrient enrichment in situations where enrichment has encouraged excessive plant growth; nocturnal respiration by these plants creates hypoxic conditions. Hemoglobin-bearing taxa are very tolerant of environments with low oxygen concentrations, because the hemoglobin in their circulating fluids enables them to carry more oxygen than organisms without it. Finally, sensitive taxa exhibit intolerance to a wide range of stressors (e.g. Wisseman 1996, Hellawell 1986, Barbour et al. 1999), including nutrient enrichment, acidification, thermal stress, sediment deposition, habitat disruption, and other causes of degraded ecosystem health. These taxa are expected to be present in predictable numbers in well-functioning streams.

The absence of invertebrate groups known to be sensitive to metals and the Metals Tolerance Index (MTI, McGuire 1998) are considered signals of possible metals contamination. Metals sensitivity for some groups, especially the heptageniid mayflies, is well-known (e.g. Kiffney and Clements 1994, Clements 1999, Clements 2004, Montz et al. 2010, Iwasaki et al. 2013). In the present approach, the absence of these groups in environs where they are typically expected to occur is considered a signal of possible metals contamination, especially when these signals are combined with a measure of overall assemblage tolerance of metals. The MTI ranks taxa according to their sensitivity to metals. Weighting taxa by their abundance in a sample, assemblage tolerance is estimated by averaging the tolerance of all sampled individuals. Higher values for the MTI indicate assemblages with greater tolerance to metals contamination.

Thermal characteristics of the sampled site are predicted by the richness and abundance of cold stenotherm taxa (Clark 1997), which require low water temperatures, and by calculation of the predicted temperature preference of the macroinvertebrate assemblage (Brandt 2001). Hemoglobin-bearing taxa are also indicators of warm water temperatures (Walshe 1947), because dissolved oxygen is directly associated with water temperature (colder water can hold more dissolved oxygen); oxygen concentrations can also vary with the degree of nutrient enrichment. Increased temperatures and high nutrient concentrations can, alone or in concert, create conditions favorable to hypoxic sediments, habitats preferred by hemoglobin-bearers.

Stress from sediment is evaluated by caddisfly richness and by “clinger” richness (Kleindl 1995, Bollman 1998, Karr and Chu 1999, Wagenhoff et al. 2012, Leitner et al. 2015). The Fine Sediment Biotic Index (FSBI) (Relyea et al. 2001) is also used. Similar to the HBI, tolerance values are assigned to taxa based on the substrate particle sizes with which the taxa are most frequently associated. Scores are determined by weighting these tolerance values by the relative

abundance of taxa in a sample. Higher values of the FSBI indicate assemblages with greater fine sediment sensitivity. However, it appears that FSBI values may be influenced by the presence of other deposited material, such as large organic material, including leaves and woody debris.

Functional characteristics of the macroinvertebrate assemblages may also reveal the condition of instream and streamside habitats. Alterations from predicted patterns of the functional characteristics may be interpreted as evidence of water quality or habitat disruption. Predicted patterns are based on the morphology and behaviors associated with feeding, and are interpreted in terms of the River Continuum Concept (Vannote et al. 1980) in the narratives. For example, the abundance of stonefly predators is likely to be related to the diversity of invertebrate prey species, and thus the complexity of instream habitats. Sites with fewer than expected stonefly species are likely to have reduced habitat complexity. Also, the absence of long-lived species (those that take 2 years to mature in the stream) is likely related to catastrophes like periodic scour, thermal stress or toxic pollutants that could interrupt long life cycles. In addition, shredders and the microbes they depend on are sensitive to modifications of the riparian zone vegetation (Plafkin et al. 1989).

RESULTS

Quality Control Procedures

Sorting efficiency for the randomly-selected quality control samples was 95.63%. PDE (0.74%), PTD (1.76%), and Bray-Curtis similarity was 98.96%. All QC parameters met Rhithron's internal quality criteria (Rhithron Associates 2013), and were all well within industry standards for sorting and taxonomic data quality (Stribling et al. 2003).

Data analysis

Taxa lists and counts, and values and scores for standard bioassessment metrics for composited replicate samples are given in the Appendix. Table 1 summarizes B-IBI and RIVPACS scores for sites and for sample replicates.

Site B-IBI scores varied from 0 to 50.8 for City of Bellevue samples collected in 2014. These scores indicated "very poor" conditions for 3 sites (Kelsey Pelzer, Kelsey Farm, Sunset SE 30th) and "fair" condition for two sites (Unnamed Tributary (Vasa) and Lewis I 90). B-IBI site scores are graphed in Figure 1.

Table 1. B-IBI scores and RIVPACS scores for replicates and for sites. The B-IBI site scores and the RIVPACs site scores for the Unnamed Tributary site, from which 3 replicates were collected, and the Lewis Creek site, from which 3 replicates were collected, were obtained by scoring the composited replicates. All B-IBI scores were calculated by the PSSB website database application. City of Bellevue, 2014.

Station name	Bellevue site ID	PSSB site ID	B-IBI Scores		RIVPACS Scores	
			Replicate	Site (composite)	Replicate	Site (composite)
Unnamed Tributary (Vasa) Rep 1	0160 S. of Vasa Rep 1	Unnamed0160RM.1	27.7	**42.6**	0.72	**0.72**
Unnamed Tributary (Vasa) Rep 2	0160 S. of Vasa Rep 2		35.3		0.64	
Unnamed Tributary (Vasa) Rep 3	0160 S. of Vasa Rep 3		30.0		0.64	
Lewis I-90 Rep 1	Lewis I 90 Rep 1	LewisBelRM0.8	32.8	**50.8**	0.88	**0.96**
Lewis I-90 Rep 2	Lewis I 90 Rep 2		34.2		0.88	
Lewis I-90 Rep 3	Lewis I 90 Rep 3		19.8		0.56	
Kelsey Peltzer Rep 1	Kelsey Peltzer 1A-E	KelBelRM3.9	**5.9**		**0.48**	
Kelsey Farm	Kelsey Farm 1-6	KelBelRM1.6	**8.5**		**0.40**	
Sunset SE 30th	Sunset SE 30th Rep 1A-D	Sunset/RichardsRM0	**0**		**0.32**	

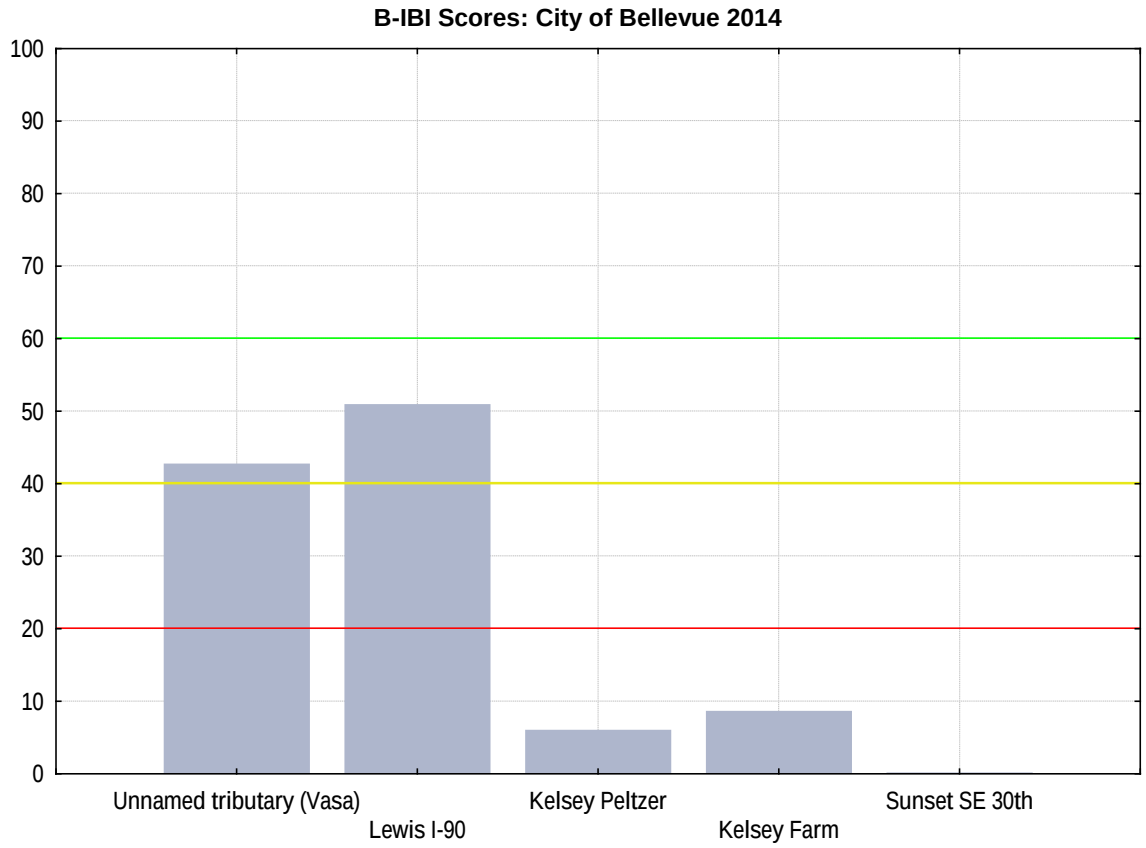

Figure 1. B-IBI site scores for stream sites in the City of Bellevue, 2014. The B-IBI score for the Sunset SE 30th site was 0. The green line indicates the threshold (B-IBI = 60) for "good" conditions, as described on the Puget Sound Stream Benthos website (pugetsoundstreambenthos.org, accessed May 2014) for scoring using a 0-100 continuous scale. Scores below the threshold indicate impaired conditions. The yellow line is the threshold (B-IBI = 40) for "fair" conditions; scores falling below the threshold indicate "poor" conditions. Scores falling below the red line (B-IBI = 20) indicate "very poor" conditions.

RIVPACS site scores varied from 0.32 to 0.96. These scores indicated impaired biological conditions in 2014 for 5 of the 6 sites. A RIVPACS score of 0.96 indicated "unimpaired" conditions at one site (Lewis I-90). RIVPACS site scores for replicates collected at the Unnamed Tributary (Vasa) and at Lewis 1-90 were obtained by scoring composited replicates. Site scores are graphed in Figure 2.

B-IBI site scores and RIVPACS site scores for the 5 locations in this study were significantly correlated with each other ($r = 0.9653$, $p = 0.0077$). Figure 3 illustrates this relationship.

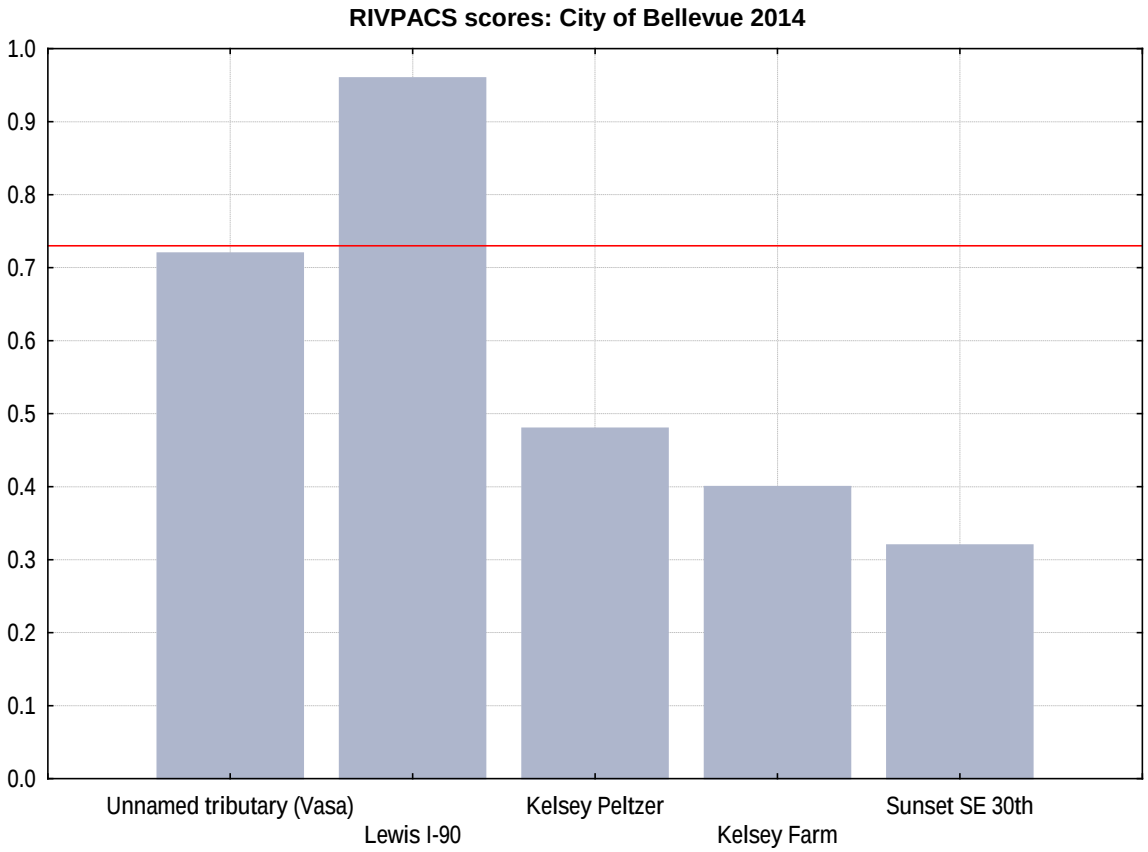

Figure 2. RIVPACS site scores for stream sites in the City of Bellevue, 2014. The red line indicates the threshold (RIVPACS = 0.73) for "unimpaired" conditions, set by WDOE. Scores below the threshold indicate impaired conditions.

