Summary Report

Benthic Macroinvertebrate Biomonitoring/Surveys Blue River, Colorado

2022

Prepared for:

The Blue River Watershed Group and Trout Unlimited

Prepared by:

David E. Rees
Timberline Aquatics, Inc.
4219 Table Mountain Place, Suite A
Fort Collins, Colorado 80526

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Table of Contents

Introduction 1
Study Area 2
Methods 4
  Multi-Metric Index (MMI v4) 5
  Additional Metrics Used in this Study 6
Results/Discussion 9
  MMI v4 9
  Additional Evaluation (Individual Metrics) 19
  Functional Feeding Groups 33
Conclusions 37
Literature Cited 38
Appendix A A-1
Appendix B B-1
Appendix C C-1

List of Tables

Table 1. Coordinates and elevations of sampling locations on Blue River in 2022. 2
Table 2. MMI v4 scores from composited replicate Hess samples collected from ten study sites on the Blue River on 19 April 2022. Scores indicating 'impairment' are provided in red. 13
Table 3. MMI v4 scores from composited replicate Hess samples collected from ten study sites on the Blue River on 12 August 2022. Scores indicating 'impairment' are provided in red. 14
Table 4. MMI v4 scores from composited replicate Hess samples collected from ten study sites on the Blue River on 25-26 October 2022. Scores indicating 'impairment' are provided in red. 15
Table 5. Aquatic life use designations based on MMI v4 scores from composited quantitative (Hess) samples at sites in the Blue River study area, 2022. 18
Table 6. Individual metrics and comparative values for quantitative benthic macroinvertebrate samples collected from the Blue River, 19 April 2022. 20
Table 7. Additional metrics and comparative values for quantitative benthic macroinvertebrate samples collected on the Blue River, 19 April 2022. 21
Table 8. Individual metrics and comparative values for quantitative benthic macroinvertebrate samples collected from the Blue River, 12 August 2022. 23
Table 9. Additional metrics and comparative values for quantitative benthic macroinvertebrate samples collected on the Blue River, 12 August 2022. 24
Table 10. Individual metrics and comparative values for quantitative benthic macroinvertebrate samples collected from the Blue River, 25-26 October 2022. 26
Table 11. Additional metrics and comparative values for quantitative benthic macroinvertebrate samples collected on the Blue River, 25-26 October 2022. 27
Table 12. Relative abundance of functional feeding groups on 19 April 2022 at sampling locations in the Blue River study area. 34
Table 13. Relative abundance of functional feeding groups on 12 August 2022 at sampling locations in the Blue River study area. 35
Table 14. Relative abundance of functional feeding groups on 25-26 October 2022 at sampling locations in the Blue River study area. 36

List of Figures

Figure 1. Map of study sites used for Blue River benthic macroinvertebrate biomonitoring in 2022..... 3
Figure 2. MMI v4 scores from composited quantitative (Hess) samples at study sites on the Blue River during April 2020, 2021, and 2022..... 16
Figure 3. MMI v4 scores from composited quantitative (Hess) samples at study sites on the Blue River during August 2020, 2021, and 2022. 16
Figure 4. MMI v4 scores from composited quantitative (Hess) samples at study sites on the Blue River during November 2020, October 2021, and October 2022. 17
Figure 5. HBI values from composited quantitative (Hess) samples at study sites on the Blue River during April, August, and October 2022. 17
Figure 6. Shannon Diversity values from composited quantitative (Hess) samples at study sites on the Blue River during April, August, and October 2022. 18
Figure 7. Total EPT Taxa values from spring, summer, and fall sampling on the Blue River during 2022. 29
Figure 8. Taxa Richness values from spring, summer, and fall sampling on the Blue River during 2022. 30
Figure 9. Clinger Taxa values from spring, summer, and fall sampling on the Blue River during 2022. 30
Figure 10. Percent Shredders and Scrapers from spring, summer, and fall sampling on the Blue River during 2022..... 31
Figure 11. Percent EPT values from spring, summer, and fall sampling on the Blue River during 2022. 31
Figure 12. Estimated Total Density values (number/m^2) from spring, summer, and fall sampling on the Blue River, 2022..... 32
Figure 13. Estimated Total Dry Weight (g/m^2) of benthic macroinvertebrates during spring, summer, and fall sampling on the Blue River, 2022..... 32
Figure 14. Mean Dry Weight (mg/individual) for benthic macroinvertebrate specimens during spring, summer, and fall of 2022..... 33
Figure 15. Functional feeding group composition for study sites in the Blue River study area, 19 April 2022. 34
Figure 16. Functional feeding group composition for study sites in the Blue River study area, 12 August 2022. 35
Figure 17. Functional feeding group composition for study sites in the Blue River study area, 25-26 October 2022..... 36

Introduction

Evolution and ecological pressures have resulted in benthic macroinvertebrate communities with taxa-specific adaptations to the aquatic environment. Therefore, biological community assessments are often used to evaluate anthropogenic impacts on rivers and streams. Recent studies have emphasized the need for biomonitoring programs using benthic macroinvertebrates to improve evaluations of aquatic ecosystems (Plafkin et al. 1989, Barbour et al. 1999, Paul et al. 2005, Merritt et al. 2008). Benthic macroinvertebrates, especially aquatic insects, are useful for this purpose because they are (a) common in most streams, (b) readily collected, (c) relatively easily identified, (d) have limited mobility, and (e) generally have life cycles of a year or more. These unique features provide an opportunity to monitor past and present influences on the aquatic environment at specific locations in river systems. Surveillance of aquatic conditions using macroinvertebrate communities as indicators of biotic integrity has become a widely used practice (Rosenberg and Resh 1993, Rosenberg et al. 2008).

Long-term monitoring studies are essential for the evaluation of aquatic life in systems with increasing water demands or changes in land use practices (Likens and Lambert 1998, Voelz et al. 2005). Sustained biomonitoring studies also provide a better understanding of impacts from anthropogenic disturbances when compared to natural, seasonal, and annual variations in benthic communities. The results provided by consistent sampling practices and accurate identifications can provide valuable information regarding short-term and long-term changes in aquatic conditions.

The benthic macroinvertebrate biomonitoring study on the Blue River, Colorado, was designed to provide seasonal information regarding the health of benthic macroinvertebrate communities both spatially and over time. Seasonal data collected during the spring, summer, and fall from 2020 to 2022 was used to evaluate changes in macroinvertebrate community structure and function within this drainage. Potential stressors in the study area include: an altered temperature and flow regime downstream from Dillon Reservoir, urban runoff from surrounding communities, and a variety of other possible perturbations associated with human activities.

Colorado, like much of the western U.S., is well-known for its numerous impoundments on rivers and streams of various sizes, and several detailed studies document the downstream impacts of regulated Colorado rivers on benthic macroinvertebrate communities (Stanford and Ward 1984, Zimmerman and Ward 1984, Rader and Ward 1988, Voelz and Ward 1991, Collier et al. 1996). These studies support the concept that changes in flow patterns and riverine thermal regimes below dams can clearly impact the structure and function of macroinvertebrate communities for many kilometers downstream. Previous studies on the Blue River below Dillon Reservoir by Voelz and Ward (1989, 1990) determined that a sequential gradient of stress, followed by macroinvertebrate community recovery, occurred within the first 20 km below the

impoundment. Typically, deep releases (hypolimnetic or cold) from thermally stratified reservoirs will increase winter water temperatures (Gore 1977, Ward and Stanford 1979, Dickerson et al. 2012), decrease summer temperatures (Lehmkuhl 1972, Ward and Stanford 1979, Vinson 2001), and increase diel constancy of thermal events (Armitage 1984). Abrupt releases, either deep or surface, from dams can also be detrimental to aquatic biota, particularly when they cause sudden changes in water temperatures. These types of releases have been shown to produce a shock effect, potentially reducing diversity and abundance of benthic macroinvertebrates with a narrow range of thermal tolerances (Olden and Naiman 2010, Carolli et al. 2011, McLaren et al. 2019). Numerous studies support the concept that dams and reservoirs can significantly modify the downstream abiotic and biotic components of free-flowing rivers and streams (Ward and Stanford 1979, Caissie 2006, Olden and Naiman 2010, Poff and Zimmerman 2010, Ellis and Jones 2013, Wang et al. 2018).

Study Area

During seasonal monitoring (spring, summer, and fall) in 2022, a total of ten stations were sampled to evaluate the health of benthic macroinvertebrate communities in the Blue River (Table 1, Figure 1). Sampling sites included two locations upstream from Dillon Reservoir and eight locations downstream from Dillon Reservoir, between Dillon Dam and Green Mountain Reservoir. Study sites were generally selected to assess potential impacts and recovery from regulated flows and the altered thermal regime downstream from Dillon Dam. All of these study sites were previously monitored from 2020-2021, except for site BRaFG which was added in 2021 to provide an assessment of seasonal conditions in the Blue River within the Town of Breckenridge (Figure 1). Sampling locations between Dillon Dam and Green Mountain Reservoir were strategically positioned in areas where there was historical data and/or potential influences to the temperature and flow regime from tributaries.

Table 1. Coordinates and elevations of sampling locations on Blue River in 2022.

	Latitude	Longitude	Elevation (m)
BRaFG	39.49379	-106.04548	2898
UBR	39.56651	-106.04884	2773
Blue 5	39.62601	-106.06658	2684
DRD	39.63651	-106.07419	2675
Blue 3	39.65595	-106.07685	2647
D 5	39.70545	-106.11062	2596
Blue 2	39.72713	-106.1321	2574
Blue 1	39.74336	-106.13196	2558
SCR	39.78217	-106.16035	2502
BRC	39.8217	-106.20584	2443

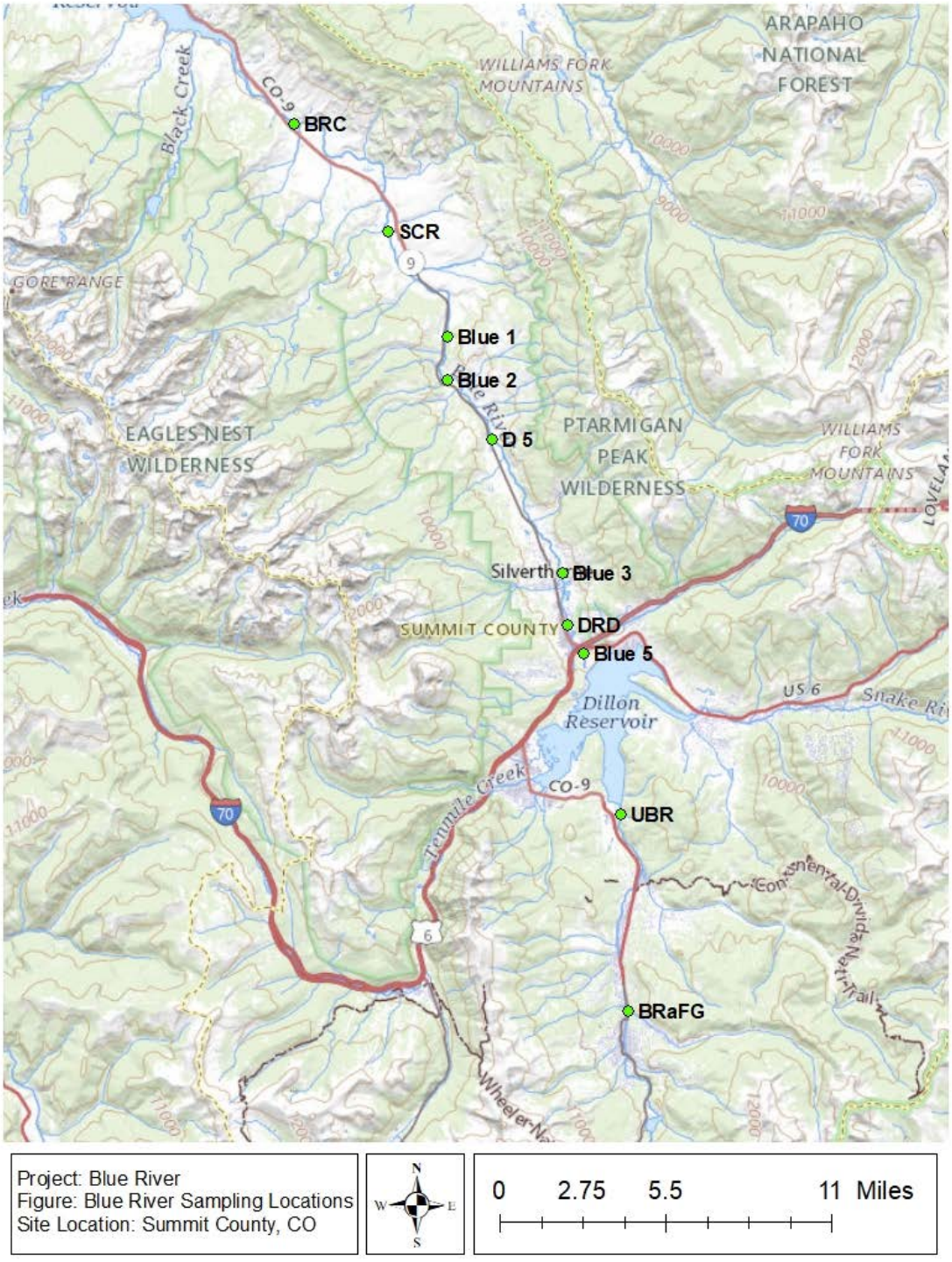

Figure 1. Map of study sites used for Blue River benthic macroinvertebrate biomonitoring in 2022.

Methods

The purpose of this biomonitoring study was to assess seasonal and annual variability in benthic macroinvertebrate communities at specific locations along the Blue River where releases from Dillon Reservoir and/or other anthropogenic stressors (e.g., urban runoff, etc.) may be influencing the health of aquatic life. The objective of this study required that three (3) quantitative, replicate Hess samples were taken from similar habitat at each study site. Several biotic analysis tools (metrics) were utilized in this study to account for different types of responses to various stressors. This approach was designed to identify the spatial distribution of disturbances, as well as any temporal variability. This report focuses on the results from 2022.

Three replicate, quantitative samples were collected from ten study sites on the Blue River during April, August, and October (spring, summer, and fall) of 2022. All samples were collected from similar riffle habitat to provide benthic macroinvertebrate data that was representative and comparable throughout the study area. Substrate within each sample was thoroughly agitated and individual rocks were scrubbed by hand to dislodge benthic organisms. All macroinvertebrates were rinsed into sample jars and preserved in 80% ethanol solution. Each sample jar was labeled with the date, sampling location, and sample ID number on the outside and inside of the container. All samples were transported to the lab at Timberline Aquatics, Inc. where benthic macroinvertebrates were sorted, identified, and enumerated. The sorting and identification process was conducted for each entire sample to avoid any potential problems or controversy associated with subsampling. The sampling and sample processing methodology has remained consistent throughout the last three years.

The sorting process involved separating macroinvertebrates from debris in each sample. All macroinvertebrates were removed from each sample and placed into vials containing coarse taxonomic groups. Benthic macroinvertebrates were then identified to a taxonomic level consistent with the Operational Taxonomic Unit (OTU) established by the Water Quality Control Division (WQCD) of the Colorado Department of Public Health and Environment (CDPHE). This level of identification was typically genus or species for mayflies, stoneflies, caddisflies, and many dipterans. Members of the family Chironomidae were also identified to the genus level. Specimens were identified using a variety of taxonomic keys, including Ward et al. (2002) and Merritt et al. (2008). As part of the quality control protocols at Timberline Aquatics, Inc., all sorted macroinvertebrate samples were checked by a qualified taxonomist, and 10% of identifications were checked for accuracy at Colorado State University.