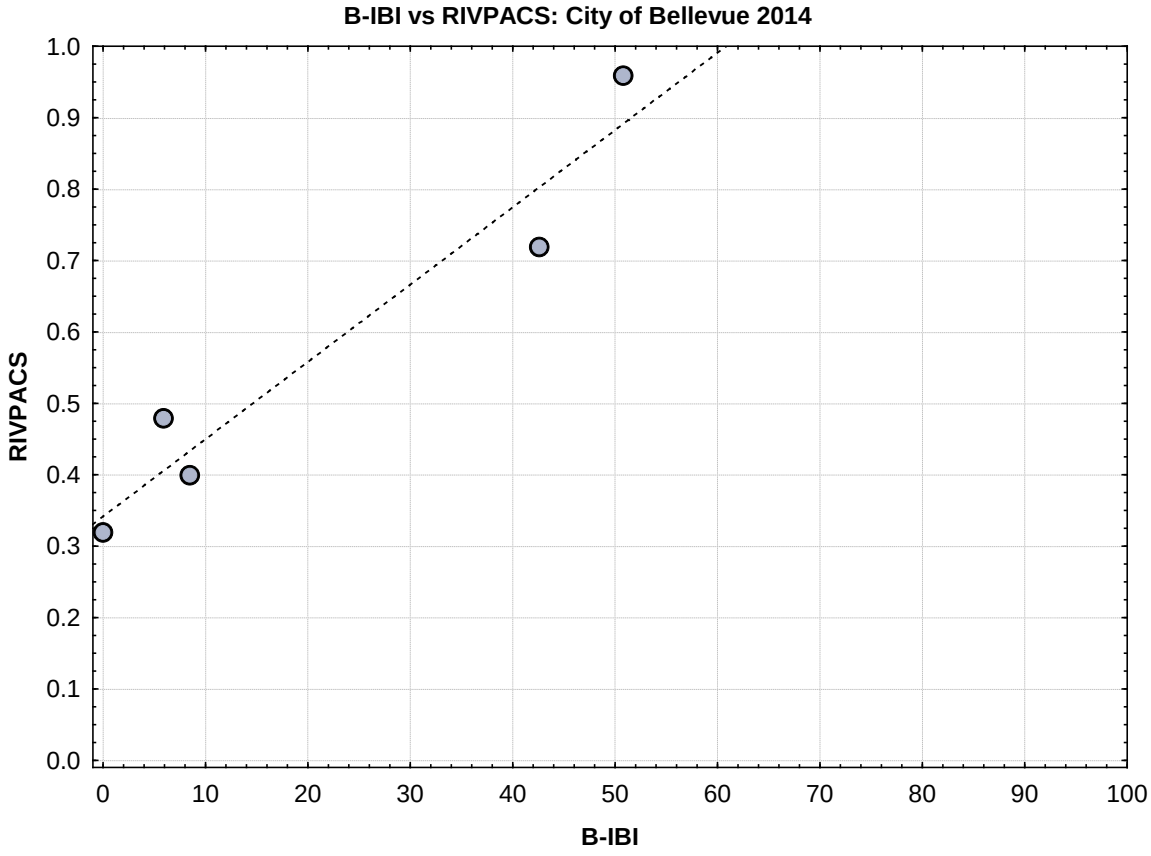

Figure 3. Correlation between B-IBI site scores and RIVPACS site scores for locations in the City of Bellevue, 2014. The relationship was significant (r= 0.9653, p = 0.0077).

Aquatic invertebrate assemblage characteristics

Unnamed Tributary (Vasa) (replicates)

- **Bioassessment scores: 2014**

Three replicate samples were collected at this site in 2014 and this analysis is based on an average of the 3 replicates. The B-IBI site score (31.0) indicated "fair" biological condition. The mean RIVPACS score (0.68) over 3 replicates indicated impaired conditions.

- **Indicators of ecological condition: 2014**

Three replicate samples were collected at this site in 2014 and discussion of the indicators of ecological condition are based on a composite of all 3 replicates. Because only a total of 439 invertebrates for the 3 samples were represented, the results of richness metrics should be comparable to results from sites where only a single sample was collected. However, it should be noted that the low number of organisms in these samples is suggestive of either water quality or habitat disturbances.

a. Water quality

Four mayfly taxa were found in the samples collected at this site including the ubiquitous *Baetis tricaudatus*, *Diphetor hageni*, *Ironodes* sp. and several specimens of the cold stenotherm *Cinygma* sp. The low biotic index value (2.91) is suggestive of a sensitive assemblage. The presence of 3 sensitive taxa and the fact that the relatively sensitive chloroperlid stonefly *Sweltsa* sp. accounted for 14.4% of the sampled animals is concordant with the low biotic index value. Although the metals tolerance index value (4.08) exceeded the biotic index value, the presence of heptageniid mayflies suggests that metals contamination was not an issue at this site. In addition, the presence of several specimens of the turbellarian, *Polycelis* sp., suggests that ground water contributed to surface flow at this site. Thus, it seems likely that water quality was good at this site.

b. Thermal condition

Three cold stenotherm taxa were detected in the samples, accounting for a little over 6% of the sampled individuals. The thermal preference estimated for the assemblage was 14.4°C.

c. Sediment deposition

Fourteen "clinger" and 5 caddisfly taxa were collected in these samples, thus it seems likely that colonization was not appreciably limited by fine sediment. An FSBI value of 3.90 indicated a moderately sediment-tolerant assemblage.

d. Habitat diversity and integrity

Taxa richness (33) was moderately high suggesting that habitats were diverse and fairly well intact. There were 6 stonefly taxa found suggesting that reach-scale habitat features were relatively undisrupted. Although there were 2 semi-voltine taxa present in the samples represented by 12 individuals (2.7% of the assemblage), the diversity of organisms makes it seems likely that this site was not subjected to thermal stress, toxic pollutants or other catastrophes that would interrupt long life cycles. All the functional-feeding groups were well represented and gatherers (32.6%) and filterers (26.7%) dominated the functional mix.

Lewis I-90 (replicates)

- **Bioassessment scores: 2014**

Three replicate samples were collected at this site in 2014 and this analysis is based on an average of the 3 replicates. The B-IBI site score for this site was 28.9, indicating "fair" conditions. The mean RIVPACS result over the 3 replicates (0.77) indicated “unimpaired” conditions.

- **Indicators of ecological condition: 2014**

Discussion of the indicators of ecological condition are based on a composite of the 3 replicate samples that were collected at this site in 2014. Since a total of 854 invertebrates were represented, the results of richness metrics cannot be compared directly to results from sites where only a single sample was collected.

a. Water quality

Although 3 mayfly taxa were found in the composite sample (*Baetis tricaudatus, Diphetor hageni, and Cinygma* sp.), the group was dominated by *B. tricaudatus* (146 individuals versus 3 of the other two taxa) and only 2 specimens of the sensitive cold stenotherm, *Cinygma* sp., were found. The biotic index value (4.22) was moderately elevated above expectations for a Puget Sound Lowlands stream indicating a moderately tolerant assemblage. Although 5 sensitive taxa were found, the hemoglobin-bearing midge *Polypedilum* sp. accounted for slightly over 10% of the sampled invertebrates suggesting that hypoxic substrates might be present at this site. These results suggest that water quality was mildly impaired here. The slightly elevated biotic index combined with the suggestion of hypoxic substrates suggests that the water quality impairment may be related to nutrient enrichment. The presence of several specimens of the turbellarian, *Polycelis* sp., suggests that ground water contributed to surface flow at this site. There was no evidence of metals contamination.

b. *Thermal condition*

Four cold stenotherm taxa were collected accounting for only approximately 1% of the invertebrates collected in the sample. The temperature preference of the assemblage was 14.9 °C.

c. Sediment deposition

Caddisflies were represented by 8 taxa and "clingers" were represented by 21 taxa. These findings suggest that the deposition of fine sediment did not limit colonization in this reach. The FSBI (4.58) indicated a moderately sediment-tolerant assemblage.

d. Habitat diversity and integrity

Taxa richness (43) was high at this site suggesting that in-stream habitats were diverse and intact, although this may be an overestimate compared to the other sites because this result is based on 3 samples. At least 5 stonefly taxa were recorded from this site, thus riparian zones, channel morphology and stream banks were probably in good condition. Six semi-voltine taxa were collected, suggesting stable instream conditions. Scour, toxic inputs, and thermal extremes seem unlikely. All functional feeding groups were well represented with the dominant groups being the gatherers (34.8%) and filterers (35.3%) suggesting the importance of fine particulate organic matter to the energy flow of the system. In addition, shredders were abundant (15%) suggesting ample inputs of streamside vegetation.

Kelsey Peltzer

- **Bioassessment scores: 2014**

The B-IBI score for Kelsey Peltzer was 5.9 indicating "very poor" biological conditions. The RIVPACS score (0.48) also indicated impaired biological condition.

- **Indicators of ecological condition: 2014**

a. Water quality

Low mayfly taxa richness (1, *Baetis tricaudatus*) and an elevated biotic index (5.39) suggest that water quality was impaired in this reach. There were no sensitive taxa collected and relatively tolerant organisms, including the blackfly *Simulium* sp. (48%), the isopod *Caecidotea* sp. (6.9%) and several tolerant midge species, were abundant at this site. The functional composition of the assemblage was strongly dominated by collectors and filterers (84%): a pattern that is sometimes interpreted as evidence of water quality impairment. The taxonomic composition of the assemblage suggests nutrient enrichment in this reach. No evidence for metals contamination was found.

b. Thermal condition

No cold stenotherm taxa were encountered in the sample. The temperature preference of the assemblage was 14.8 °C.

c. Sediment deposition

Only 2 caddisfly taxa and 6 "clinger" taxa were present in this sample: both fewer than expected. The FSBI was 3.10, indicating that the taxa were fine sediment tolerant. These findings suggest that sediment deposition may have limited colonization of the stony substrate habitats.

d. Habitat diversity and integrity

Only 23 taxa were collected at this site, which may indicate disturbed or monotonous instream habitats. The sample contained only 2 stonefly taxa, both nemourids (*Malenka* sp. and *Zapada cinctipes*), suggesting that appreciable amounts of leafy and woody material was present. Low stonefly diversity may indicate disturbed reach-scale habitat features. Only one long-lived taxon was present, thus periodic thermal extremes, dewatering, or toxic pollutants cannot be ruled out in this reach. The domination of the assemblage by filterers (49%) and gatherers (35%) may indicate water quality impairment and that fine organic particulates were an important energy source in this reach.

Kelsey Farm

- **Bioassessment scores: 2014**

The B-IBI score (8.5) calculated for the sample collected at this site indicated "very poor" conditions; the RIVPACS score (0.40) also indicated impairment.

- **Indicators of ecological condition: 2014**

a. Water quality

A single mayfly taxon, the ubiquitous *Baetis tricaudatus*, was very abundant at this site. Low mayfly taxa richness combined with a very elevated biotic index value (6.09) suggests water quality impairment. No sensitive taxa were collected in this reach. The assemblage was dominated by relatively tolerant organisms. For example, midges in the family Chironomidae were a dominant component of the assemblage (36%). Although, not all chironomid taxa are tolerant, almost all of the midges found in this sample were tolerant. In addition, the invasive New Zealand mud snail (*Potamopyrgus antipodarum*) was the dominant taxon (29%) in the assemblage. The functional composition of the assemblage was dominated by gatherers (37%) and filterers (29%) and *P. antipodarum* (29%), which was classified as a scraper in this study, but

may often be omnivorous. The domination of filterers and gatherers combined with the domination of *P. antipodarum* is suggestive of water quality impairment and the taxonomic composition of the assemblage suggests nutrient enrichment. There was no evidence of metals contamination.

b. Thermal condition

The composition of the fauna suggested relatively warm water temperatures, and the calculated temperature preference of the assemblage (15.9 °C) supported this contention. No cold stenotherm taxa were found.

c. Sediment deposition

No caddisfly taxa were found in this reach and only 6 “clinger” taxa were recorded. The FSBI value was 4.15 indicating an assemblage that was moderately tolerant of fine sediment. These results suggest that colonization of stony substrates is probably limited by the deposition of fine sediment.

d. Habitat diversity and integrity

Taxa richness (25) was low in this assemblage suggesting that instream habitats were not very diverse. Only one stonefly taxon was collected (*Malenka* sp.) and it was represented by only one individual. This very low stonefly abundance and diversity suggests that reach-scale habitat features were very disturbed. Only one semi-voltine taxon was found, thus instream habitats may have been disturbed by periodic thermal extremes, dewatering, scouring or release of toxic pollutants. The functional composition of the assemblage was dominated by gatherers and filterers, which may be an indication of water quality impairment. Their abundance suggests that fine organic particulates were an important energy source in this reach.

Sunset SE 30th

- **Bioassessment scores: 2014**

The B-IBI score (0) generated by this sample indicated "very poor" biological conditions, and the RIVPACS score (0.32) also indicated impairment. This sample had both the lowest B-IBI score and the lowest RIVPACS score of any sample in this study.

- **Indicators of ecological condition: 2014**

a. Water quality

Baetis tricaudatus was the only mayfly taxon collected in this reach. The low mayfly richness combined with a moderately elevated biotic index value (4.85) suggests water quality was

impaired at this site. The sample was dominated by tolerant organisms like the amphipod *Crangonyx* sp. (25%) and blackflies (26%). The sample contained no sensitive taxa. The assemblage was dominated by gatherers (54%) and filterers (26%), which was also suggestive of nutrient enrichment.

b. Thermal condition

No cold stenotherm taxa were recorded from this reach. The assemblage appeared to be dominated by relatively warm-water taxa as the assemblage temperature preference was 15.3 °C.

c. Sediment deposition

Only one caddisfly taxon was recorded from this reach and it was represented by only 2 individuals. Very few "clinger" taxa (4) were also collected here. The FSBI (3.69) indicated a moderately sediment tolerant assemblage. Thus, it appears that colonization of stony sediments is probably impaired by the deposition of fine sediments.

d. Habitat diversity and integrity

Very few taxa (14), the lowest in this study, were collected at this site, which may indicate disturbed or monotonous instream habitats. The sample contained only 1 stonefly taxon (*Malenka* sp.). The low taxa richness of stoneflies suggests that there may be loss of streambank stability, disturbed riparian zones, or altered channel morphology. Leaf litter and large organic material may have been abundant in the reach because *Malenka* sp., a shredder, made up about 7% of the assemblage. No long-lived taxa were recorded, thus catastrophes such as periodic dewatering, scouring sediment pulses, or intermittent inputs of toxic pollutants cannot be ruled out. The functional composition of the benthic assemblage was dominated by gatherers (54%) and filterers (26%), providing further evidence for water quality impairment and suggesting the importance of fine particles as a food source and shredders were notably abundant (8%) suggesting that leaf litter was also probably abundant.

DISCUSSION

The B-IBI of all sites indicated "fair" conditions at 2 sites and "very poor" conditions at 3 sites, and the RIVPACS score of only one site (Lewis I-90) was considered unimpaired. Multiple sources of stress were suggested by invertebrate assemblages at a minimum of 3 sites. Table 2 summarizes the stressors suggested by the analysis of the taxonomic and functional characteristics of the biotic assemblages. Evidence for metals contamination could not be readily identified from the components of the biota at any site.

Table 2. Summary of possible stressors, as suggested by the taxonomic and functional composition of invertebrate assemblages. City of Bellevue, 2014.

Site	water quality degradation	metals	thermal stress	sediment deposition	habitat disruption
Unnamed Tributary(Vasa)					
Lewis I-90	?				
Kelsey Peltzer	+			+	+
Kelsey Farm	+		+	+	+
Sunset SE 30th	+		+	+	+

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APPENDIX

Taxa lists and metric summaries

City of Bellevue, Washington

2014

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD001

RAI No.: CB14LD001 **Sta. Name:** Unnamed Trib (Vasa) Rep 1
Client ID: 0160 S. of Vasa Rep 1
Date Coll.: 8/19/2014 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Other Non-Insect							
Acari	2	1.43%	Yes	Unknown		5	PR
Planariidae							
Polycelis sp.	3	2.14%	Yes	Unknown		1	OM
Oligochaeta							
Enchytraeidae							
Fridericia sp.	2	1.43%	Yes	Unknown		11	CG
Lumbriculidae							
Lumbriculidae	1	0.71%	Yes	Unknown	Damaged	4	CG
Ephemeroptera							
Baetidae							
Baetis tricaudatus	41	29.29%	Yes	Larva		4	CG
Diphetor hageni	2	1.43%	Yes	Larva		5	CG
Heptageniidae							
Cinygma sp.	8	5.71%	Yes	Larva		0	SC
Ironodes sp.	2	1.43%	Yes	Larva		0	SC
Plecoptera							
Chloroperlidae							
Sweltsa sp.	11	7.86%	Yes	Larva		0	PR
Nemouridae							
Zapada cinctipes	1	0.71%	Yes	Larva		3	SH
Pteronarcyidae							
Pteronarcys princeps	8	5.71%	Yes	Larva		0	SH
Trichoptera							
Glossosomatidae							
Glossosoma sp.	18	12.86%	Yes	Larva		0	SC
Glossosomatidae	2	1.43%	No	Pupa		0	SC
Hydropsychidae							
Hydropsyche sp.	31	22.14%	Yes	Larva		5	CF
Rhyacophilidae							
Rhyacophila Betteni Gr.	1	0.71%	Yes	Larva		0	PR
Coleoptera							
Elmidae							
Lara sp.	2	1.43%	Yes	Larva		1	SH
Diptera							
Simuliidae							
Simulium sp.	5	3.57%	Yes	Larva		6	CF
Sample Count	**140**						

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD002

RAI No.: CB14LD002 **Sta. Name:** Unnamed Trib (Vasa) Rep 2
Client ID: 0160 S. of Vasa Rep 2
Date Coll.: 8/19/2014 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Other Non-Insect							
Acari	1	0.54%	Yes	Unknown		5	PR
Physidae							
Physidae	1	0.54%	Yes	Unknown		8	SC
Planariidae							
Polycelis sp.	1	0.54%	Yes	Unknown		1	OM
Planorbidae							
Planorbidae	2	1.08%	Yes	Immature		6	SC
Sphaeriidae							
Sphaeriidae	1	0.54%	Yes	Unknown		8	CF
Oligochaeta							
Enchytraeidae							
Enchytraeus sp.	7	3.78%	Yes	Unknown		4	CG
Mesenchytraeus sp.	1	0.54%	Yes	Unknown		4	CG
Lumbriculidae							
Lumbriculidae	5	2.70%	Yes	Unknown	Damaged	4	CG
Naididae							
Tubificinae	1	0.54%	Yes	Immature		11	CG
Ephemeroptera							
Baetidae							
Baetis tricaudatus	29	15.68%	Yes	Larva		4	CG
Diphetor hageni	1	0.54%	Yes	Larva		5	CG
Heptageniidae							
Cinygma sp.	5	2.70%	Yes	Larva		0	SC
Plecoptera							
Chloroperlidae							
Sweltsa sp.	29	15.68%	Yes	Larva		0	PR
Leuctridae							
Leuctridae	1	0.54%	Yes	Larva	Early Instar	0	SH
Nemouridae							
Malenka sp.	1	0.54%	Yes	Larva		1	SH
Soyedina sp.	1	0.54%	Yes	Larva		2	SH
Zapada cinctipes	2	1.08%	Yes	Larva		3	SH
Pteronarcyidae							
Pteronarcys princeps	1	0.54%	Yes	Larva		0	SH
Trichoptera							
Glossosomatidae							
Glossosoma sp.	25	13.51%	Yes	Larva		0	SC
Glossosomatidae	7	3.78%	No	Pupa		0	SC
Hydropsychidae							
Hydropsyche sp.	35	18.92%	Yes	Larva		5	CF
Lepidostomatidae							
Lepidostoma sp.	3	1.62%	Yes	Larva		1	SH
Coleoptera							
Elmidae							
Lara sp.	1	0.54%	Yes	Larva		1	SH

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD002

RAI No.: CB14LD002 **Sta. Name:** Unnamed Trib (Vasa) Rep 2
Client ID: 0160 S. of Vasa Rep 2
Date Coll.: 8/19/2014 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Diptera							
Simuliidae							
Simulium sp.	1	0.54%	No	Pupa		6	CF
Simulium sp.	15	8.11%	Yes	Larva		6	CF
Chironomidae							
Chironomidae							
Brillia sp.	1	0.54%	Yes	Larva		4	SH
Eukiefferiella sp.	1	0.54%	Yes	Larva	Early Instar	8	CG
Parametriocnemus sp.	6	3.24%	Yes	Larva		5	CG
Sample Count	**185**						

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD003

RAI No.: CB14LD003 **Sta. Name:** Unnamed Trib (Vasa) Rep 3
Client ID: 0160 S. of Vasa Rep 3
Date Coll.: 8/19/2014 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Other Non-Insect							
Acari	1	0.88%	Yes	Unknown		5	PR
Crangonyctidae							
Crangonyx sp.	1	0.88%	Yes	Unknown		6	CG
Oligochaeta							
Enchytraeidae							
Fridericia sp.	2	1.75%	Yes	Unknown		11	CG
Ephemeroptera							
Baetidae							
Baetis tricaudatus	40	35.09%	Yes	Larva		4	CG
Diphetor hageni	1	0.88%	Yes	Larva		5	CG
Heptageniidae							
Cinygma sp.	2	1.75%	Yes	Larva		0	SC
Ironodes sp.	1	0.88%	Yes	Larva		0	SC
Plecoptera							
Chloroperlidae							
Sweltsa sp.	23	20.18%	Yes	Larva		0	PR
Leuctridae							
Leuctridae	2	1.75%	Yes	Larva	Early Instar	0	SH
Nemouridae							
Zapada cinctipes	1	0.88%	Yes	Larva		3	SH
Trichoptera							
Glossosomatidae							
Glossosoma sp.	7	6.14%	Yes	Larva		0	SC
Hydropsychidae							
Hydropsyche sp.	20	17.54%	Yes	Larva		5	CF
Philopotamidae							
Wormaldia sp.	1	0.88%	Yes	Larva		0	CF
Diptera							
Simuliidae							
Simulium sp.	8	7.02%	Yes	Larva		6	CF
Tipulidae							
Limonia sp.	1	0.88%	Yes	Larva		6	SH
Chironomidae							
Chironomidae							
Phaenopsectra sp.	1	0.88%	Yes	Larva		7	SC
Parametriocnemus sp.	2	1.75%	Yes	Larva		5	CG
Sample Count	**114**						