Population densities and species lists were developed for each sampling event during 2022 and a variety analysis tools were used to provide information regarding aquatic conditions. All macroinvertebrate data were analyzed using the MMI v4 and an additional assortment of individual metrics. The following section provides a brief description of each tool that was used to assess the health of aquatic communities in this study.

Multi-Metric Index (MMI v4)

In the fall of 2010, the WQCD developed a Multi-Metric Index (MMI) to assist in the evaluation of benthic macroinvertebrate data from across the State of Colorado (Colorado Department of Public Health and Environment 2010). In 2017, the MMI was recalibrated and updated to produce a new analysis tool (the MMI v4) that relies on specific methods and protocols for sample processing and analysis (Colorado Department of Public Health and Environment 2017). This most recent version of the MMI provides a single index score based on eight equally weighted metrics. This score is then assessed along a threshold gradient correlated to overall aquatic health which determines the "aquatic life use designation' for a sampling location. The MMI v4 was applied to quantitative benthic macroinvertebrate data collected from the Blue River in 2022 (and previous years) using the guidelines established in the WQCD Listing Methodology, 2020 Listing Cycle (Colorado Department of Public Health and Environment 2019).

The group of metrics used in MMI v4 calculations depends on the sampling location and corresponding Biotype (Mountains, Transitional, or Plains). In the Blue River study area, the nine most upstream study sites were located in Biotype 2 (Mountains), while site BRC was located within Biotype 1 (the Transition Zone), which includes lower mountain areas in the State of Colorado. Each of the individual metrics used in the analysis produces a score that is adjusted to a scale from 1 to 100 based on the range of metric values found at "reference sites". In Biotype 1, these metrics include: EPT Taxa, % Non-Insect Individuals, % EPT Individuals (no Baetidae), % Coleoptera Individuals, % Intolerant Taxa, % Increaser Individuals (Mid-Elevation), Clinger Taxa, and Predator/Shredder Taxa. In Biotype 2, these metrics include: EPT Taxa, % EPT Individuals (no Baetidae), Clinger Taxa, Total Taxa, Intolerant Taxa, % Increasers (Mountains), Predator Taxa, and % Scraper Individuals. A detailed description of the component metrics and methods used to calculate MMI v4 scores can be found in the *Aquatic Life Use Attainment: Methodology to Determine Use Attainment for Rivers and Streams, Policy 10-1* and Appendix D of the *Section 303(d) Listing Methodology 2020 Listing Cycle* (Colorado Department of Public Health and Environment 2017 and 2019). The MMI v4 was developed using macroinvertebrate data that was mostly collected during the late summer or fall; therefore, it is expected to be most accurate when applied during those seasons. Thresholds for the MMI v4 in Biotypes 1 and 2 are as follows:

Biotype	**Attainment Threshold**	**Impairment Threshold**
Transitional (Biotype 1)	45.2	33.7
Mountains (Biotype 2)	47.5	39.8

MMI v4 scores that fall between the thresholds for attainment and impairment (the 'Grey Zone') require further evaluation using additional metrics to determine an aquatic life use designation. The additional metrics include Shannon Diversity (Diversity) and the Hilsenhoff Biotic Index (HBI). The specific thresholds for the auxiliary metrics in Biotypes 1 and 2 are listed below, followed by descriptions of each metric:

Biotype	HBI	Diversity
Transitional (Biotype 1)	5.8	2.1
Mountains (Biotype 2)	4.9	3.2

Shannon Diversity (Diversity): Diversity was used as an auxiliary metric for the MMI v4 and as an independent metric in this study to evaluate changes in macroinvertebrate community structure by providing a measure of community balance. In unpolluted waters, Diversity values typically range from near 3.0 to 4.0. In polluted waters, this value is generally less than 1.0 (Ward et al. 2002).

Hilsenhoff Biotic Index (HBI): The HBI is another auxiliary metric used for the MMI v4; however, it is also valuable as an independent metric and has been widely used and/or recommended in numerous regional biomonitoring studies (Paul et al. 2005). Most of the value from this metric lies in the detection of organic pollution, but it is also used to evaluate aquatic conditions in a variety of other circumstances. The HBI was originally developed using macroinvertebrate taxa from streams in Wisconsin; therefore, it may require regional modifications (Hilsenhoff 1988). Tolerance values for taxa occurring in this study area were taken from a list provided by the CDPHE, which was derived from a variety of regional sources. Although HBI values may naturally vary across regions, a comparison of the values produced within the same river system should provide information regarding locations impacted by nutrient-enrichment and/or other aquatic disturbances. Values for the HBI range from 0.0 to 10.0 and increase as water quality decreases.

Additional Metrics Used in this Study

In addition to the MMI v4 and associated auxiliary metrics, several other individual metrics were applied in the analysis of macroinvertebrate data from sites in the Blue River study area in order to provide a more thorough evaluation of macroinvertebrate community structure and function. The following section provides a description of each individual metric used in this study:

Richness measures:

Total EPT (Ephemeroptera Plecoptera Trichoptera) Taxa: The effectiveness of this metric is based on the assumption that the orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) are generally more sensitive to pollution/perturbations than other benthic macroinvertebrate orders (Lenat 1988). The Total EPT Taxa metric is currently an important and widely used metric in many regions of the United States (Barbour et al. 1999). The Total EPT Taxa value is simply given as the total number of distinguishable taxa in the orders Ephemeroptera, Plecoptera, and

Trichoptera found at each sampling location. For the purpose of this study, each major component (insect order) used in this metric was reviewed separately in addition to the Total EPT Taxa value. Results from this metric are expected to naturally vary among river systems, but this tool can be an excellent indicator of disturbances within a specific drainage. The Total EPT Taxa value is expected to decrease in response to a variety of stressors, including nutrient-enrichment (Wang et al. 2007).

Taxa Richness: The Taxa Richness (or Total Taxa) metric is reported as the total number of identifiable taxa collected from each sampling location. Total Taxa has become one of the most widely used metrics to evaluate stream health, as it provides a general indication of community health and stability (Courtemanch 1996). Taxa Richness values are expected to decrease with increased perturbations to the aquatic environment (Resh and Jackson 1993).

Clinger Taxa: This metric requires the reorganization of macroinvertebrates into groups based on their habits or modes of locomotion. The number of Clinger Taxa includes those macroinvertebrates which are adapted to attach to relatively clean benthic substrate. Perturbations such as excessive sedimentation, rapid changes in discharge, or excessive algal growth can cause a reduction in this metric value (Hughes and Brossett 2009).

***Composition measures*:**

Percent Clingers: This metric relies on the assumption that proportion of benthic macroinvertebrates with specific habitat adaptations will respond negatively to unnatural alterations in their preferred habitat. A variety of perturbations (sedimentation, rapid changes in discharge, and excessive algal growth) can not only reduce the richness of clinger taxa, but these types of impacts are expected to cause a decline in the proportion of these specialized macroinvertebrates.

Percent Shredders and Scrapers: Shredders and Scrapers are often considered sensitive to disturbances because they are specialized feeders (Barbour et al. 1999). Consequently, these sensitive feeding groups are expected to be well-represented in healthy streams. Much of the value in this type of analysis comes from a comparison of sites within a specific study area.

Percent Chironomidae: The midge family Chironomidae is generally considered to be fairly tolerant of environmental stress, when compared to other aquatic insect families (Plafkin et al. 1989). The Percent Chironomidae metric relies on the assumption that the relative proportion of representatives from this family will increase with increasing stress or pollution. Streams that are undisturbed often have a relatively even distribution of Ephemeroptera, Plecoptera, Trichoptera, and Chironomidae (Mandaville 2002); while the family Chironomidae often dominates (75% or more of the macroinvertebrate density) at sites degraded by metals or other pollutants (Barton and Metcalf-Smith 1992). Most species in the family

Chironomidae tend to have a relatively short life-cycle which enables them to continually re-colonize unstable or polluted habitats, making their abundance a relatively reliable indicator of certain types of environmental stress (Lenat 1983).

Percent EPT: As previously stated, most taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera are expected to be sensitive to environmental perturbations or pollution. Therefore, the percentage of individuals representing EPT orders (at each sampling location) provides a measure of benthic macroinvertebrates that are expected to be sensitive to anthropogenic stressors or pollution. A decrease in the Percent EPT value suggests that the benthic macroinvertebrate community consists of a higher proportion of tolerant taxa.

***Abundance measures*:**

Density: Macroinvertebrate abundance (Density) was reported as the mean number of macroinvertebrates per m^2 collected at each study site. The Density metric provides a means of measuring and comparing standing crop at each site. This metric can be useful when comparing food-web components among sites or when paired with dry weight information to evaluate changes in biomass throughout the study area.

Biomass: Biomass was reported as the mean dry weight of benthic macroinvertebrates per m^2 at each site. Biomass values were obtained by drying macroinvertebrates from each sample in a scientific drying oven at 100° C for 24 hours or until all water content had evaporated (no decrease in weight could be detected). Biomass values provide production-related information in terms of weight of macroinvertebrates produced at each site. Density and Biomass values offered a strategy for measuring standing crop, which provided an indication of productivity for the macroinvertebrate portion of the food web at each sampling location.

***Trophic measures*:**

Functional Feeding Groups: Most of the previously described metrics use macroinvertebrate information that is based on community structure; however, macroinvertebrate taxa were also separated into functional guilds based on methods of food acquisition to provide an assessment of ecological function. All specimens from each site were categorized according to feeding strategy to determine the relative proportion of various groups. Some representation of each feeding group usually indicates healthy aquatic conditions; however, it is normal for certain groups (such as collector-gatherers) to be more abundant than others (Ward et al. 2002). Scrapers and shredders are often considered sensitive to disturbance because they are specialized feeders (Barbour et al. 1999). Consequently, an assortment of feeding groups (including the most sensitive groups) is expected to be observed at healthy study sites in Colorado streams. Much of the value in this type of analysis comes from the comparison of sites within a specific drainage. Changes in the proportion of functional feeding groups can provide insight into various types of stress in river systems (Ward et al. 2002).

Results/Discussion

Quantitative benthic macroinvertebrate samples were collected from ten study sites on the Blue River during the spring (19 April), summer (12 August), and fall (25-26 October) of 2022 to evaluate the health (structure and function) of macroinvertebrate communities in this study area. After samples were collected, they were transported to the lab at Timberline Aquatics, Inc. where specimens were sorted, identified, and enumerated (Appendix A; Tables A1-A10, Appendix B; Tables B1-B10, Appendix C; Tables C1-C10). The previously described metrics and analysis tools (including the MMI v4) were used to provide a comprehensive assessment of macroinvertebrate community integrity in the Blue River study area.

In general, results from 2022 demonstrated patterns of stress and recovery throughout the study area that were similar to patterns observed during seasonal sampling in 2020 and 2021. Regulated flows from Dillon Reservoir (and other potential anthropogenic stressors) appeared to have a continuous and substantial influence on macroinvertebrate community health at specific locations within the study area. Most aspects of macroinvertebrate community structure and function appeared to be negatively impacted near Dillon Dam, with gradual recovery occurring in a downstream direction. Overall, a fairly predictable pattern of stress and recovery in this study area tended to persist not only among seasons, but also among years (2020, 2021, and 2022).

MMI v4

A comprehensive evaluation of benthic macroinvertebrate community health was provided by the MMI v4 for 10 study sites on the Blue River during three seasons (spring, summer, and fall) in 2022. Changes in macroinvertebrate community structure and function from upstream to downstream were demonstrated by the MMI v4 and individual (component) metrics used in MMI v4 calculations (Tables 2-4). A comparison of MMI v4 scores among study sites indicated that a pattern of increased stress and recovery was fairly consistent, regardless of the season; however, the results from several study sites indicated that stress was greatest during the summer.

Study sites on the Blue River were distributed between two Biotypes in the State of Colorado (based on State classifications). The nine most upstream study sites were located in mountain habitat (Biotype 2), while the remaining study site (BRC) was located in a transitional area (Biotype 1) between the mountains and plains. In order to correctly utilize the MMI v4, all specimens were identified to the Operational Taxonomic Unit (OTU) that was established by the WQCD. For each Biotype, the MMI v4 was calculated using the appropriate set of component metrics, and final scores were evaluated using the corresponding thresholds for ‘attainment’ and ‘impairment’. While it is not always appropriate to compare MMI v4 scores between Biotypes, some of the component metrics (or individual metrics in the following section) provided an opportunity to make valid comparisons throughout the study area.

Spring 2022

Benthic macroinvertebrate sampling was conducted on 19 April, 2022 to assess aquatic community health during the spring season and provide data that could be compared to results from previous spring sampling events. During the spring of 2022, MMI v4 scores (and component metric scores) varied considerably throughout the study area (Table 2). The two sampling locations upstream from Dillon Reservoir (BRaFG and UBR) produced MMI v4 scores (30.9 and 64.6, respectively) that demonstrated 'impairment' upstream, followed by substantial recovery downstream. Site BRaFG was initially established in the spring of 2021, while all other sites had been sampled since 2020. The MMI v4 scores from both years of monitoring (2021 and 2022) at site BRaFG indicated that this site was 'impaired' for aquatic life use (Figure 2). Possible stressors included flow manipulations (dewatering from upstream diversions) and urban runoff associated with the Town of Breckenridge. Farther downstream, the higher MMI v4 score of 64.6 for site UBR implied that there were considerable improvements in aquatic conditions.

Downstream from Dillon Reservoir, results from the MMI v4 showed a general pattern of relatively severe stress below the impoundment followed by gradual recovery with distance downstream (Table 2, Figure 2). Site Blue 5 produced the lowest MMI v4 score (21.0) in the study area, and site Blue 1 produced the highest MMI v4 score (73.0) in Biotype 2. Farther downstream, the only site located in Biotype 1 (BRC), generated a relatively high MMI v4 score (79.2) that was indicative of healthy community parameters. Components for the MMI v4 suggested that much of the stress to aquatic life downstream from Dillon Reservoir could be attributed to the loss of sensitive and specialized macroinvertebrates (based on the EPT Taxa, % EPT Individuals [no Baetidae], % Scraper Individuals, and % Increasers Mountain Trn, scores). As the richness and relative abundance of sensitive and specialized taxa increased in a downstream direction, MMI v4 scores responded by showing consistent improvements in macroinvertebrate community health. A similar pattern of stress and recovery was also observed during previous spring sampling events (Figure 2).

During April of 2022, three study sites (BRaFG, Blue 5, and DRD) produced MMI v4 scores that were below the 'impairment' threshold, and site D 5 generated an MMI v4 score (40.9) that was in the 'Grey Zone' (the range of scores between the 'attainment' and 'impairment' thresholds). Both auxiliary metrics (Diversity and HBI) indicated that site D 5 was in 'attainment' for aquatic life use; however, the low Diversity value for site Blue 3 would have resulted in an 'impairment' designation if the MMI v4 score for that site had been slightly lower (Table 2). Results from the MMI v4 (and auxiliary metrics) suggested that much of the stress to benthic macroinvertebrate communities downstream from Dillon Reservoir was likely due to departures from the natural temperature and flow regimes (reservoir operations) and possibly other anthropogenic activities.

Summer 2022

During the summer season (12 August 2022), results from the MMI v4 (and component metrics) indicated that stress to aquatic life had become more wide-spread in the study

area, resulting in 'impairment' designations for eight of the ten study sites. Both sampling locations upstream from Dillon Reservoir (BRaFG and UBR) generated MMI v4 scores that were below the 'impairment' threshold, and the six consecutive study sites downstream from Dillon Dam were also designated as 'impaired' for aquatic life use (Table 3). The lowest MMI v4 score in the study area (24.7) occurred immediately downstream from Dillon Reservoir at site Blue 5. This was followed by slight recovery in a downstream direction to site Blue 3; however, a second decline in MMI v4 scores was observed at site D 5. More substantial recovery was eventually observed in the downstream portion of the study area, with the highest MMI v4 score in Biotype 2 (50.9) occurring at site SCR. The single sampling location in Biotype 1 (BRC) produced an MMI v4 score (69.9) that was well-above the 'attainment' threshold (Table 3, Figure 3).

An evaluation of the component metrics for the MMI v4 suggested that specific impacts to aquatic life consisted of reductions in the proportion of sensitive and specialized individuals (based on % EPT Individuals [no Baetidae] and % Scraper Individuals, respectively) upstream from Dillon Reservoir, and a similar reduction in the proportion of sensitive individuals with an increase in the proportion of tolerant taxa (based on % Increasers, Mountain Trn) downstream from the impoundment. Auxiliary metrics indicated that community balance (Diversity) was disrupted at most of the sampling locations that received poor MMI v4 scores, and the HBI and TIV metrics detected high proportions of nutrient-tolerant and sediment-tolerant individuals (respectively) at site Blue 2 (Table 3).

Aquatic conditions in the Blue River downstream from Dillon Reservoir were somewhat unique during the summer of 2022. Warmer surface water from the reservoir did not spill in the months prior to sampling on 12 August 2022. While the negative influence of cold-water releases during the summer months could have been potentially alleviated by a return to a more normal thermal regime, the hypolimnetic releases persisted during the summer of 2022 resulting in a sustained departure from the natural thermal regime. It is likely that these conditions, along with other anthropogenic stressors (e.g., urban runoff, etc.), contributed to the wide-spread impacts on macroinvertebrate community structure and function that were observed on 12 August 2022.

Fall 2022

Benthic macroinvertebrate sampling continued on 25-26 October, 2022 at the same ten study sites that were sampled during the spring and summer. During the fall season, the spatial pattern of stress and recovery was similar to the pattern observed during the spring (Tables 2 and 4). Scores generated by the MMI v4 in Biotype 2 ranged from 22.3 (site Blue 5) to 70.6 (site SCR), while the single sampling site in Biotype 1 (BRC) generated a relatively high score of 69.8 (Table 4). Upstream from Dillon Reservoir, site BRaFG produced an MMI v4 score (31.9) indicating 'impairment', while approximately 10 miles downstream, site UBR received a score (61.1) indicating substantial improvements in most community parameters. During the fall of 2022, MMI v4 scores showed a pattern of impact and recovery that was similar the patterns observed during previous fall sampling events (Figure 4).

The component metrics for the MMI v4 provided additional insight into changes in macroinvertebrate community structure that were occurring throughout the study area during the fall season (Table 4). Much of the stress at site BRaFG was detected by metrics that measured low proportions of sensitive and specialized individuals (based on % EPT Individuals [no Baetidae] and % Scraper Individuals, respectively), and relatively high numbers of tolerant individuals (based on % Increasers, Mountain Trn). These same three component metrics suggested that macroinvertebrate communities immediately downstream from the impoundment consisted of high proportions of tolerant taxa that were less specialized in their habits and habitat requirements. Many of the scores from component metrics improved rapidly downstream from site DRD, eventually leading to considerably higher MMI v4 scores in the downstream portion of the study area (Table 4; Figure 4). Results from the MMI v4 (and component metrics) suggested that macroinvertebrate community health was rapidly improving in a relatively short distance downstream from Dillon Dam and the Town of Silverthorne in the fall of 2022.

A review of results provided by auxiliary metrics (HBI and Diversity) during all seasons in 2022 was used to determine the status of MMI v4 scores that were in the 'Grey Zone' (site D 5 in the spring, site Blue 1 in the summer, and site Blue 3 in the fall), and to assist in the overall evaluation of macroinvertebrate data throughout the study area (Tables 2-4; Figures 5-6). In 2022, most HBI values remained below the threshold set by the WQCD, and exceedances (indicating high proportions of nutrient-tolerant individuals) only occurred seasonally at a few locations. These included sites Blue 5 and DRD in the spring and sites D 5 and Blue 2 during the summer (Figure 5). Overall, most HBI values suggested that nutrient-enrichment was an unlikely source of stress in 2022.

Diversity values were also calculated (as part of the MMI v4 tool) using macroinvertebrate data from all three seasons in 2022. Although many Diversity values were below the State's threshold (3.2 in Biotype 2), only sites Blue 5 and DRD consistently produced Diversity scores that were below the threshold during all seasons (Figure 6). Overall, low Diversity values were frequently detected at study sites that produced MMI v4 scores below the 'impairment' threshold, suggesting that macroinvertebrate community balance was a good indicator of stress in this study area.

In summary, it is likely that flow diversions and urban runoff from the Town of Breckenridge had a negative impact on the macroinvertebrate community at site BRaFG, while alterations from the natural flow and temperature regime, along with urban runoff from the Town of Silverthorne had a negative influence on study sites downstream from Dillon Reservoir. Seasonal and spatial variability in the pattern of recovery downstream from the reservoir suggested that factors such as hypolimnetic releases (deviation from the natural temperature regime), input from tributaries, and possibly contributions from urban runoff may have had various influences on the health of benthic macroinvertebrate communities at different locations throughout the year. The following section provides a review of additional individual metrics that were used to assist in the assessment of macroinvertebrate community health (structure and function) in 2022.

Table 2. MMI v4 scores from composited replicate Hess samples collected from ten study sites on the Blue River on 19 April 2022. Scores indicating 'impairment' are provided in red.

Metric	BRaFG	UBR	Blue 5	DRD	Blue 3	D 5	Blue 2	Blue 1	SCR	BRC
	Biotype 2									Biotype 1
EPT Taxa	51.7	96.0	22.2	44.3	88.7	81.3	88.7	100.0	88.7	79.2
% EPT individuals, no Baetidae	47.1	55.1	0.8	4.0	37.6	24.5	43.4	69.6	91.9	100.0
Clinger Taxa	20.0	50.0	15.0	25.0	50.0	40.0	60.0	65.0	60.0	96.2
Total Taxa	38.1	61.9	28.6	42.9	54.8	54.8	64.3	69.0	69.0	--
Intolerant Taxa	33.3	61.9	19.0	33.3	61.9	57.1	61.9	76.2	61.9	--
% Increasers, Mountain Trn	18.5	68.1	0.4	4.4	21.8	17.5	31.7	51.3	25.8	--
Predator Taxa	38.5	46.2	15.4	23.1	38.5	23.1	53.8	61.5	69.2	--
% Scraper Individuals	0.0	77.3	66.9	20.8	27.4	29.3	87.2	91.2	34.8	--
% Non-Insect Individuals	--	--	--	--	--	--	--	--	--	92.6
% Coleoptera Individuals	--	--	--	--	--	--	--	--	--	8.6
% Intolerant Taxa	--	--	--	--	--	--	--	--	--	79.6
% Increasers, Mid-Elevation	--	--	--	--	--	--	--	--	--	98.8
Predator/Shredder taxa	--	--	--	--	--	--	--	--	--	78.6
MMI Score	**30.9**	**64.6**	**21.0**	**24.7**	**47.6**	**40.9**	**61.4**	**73.0**	**62.7**	**79.2**
Auxiliary Metrics										
Shannon Diversity	3.19	3.36	2.68	2.21	2.99	3.53	3.59	3.52	3.32	4.04
HBI	3.48	4.18	5.83	5.09	3.91	4.18	3.99	3.20	1.98	2.27
TIV (Sediment Region 1)	4.10	4.09	6.73	5.35	4.23	5.21	5.42	3.97	2.98	NA

Table 3. MMI v4 scores from composited replicate Hess samples collected from ten study sites on the Blue River on 12 August 2022. Scores indicating 'impairment' are provided in red.

Metric	BRaFG	UBR	Blue 5	DRD	Blue 3	D 5	Blue 2	Blue 1	SCR	BRC
	Biotype 2									Biotype 1
EPT Taxa	35.7	49.2	26.8	40.2	49.2	35.7	53.6	62.6	67.0	62.5
% EPT individuals, no Baetidae	6.0	26.8	3.0	9.7	45.1	19.6	12.5	31.0	35.7	66.0
Clinger Taxa	40.0	40.0	40.0	45.0	50.0	30.0	45.0	50.0	60	67.3
Total Taxa	52.4	52.4	35.7	57.1	54.8	50.0	66.7	71.4	76.2	--
Intolerant Taxa	38.1	52.4	33.3	42.9	57.1	47.6	57.1	66.7	76.2	--
% Increasers, Mountain Trn	9.4	16.6	4.2	9.5	8.9	1.8	5.7	8.5	17.9	--
Predator Taxa	38.5	23.1	23.1	23.1	30.8	30.8	53.8	61.5	69.2	--
% Scraper Individuals	10.7	13.2	31.9	16.1	14.5	7.9	10.1	6.3	4.8	--
% Non-Insect Individuals	--	--	--	--	--	--	--	--	--	96.1
% Coleoptera Individuals	--	--	--	--	--	--	--	--	--	12.2
% Intolerant Taxa	--	--	--	--	--	--	--	--	--	90.4
% Increasers, Mid-Elevation	--	--	--	--	--	--	--	--	--	100.0
Predator/Shredder taxa	--	--	--	--	--	--	--	--	--	64.3
MMI Score	**28.8**	**34.2**	**24.7**	**30.4**	**38.8**	**27.9**	**38.1**	**44.8**	**50.9**	**69.9**
	Auxiliary Metrics									
Shannon Diversity	3.34	3.49	2.00	2.79	3.49	2.60	3.12	3.17	3.56	3.87
HBI	4.88	4.62	4.64	4.56	3.67	5.12	5.30	4.67	4.41	3.45
TIV (Sediment Region 1)	5.70	5.03	5.59	5.06	4.84	6.03	6.17	5.28	5.17	NA

Table 4. MMI v4 scores from composited replicate Hess samples collected from ten study sites on the Blue River on 25-26 October 2022. Scores indicating 'impairment' are provided in red.

Metric	BRaFG	UBR	Blue 5	DRD	Blue 3	D 5	Blue 2	Blue 1	SCR	BRC
	Biotype 2									Biotype 1
EPT Taxa	32.7	57.1	20.4	24.5	57.1	57.1	65.3	65.3	69.4	54.2
% EPT individuals, no Baetidae	28.0	56.1	1.1	7.7	44.5	46.3	48.0	67.4	82.5	92.3
Clinger Taxa	30.0	55.0	20.0	25.0	60.0	85.0	75.0	75.0	90.0	72.1
Total Taxa	64.3	69.0	45.2	47.6	61.9	76.2	81.0	66.7	78.6	--
Intolerant Taxa	42.9	71.4	33.3	38.1	66.7	66.7	85.7	76.2	81.0	--
% Increasers, Mountain Trn	15.0	62.8	2.0	8.4	30.1	19.4	23.3	44.1	44.8	--
Predator Taxa	38.5	61.5	30.8	46.2	46.2	53.8	69.2	61.5	76.9	--
% Scraper Individuals	4.0	55.7	25.3	4.6	9.0	20.9	40.8	72.8	41.5	--
% Non-Insect Individuals	--	--	--	--	--	--	--	--	--	95.6
% Coleoptera Individuals	--	--	--	--	--	--	--	--	--	8.8
% Intolerant Taxa	--	--	--	--	--	--	--	--	--	82.0
% Increasers, Mid-Elevation	--	--	--	--	--	--	--	--	--	96.2
Predator/Shredder taxa	--	--	--	--	--	--	--	--	--	57.1
MMI Score	**31.9**	**61.1**	**22.3**	**25.3**	**46.9**	**53.2**	**61.0**	**66.1**	**70.6**	**69.8**
	Auxiliary Metrics									
Shannon Diversity	3.04	3.76	2.99	3.07	3.57	3.61	3.90	3.58	3.97	2.82
HBI	3.65	3.24	4.61	4.22	3.60	2.70	3.33	3.35	2.00	2.17
TIV (Sediment Region 1)	4.18	4.17	6.48	5.15	4.01	4.36	4.74	4.01	3.87	NA

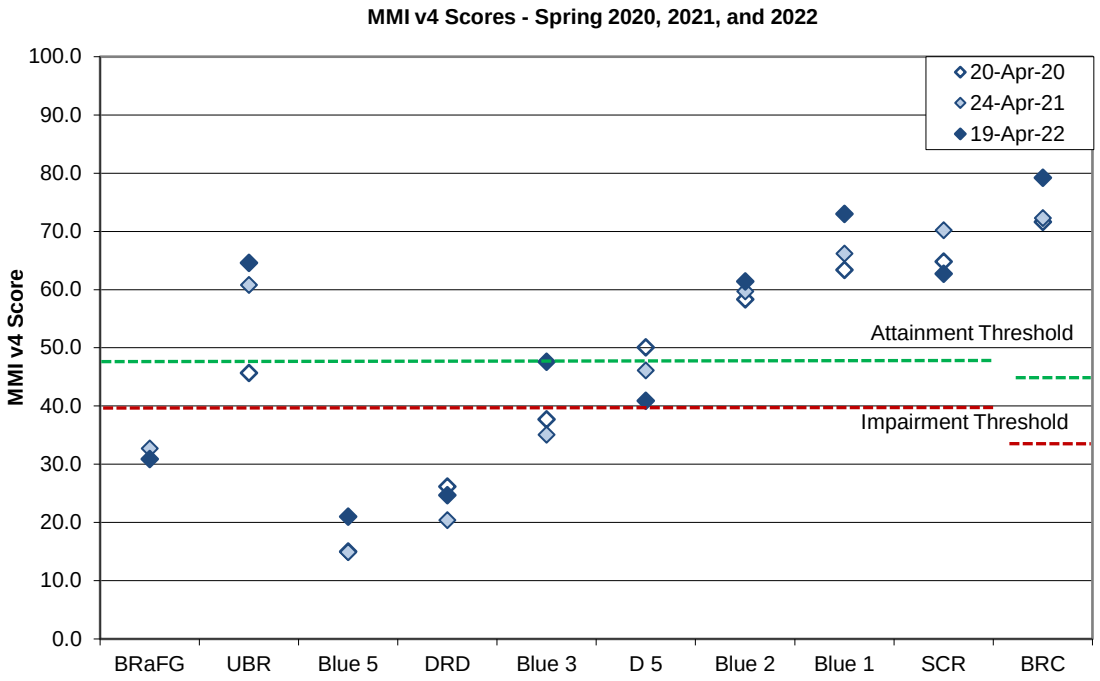

Figure 2. MMI v4 scores from composited quantitative (Hess) samples at study sites on the Blue River during April 2020, 2021, and 2022.