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD004

RAI No.: CB14LD004 **Sta. Name:** Lewis I-90 Rep 1
Client ID: Lewis I 90 Rep 1
Date Coll.: 8/28/2014 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Other Non-Insect							
Nemata	1	0.29%	Yes	Unknown		5	UN
Acari	7	2.06%	Yes	Unknown		5	PR
Crangonyctidae							
Crangonyx sp.	1	0.29%	Yes	Unknown		6	CG
Planariidae							
Polycelis sp.	2	0.59%	Yes	Unknown		1	OM
Planorbidae							
Planorbidae	1	0.29%	Yes	Immature		6	SC
Oligochaeta							
Lumbriculidae							
Lumbriculidae	3	0.88%	Yes	Unknown	Damaged	4	CG
Naididae							
Tubificinae	1	0.29%	Yes	Immature		11	CG
Ephemeroptera							
Baetidae							
Baetis tricaudatus	94	27.65%	Yes	Larva		4	CG
Diphetor hageni	1	0.29%	Yes	Larva		5	CG
Heptageniidae							
Cinygma sp.	2	0.59%	Yes	Larva		0	SC
Plecoptera							
Chloroperlidae							
Sweltsa sp.	1	0.29%	Yes	Larva		0	PR
Nemouridae							
Malenka sp.	7	2.06%	Yes	Larva		1	SH
Zapada cinctipes	1	0.29%	Yes	Larva		3	SH
Perlodidae							
Skwala sp.	2	0.59%	Yes	Larva		3	PR
Pteronarcyidae							
Pteronarcys princeps	1	0.29%	Yes	Larva		0	SH
Trichoptera							
Glossosomatidae							
Glossosoma sp.	15	4.41%	Yes	Larva		0	SC
Glossosomatidae	1	0.29%	No	Pupa		0	SC
Hydropsychidae							
Hydropsyche sp.	61	17.94%	Yes	Larva		5	CF
Lepidostomatidae							
Lepidostoma sp.	4	1.18%	Yes	Larva		1	SH
Philopotamidae							
Dolophilodes sp.	1	0.29%	Yes	Larva		0	CF
Rhyacophilidae							
Rhyacophila Betteni Gr.	1	0.29%	Yes	Larva		0	PR
Coleoptera							
Elmidae							
Heterlimnius corpulentus	1	0.29%	Yes	Adult		3	CG
Heterlimnius corpulentus	3	0.88%	No	Larva		3	CG

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD004

RAI No.: CB14LD004 **Sta. Name:** Lewis I-90 Rep 1
Client ID: Lewis I 90 Rep 1
Date Coll.: 8/28/2014 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Diptera							
Dixidae							
Dixa sp.	1	0.29%	Yes	Larva		1	CG
Empididae							
Empididae	1	0.29%	No	Pupa		6	PR
Empididae sp. (RAI Taxon # 0001)	1	0.29%	Yes	Larva		6	PR
Neoplasta sp.	1	0.29%	Yes	Larva		5	PR
Simuliidae							
Simulium sp.	27	7.94%	Yes	Larva		6	CF
Simulium sp.	2	0.59%	No	Pupa		6	CF
Tipulidae							
Antocha monticola	2	0.59%	Yes	Larva		3	CG
Chironomidae							
Chironomidae							
Polypedilum sp.	41	12.06%	Yes	Larva		6	SH
Micropsectra sp.	3	0.88%	Yes	Larva		4	CG
Rheotanytarsus sp.	1	0.29%	Yes	Pupa		6	CF
Brillia sp.	8	2.35%	Yes	Larva		4	SH
Eukiefferiella tirolensis	2	0.59%	Yes	Larva		8	CG
Parametriocnemus sp.	38	11.18%	Yes	Larva		5	CG
Sample Count	**340**						

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD005

RAI No.: CB14LD005 **Sta. Name:** Lewis I-90 Rep 2
Client ID: Lewis I 90 Rep 2
Date Coll.: 8/28/2014 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Other Non-Insect							
Nemata	3	0.66%	Yes	Unknown		5	UN
Acari	19	4.16%	Yes	Unknown		5	PR
Ancylidae							
Ferrissia sp.	1	0.22%	Yes	Unknown		6	SC
Crangonyctidae							
Crangonyx sp.	4	0.88%	Yes	Unknown		6	CG
Planariidae							
Polycelis sp.	3	0.66%	Yes	Unknown		1	OM
Sphaeriidae							
Sphaeriidae	2	0.44%	Yes	Unknown		8	CF
Tetrastemmatidae							
Prostoma sp.	3	0.66%	Yes	Unknown		11	PR
Oligochaeta							
Lumbriculidae							
Lumbriculidae	22	4.81%	Yes	Unknown	Damaged	4	CG
Ephemeroptera							
Baetidae							
Baetis tricaudatus	48	10.50%	Yes	Larva		4	CG
Plecoptera							
Chloroperlidae							
Sweltsa sp.	1	0.22%	Yes	Larva		0	PR
Nemouridae							
Malenka sp.	8	1.75%	Yes	Larva		1	SH
Zapada sp.	1	0.22%	Yes	Larva	Early Instar	2	SH
Perlodidae							
Skwala sp.	1	0.22%	Yes	Larva		3	PR
Trichoptera							
Brachycentridae							
Micrasema sp.	1	0.22%	Yes	Larva		1	SH
Glossosomatidae							
Glossosoma sp.	17	3.72%	Yes	Larva		0	SC
Glossosomatidae	16	3.50%	No	Pupa		0	SC
Hydropsychidae							
Hydropsyche sp.	186	40.70%	Yes	Larva		5	CF
Lepidostomatidae							
Lepidostoma sp.	1	0.22%	Yes	Larva		1	SH
Limnephilidae							
Dicosmoecus atripes	2	0.44%	Yes	Larva		1	SC
Limnephilidae	1	0.22%	No	Pupa		3	SH
Rhyacophilidae							
Rhyacophila Betteni Gr.	6	1.31%	Yes	Larva		0	PR
Rhyacophila grandis	1	0.22%	Yes	Larva		1	PR

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD005

RAI No.: CB14LD005 **Sta. Name:** Lewis I-90 Rep 2
Client ID: Lewis I 90 Rep 2
Date Coll.: 8/28/2014 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Coleoptera							
Elmidae							
Heterlimnius corpulentus	37	8.10%	Yes	Larva		3	CG
Lara sp.	1	0.22%	Yes	Larva		1	SH
Narpus concolor	1	0.22%	Yes	Adult		2	CG
Narpus concolor	4	0.88%	No	Larva		2	CG
Zaitzevia sp.	3	0.66%	Yes	Adult		5	CG
Zaitzevia sp.	1	0.22%	No	Larva		5	CG
Diptera							
Empididae							
Empididae sp. (RAI Taxon # 0001)	1	0.22%	Yes	Larva		6	PR
Simuliidae							
Simulium sp.	11	2.41%	Yes	Larva		6	CF
Chironomidae							
Chironomidae							
Polypedilum sp.	46	10.07%	Yes	Larva		6	SH
Micropsectra sp.	1	0.22%	Yes	Larva		4	CG
Tanytarsini	1	0.22%	No	Larva	Damaged	6	CF
Brillia sp.	2	0.44%	Yes	Larva		4	SH
Chaetocladius sp.	1	0.22%	Yes	Larva		6	CG
Sample Count	**457**						

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD006

RAI No.: CB14LD006 **Sta. Name:** Lewis I-90 Rep 3
Client ID: Lewis I 90 Rep 3
Date Coll.: 8/28/2014 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Other Non-Insect							
Acari	8	14.04%	Yes	Unknown		5	PR
Crangonyctidae							
Crangonyx sp.	1	1.75%	Yes	Unknown		6	CG
Ephemeroptera							
Baetidae							
Baetis tricaudatus	4	7.02%	Yes	Larva		4	CG
Plecoptera							
Chloroperlidae							
Sweltsa sp.	1	1.75%	Yes	Larva		0	PR
Perlodidae							
Skwala sp.	1	1.75%	Yes	Larva		3	PR
Trichoptera							
Glossosomatidae							
Glossosoma sp.	3	5.26%	Yes	Larva		0	SC
Glossosomatidae	2	3.51%	No	Pupa		0	SC
Hydropsychidae							
Hydropsyche sp.	8	14.04%	Yes	Larva		5	CF
Limnephilidae							
Dicosmoecus atripes	3	5.26%	Yes	Larva		1	SC
Coleoptera							
Elmidae							
Heterlimnius corpulentus	1	1.75%	Yes	Adult		3	CG
Heterlimnius corpulentus	18	31.58%	No	Larva		3	CG
Lara sp.	1	1.75%	Yes	Larva		1	SH
Diptera							
Tipulidae							
Antocha monticola	1	1.75%	Yes	Larva		3	CG
Chironomidae							
Chironomidae							
Polypedilum sp.	3	5.26%	Yes	Larva		6	SH
Rheotanytarsus sp.	1	1.75%	Yes	Pupa		6	CF
Brillia sp.	1	1.75%	Yes	Larva		4	SH
Sample Count	**57**						

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD007

RAI No.: CB14LD007 **Sta. Name:** Kelsey Peltzer Rep 1
Client ID: Kelsey Peltzer 1A-E
Date Coll.: 8/29/2014 **No. Jars:** 5 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Other Non-Insect							
Turbellaria	11	2.00%	Yes	Unknown		4	PR
Nemata	6	1.09%	Yes	Unknown		5	UN
Acari	2	0.36%	Yes	Unknown		5	PR
Asellidae							
Caecidotea sp.	38	6.90%	Yes	Unknown		8	CG
Crangonyctidae							
Crangonyx sp.	74	13.43%	Yes	Unknown		6	CG
Oligochaeta							
Lumbriculidae							
Lumbriculidae	3	0.54%	Yes	Unknown	Damaged	4	CG
Naididae							
Nais sp.	1	0.18%	Yes	Unknown		8	CG
Ephemeroptera							
Baetidae							
Baetis tricaudatus	24	4.36%	Yes	Larva		4	CG
Plecoptera							
Nemouridae							
Malenka sp.	36	6.53%	Yes	Larva		1	SH
Zapada cinctipes	1	0.18%	Yes	Larva		3	SH
Trichoptera							
Hydropsychidae							
Hydropsychidae	2	0.36%	No	Pupa		4	CF
Parapsyche sp.	27	4.90%	Yes	Larva		0	PR
Rhyacophilidae							
Rhyacophila Brunnea/Vemna Gr.	1	0.18%	Yes	Larva		2	PR
Diptera							
Ceratopogonidae							
Forcipomyiinae	1	0.18%	Yes	Larva		6	PR
Empididae							
Neoplasta sp.	1	0.18%	Yes	Larva		5	PR
Simuliidae							
Simulium sp.	37	6.72%	No	Pupa		6	CF
Simulium sp.	230	41.74%	Yes	Larva		6	CF
Tipulidae							
Dicranota sp.	3	0.54%	Yes	Larva		3	PR
Chironomidae							
Chironomidae							
Micropsectra sp.	6	1.09%	Yes	Larva		4	CG
Rheotanytarsus sp.	1	0.18%	Yes	Larva		6	CF
Pagastia sp.	1	0.18%	Yes	Larva		1	CG
Eukiefferiella Claripennis Gr.	32	5.81%	Yes	Larva		8	CG
Parametriocnemus sp.	6	1.09%	Yes	Larva		5	CG
Tvetenia sp.	1	0.18%	No	Pupa		5	CG
Tvetenia Bavarica Gr.	5	0.91%	Yes	Larva		5	CG
Conchapelopia sp.	1	0.18%	Yes	Larva		6	PR

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD007

RAI No.: CB14LD007 **Sta. Name:** Kelsey Peltzer Rep 1
Client ID: Kelsey Peltzer 1A-E
Date Coll.: 8/29/2014 **No. Jars:** 5 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Sample Count	**551**						