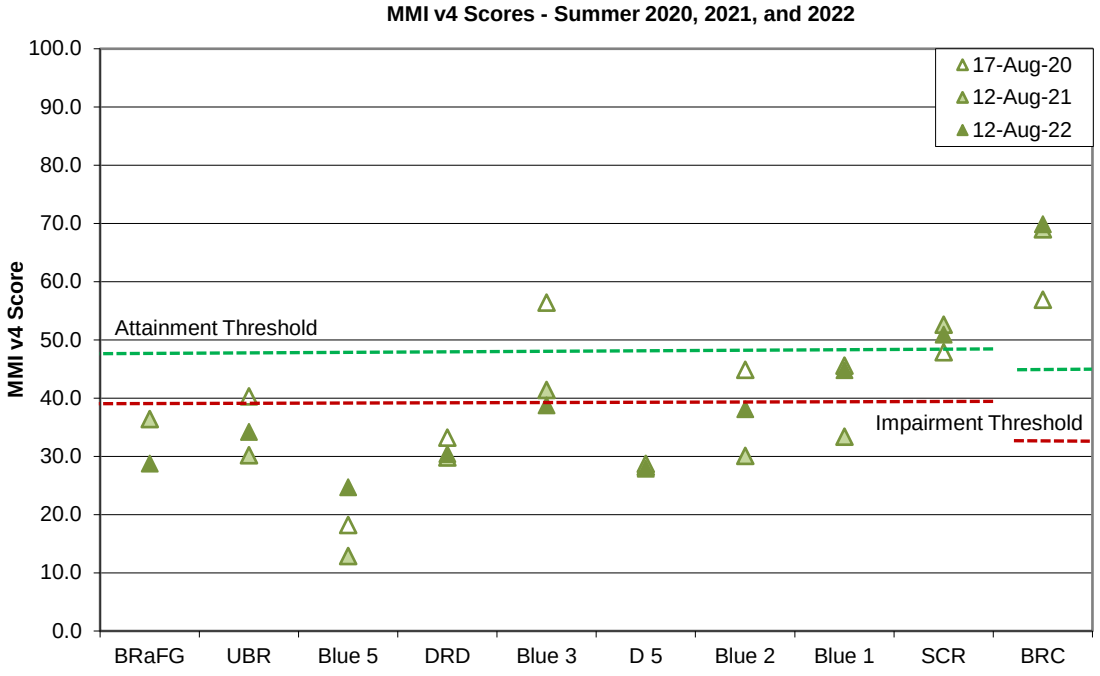

Figure 3. MMI v4 scores from composited quantitative (Hess) samples at study sites on the Blue River during August 2020, 2021, and 2022.

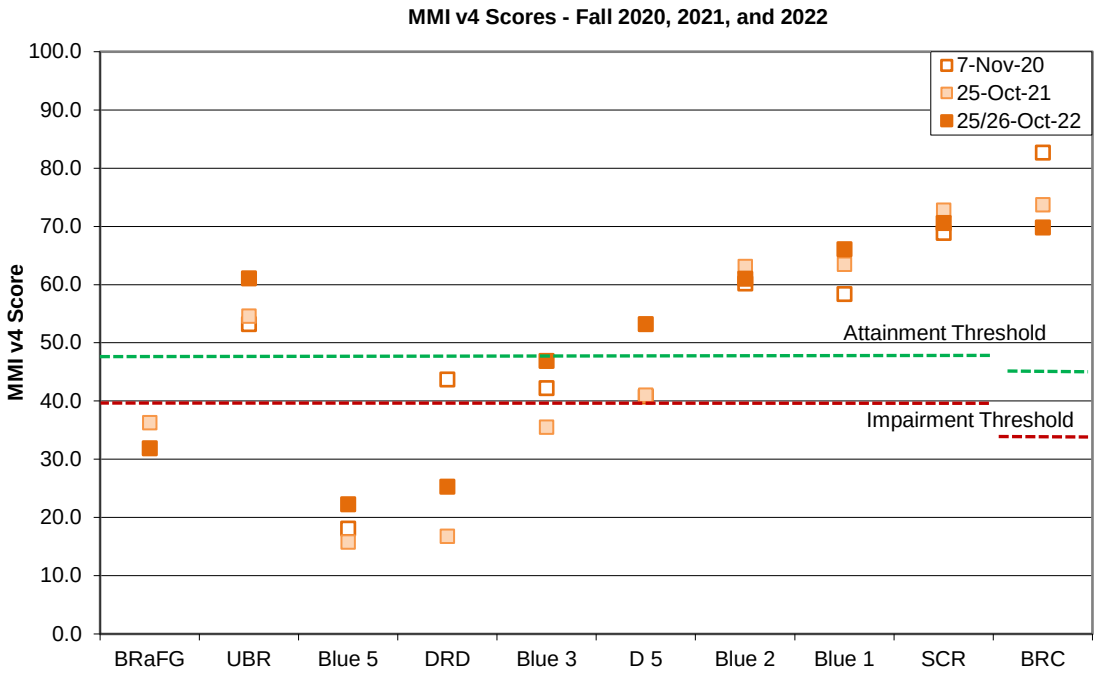

Figure 4. MMI v4 scores from composited quantitative (Hess) samples at study sites on the Blue River during November 2020, October 2021, and October 2022.

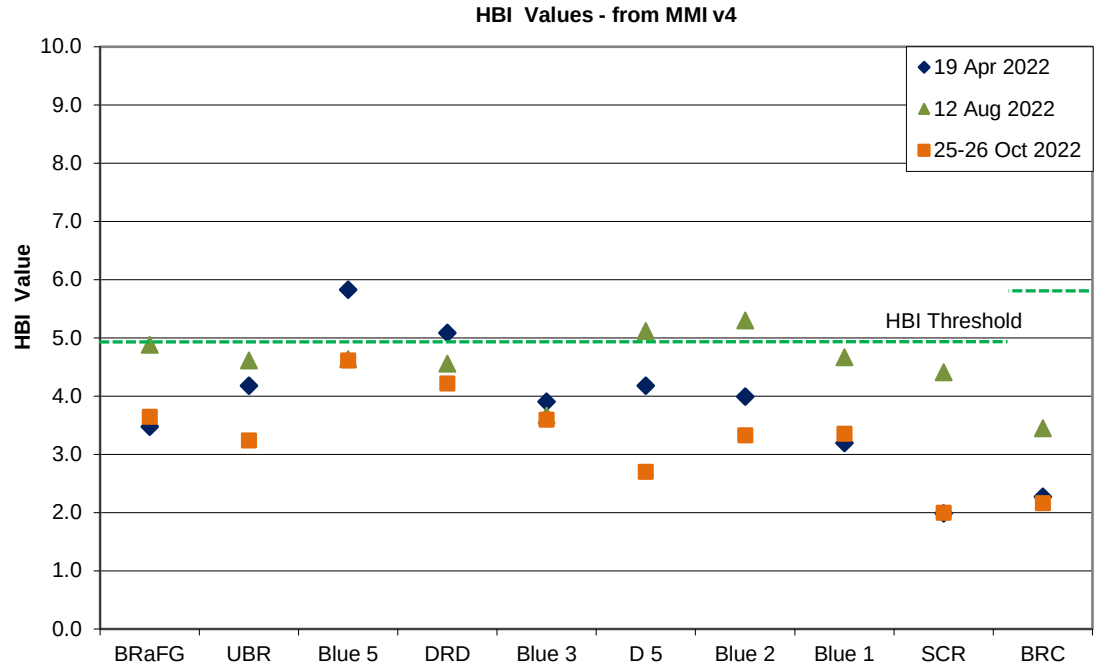

Figure 5. HBI values from composited quantitative (Hess) samples at study sites on the Blue River during April, August, and October 2022.

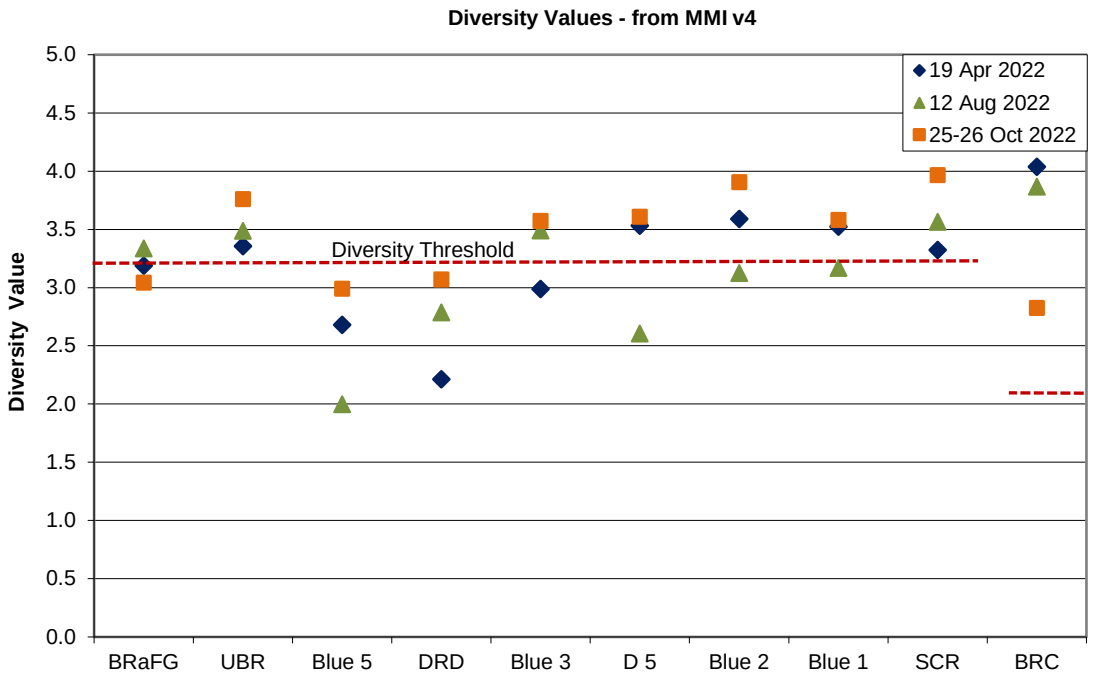

Figure 6. Shannon Diversity values from composited quantitative (Hess) samples at study sites on the Blue River during April, August, and October 2022.

Table 5. Aquatic life use designations based on MMI v4 scores from composited quantitative (Hess) samples at sites in the Blue River study area, 2022.

Aquatic Life Use Designations in 2022 based on MMI (v4)			
Site	**Spring 2022**	**Summer 2022**	**Fall 2022**
BRaFG	Impairment	Impairment	Impairment
UBR	Attainment	Impairment	Attainment
Blue 5	Impairment	Impairment	Impairment
DRD	Impairment	Impairment	Impairment
Blue 3	Attainment	Impairment	Attainment
D 5	Attainment	Impairment	Attainment
Blue 2	Attainment	Impairment	Attainment
Blue 1	Attainment	Impairment	Attainment
SCR	Attainment	Attainment	Attainment
BRC	Attainment	Attainment	Attainment

Additional Evaluation (Individual Metrics)

In the previous section, results from the MMI v4 (and associated metrics) were derived from a subset of specimens (approximately 300) from composited Hess samples. This rarefication process is built into the MMI v4 program to ensure that a consistent allocation of data can be compared when using different sampling techniques throughout the State of Colorado. It should be noted that some bias may occur during this rarefication process, because some rare taxa are inevitably excluded, while other taxa may not be adequately represented. Therefore, the following analysis was conducted using all specimens from each quantitative sample (Tables 6-11).

Spring 2022

A variety of individual metrics were used to provide a comprehensive evaluation of macroinvertebrate community structure and function at study sites upstream and downstream from Dillon Reservoir in the spring (19 April) of 2022 (Tables 6-7). Upstream from the reservoir, metrics that rely on the richness of taxa (particularly sensitive taxa) detected greater stress at site BRaFG, followed by moderate recovery farther downstream at site UBR (Table 6). Other individual metrics that rely on community composition were less consistent in their interpretation of aquatic conditions, with certain metrics producing better values at site BRaFG (Tables 6-7). For example, components of the Total EPT Taxa value (# Ephemeroptera Taxa, # Plecoptera Taxa, and # Trichoptera Taxa) consistently improved from site BRaFG downstream to site UBR (Table 6); however, the relative abundance of two of these sensitive groups (% Plecoptera individuals and % Trichoptera individuals) actually declined in a downstream direction (Table 7). Other metrics that detected greater stress at site BRaFG followed by improvements downstream at site UBR included those that measure density, dry weight, and the abundance of net-spinning caddisflies (Hydropsychidae). These types of impacts to community structure (observed at site BRaFG) are consistent with the types of impacts that can occur in response to dewatering and possibly urban runoff.

Downstream from Dillon Reservoir, most individual metrics detected the greatest stress to macroinvertebrate communities at study sites that were in close proximity to Dillon Dam. This stress could be defined by impacts to community richness, abundance, and proportion of sensitive taxa, and these types of impacts are often associated with hypolimnetic releases from reservoirs. Individual metrics that detected stress in close proximity to the reservoir (with improvements downstream) included Total EPT taxa, Taxa Richness, Clinger Taxa, Hydropsychidae Density, % Clingers, % Shredders and Scrapers, and Mean Dry Weight (Tables 6-7). Although the % Ephemeroptera individuals value remained relatively high at sites Blue 5 and DRD (Table 7), most of the mayfly individuals found at these sites consisted of the relatively tolerant baetid, *Baetis tricaudatus* (Appendix A, Tables A3-A4). Generally, stoneflies and caddisflies are considered more sensitive to impacts in regulated streams and these groups comprised less than 2.0% of the macroinvertebrate community at sites Blue 5 and DRD (Table 7). Improvements in community structure observed in the downstream portion of this study area were likely enhanced by select taxa entering the Blue River from tributaries.

Table 6. Individual metrics and comparative values for quantitative benthic macroinvertebrate samples collected from the Blue River, 19 April 2022.

Metric	BRaFG	UBR	Blue 5	DRD	Blue 3	D 5	Blue 2	Blue 1	SCR	BRC
# Ephemeroptera Taxa	1	4	1	2	4	5	4	5	6	6
# Plecoptera Taxa	4	6	0	2	6	3	3	6	3	4
# Trichoptera Taxa	2	4	2	2	5	4	7	6	5	9
Total EPT Taxa	**7**	**14**	**3**	**6**	**15**	**12**	**14**	**17**	**14**	**19**
Taxa Richness	**16**	**28**	**14**	**18**	**26**	**28**	**31**	**33**	**33**	**37**
Clinger Taxa	**8**	**14**	**3**	**7**	**16**	**15**	**18**	**22**	**16**	**25**
Hydropsychidae Density (estimated #/m²)	**0**	**24**	**4**	**16**	**132**	**43**	**148**	**113**	**113**	**234**
% Clingers	**74.65%**	**70.67%**	**12.06%**	**8.27%**	**33.72%**	**27.68%**	**36.87%**	**42.66%**	**38.47%**	**64.13%**
% Shredders and Scrapers	**4.23%**	**35.64%**	**0.09%**	**2.49%**	**12.62%**	**9.33%**	**26.73%**	**47.47%**	**53.24%**	**41.97%**
% Chironomidae	**27.46%**	**27.23%**	**58.80%**	**36.35%**	**17.61%**	**57.99%**	**46.31%**	**22.91%**	**14.00%**	**8.91%**

Table 7. Additional metrics and comparative values for quantitative benthic macroinvertebrate samples collected on the Blue River, 19 April 2022.

Metric	BRaFG	UBR	Blue 5	DRD	Blue 3	D 5	Blue 2	Blue 1	SCR	BRC
% Ephemeroptera individuals	2.11%	39.48%	26.58%	55.64%	53.49%	25.30%	35.14%	47.22%	17.82%	40.33%
% Plecoptera individuals	9.15%	4.70%	0.00%	0.39%	4.32%	2.87%	1.15%	4.05%	0.65%	3.05%
% Trichoptera individuals	28.17%	6.06%	0.26%	1.57%	16.11%	7.07%	12.90%	20.38%	55.76%	38.80%
Percent EPT	**39.44%**	**50.25%**	**26.85%**	**57.61%**	**73.92%**	**35.24%**	**49.19%**	**71.65%**	**74.24%**	**82.18%**
Ephemeroptera (estimated #/m²)	12	1,239	1,171	1,644	1,251	1,610	1,184	1,448	1,178	1,336
Plecoptera (estimated #/m²)	52	150	0	12	103	183	40	126	44	103
Trichoptera (estimated #/m²)	156	192	12	48	377	451	437	626	3,677	1,286
Other (estimated #/m²)	337	1,564	3,227	1,258	615	4,123	1,715	874	1,705	597
Total Density (estimated #/m²)	**557**	**3,145**	**4,410**	**2,962**	**2,346**	**6,367**	**3,376**	**3,074**	**6,604**	**3,322**
Mean Dry Wt (estimated g/m²)	**0.2171**	**0.7992**	**0.7074**	**0.5089**	**1.2450**	**2.0593**	**2.0694**	**1.6725**	**3.4550**	**1.4209**

Summer 2022

Seasonal benthic macroinvertebrate sampling continued on 12 August 2022 to provide a mid-summer perspective of macroinvertebrate community structure and function in the Blue River study area. This particular summer was unique because warmer surface water from Dillon Reservoir never spilled into the Blue River. During the months prior to sampling, the relatively cold hypolimnetic releases were the primary influence on water temperature downstream from Dillon Dam. It was likely that this alteration from the natural temperature regime may have been a key element influencing macroinvertebrate communities downstream from Dillon Reservoir. Upstream from Dillon Reservoir, the most likely sources of stress included flow diversions near the Town of Breckenridge and urban runoff.

In general, individual metrics detected low to moderate levels of stress upstream from Dillon Reservoir (sites BRaFG and UBR), and a more extensive area of low to moderate stress at sampling locations downstream from Dillon Dam (Tables 8-9). Upstream from Dillon Reservoir, the Total EPT Taxa, Taxa Richness, Total Density, and Mean Dry Weight metrics showed improvements at site BRaFG when compared to results from the spring sampling event; however, these metric values were still indicative of low to moderate stress. Improvements in Total Density and Mean Dry Weight at site BRaFG were likely a response to more stable flows in the months prior to sampling. When metric results from August 2022 were compared between site BRaFG and site UBR, interpretation of changing aquatic conditions was often dependent on the individual metric (Tables 8-9). While the Total EPT Taxa, Taxa Richness, Hydropsychidae Density, Percent Shredders and Scrapers, and Percent EPT metrics detected improvements downstream at site UBR, these results were somewhat offset by the Clinger Taxa, % Clingers, % Chironomidae, and Density metrics which performed better at site BRaFG (Tables 8-9). A consensus of individual metric results suggested that macroinvertebrate abundance was slightly better at site BRaFG, but a higher proportion of these individuals were considered early-colonizers, which are relatively tolerant to disturbances. Downstream at site UBR, there was a greater variety of sensitive taxa, suggesting better stability in habitat conditions. Despite subtle changes in community composition between sites BRaFG and UBR, the benthic communities at both locations appeared to be slightly to moderately stressed.

Downstream from Dillon Reservoir, most of the individual metrics continued to detect substantial stress to macroinvertebrate communities at sites Blue 5 and DRD during the summer of 2022. Metrics such as Total EPT Taxa, Taxa Richness, Clinger Taxa, and Percent Clingers, produced their lowest values in the study area at site Blue 5, and the important net-spinning caddisfly (Hydropsychidae) was absent at both study sites (Table 8). A general recovery gradient occurred in a downstream direction; however, individual metrics suggested that some macroinvertebrate community parameters recovered more rapidly than others. Interestingly, a rapid increase in the richness of sensitive and specialized taxa (Total EPT Taxa and Clinger Taxa, respectively) was not always supported by improvements in the proportions of sensitive and specialized taxa (Percent EPT and % Clingers, respectively) (Tables 8-9). The Total Density value was unusually high at site D 5 (43,571 individuals/m^2), before declining in the downstream portion of the study area. The combination of these individual metric values suggested that macroinvertebrate communities may not be reaching optimal structure and function until the lower boundary of the Blue River study area (Tables 8-9).

Table 8. Individual metrics and comparative values for quantitative benthic macroinvertebrate samples collected from the Blue River, 12 August 2022.

Metric	BRaFG	UBR	Blue 5	DRD	Blue 3	D 5	Blue 2	Blue 1	SCR	BRC
# Ephemeroptera Taxa	6	5	2	6	6	6	10	9	5	5
# Plecoptera Taxa	1	4	2	3	7	4	3	5	5	6
# Trichoptera Taxa	2	5	2	1	3	6	7	8	7	8
Total EPT Taxa	**9**	**14**	**6**	**10**	**16**	**16**	**20**	**22**	**17**	**19**
Taxa Richness	**24**	**28**	**16**	**25**	**35**	**34**	**38**	**44**	**44**	**41**
Clinger Taxa	**11**	**9**	**7**	**11**	**19**	**16**	**17**	**19**	**20**	**22**
Hydropsychidae Density (estimated #/m^2)	**4**	**39**	**0**	**0**	**105**	**318**	**179**	**446**	**265**	**1,024**
% Clingers	**45.01%**	**37.76%**	**4.10%**	**21.08%**	**50.78%**	**60.55%**	**51.61%**	**47.86%**	**19.10%**	**52.47%**
% Shredders and Scrapers	**1.57%**	**6.19%**	**0.46%**	**4.56%**	**1.55%**	**0.16%**	**3.43%**	**17.27%**	**20.90%**	**24.82%**
% Chironomidae	**18.29%**	**37.89%**	**35.54%**	**18.52%**	**35.98%**	**31.79%**	**32.17%**	**24.00%**	**53.54%**	**17.46%**

Table 9. Additional metrics and comparative values for quantitative benthic macroinvertebrate samples collected on the Blue River, 12 August 2022.

Metric	BRaFG	UBR	Blue 5	DRD	Blue 3	D 5	Blue 2	Blue 1	SCR	BRC
% Ephemeroptera individuals	30.42%	27.96%	58.09%	58.97%	12.59%	6.17%	14.11%	10.82%	15.93%	29.21%
% Plecoptera individuals	1.35%	2.19%	0.91%	3.13%	1.59%	0.12%	0.57%	1.21%	1.43%	2.66%
% Trichoptera individuals	2.02%	14.82%	0.68%	1.42%	31.93%	15.70%	9.39%	21.96%	20.48%	37.35%
Percent EPT	**33.78%**	**44.97%**	**59.68%**	**63.53%**	**46.11%**	**21.98%**	**24.07%**	**33.98%**	**37.84%**	**69.22%**
Ephemeroptera (estimated #/m²)	1,054	843	989	805	1,259	2,688	1,821	1,810	2,460	1,447
Plecoptera (estimated #/m²)	47	68	16	44	162	51	74	203	223	134
Trichoptera (estimated #/m²)	70	447	12	20	3,187	6,840	1,214	3,670	3,162	1,854
Other (estimated #/m²)	2,293	1,662	691	500	5,382	33,992	9,786	11,033	9,599	1,532
Total Density (estimated #/m²)	**3,464**	**3,020**	**1,708**	**1,369**	**9,990**	**43,571**	**12,895**	**16,716**	**15,444**	**4,967**
Mean Dry Wt (estimated g/m²)	**0.6151**	**0.6957**	**0.1884**	**0.1624**	**0.8620**	**3.7585**	**1.0264**	**2.1019**	**1.5461**	**0.8942**

Fall 2022

During the fall (25-26 October) of 2022, benthic macroinvertebrate communities in the Blue River study area were evaluated using the same individual metrics that were applied during previous seasonal (spring and summer) monitoring events. A review of metric results from the fall season indicated that stress to aquatic communities occurred both upstream from Dillon Reservoir (site BRaFG) and downstream from the reservoir (sites Blue 5, DRD, and Blue 3); however, most metrics also detected strong recovery gradients in other portions of the study area (Tables 10-11). Results from the evaluation of macroinvertebrate structure and function during the fall season did not show the evidence of wide-spread stress that was observed during the summer season; however, most individual metrics produced patterns of stress and recovery that were similar to the results observed during the spring of 2022 (Tables 6-11).

Upstream from Dillon Reservoir, results from most of the applied metrics demonstrated minor to moderate levels of stress at site BRaFG, followed by improvements in community structure and function farther downstream at site UBR (Tables 10-11). A comparison of the Total EPT Taxa value (9) to the Taxa Richness value (33) suggested that only about 27% of the macroinvertebrate taxa at site BRaFG were considered sensitive to anthropogenic disturbances, while at site UBR, a comparison of the Total EPT Taxa value (16) to the Taxa Richness value (37) indicated that approximately 43% of the taxa were sensitive to disturbances (Table 10). Similarly, the Clinger Taxa, Hydropsychidae Density, % Clingers, and Percent Shredders and Scrapers metrics all detected improvements in the richness and proportions of sensitive and specialized taxa downstream at site UBR (Table 10). Although the abundance of macroinvertebrates at both sites remained relatively high (3,386 individuals/m^2 at site BRaFG and 4,213 individuals/m^2 at site UBR), site BRaFG could be characterized as supporting a macroinvertebrate community with fewer sensitive or specialized taxa and higher proportions of tolerant individuals (Tables 10-11).

In October of 2022, the applied individual metrics were consistent in demonstrating moderate stress at sites immediately downstream from Dillon Reservoir (Blue 5 and DRD), followed by the rapid recovery of macroinvertebrate community structure and function at the remaining Blue River study sites. Individual metrics that produced their lowest value in the study area at either site Blue 5 or DRD included: Total EPT Taxa, Taxa Richness, Clinger Taxa, Hydropsychidae Density, % Clingers, Percent Shredders and Scrapers, Percent EPT, Total Density, and Mean Dry Weight (Tables 10-11). All of these metrics detected rapid improvements in macroinvertebrate community health beginning at site Blue 3 and continuing into the downstream portion of the study area. Individual metrics that were highly influenced by the richness and relative abundance of sensitive taxa continued to improve in a downstream direction to site Blue 1, where the most optimum values for Total EPT Taxa (25), Taxa Richness (43), Clinger Taxa (23), and Percent EPT (75.46%) were detected. While other metrics were less consistent in their identification of the 'healthiest' study site, all individual metrics were in agreement that sites Blue 2, Blue 1, SCR, and BRC exhibited diverse communities with high proportions of sensitive individuals during the fall of 2022. Again, it is likely that the repopulation of sensitive taxa in the lower reaches of this study area reflected faunal contributions from the numerous tributaries along the Blue River.

Table 10. Individual metrics and comparative values for quantitative benthic macroinvertebrate samples collected from the Blue River, 25-26 October 2022.

Metric	BRaFG	UBR	Blue 5	DRD	Blue 3	D 5	Blue 2	Blue 1	SCR	BRC
# Ephemeroptera Taxa	2	5	3	3	8	6	7	9	8	5
# Plecoptera Taxa	5	6	3	2	6	6	4	9	5	2
# Trichoptera Taxa	2	5	0	1	5	7	9	7	7	7
Total EPT Taxa	**9**	**16**	**6**	**6**	**19**	**19**	**20**	**25**	**20**	**14**
Taxa Richness	**33**	**37**	**21**	**20**	**32**	**41**	**42**	**43**	**41**	**36**
Clinger Taxa	**11**	**18**	**5**	**8**	**16**	**20**	**22**	**23**	**20**	**20**
Hydropsychidae Density (estimated #/m^2)	**0**	**144**	**0**	**28**	**400**	**241**	**98**	**241**	**145**	**323**
% Clingers	**39.72%**	**62.33%**	**12.31%**	**11.38%**	**47.46%**	**42.19%**	**28.58%**	**40.36%**	**44.87%**	**87.79%**
% Shredders and Scrapers	**2.41%**	**25.85%**	**0.45%**	**3.25%**	**5.50%**	**10.16%**	**25.95%**	**49.08%**	**52.25%**	**51.17%**
% Chironomidae	**4.25%**	**10.06%**	**61.11%**	**32.52%**	**12.08%**	**21.25%**	**27.88%**	**15.73%**	**9.62%**	**2.72%**

Table 11. Additional metrics and comparative values for quantitative benthic macroinvertebrate samples collected on the Blue River, 25-26 October 2022.

Metric	BRaFG	UBR	Blue 5	DRD	Blue 3	D 5	Blue 2	Blue 1	SCR	BRC
% Ephemeroptera individuals	36.28%	41.37%	8.56%	51.63%	22.98%	23.48%	34.27%	47.59%	31.39%	16.62%
% Plecoptera individuals	4.25%	4.89%	0.60%	1.22%	4.64%	1.65%	1.79%	2.28%	2.25%	1.78%
% Trichoptera individuals	18.60%	16.44%	0.00%	2.85%	27.08%	27.33%	25.53%	25.59%	35.54%	56.62%
Percent EPT	**59.13%**	**62.70%**	**9.16%**	**55.69%**	**54.69%**	**52.45%**	**61.59%**	**75.46%**	**69.18%**	**75.02%**
Ephemeroptera (estimated #/m²)	1,225	1,738	222	493	828	2,654	2,829	4,214	2,115	689
Plecoptera (estimated #/m²)	145	209	16	12	170	188	149	205	154	75
Trichoptera (estimated #/m²)	629	693	0	28	975	3,088	2,109	2,266	2,396	2,340
Other (estimated #/m²)	1,387	1,573	2,352	430	1,635	5,378	3,175	2,176	2,082	1,038
Total Density (estimated #/m²)	**3,386**	**4,213**	**2,590**	**963**	**3,608**	**11,308**	**8,262**	**8,861**	**6,747**	**4,142**
Mean Dry Wt (estimated g/m²)	**0.3810**	**1.5062**	**0.1791**	**0.1000**	**1.2775**	**4.1950**	**1.9667**	**2.0465**	**2.8240**	**0.6783**

General Observations - 2022

A comparison of select metric results from all three sampling periods, 24 April (Spring), 12 August (Summer), and 25 October (Fall) in 2022, demonstrated how different components of macroinvertebrate community structure varied in response to stressors within this study area (Figures 7-14). Several richness-based metrics that appeared to respond consistently to changes in aquatic conditions included the Total EPT Taxa, Taxa Richness, and Clinger Taxa metrics. Upstream from Dillon Reservoir, these metrics detected greater stress at site BRaFG, followed by some recovery downstream at site UBR. Downstream from Dillon reservoir, these metric values were consistently reduced at sites Blue 5 and DRD (the sites in closest proximity to the dam), but values from these metrics rapidly improved in a downstream direction (Figures 7-9). This pattern of impact and recovery was expected downstream from a hypolimnetic-release reservoir, and similar results were reported during previous years of this biomonitoring study. While many macroinvertebrate taxa may be specifically sensitive to deviations from the natural temperature regime, the taxa classified as Clinger Taxa may also be adversely affected by rapid changes in discharge because they are typically poor swimmers.

Unlike the previously described metrics that rely on community richness parameters, the Percent Shredders and Scrapers and the Percent EPT metrics differed in their abilities to demonstrate stress and recovery because they rely on the relative abundance of sensitive individuals (Figures 10-11). The Percent Shredders and Scrapers metric indicated that specialized feeding guilds were poorly represented during all seasons at site BRaFG (upstream from Dillon Reservoir) and sites Blue 5 and DRD (downstream from Dillon Reservoir). Results from this metric differed slightly from other metrics by generally showing a slower capacity for recovery in the downstream portion of the study area. The recovery gradient also appeared to be seasonally influenced, with the greatest capacity for recovery occurring during the spring and fall seasons (Figure 10). The specific mechanisms that caused a reduction in the proportion of Shredders and Scrapers in this study area have not been positively identified; however, the coarse particulate organic material (a food resource for shredders) from the adjacent riparian habitat is expected to be poorly represented immediately downstream from reservoirs. Improvements in the percent composition of Shredders and Scrapers in a downstream direction could likely be attributed to the extended riparian habitat along the length of the Blue River and contributions from tributaries that improve periphyton community composition.