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD008

RAI No.: CB14LD008 **Sta. Name:** Kelsey Farm
Client ID: Kelsey Farm 1-6
Date Coll.: 9/2/2014 **No. Jars:** 6 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Other Non-Insect							
Turbellaria	23	4.08%	Yes	Unknown		4	PR
Acari	1	0.18%	Yes	Unknown		5	PR
Asellidae							
Caecidotea sp.	2	0.35%	Yes	Unknown		8	CG
Crangonyctidae							
Crangonyx sp.	16	2.84%	Yes	Unknown		6	CG
Hydrobiidae							
Potamopyrgus antipodarum	165	29.26%	Yes	Unknown		8	SC
Oligochaeta							
Lumbriculidae							
Lumbriculidae	13	2.30%	Yes	Unknown	Damaged	4	CG
Naididae							
Pristina sp.	1	0.18%	Yes	Unknown		8	CG
Ephemeroptera							
Baetidae							
Baetis tricaudatus	116	20.57%	Yes	Larva		4	CG
Plecoptera							
Nemouridae							
Malenka sp.	1	0.18%	Yes	Larva		1	SH
Coleoptera							
Elmidae							
Optioservus sp.	1	0.18%	Yes	Larva		5	SC
Diptera							
Simuliidae							
Simulium sp.	17	3.01%	Yes	Larva		6	CF
Tipulidae							
Antocha monticola	3	0.53%	Yes	Larva		3	CG
Chironomidae							
Chironomidae							
Chironomini	1	0.18%	No	Larva	Early Instar	6	CG
Cladotanytarsus sp.	2	0.35%	Yes	Larva		7	CG
Micropsectra sp.	3	0.53%	Yes	Larva		4	CG
Rheotanytarsus sp.	119	21.10%	Yes	Larva		6	CF
Rheotanytarsus sp.	26	4.61%	No	Pupa		6	CF
Corynoneura sp.	1	0.18%	Yes	Larva		7	CG
Cricotopus (Cricotopus) sp.	1	0.18%	Yes	Larva		7	SH
Eukiefferiella sp.	2	0.35%	No	Pupa		8	CG
Eukiefferiella Claripennis Gr.	3	0.53%	Yes	Larva		8	CG
Eukiefferiella Devonica Gr.	1	0.18%	Yes	Larva		8	CG
Eukiefferiella Pseudomontana Gr.	22	3.90%	Yes	Larva		8	CG
Orthocladius sp.	4	0.71%	Yes	Larva		6	CG
Parametriocnemus sp.	3	0.53%	Yes	Larva		5	CG
Thienemanniella sp.	2	0.35%	Yes	Larva		6	CG
Tvetenia Bavarica Gr.	14	2.48%	Yes	Larva		5	CG
Thienemannimyia Gr.	1	0.18%	Yes	Larva		5	PR

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD008

RAI No.: CB14LD008 **Sta. Name:** Kelsey Farm
Client ID: Kelsey Farm 1-6
Date Coll.: 9/2/2014 **No. Jars:** 6 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Sample Count	**564**						

Taxa Listing

Project ID: CB14LD
RAI No.: CB14LD009

RAI No.: CB14LD009 **Sta. Name:** Sunset SE 30th
Client ID: Sunset SE 30th Rep 1A-D
Date Coll.: 8/21/2014 **No. Jars:** 4 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Other Non-Insect							
Turbellaria	56	10.20%	Yes	Unknown		4	PR
Nemata	1	0.18%	Yes	Unknown		5	UN
Acari	2	0.36%	Yes	Unknown		5	PR
Crangonyctidae							
Crangonyx sp.	135	24.59%	Yes	Unknown		6	CG
Oligochaeta							
Lumbriculidae							
Lumbriculidae	3	0.55%	Yes	Unknown	Damaged	4	CG
Ephemeroptera							
Baetidae							
Baetis tricaudatus	155	28.23%	Yes	Larva		4	CG
Plecoptera							
Nemouridae							
Malenka sp.	40	7.29%	Yes	Larva		1	SH
Trichoptera							
Lepidostomatidae							
Lepidostoma sp.	1	0.18%	Yes	Larva		1	SH
Lepidostoma sp.	1	0.18%	No	Pupa		1	SH
Diptera							
Simuliidae							
Simulium sp.	129	23.50%	Yes	Larva		6	CF
Simulium sp.	16	2.91%	No	Pupa		6	CF
Tipulidae							
Dicranota sp.	1	0.18%	Yes	Larva		3	PR
Chironomidae							
Chironomidae							
Phaenopsectra sp.	2	0.36%	Yes	Larva		7	SC
Cricotopus (Cricotopus) sp.	2	0.36%	Yes	Larva		7	SH
Eukiefferiella Claripennis Gr.	4	0.73%	Yes	Larva		8	CG
Tvetenia tshernovskii	1	0.18%	Yes	Larva		5	CG
Sample Count	**549**						

Metrics Report

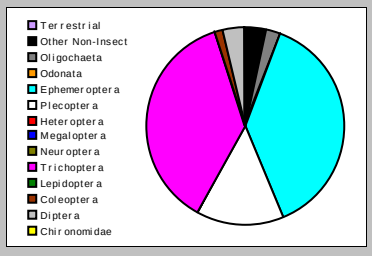
Project ID: CB14LD
RAI No.: CB14LD001
Sta. Name: Unnamed Trib (Vasa) Rep 1
Client ID: 0160 S. of Vasa Rep 1
STORET ID
Coll. Date: 8/19/2014
Latitude: **Longitude:**

Abundance Measures

Sample Count: 140
Sample Abundance: 140.00 100.00% of sample used
Coll. Procedure: Surber
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	2	5	3.57%
Oligochaeta	2	3	2.14%
Odonata			
Ephemeroptera	4	53	37.86%
Plecoptera	3	20	14.29%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	3	52	37.14%
Lepidoptera			
Coleoptera	1	2	1.43%
Diptera	1	5	3.57%
Chironomidae			

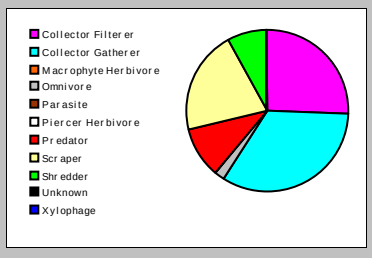


Dominant Taxa

Category	A	PRA
Baetis tricaudatus	41	29.29%
Hydropsyche	31	22.14%
Glossosoma	18	12.86%
Sweltsa	11	7.86%
Pteronarcys princeps	8	5.71%
Cinygma	8	5.71%
Simulium	5	3.57%
Polycelis	3	2.14%
Lara	2	1.43%
Ironodes	2	1.43%
Glossosomatidae	2	1.43%
Fridericia	2	1.43%
Diphetor hageni	2	1.43%
Acari	2	1.43%
Rhyacophila Betteni Gr.	1	0.71%

Functional Composition

Category	R	A	PRA
Predator	3	14	10.00%
Parasite			
Collector Gatherer	4	46	32.86%
Collector Filterer	2	36	25.71%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	3	30	21.43%
Shredder	3	11	7.86%
Omnivore	1	3	2.14%
Unknown			

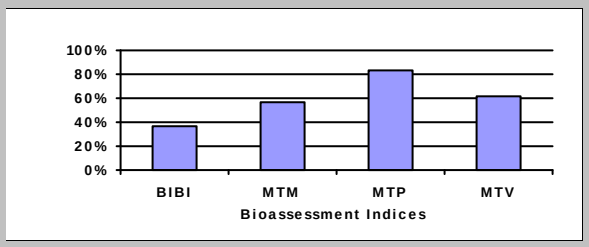


Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	16
E Richness	4
P Richness	3
T Richness	3
EPT Richness	10
EPT Percent	89.29%
All Non-Insect Abundance	8
All Non-Insect Richness	4
All Non-Insect Percent	5.71%
Oligochaeta+Hirudinea Percent	2.14%
Baetidae/Ephemeroptera	0.811
Hydropsychidae/Trichoptera	0.596
Dominance	
Dominant Taxon Percent	29.29%
Dominant Taxa (2) Percent	51.43%
Dominant Taxa (3) Percent	64.29%
Dominant Taxa (10) Percent	92.14%
Diversity	
Shannon H (loge)	2.111
Shannon H (log2)	3.045
Margalef D	3.044
Simpson D	0.166
Evenness	0.095
Function	
Predator Richness	3
Predator Percent	10.00%
Filterer Richness	2
Filterer Percent	25.71%
Collector Percent	58.57%
Scraper+Shredder Percent	29.29%
Scraper/Filterer	0.833
Scraper/Scraper+Filterer	0.455
Habit	
Burrower Richness	1
Burrower Percent	0.71%
Swimmer Richness	2
Swimmer Percent	30.71%
Clinger Richness	10
Clinger Percent	63.57%
Characteristics	
Cold Stenotherm Richness	2
Cold Stenotherm Percent	11.43%
Hemoglobin Bearer Richness	
Hemoglobin Bearer Percent	
Air Breather Richness	0
Air Breather Percent	0.00%
Voltinism	
Univoltine Richness	9
Semivoltine Richness	2
Multivoltine Percent	34.29%
Tolerance	
Sediment Tolerant Richness	1
Sediment Tolerant Percent	0.71%
Sediment Sensitive Richness	1
Sediment Sensitive Percent	12.86%
Metals Tolerance Index	4.111
Pollution Sensitive Richness	2
Pollution Tolerant Percent	0.00%
Hilsenhoff Biotic Index	2.761
Intolerant Percent	39.29%
Supertolerant Percent	0.00%
CTQa	62.000

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	18	36.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	25	83.33%	None
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	11	61.11%	Slight
MTM	Montana DEQ Mountains (Bukantis 1998)	12	57.14%	Slight



Metrics Report

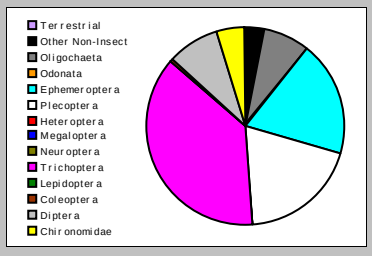
Project ID: CB14LD
RAI No.: CB14LD002
Sta. Name: Unnamed Trib (Vasa) Rep 2
Client ID: 0160 S. of Vasa Rep 2
STORET ID
Coll. Date: 8/19/2014
Latitude: **Longitude:**

Abundance Measures

Sample Count: 185
Sample Abundance: 185.00 100.00% of sample used
Coll. Procedure: Surber
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	5	6	3.24%
Oligochaeta	4	14	7.57%
Odonata			
Ephemeroptera	3	35	18.92%
Plecoptera	6	35	18.92%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	3	70	37.84%
Lepidoptera			
Coleoptera	1	1	0.54%
Diptera	1	16	8.65%
Chironomidae	3	8	4.32%

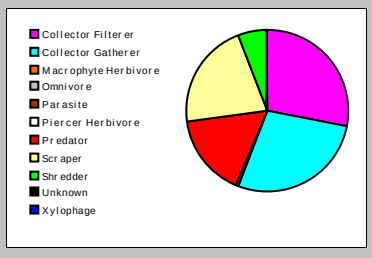


Dominant Taxa

Category	A	PRA
Hydropsyche	35	18.92%
Sweltsa	29	15.68%
Baetis tricaudatus	29	15.68%
Glossosoma	25	13.51%
Simulium	16	8.65%
Glossosomatidae	7	3.78%
Enchytraeus	7	3.78%
Parametriocnemus	6	3.24%
Lumbriculidae	5	2.70%
Cinygma	5	2.70%
Lepidostoma	3	1.62%
Zapada cinctipes	2	1.08%
Planorbidae	2	1.08%
Brillia	1	0.54%
Acari	1	0.54%

Functional Composition

Category	R	A	PRA
Predator	2	30	16.22%
Parasite			
Collector Gatherer	8	51	27.57%
Collector Filterer	3	52	28.11%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	4	40	21.62%
Shredder	8	11	5.95%
Omnivore	1	1	0.54%
Unknown			

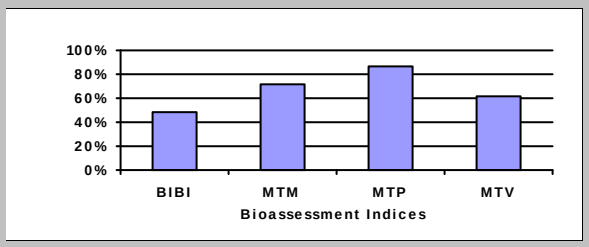


Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	26
E Richness	3
P Richness	6
T Richness	3
EPT Richness	12
EPT Percent	75.68%
All Non-Insect Abundance	20
All Non-Insect Richness	9
All Non-Insect Percent	10.81%
Oligochaeta+Hirudinea Percent	7.57%
Baetidae/Ephemeroptera	0.857
Hydropsychidae/Trichoptera	0.500
Dominance	
Dominant Taxon Percent	18.92%
Dominant Taxa (2) Percent	34.59%
Dominant Taxa (3) Percent	50.27%
Dominant Taxa (10) Percent	88.65%
Diversity	
Shannon H (loge)	2.423
Shannon H (log2)	3.495
Margalef D	4.830
Simpson D	0.120
Evenness	0.073
Function	
Predator Richness	2
Predator Percent	16.22%
Filterer Richness	3
Filterer Percent	28.11%
Collector Percent	55.68%
Scraper+Shredder Percent	27.57%
Scraper/Filterer	0.769
Scraper/Scraper+Filterer	0.435
Habit	
Burrower Richness	2
Burrower Percent	3.24%
Swimmer Richness	2
Swimmer Percent	16.22%
Clinger Richness	10
Clinger Percent	66.49%
Characteristics	
Cold Stenotherm Richness	3
Cold Stenotherm Percent	3.78%
Hemoglobin Bearer Richness	1
Hemoglobin Bearer Percent	1.08%
Air Breather Richness	0
Air Breather Percent	0.00%
Voltinism	
Univoltine Richness	16
Semivoltine Richness	2
Multivoltine Percent	21.62%
Tolerance	
Sediment Tolerant Richness	2
Sediment Tolerant Percent	3.78%
Sediment Sensitive Richness	1
Sediment Sensitive Percent	13.51%
Metals Tolerance Index	3.849
Pollution Sensitive Richness	3
Pollution Tolerant Percent	1.62%
Hilsenhoff Biotic Index	2.897
Intolerant Percent	40.54%
Supertolerant Percent	1.62%
CTQa	76.190

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	24	48.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	26	86.67%	None
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	11	61.11%	Slight
MTM	Montana DEQ Mountains (Bukantis 1998)	15	71.43%	Slight



Metrics Report

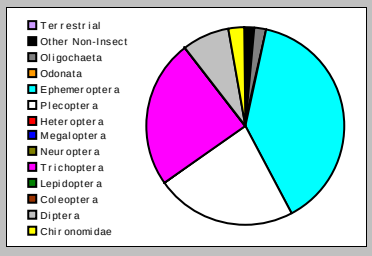
Project ID: CB14LD
RAI No.: CB14LD003
Sta. Name: Unnamed Trib (Vasa) Rep 3
Client ID: 0160 S. of Vasa Rep 3
STORET ID
Coll. Date: 8/19/2014
Latitude: **Longitude:**

Abundance Measures

Sample Count: 114
Sample Abundance: 114.00 100.00% of sample used
Coll. Procedure: Surber
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	2	2	1.75%
Oligochaeta	1	2	1.75%
Odonata			
Ephemeroptera	4	44	38.60%
Plecoptera	3	26	22.81%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	3	28	24.56%
Lepidoptera			
Coleoptera			
Diptera	2	9	7.89%
Chironomidae	2	3	2.63%

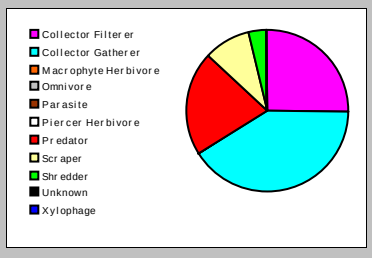


Dominant Taxa

Category	A	PRA
Baetis tricaudatus	40	35.09%
Sweltsa	23	20.18%
Hydropsyche	20	17.54%
Simulium	8	7.02%
Glossosoma	7	6.14%
Parametriocnemus	2	1.75%
Leuctridae	2	1.75%
Fridericia	2	1.75%
Cinygma	2	1.75%
Phaenopsectra	1	0.88%
Limonia	1	0.88%
Ironodes	1	0.88%
Diphetor hageni	1	0.88%
Crangonyx	1	0.88%
Acari	1	0.88%

Functional Composition

Category	R	A	PRA
Predator	2	24	21.05%
Parasite			
Collector Gatherer	5	46	40.35%
Collector Filterer	3	29	25.44%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	4	11	9.65%
Shredder	3	4	3.51%
Omnivore			
Unknown			

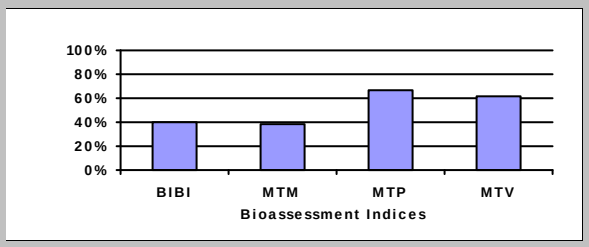


Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	17
E Richness	4
P Richness	3
T Richness	3
EPT Richness	10
EPT Percent	85.96%
All Non-Insect Abundance	4
All Non-Insect Richness	3
All Non-Insect Percent	3.51%
Oligochaeta+Hirudinea Percent	1.75%
Baetidae/Ephemeroptera	0.932
Hydropsychidae/Trichoptera	0.714
Dominance	
Dominant Taxon Percent	35.09%
Dominant Taxa (2) Percent	55.26%
Dominant Taxa (3) Percent	72.81%
Dominant Taxa (10) Percent	93.86%
Diversity	
Shannon H (loge)	1.970
Shannon H (log2)	2.842
Margalef D	3.378
Simpson D	0.198
Evenness	0.099
Function	
Predator Richness	2
Predator Percent	21.05%
Filterer Richness	3
Filterer Percent	25.44%
Collector Percent	65.79%
Scraper+Shredder Percent	13.16%
Scraper/Filterer	0.379
Scraper/Scraper+Filterer	0.275
Habit	
Burrower Richness	1
Burrower Percent	0.88%
Swimmer Richness	2
Swimmer Percent	35.96%
Clinger Richness	10
Clinger Percent	57.89%
Characteristics	
Cold Stenotherm Richness	2
Cold Stenotherm Percent	3.51%
Hemoglobin Bearer Richness	1
Hemoglobin Bearer Percent	0.88%
Air Breather Richness	1
Air Breather Percent	0.88%
Voltinism	
Univoltine Richness	11
Semivoltine Richness	0
Multivoltine Percent	39.47%
Tolerance	
Sediment Tolerant Richness	1
Sediment Tolerant Percent	0.88%
Sediment Sensitive Richness	2
Sediment Sensitive Percent	7.02%
Metals Tolerance Index	4.424
Pollution Sensitive Richness	2
Pollution Tolerant Percent	0.88%
Hilsenhoff Biotic Index	3.125
Intolerant Percent	31.58%
Supertolerant Percent	0.00%
CTQa	66.308

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	20	40.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	20	66.67%	Slight
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	11	61.11%	Slight
MTM	Montana DEQ Mountains (Bukantis 1998)	8	38.10%	Moderate



Tuesday, March 10, 2015

Metrics Report

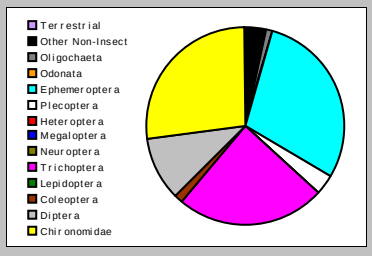
Project ID: CB14LD
RAI No.: CB14LD004
Sta. Name: Lewis I-90 Rep 1
Client ID: Lewis I 90 Rep 1
STORET ID
Coll. Date: 8/28/2014
Latitude: 47.5620 **Longitude:** -122.0990

Abundance Measures

Sample Count: 340
Sample Abundance: 340.00 100.00% of sample used
Coll. Procedure: Surber
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	5	12	3.53%
Oligochaeta	2	4	1.18%
Odonata			
Ephemeroptera	3	97	28.53%
Plecoptera	5	12	3.53%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	5	83	24.41%
Lepidoptera			
Coleoptera	1	4	1.18%
Diptera	5	35	10.29%
Chironomidae	6	93	27.35%

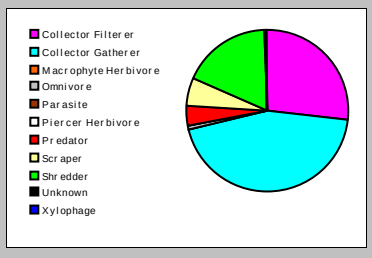


Dominant Taxa

Category	A	PRA
Baetis tricaudatus	94	27.65%
Hydropsyche	61	17.94%
Polypedilum	41	12.06%
Parametriocnemus	38	11.18%
Simulium	29	8.53%
Glossosoma	15	4.41%
Brillia	8	2.35%
Malenka	7	2.06%
Acari	7	2.06%
Lepidostoma	4	1.18%
Heterlimnius corpulentus	4	1.18%
Micropsectra	3	0.88%
Lumbriculidae	3	0.88%
Skwala	2	0.59%
Antocha monticola	2	0.59%

Functional Composition

Category	R	A	PRA
Predator	6	14	4.12%
Parasite			
Collector Gatherer	11	150	44.12%
Collector Filterer	4	92	27.06%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	3	19	5.59%
Shredder	6	62	18.24%
Omnivore	1	2	0.59%
Unknown	1	1	0.29%

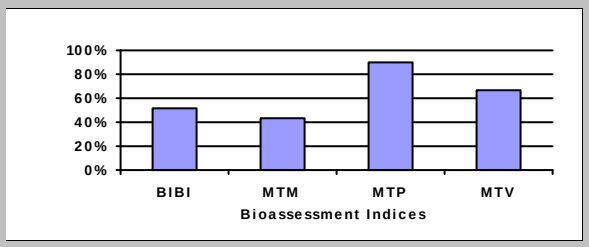


Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	32
E Richness	3
P Richness	5
T Richness	5
EPT Richness	13
EPT Percent	56.47%
All Non-Insect Abundance	16
All Non-Insect Richness	7
All Non-Insect Percent	4.71%
Oligochaeta+Hirudinea Percent	1.18%
Baetidae/Ephemeroptera	0.979
Hydropsychidae/Trichoptera	0.735
Dominance	
Dominant Taxon Percent	27.65%
Dominant Taxa (2) Percent	45.59%
Dominant Taxa (3) Percent	57.65%
Dominant Taxa (10) Percent	89.41%
Diversity	
Shannon H (loge)	2.322
Shannon H (log2)	3.350
Margalef D	5.337
Simpson D	0.150
Evenness	0.072
Function	
Predator Richness	6
Predator Percent	4.12%
Filterer Richness	4
Filterer Percent	27.06%
Collector Percent	71.18%
Scraper+Shredder Percent	23.82%
Scraper/Filterer	0.207
Scraper/Scraper+Filterer	0.171
Habit	
Burrower Richness	3
Burrower Percent	3.53%
Swimmer Richness	3
Swimmer Percent	28.24%
Clinger Richness	14
Clinger Percent	37.94%
Characteristics	
Cold Stenotherm Richness	3
Cold Stenotherm Percent	1.18%
Hemoglobin Bearer Richness	2
Hemoglobin Bearer Percent	12.35%
Air Breather Richness	1
Air Breather Percent	0.59%
Voltinism	
Univoltine Richness	18
Semivoltine Richness	2
Multivoltine Percent	57.94%
Tolerance	
Sediment Tolerant Richness	3
Sediment Tolerant Percent	1.76%
Sediment Sensitive Richness	2
Sediment Sensitive Percent	4.71%
Metals Tolerance Index	4.283
Pollution Sensitive Richness	3
Pollution Tolerant Percent	0.29%
Hilsenhoff Biotic Index	4.378
Intolerant Percent	10.59%
Supertolerant Percent	0.59%
CTQa	71.385

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	26	52.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	27	90.00%	None
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	12	66.67%	Slight
MTM	Montana DEQ Mountains (Bukantis 1998)	9	42.86%	Moderate