The Percent EPT metric was less seasonally and spatially consistent in the identification of study sites with anthropogenic stress, although site Blue 5 did produce the lowest values from this metric during the spring and fall seasons (Figure 11). The inability of the Percent EPT metric to consistently detect stress at sites downstream from Dillon Dam was mostly due to high densities of the relatively tolerant mayfly, *Baetis tricaudatus*. This species is known to be one of the few mayflies that can survive and flourish in habitats with altered temperature and flow regimes. During all seasons in 2022, *Baetis tricaudatus* accounted for more than 78% of the individuals that were included in EPT taxa at site Blue 5, and *B. tricaudatus* was also the most abundant EPT taxon at site DRD (Appendix A-C; Tables A3-A4, B3-B4, and C3-C4). Farther downstream, the low

Percent EPT values observed at sites D 5, Blue 2, and Blue 1 in August were not caused by a reduction in the number of EPT individuals, but rather by an increase in the proportion of black flies of the genus *Simulium* sp. and several species of midges (Family Chironomidae) (Appendix B; Tables B6-B8). Black flies are considered collector-filterers, and high densities of this taxon could indicate an increase in the abundance of fine particulate organic matter (and possibly the lack of predators) in this segment of the Blue River during the summer season.

While most metrics detected a pattern of impact followed by recovery downstream of Dillon Reservoir, other individual metrics such as Total Density, Total Dry Weight, and Mean Dry Weight exhibited greater variability among sampling locations and seasons (Figures 12-14). Measures of total macroinvertebrate density, total dry weight, and mean dry weight of individuals (number/m^2, g/m^2, and mg/individual, respectively) generally detected elevated stress immediately downstream from Dillon Dam; however, the recovery gradient was variable (depending on the season), and most of the perceived improvements were observed in the middle portion of the study area (Figures 12-14). Interestingly, the Mean Dry Weight metric indicated that individual macroinvertebrate body size generally increased downstream from site DRD, except during the summer when low values continued throughout much of the study area (Figure 14). These results suggested that the feeding habits and energy dynamics of fish below Dillon Dam could be limited by the small body size (and biomass) of the available benthic macroinvertebrates, and these impacts varied by location and season in 2022.

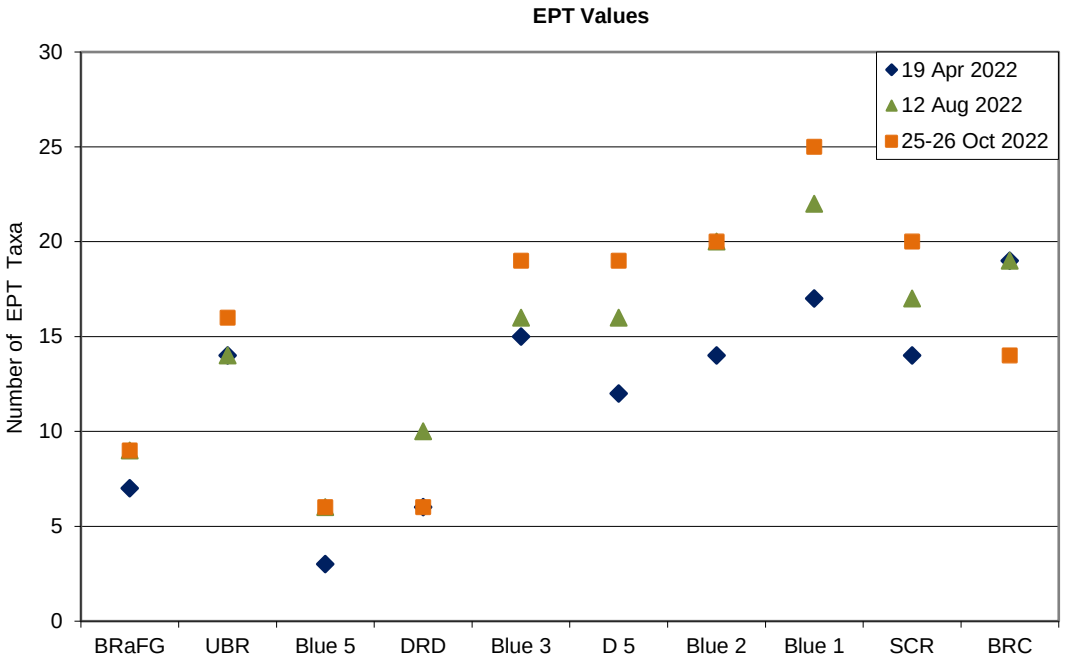

Figure 7. Total EPT Taxa values from spring, summer, and fall sampling on the Blue River during 2022.

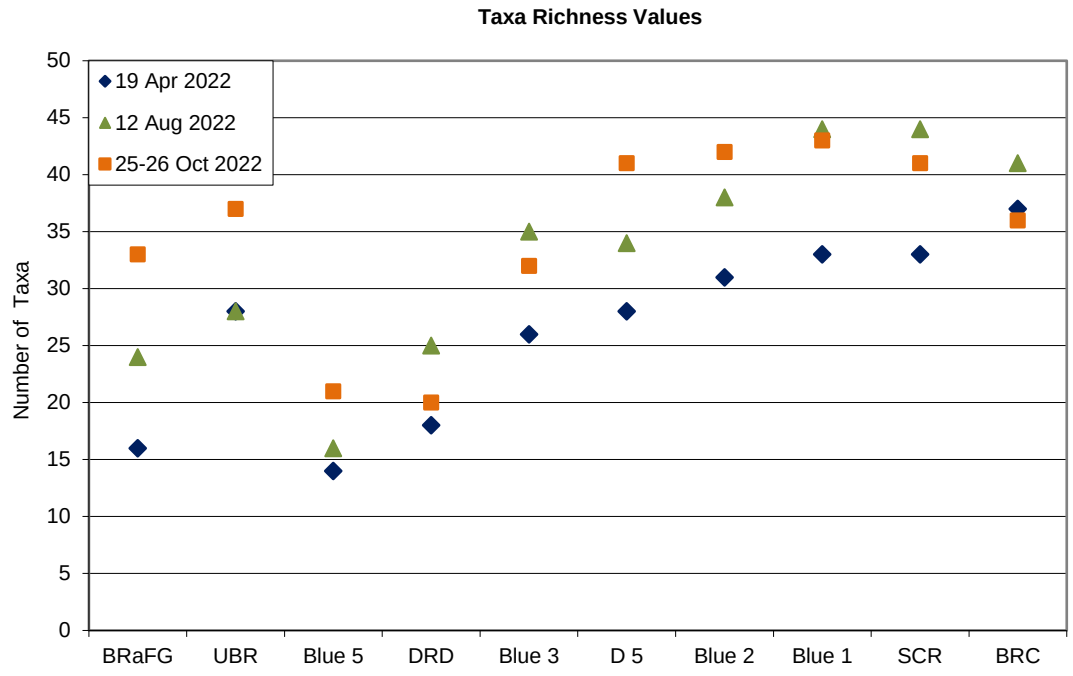

Figure 8. Taxa Richness values from spring, summer, and fall sampling on the Blue River during 2022.

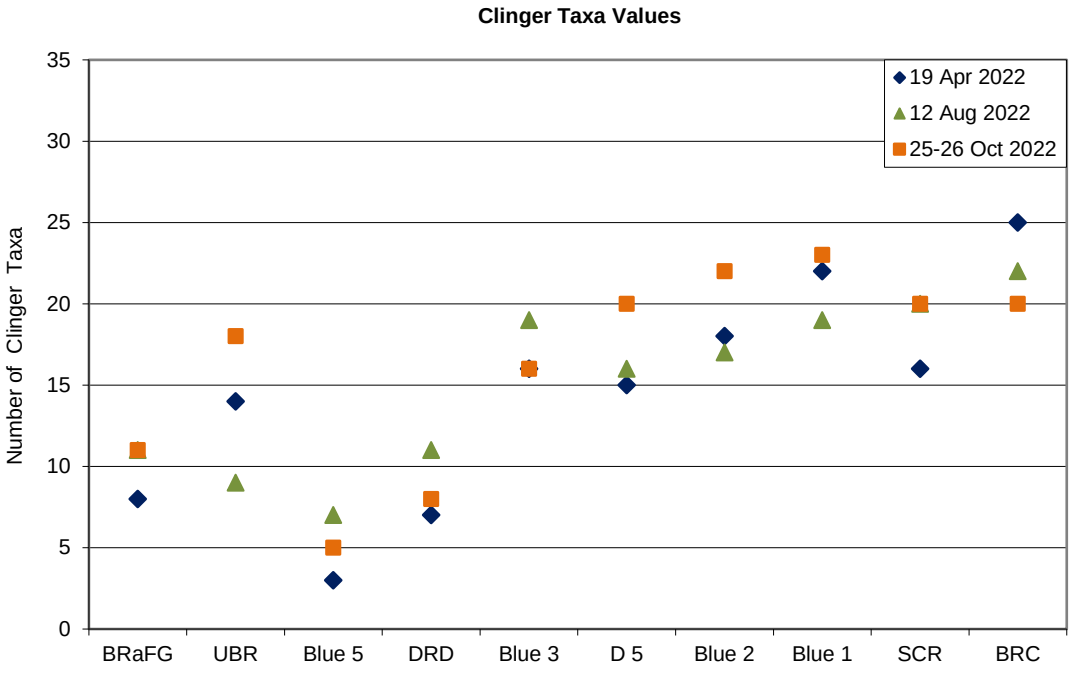

Figure 9. Clinger Taxa values from spring, summer, and fall sampling on the Blue River during 2022.

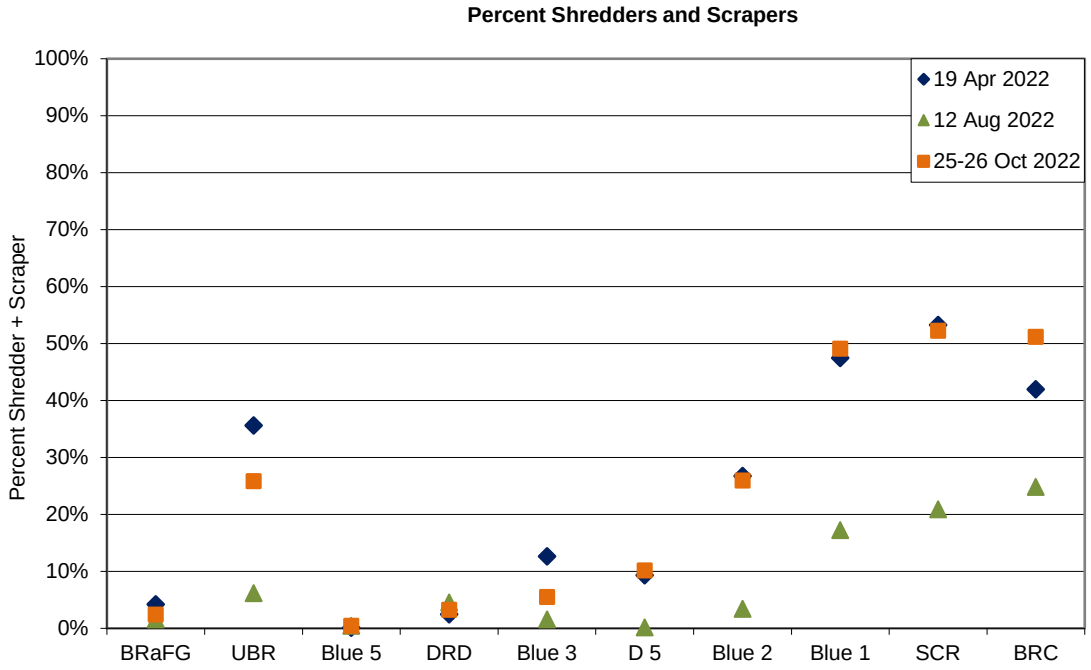

Figure 10. Percent Shredders and Scrapers from spring, summer, and fall sampling on the Blue River during 2022.

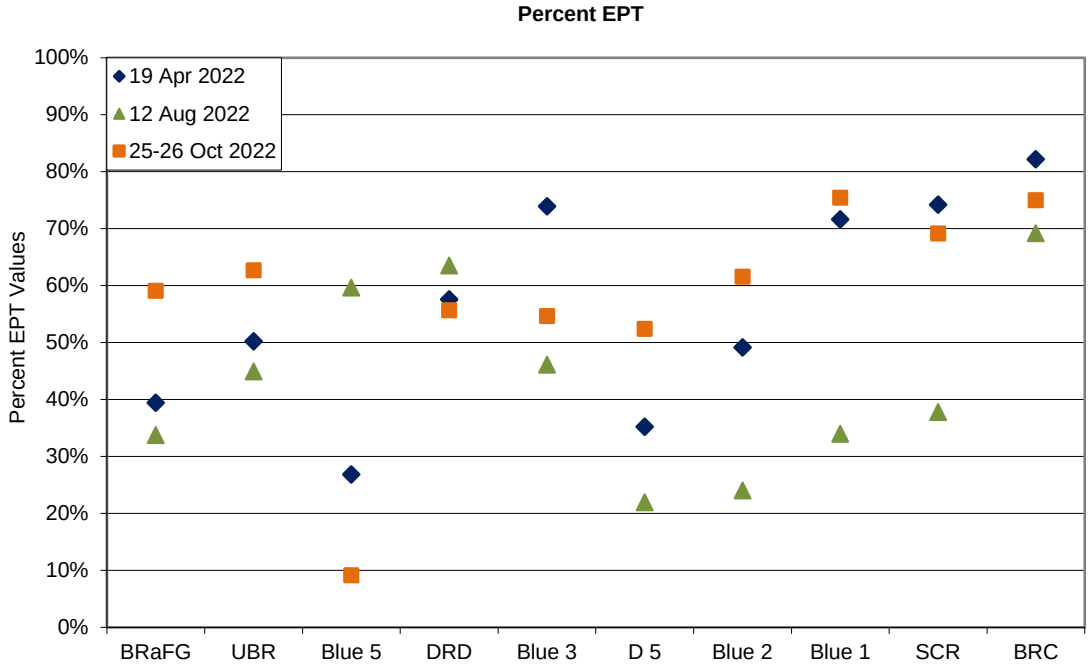

Figure 11. Percent EPT values from spring, summer, and fall sampling on the Blue River during 2022.

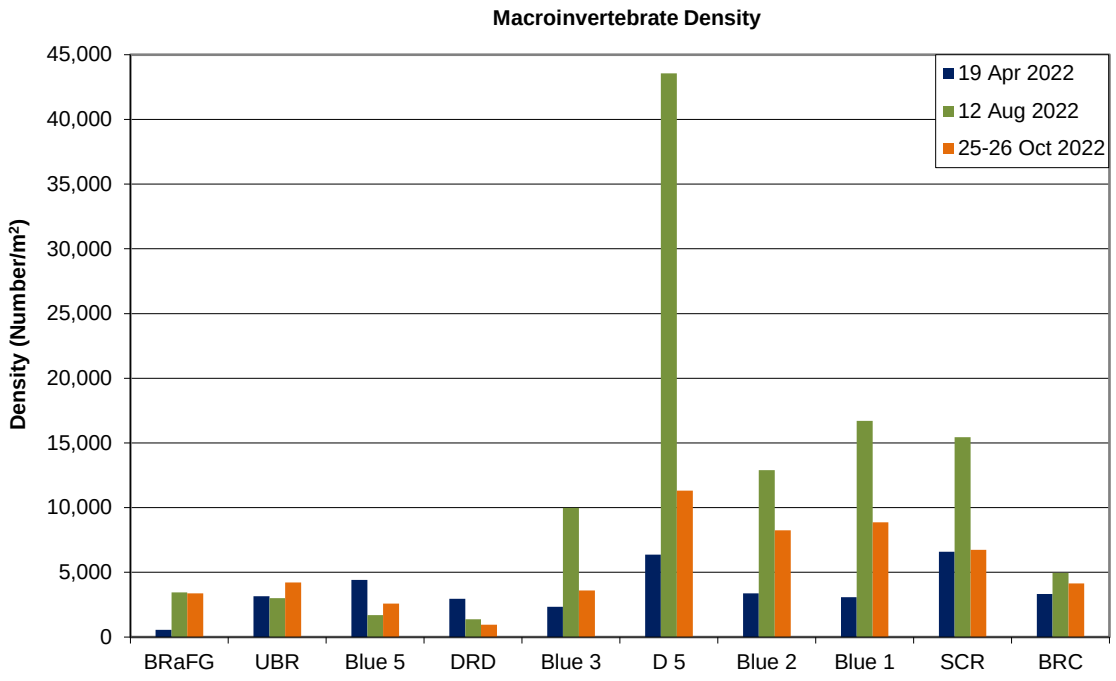

Figure 12. Estimated Total Density values (number/m^2) from spring, summer, and fall sampling on the Blue River, 2022.