Metrics Report

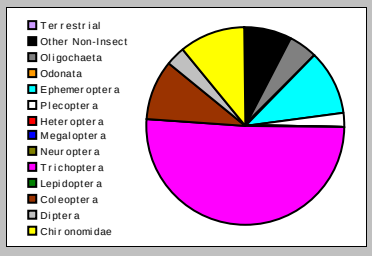
Project ID: CB14LD
RAI No.: CB14LD005
Sta. Name: Lewis I-90 Rep 2
Client ID: Lewis I 90 Rep 2
STORET ID
Coll. Date: 8/28/2014
Latitude: 47.5620 **Longitude:** -122.0990

Abundance Measures

Sample Count: 457
Sample Abundance: 457.00 100.00% of sample used
Coll. Procedure: Surber
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	7	35	7.66%
Oligochaeta	1	22	4.81%
Odonata			
Ephemeroptera	1	48	10.50%
Plecoptera	4	11	2.41%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	7	231	50.55%
Lepidoptera			
Coleoptera	4	47	10.28%
Diptera	2	12	2.63%
Chironomidae	4	51	11.16%

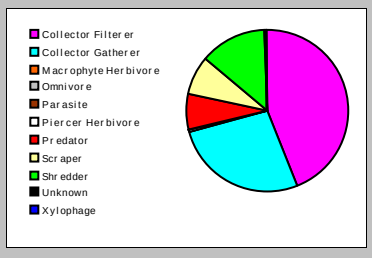


Dominant Taxa

Category	A	PRA
Hydropsyche	186	40.70%
Baetis tricaudatus	48	10.50%
Polypedilum	46	10.07%
Heterlimnius corpulentus	37	8.10%
Lumbriculidae	22	4.81%
Acari	19	4.16%
Glossosoma	17	3.72%
Glossosomatidae	16	3.50%
Simulium	11	2.41%
Malenka	8	1.75%
Rhyacophila Betteni Gr.	6	1.31%
Narpus concolor	5	1.09%
Zaitzevia	4	0.88%
Crangonyx	4	0.88%
Nemata	3	0.66%

Functional Composition

Category	R	A	PRA
Predator	7	32	7.00%
Parasite			
Collector Gatherer	8	122	26.70%
Collector Filterer	3	200	43.76%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	3	36	7.88%
Shredder	7	61	13.35%
Omnivore	1	3	0.66%
Unknown	1	3	0.66%

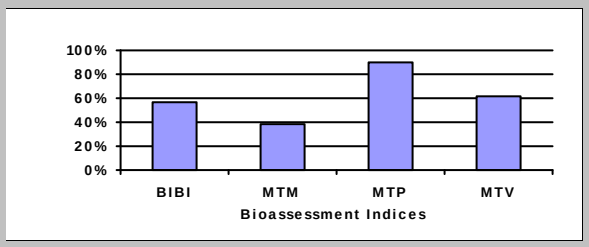


Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	30
E Richness	1
P Richness	4
T Richness	7
EPT Richness	12
EPT Percent	63.46%
All Non-Insect Abundance	57
All Non-Insect Richness	8
All Non-Insect Percent	12.47%
Oligochaeta+Hirudinea Percent	4.81%
Baetidae/Ephemeroptera	1.000
Hydropsychidae/Trichoptera	0.805
Dominance	
Dominant Taxon Percent	40.70%
Dominant Taxa (2) Percent	51.20%
Dominant Taxa (3) Percent	61.27%
Dominant Taxa (10) Percent	89.72%
Diversity	
Shannon H (loge)	2.118
Shannon H (log2)	3.056
Margalef D	4.775
Simpson D	0.220
Evenness	0.074
Function	
Predator Richness	7
Predator Percent	7.00%
Filterer Richness	3
Filterer Percent	43.76%
Collector Percent	70.46%
Scraper+Shredder Percent	21.23%
Scraper/Filterer	0.180
Scraper/Scraper+Filterer	0.153
Habit	
Burrower Richness	2
Burrower Percent	5.25%
Swimmer Richness	1
Swimmer Percent	10.50%
Clinger Richness	15
Clinger Percent	64.99%
Characteristics	
Cold Stenotherm Richness	1
Cold Stenotherm Percent	0.44%
Hemoglobin Bearer Richness	1
Hemoglobin Bearer Percent	10.07%
Air Breather Richness	0
Air Breather Percent	0.00%
Voltinism	
Univoltine Richness	17
Semivoltine Richness	5
Multivoltine Percent	26.48%
Tolerance	
Sediment Tolerant Richness	2
Sediment Tolerant Percent	5.03%
Sediment Sensitive Richness	1
Sediment Sensitive Percent	3.72%
Metals Tolerance Index	4.060
Pollution Sensitive Richness	2
Pollution Tolerant Percent	1.09%
Hilsenhoff Biotic Index	4.194
Intolerant Percent	13.79%
Supertolerant Percent	0.44%
CTQa	72.217

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	28	56.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	27	90.00%	None
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	11	61.11%	Slight
MTM	Montana DEQ Mountains (Bukantis 1998)	8	38.10%	Moderate



Metrics Report

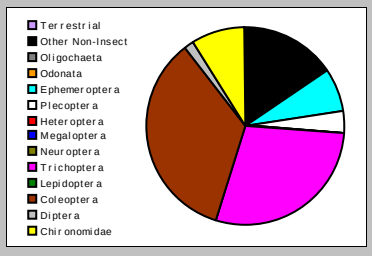
Project ID: CB14LD
RAI No.: CB14LD006
Sta. Name: Lewis I-90 Rep 3
Client ID: Lewis I 90 Rep 3
STORET ID
Coll. Date: 8/28/2014
Latitude: 47.5620 **Longitude:** -122.0990

Abundance Measures

Sample Count: 57
Sample Abundance: 57.00 100.00% of sample used
Coll. Procedure: Surber
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	2	9	15.79%
Oligochaeta			
Odonata			
Ephemeroptera	1	4	7.02%
Plecoptera	2	2	3.51%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	3	16	28.07%
Lepidoptera			
Coleoptera	2	20	35.09%
Diptera	1	1	1.75%
Chironomidae	3	5	8.77%

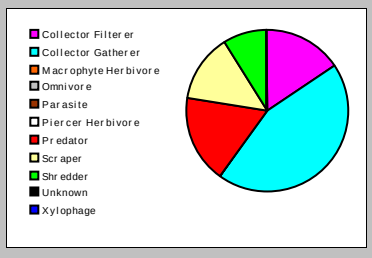


Dominant Taxa

Category	A	PRA
Heterlimnius corpulentus	19	33.33%
Hydropsyche	8	14.04%
Acari	8	14.04%
Baetis tricaudatus	4	7.02%
Polypedilum	3	5.26%
Glossosoma	3	5.26%
Dicosmoecus atripes	3	5.26%
Glossosomatidae	2	3.51%
Sweltsa	1	1.75%
Skwala	1	1.75%
Rheotanytarsus	1	1.75%
Lara	1	1.75%
Crangonyx	1	1.75%
Brillia	1	1.75%
Antocha monticola	1	1.75%

Functional Composition

Category	R	A	PRA
Predator	3	10	17.54%
Parasite			
Collector Gatherer	4	25	43.86%
Collector Filterer	2	9	15.79%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	2	8	14.04%
Shredder	3	5	8.77%
Omnivore			
Unknown			

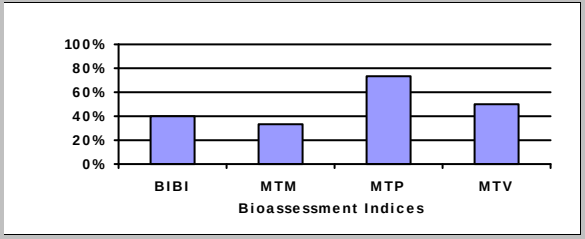


Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	14
E Richness	1
P Richness	2
T Richness	3
EPT Richness	6
EPT Percent	38.60%
All Non-Insect Abundance	9
All Non-Insect Richness	2
All Non-Insect Percent	15.79%
Oligochaeta+Hirudinea Percent	0.00%
Baetidae/Ephemeroptera	1.000
Hydropsychidae/Trichoptera	0.500
Dominance	
Dominant Taxon Percent	33.33%
Dominant Taxa (2) Percent	47.37%
Dominant Taxa (3) Percent	61.40%
Dominant Taxa (10) Percent	91.23%
Diversity	
Shannon H (loge)	2.295
Shannon H (log2)	3.310
Margalef D	3.600
Simpson D	0.107
Evenness	0.091
Function	
Predator Richness	3
Predator Percent	17.54%
Filterer Richness	2
Filterer Percent	15.79%
Collector Percent	59.65%
Scraper+Shredder Percent	22.81%
Scraper/Filterer	0.889
Scraper/Scraper+Filterer	0.471
Habit	
Burrower Richness	1
Burrower Percent	1.75%
Swimmer Richness	1
Swimmer Percent	7.02%
Clinger Richness	8
Clinger Percent	64.91%
Characteristics	
Cold Stenotherm Richness	1
Cold Stenotherm Percent	5.26%
Hemoglobin Bearer Richness	1
Hemoglobin Bearer Percent	5.26%
Air Breather Richness	1
Air Breather Percent	1.75%
Voltinism	
Univoltine Richness	6
Semivoltine Richness	3
Multivoltine Percent	29.82%
Tolerance	
Sediment Tolerant Richness	1
Sediment Tolerant Percent	1.75%
Sediment Sensitive Richness	1
Sediment Sensitive Percent	5.26%
Metals Tolerance Index	3.692
Pollution Sensitive Richness	1
Pollution Tolerant Percent	0.00%
Hilsenhoff Biotic Index	3.456
Intolerant Percent	17.54%
Supertolerant Percent	0.00%
CTQa	66.000

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	20	40.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	22	73.33%	Slight
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	9	50.00%	Moderate
MTM	Montana DEQ Mountains (Bukantis 1998)	7	33.33%	Moderate



Tuesday, March 10, 2015

Metrics Report

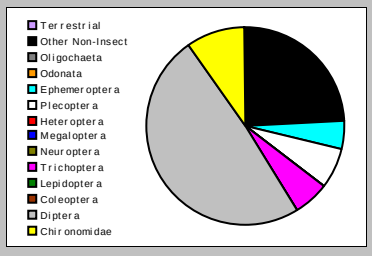
Project ID: CB14LD
RAI No.: CB14LD007
Sta. Name: Kelsey Peltzer Rep 1
Client ID: Kelsey Peltzer 1A-E
STORET ID
Coll. Date: 8/29/2014
Latitude: 47.6220 **Longitude:** -122.1460

Abundance Measures

Sample Count: 551
Sample Abundance: 5,510.00 10.00% of sample used
Coll. Procedure: Surber
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	5	131	23.77%
Oligochaeta	2	4	0.73%
Odonata			
Ephemeroptera	1	24	4.36%
Plecoptera	2	37	6.72%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	2	30	5.44%
Lepidoptera			
Coleoptera			
Diptera	4	272	49.36%
Chironomidae	7	53	9.62%

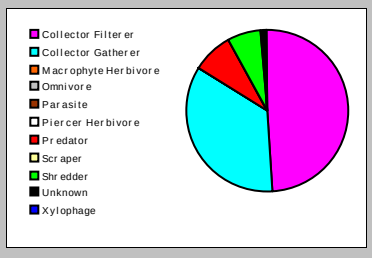


Dominant Taxa

Category	A	PRA
Simulium	267	48.46%
Crangonyx	74	13.43%
Caecidotea	38	6.90%
Malenka	36	6.53%
Eukiefferiella Claripennis Gr.	32	5.81%
Parapsyche	27	4.90%
Baetis tricaudatus	24	4.36%
Turbellaria	11	2.00%
Parametriocnemus	6	1.09%
Nemata	6	1.09%
Micropsectra	6	1.09%
Tvetenia Bavarica Gr.	5	0.91%
Lumbriculidae	3	0.54%
Dicranota	3	0.54%
Hydropsychidae	2	0.36%

Functional Composition

Category	R	A	PRA
Predator	8	47	8.53%
Parasite			
Collector Gatherer	10	191	34.66%
Collector Filterer	2	270	49.00%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper			
Shredder	2	37	6.72%
Omnivore			
Unknown	1	6	1.09%

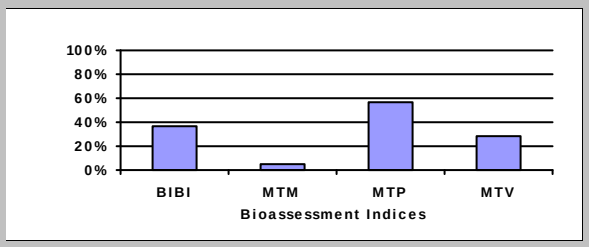


Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	23
E Richness	1
P Richness	2
T Richness	2
EPT Richness	5
EPT Percent	16.52%
All Non-Insect Abundance	135
All Non-Insect Richness	7
All Non-Insect Percent	24.50%
Oligochaeta+Hirudinea Percent	0.73%
Baetidae/Ephemeroptera	1.000
Hydropsychidae/Trichoptera	0.967
Dominance	
Dominant Taxon Percent	48.46%
Dominant Taxa (2) Percent	61.89%
Dominant Taxa (3) Percent	68.78%
Dominant Taxa (10) Percent	94.56%
Diversity	
Shannon H (loge)	1.956
Shannon H (log2)	2.822
Margalef D	3.528
Simpson D	0.243
Evenness	0.083
Function	
Predator Richness	8
Predator Percent	8.53%
Filterer Richness	2
Filterer Percent	49.00%
Collector Percent	83.67%
Scraper+Shredder Percent	6.72%
Scraper/Filterer	0.000
Scraper/Scraper+Filterer	0.000
Habit	
Burrower Richness	2
Burrower Percent	0.73%
Swimmer Richness	1
Swimmer Percent	4.36%
Clinger Richness	6
Clinger Percent	60.80%
Characteristics	
Cold Stenotherm Richness	0
Cold Stenotherm Percent	0.00%
Hemoglobin Bearer Richness	
Hemoglobin Bearer Percent	
Air Breather Richness	1
Air Breather Percent	0.54%
Voltinism	
Univoltine Richness	10
Semivoltine Richness	1
Multivoltine Percent	16.33%
Tolerance	
Sediment Tolerant Richness	2
Sediment Tolerant Percent	1.09%
Sediment Sensitive Richness	0
Sediment Sensitive Percent	0.00%
Metals Tolerance Index	4.267
Pollution Sensitive Richness	0
Pollution Tolerant Percent	6.90%
Hilsenhoff Biotic Index	5.394
Intolerant Percent	11.80%
Supertolerant Percent	12.89%
CTQa	92.368

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	18	36.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	17	56.67%	Slight
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	5	27.78%	Moderate
MTM	Montana DEQ Mountains (Bukantis 1998)	1	4.76%	Severe



Metrics Report

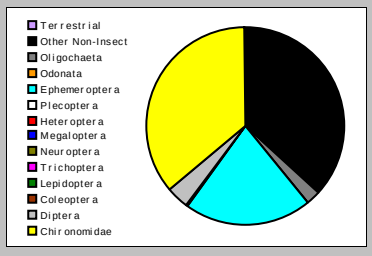
Project ID: CB14LD
RAI No.: CB14LD008
Sta. Name: Kelsey Farm
Client ID: Kelsey Farm 1-6
STORET ID
Coll. Date: 9/2/2014
Latitude: 47.6050 **Longitude:** -122.1620

Abundance Measures

Sample Count: 564
Sample Abundance: 16,920.00 3.33% of sample used
Coll. Procedure: Surber
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	5	207	36.70%
Oligochaeta	2	14	2.48%
Odonata			
Ephemeroptera	1	116	20.57%
Plecoptera	1	1	0.18%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera			
Lepidoptera			
Coleoptera	1	1	0.18%
Diptera	2	20	3.55%
Chironomidae	13	205	36.35%

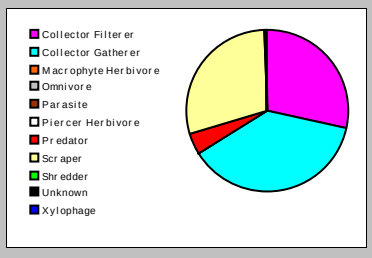


Dominant Taxa

Category	A	PRA
Potamopyrgus antipodarum	165	29.26%
Rheotanytarsus	145	25.71%
Baetis tricaudatus	116	20.57%
Turbellaria	23	4.08%
Eukiefferiella Pseudomontana Gr	22	3.90%
Simulium	17	3.01%
Crangonyx	16	2.84%
Tvetenia Bavarica Gr.	14	2.48%
Lumbriculidae	13	2.30%
Orthocladius	4	0.71%
Parametriocnemus	3	0.53%
Micropsectra	3	0.53%
Eukiefferiella Claripennis Gr.	3	0.53%
Antocha monticola	3	0.53%
Caecidotea	2	0.35%

Functional Composition

Category	R	A	PRA
Predator	3	25	4.43%
Parasite			
Collector Gatherer	16	209	37.06%
Collector Filterer	2	162	28.72%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	2	166	29.43%
Shredder	2	2	0.35%
Omnivore			
Unknown			

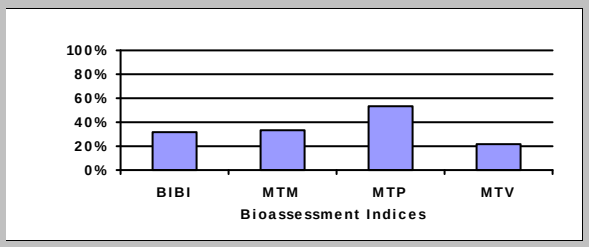


Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	25
E Richness	1
P Richness	1
T Richness	0
EPT Richness	2
EPT Percent	20.74%
All Non-Insect Abundance	221
All Non-Insect Richness	7
All Non-Insect Percent	39.18%
Oligochaeta+Hirudinea Percent	2.48%
Baetidae/Ephemeroptera	1.000
Hydropsychidae/Trichoptera	0.000
Dominance	
Dominant Taxon Percent	29.26%
Dominant Taxa (2) Percent	54.96%
Dominant Taxa (3) Percent	75.53%
Dominant Taxa (10) Percent	94.86%
Diversity	
Shannon H (loge)	2.005
Shannon H (log2)	2.892
Margalef D	3.820
Simpson D	0.197
Evenness	0.088
Function	
Predator Richness	3
Predator Percent	4.43%
Filterer Richness	2
Filterer Percent	28.72%
Collector Percent	65.78%
Scraper+Shredder Percent	29.79%
Scraper/Filterer	1.025
Scraper/Scraper+Filterer	0.506
Habit	
Burrower Richness	1
Burrower Percent	2.48%
Swimmer Richness	1
Swimmer Percent	20.57%
Clinger Richness	6
Clinger Percent	29.79%
Characteristics	
Cold Stenotherm Richness	0
Cold Stenotherm Percent	0.00%
Hemoglobin Bearer Richness	
Hemoglobin Bearer Percent	
Air Breather Richness	1
Air Breather Percent	0.53%
Voltinism	
Univoltine Richness	7
Semivoltine Richness	1
Multivoltine Percent	61.17%
Tolerance	
Sediment Tolerant Richness	2
Sediment Tolerant Percent	2.84%
Sediment Sensitive Richness	0
Sediment Sensitive Percent	0.00%
Metals Tolerance Index	3.018
Pollution Sensitive Richness	0
Pollution Tolerant Percent	0.89%
Hilsenhoff Biotic Index	6.092
Intolerant Percent	0.18%
Supertolerant Percent	34.75%
CTQa	97.684

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	16	32.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	16	53.33%	Moderate
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	4	22.22%	Moderate
MTM	Montana DEQ Mountains (Bukantis 1998)	7	33.33%	Moderate



Metrics Report

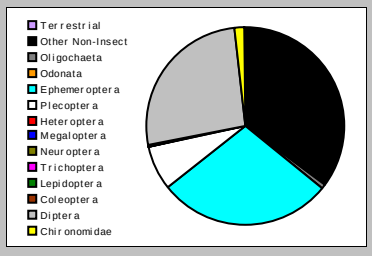
Project ID: CB14LD
RAI No.: CB14LD009
Sta. Name: Sunset SE 30th
Client ID: Sunset SE 30th Rep 1A-D
STORET ID
Coll. Date: 8/21/2014
Latitude: 47.5851 **Longitude:** -122.1644

Abundance Measures

Sample Count: 549
Sample Abundance: 2,352.86 23.33% of sample used
Coll. Procedure: Surber
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	4	194	35.34%
Oligochaeta	1	3	0.55%
Odonata			
Ephemeroptera	1	155	28.23%
Plecoptera	1	40	7.29%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	1	2	0.36%
Lepidoptera			
Coleoptera			
Diptera	2	146	26.59%
Chironomidae	4	9	1.64%

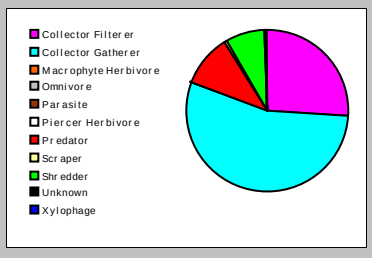


Dominant Taxa

Category	A	PRA
Baetis tricaudatus	155	28.23%
Simulium	145	26.41%
Crangonyx	135	24.59%
Turbellaria	56	10.20%
Malenka	40	7.29%
Eukiefferiella Claripennis Gr.	4	0.73%
Lumbriculidae	3	0.55%
Phaenopsectra	2	0.36%
Lepidostoma	2	0.36%
Cricotopus (Cricotopus)	2	0.36%
Acari	2	0.36%
Tvetenia tshernovskii	1	0.18%
Nemata	1	0.18%
Dicranota	1	0.18%

Functional Composition

Category	R	A	PRA
Predator	3	59	10.75%
Parasite			
Collector Gatherer	5	298	54.28%
Collector Filterer	1	145	26.41%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	1	2	0.36%
Shredder	3	44	8.01%
Omnivore			
Unknown	1	1	0.18%



Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	14
E Richness	1
P Richness	1
T Richness	1
EPT Richness	3
EPT Percent	35.88%
All Non-Insect Abundance	197
All Non-Insect Richness	5
All Non-Insect Percent	35.88%
Oligochaeta+Hirudinea Percent	0.55%
Baetidae/Ephemeroptera	1.000
Hydropsychidae/Trichoptera	0.000
Dominance	
Dominant Taxon Percent	28.23%
Dominant Taxa (2) Percent	54.64%
Dominant Taxa (3) Percent	79.24%
Dominant Taxa (10) Percent	99.09%
Diversity	
Shannon H (loge)	1.659
Shannon H (log2)	2.393
Margalef D	2.071
Simpson D	0.223
Evenness	0.120
Function	
Predator Richness	3
Predator Percent	10.75%
Filterer Richness	1
Filterer Percent	26.41%
Collector Percent	80.69%
Scraper+Shredder Percent	8.38%
Scraper/Filterer	0.014
Scraper/Scraper+Filterer	0.014
Habit	
Burrower Richness	1
Burrower Percent	0.55%
Swimmer Richness	1
Swimmer Percent	28.23%
Clinger Richness	4
Clinger Percent	34.43%
Characteristics	
Cold Stenotherm Richness	0
Cold Stenotherm Percent	0.00%
Hemoglobin Bearer Richness	1
Hemoglobin Bearer Percent	0.36%
Air Breather Richness	1
Air Breather Percent	0.18%
Voltinism	
Univoltine Richness	6
Semivoltine Richness	0
Multivoltine Percent	40.44%
Tolerance	
Sediment Tolerant Richness	2
Sediment Tolerant Percent	0.73%
Sediment Sensitive Richness	0
Sediment Sensitive Percent	0.00%
Metals Tolerance Index	4.408
Pollution Sensitive Richness	0
Pollution Tolerant Percent	0.00%
Hilsenhoff Biotic Index	4.847
Intolerant Percent	7.65%
Supertolerant Percent	0.73%
CTQa	79.800

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MTV	Montana Revised Valleys/Foothills (Bollman 1998)	4	22.22%	Moderate
MTM	Montana DEQ Mountains (Bukantis 1998)	3	14.29%	Severe