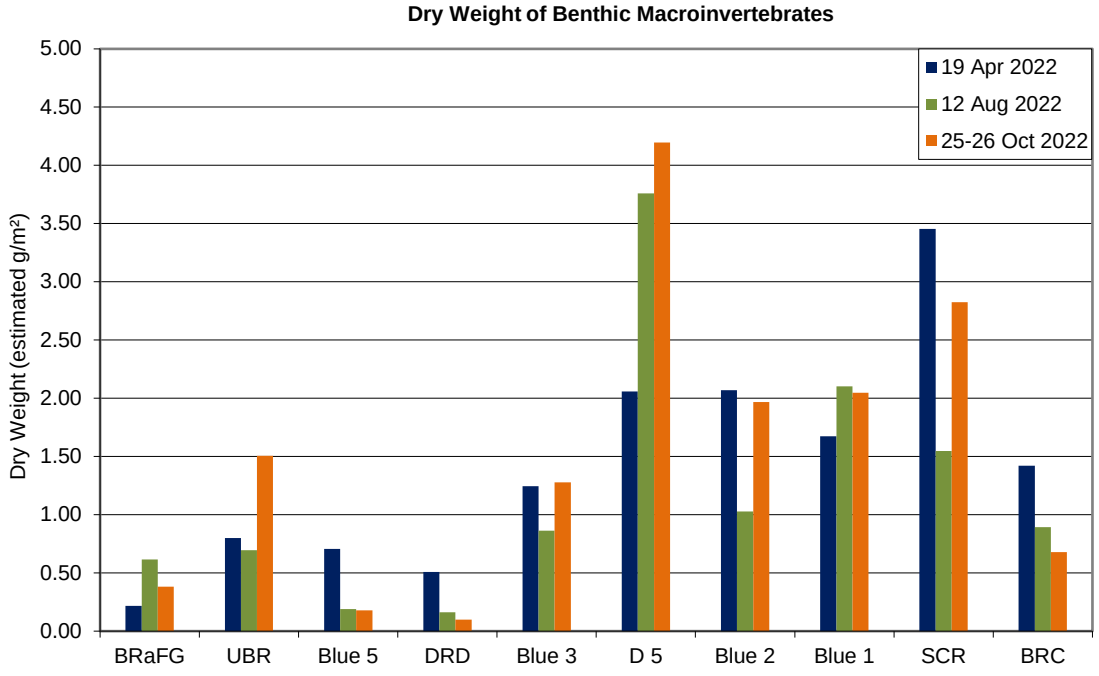

Figure 13. Estimated Total Dry Weight (g/m^2) of benthic macroinvertebrates during spring, summer, and fall sampling on the Blue River, 2022.

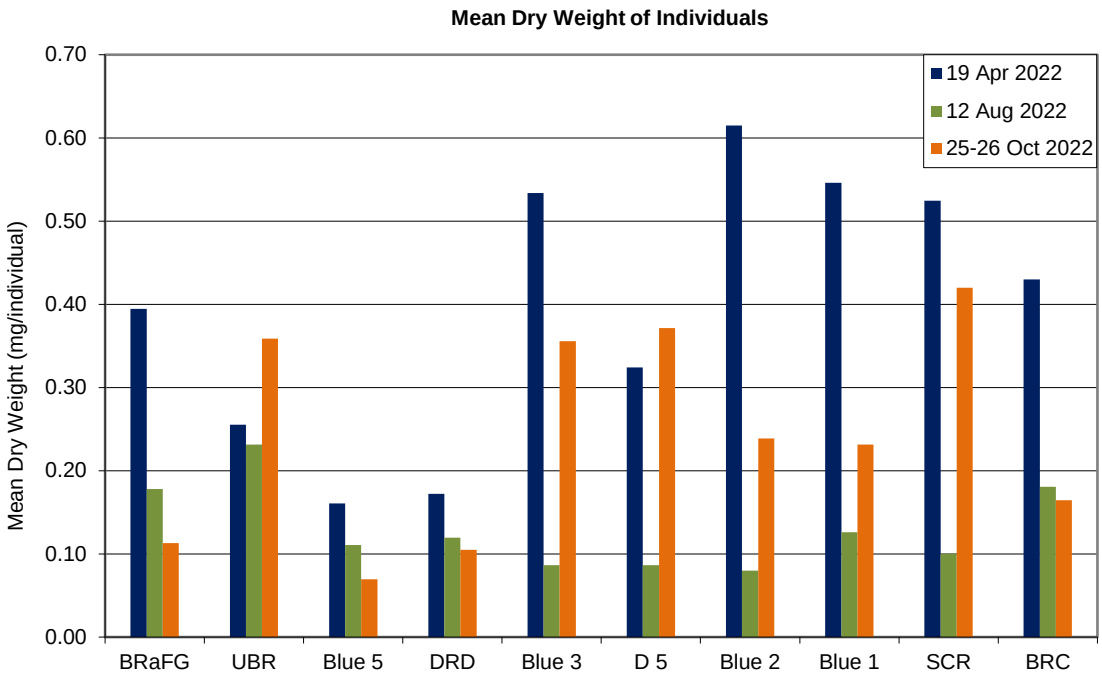

Figure 14. Mean Dry Weight (mg/individual) for benthic macroinvertebrate specimens during spring, summer, and fall of 2022.

Functional Feeding Groups

The reorganization of benthic macroinvertebrate taxa according to their method of food acquisition provided an opportunity to evaluate aquatic communities based on ecological function rather than taxonomic structure. In 2022, the percent composition of each feeding group was compared among study sites to provide an estimate of ecological balance and availability of food resources (Tables 12-14; Figures 15-17). While it is common for certain groups (collector-gatherers) to be slightly dominant, sensitive feeding groups (shredders and scrapers) should also be well-represented in healthy streams. Upstream from Dillon Reservoir, site BRaFG consistently supported low proportions of sensitive groups, although the proportion of scrapers increased at site UBR during all seasons (Figures 15-17). Similarly, the study sites immediately downstream from Dillon Reservoir were dominated by the most tolerant feeding group (collector-gatherers) and sensitive feeding groups (shredders and scrapers) were poorly represented (Tables 12-14). Farther downstream, there was a general decline in the proportion of collector-gatherers and an increase in the proportion of shredders and scrapers. This analysis provided additional evidence of improvements in aquatic community health with distance downstream from Dillon Reservoir. The more diverse ecological function in the downstream portion of the study area could probably be attributed to influences/inputs from tributaries and the return to a more natural thermal regime. Interestingly, the rate of longitudinal recovery appeared to be dependent on the season, with the most wide-spread reduction of sensitive feeding groups occurring during August of 2022 (Figures 16). These results supported the results from the MMI v4 and many of the individual metrics.

Table 12. Relative abundance of functional feeding groups on 19 April 2022 at sampling locations in the Blue River study area.

Site	Functional Feeding Group					
	Collector-Gatherer	Collector-Filterer	Shredder	Scraper	Predator	Omnivore
BRaFG	34.51%	27.46%	4.23%	0.00%	22.54%	11.27%
UBR	50.00%	5.57%	0.99%	34.65%	5.07%	3.71%
Blue 5	85.48%	11.88%	0.00%	0.09%	0.18%	2.38%
DRD	90.29%	5.12%	1.18%	1.31%	1.18%	0.92%
Blue 3	66.78%	15.61%	2.49%	10.13%	2.49%	2.49%
D 5	79.33%	6.16%	1.22%	8.11%	2.62%	2.56%
Blue 2	61.98%	7.49%	1.27%	25.46%	2.42%	1.38%
Blue 1	38.99%	5.32%	15.44%	32.03%	4.81%	3.42%
SCR	20.94%	16.94%	38.41%	14.82%	4.59%	4.29%
BRC	35.87%	15.01%	13.25%	28.72%	6.10%	1.06%

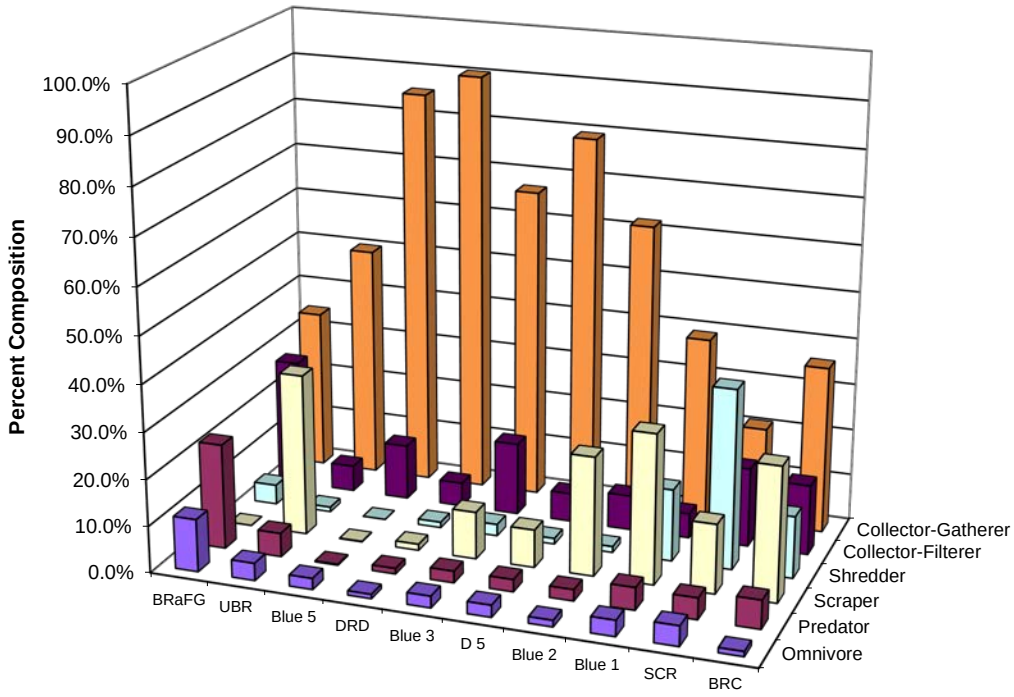

Figure 15. Functional feeding group composition for study sites in the Blue River study area, 19 April 2022.

Table 13. Relative abundance of functional feeding groups on 12 August 2022 at sampling locations in the Blue River study area.

Site	Functional Feeding Group					
	Collector-Gatherer	Collector-Filterer	Shredder	Scraper	Predator	Omnivore
BRaFG	50.39%	34.90%	0.22%	1.35%	5.27%	7.86%
UBR	67.14%	21.26%	0.64%	5.54%	2.32%	3.09%
Blue 5	93.85%	1.59%	0.00%	0.46%	1.37%	2.73%
DRD	73.79%	13.39%	1.42%	3.13%	3.42%	4.84%
Blue 3	51.86%	42.04%	0.12%	1.44%	2.25%	2.29%
D 5	38.01%	59.27%	0.06%	0.10%	0.86%	1.69%
Blue 2	45.02%	49.26%	2.59%	0.84%	2.02%	0.27%
Blue 1	33.70%	44.96%	16.53%	0.74%	2.55%	1.51%
SCR	61.83%	11.66%	14.97%	5.93%	3.84%	1.76%
BRC	41.27%	27.49%	4.62%	20.20%	5.09%	1.33%

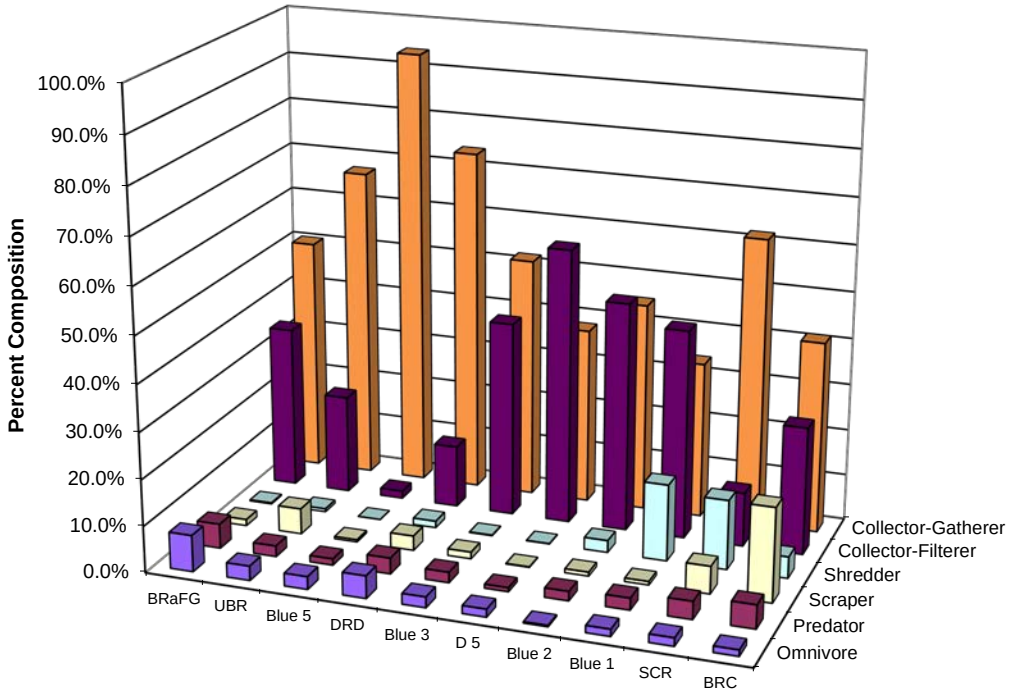

Figure 16. Functional feeding group composition for study sites in the Blue River study area, 12 August 2022.

Table 14. Relative abundance of functional feeding groups on 25-26 October 2022 at sampling locations in the Blue River study area.

Site	Functional Feeding Group					
	Collector-Gatherer	Collector-Filterer	Shredder	Scraper	Predator	Omnivore
BRaFG	47.07%	18.71%	1.95%	0.46%	13.78%	18.03%
UBR	48.48%	15.60%	0.65%	25.21%	6.28%	3.79%
Blue 5	69.67%	11.71%	0.45%	0.00%	2.55%	15.62%
DRD	84.55%	2.85%	1.22%	2.03%	3.66%	5.69%
Blue 3	52.86%	26.54%	1.40%	4.10%	5.61%	9.49%
D 5	42.33%	25.82%	2.37%	7.79%	4.81%	16.89%
Blue 2	56.65%	10.25%	15.80%	10.16%	5.41%	1.74%
Blue 1	37.55%	7.58%	20.64%	28.44%	2.76%	3.02%
SCR	22.58%	7.55%	27.53%	24.71%	10.89%	6.74%
BRC	20.28%	24.60%	1.13%	50.05%	3.47%	0.47%

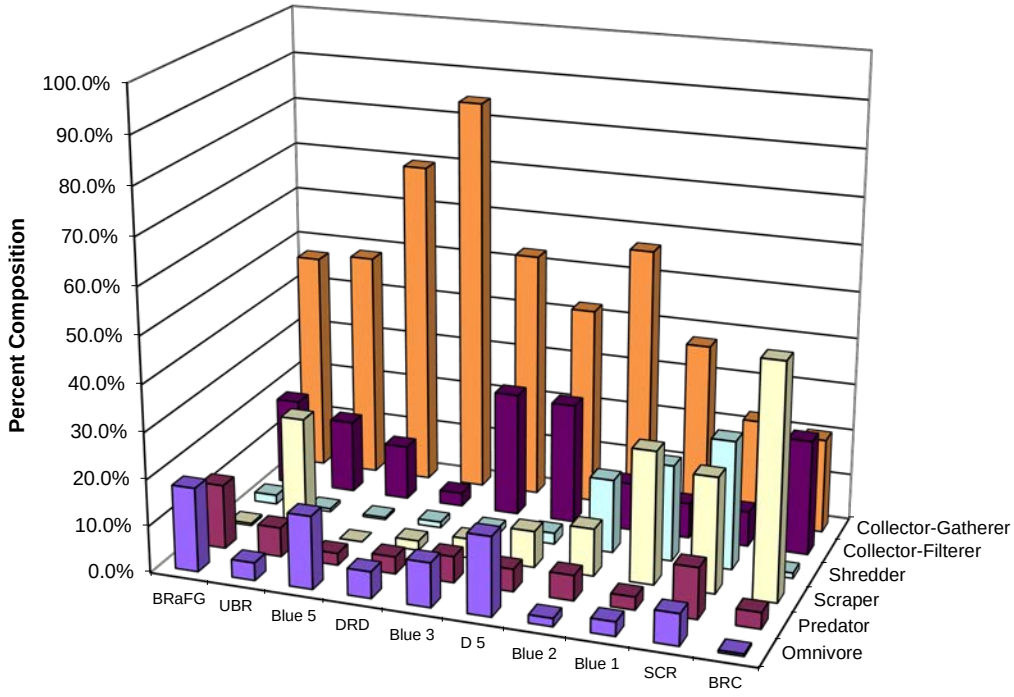

Figure 17. Functional feeding group composition for study sites in the Blue River study area, 25-26 October 2022.

Conclusions

The seasonal benthic macroinvertebrate biomonitoring study on the Blue River in 2022 produced results that were fairly predictable based on previous biomonitoring studies. Upstream from Dillon Reservoir, the macroinvertebrate community at site BRaFG appeared to be moderately stressed during all seasons, and while some recovery was consistently observed downstream at site UBR, the level of recovery varied by season. Downstream from Dillon Reservoir, the two study sites immediately below Dillon Dam (Blue 5 and DRD) were consistently 'impaired' for aquatic life use based on results from the MMI v4 and most additional metrics. Recovery of macroinvertebrate community structure and function was observed with distance downstream from the dam; however, this recovery gradient also varied by season. The most likely sources of stress at site BRaFG included diversions, dewatering, and urban runoff from the Town of Breckenridge, while downstream from Dillon Dam, the probable causes for stress included hypolimnetic releases from Dillon Reservoir, and runoff from the Town of Silverthorne. The recovery gradient was likely influenced by ambient conditions, contributions from tributaries, and the distance downstream that was required to attain more natural aquatic conditions (temperature, flow, etc.).

A predictable recovery gradient of macroinvertebrate structure and function occurred with distance downstream from Dillon Reservoir during 2022; although, the distance to recovery varied by season. It is likely that deviations from the natural thermal and flow regimes had a collectively negative impact on benthic macroinvertebrate community structure and function, while the numerous tributaries ameliorated these conditions in the downstream portion of the study area. Research has shown that regulated flows (altered thermal regime, magnitude and timing of releases, and frequency of these disruptions) can have an adverse effect on the abundance and diversity of macroinvertebrate communities (Ward and Stanford 1979, Stanford and Ward 2001).

Overall, the biomonitoring results from 2022 were similar to results from previous years (2020 and 2021) of this study. During each year of seasonal biomonitoring, the measurable negative impacts to macroinvertebrate communities have been more extensive (spatially) during the summer season. As previously discussed, the most likely source of stress downstream from Dillon Reservoir is the altered temperature regime. Deviations from the natural temperature regime are most obvious in the summer when hypolimnetic releases into the Blue River are considerably colder than the expected water temperatures in free-flowing streams. In the summer of 2022, surface water from Dillon Reservoir never spilled. While it is possible that warmer surface water from Dillon Reservoir could alleviate some of the negative impacts from relatively cold hypolimnetic releases, abrupt changes in water temperature (resulting from a shift between hypolimnetic releases and reservoir surface water spills) could produce a shock effect, potentially causing additional negative impacts to benthic macroinvertebrates with a narrow range of thermal tolerances (Olden and Naiman 2010, Carolli et al. 2011, McLaren et al. 2019). Future research may be needed to determine how regulated flows can be optimized to reduce the negative impacts on benthic macroinvertebrate communities.

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Appendix A

Benthic Macroinvertebrate Data – Spring 2022

Table A1. Macroinvertebrate data collected from site BRaFG on 19 April 2022.

Blue River				
BRaFG		Sample		
19 April 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Baetis tricaudatus		1	2	**12**
Diphetor hageni				
Drunella grandis				
Ephemerella dorothea infrequens				
Cinygmula sp.				
Epeorus longimanus				
Plecoptera				
Chloroperlidae				
Sweltsa sp.			1	**4**
Prostoia besametsa	1	2	1	**16**
Zapada oregonensis				
Claassenia sabulosa				
Cultus sp.				
Diura knowltoni				
Isoperla sp.	2	4	1	**28**
Isoperla fulva				
Kogotus modestus				
Megarcys signata		1		**4**
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus	11	18	10	**152**
Brachycentrus occidentalis				
Micrasema bactro				
Glossosoma sp.				
Arctopsyche grandis				
Hydropsyche cockerelli				
Hydropsyche oslari				
Lepidostoma sp.				
Hesperophylax sp.			1	**4**
Rhyacophila brunnea				
Rhyacophila coloradensis				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.		1		**4**
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.	1		1	**8**
Diamesa sp.				
Eukiefferiella sp.				
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.				
Pagastia sp.	3	5	2	**39**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.	12	6	8	**101**
Synorthocladius sp.				
Thienemannimyia genus group				
Tvetenia sp.				

Table A1. cont. Macroinvertebrate data collected from site BRaFG on 19 April 2022.

Other Diptera				
Atherix pachypus				
Bibiocephala sp.				
Chelifera/Neoplasta sp.				
Clinocera sp.				
Wiedemannia sp.				
Simulium sp.				
Antocha sp.				
Coleoptera				
Heterlimnius corpulentus			6	**24**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	4	2	11	**66**
Protzia sp.				
Sperchon sp.	3		3	**24**
Torrenticola sp.				
Polycelis coronata	4	5	7	**63**
Enchytraeidae			2	**8**
Totals	**41**	**45**	**56**	**557**
Shannon Weaver Diversity				**3.19**
Calculated Evenness				**0.797**
EPT				**7**
% EPT				**39.44%**
Density				**557**
% Non-Insect				**28.87%**
% Shredder/Scraper				**4.23%**
Taxa Richness				**16**
# Ephemeroptera Taxa				**1**
# Plecoptera Taxa				**4**
# Trichoptera Taxa				**2**
% Ephemeroptera individuals				**2.11%**
% Plectopera individuals				**9.15%**
% Trichoptera individuals				**28.17%**
# Ephemeroptera individuals				**3**
# Plectopera individuals				**13**
# Trichoptera individuals				**40**
Percent Chironomidae				**27.46%**
Clinger Taxa				**8**
% Clinger				**74.65%**
Percent Tolerant Organisms				**17.61%**
# Intolerant Taxa				**7**
Density Hydropsychidae				**0**
Ephemeroptera (estimated #/m²)				**12**
Plecoptera (estimated #/m²)				**52**
Trichoptera (estimated #/m²)				**156**
Other (estimated #/m²)				**337**

Table A2. Macroinvertebrate data collected from site UBR on 19 April 2022.

Blue River				
UBR		Sample		
19 April 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Baetis tricaudatus	10	12	15	**144**
Diphetor hageni	2	1	1	**16**
Drunella grandis				
Ephemerella dorothea infrequens				
Cinygmula sp.	6	7	8	**82**
Epeorus longimanus	77	108	72	**997**
Plecoptera				
Chloroperlidae	3	1	4	**32**
Sweltsa sp.	8	1	2	**43**
Prostoia besametsa	3	1	1	**20**
Zapada oregonensis				
Claassenia sabulosa				
Cultus sp.				
Diura knowltoni			1	**4**
Isoperla sp.				
Isoperla fulva		4		**16**
Kogotus modestus		4	5	**35**
Megarcys signata				
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus	5	23	11	**152**
Brachycentrus occidentalis				
Micrasema bactro				
Glossosoma sp.				
Arctopsyche grandis	1	4	1	**24**
Hydropsyche cockerelli				
Hydropsyche oslari				
Lepidostoma sp.	2	1		**12**
Hesperophylax sp.				
Rhyacophila brunnea			1	**4**
Rhyacophila coloradensis				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Corynoneura sp.		1	1	**8**
Cricotopus/*Orthocladius* sp.	7	4	1	**47**
Diamesa sp.				
Eukiefferiella sp.	1	1		**8**
Hydrobaenus sp.			1	**4**
Micropsectra/Tanytarsus sp.	16	9	17	**163**
Pagastia sp.	1	2		**12**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.	62	46	34	**551**
Synorthocladius sp.				
Thienemannimyia genus group	2		1	**12**
Tvetenia sp.	6	7		**51**

Table A2. cont. Macroinvertebrate data collected from site UBR on 19 April 2022.

Other Diptera				
Atherix pachypus				
Bibiocephala sp.				
Chelifera/Neoplasta sp.				
Clinocera sp.				
Wiedemannia sp.				
Simulium sp.				
Antocha sp.			2	**8**
Coleoptera				
Heterlimnius corpulentus	11	29	31	**276**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	1	2	2	**20**
Protzia sp.				
Sperchon sp.				
Torrenticola sp.				
Polycelis coronata	3	13	14	**117**
Enchytraeidae	5	23	46	**287**
Totals	**232**	**304**	**272**	**3145**
Shannon Weaver Diversity				**3.36**
Calculated Evenness				**0.699**
EPT				**14**
% EPT				**50.25%**
Density				**3,145**
% Non-Insect				**13.49%**
% Shredder/Scraper				**35.64%**
Taxa Richness				**28**
# Ephemeroptera Taxa				**4**
# Plecoptera Taxa				**6**
# Trichoptera Taxa				**4**
% Ephemeroptera individuals				**39.48%**
% Plectopera individuals				**4.70%**
% Trichoptera individuals				**6.06%**
# Ephemeroptera individuals				**319**
# Plectopera individuals				**38**
# Trichoptera individuals				**49**
Percent Chironomidae				**27.23%**
Clinger Taxa				**14**
% Clinger				**70.67%**
Percent Tolerant Organisms				**15.59%**
# Intolerant Taxa				**14**
Density Hydropsychidae				**24**
Ephemeroptera (estimated #/m²)				**1,239**
Plecoptera (estimated #/m²)				**150**
Trichoptera (estimated #/m²)				**192**
Other (estimated #/m²)				**1,564**

Table A3. Macroinvertebrate data collected from site Blue 5 on 19 April 2022.

Blue River				
Blue 5		Sample		
19 April 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Baetis tricaudatus	82	116	104	**1171**
Diphetor hageni				
Drunella grandis				
Ephemerella dorothea infrequens				
Cinygmula sp.				
Epeorus longimanus				
Plecoptera				
Chloroperlidae				
Sweltsa sp.				
Prostoia besametsa				
Zapada oregonensis				
Claassenia sabulosa				
Cultus sp.				
Diura knowltoni				
Isoperla sp.				
Isoperla fulva				
Kogotus modestus				
Megarcys signata				
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus				
Brachycentrus occidentalis				
Micrasema bactro				
Glossosoma sp.				
Arctopsyche grandis		1		**4**
Hydropsyche cockerelli				
Hydropsyche oslari				
Lepidostoma sp.				
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis		1	1	**8**
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.	22	33	29	**326**
Diamesa sp.	10	8	6	**94**
Eukiefferiella sp.	51	167	112	**1280**
Hydrobaenus sp.	1			**4**
Micropsectra/Tanytarsus sp.		5	8	**51**
Pagastia sp.	15	20	20	**214**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.				
Synorthocladius sp.	1			**4**
Thienemannimyia genus group				
Tvetenia sp.	30	95	35	**621**

Table A3. cont. Macroinvertebrate data collected from site Blue 5 on 19 April 2022.

Other Diptera				
Atherix pachypus				
Bibiocephala sp.				
Chelifera/Neoplasta sp.				
Clinocera sp.				
Wiedemannia sp.				
Simulium sp.	40	64	30	**520**
Antocha sp.				
Coleoptera				
Heterlimnius corpulentus				
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.				
Protzia sp.				
Sperchon sp.				
Torrenticola sp.				
Polycelis coronata	7	14	6	**105**
Enchytraeidae	1		1	**8**
Totals	**260**	**524**	**352**	**4410**
Shannon Weaver Diversity				**2.66**
Calculated Evenness				**0.698**
EPT				**3**
% EPT				**26.85%**
Density				**4,410**
% Non-Insect				**2.55%**
% Shredder/Scraper				**0.09%**
Taxa Richness				**14**
# Ephemeroptera Taxa				**1**
# Plecoptera Taxa				**0**
# Trichoptera Taxa				**2**
% Ephemeroptera individuals				**26.58%**
% Plectopera individuals				**0.00%**
% Trichoptera individuals				**0.26%**
# Ephemeroptera individuals				**302**
# Plectopera individuals				**0**
# Trichoptera individuals				**3**
Percent Chironomidae				**58.80%**
Clinger Taxa				**3**
% Clinger				**12.06%**
Percent Tolerant Organisms				**30.46%**
# Intolerant Taxa				**5**
Density Hydropsychidae				**4**
Ephemeroptera (estimated #/m²)				**1,171**
Plecoptera (estimated #/m²)				**0**
Trichoptera (estimated #/m²)				**12**
Other (estimated #/m²)				**3,227**

Table A4. Macroinvertebrate data collected from site DRD on 19 April 2022.

Blue River				
DRD		Sample		
19 April 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Baetis tricaudatus	138	126	150	**1605**
Diphetor hageni				
Drunella grandis				
Ephemerella dorothea infrequens				
Cinygmula sp.				
Epeorus longimanus		4	6	**39**
Plecoptera				
Chloroperlidae				
Sweltsa sp.			1	**4**
Prostoia besametsa	2			**8**
Zapada oregonensis				
Claassenia sabulosa				
Cultus sp.				
Diura knowltoni				
Isoperla sp.				
Isoperla fulva				
Kogotus modestus				
Megarcys signata				
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus				
Brachycentrus occidentalis				
Micrasema bactro				
Glossosoma sp.				
Arctopsyche grandis		1	3	**16**
Hydropsyche cockerelli				
Hydropsyche oslari				
Lepidostoma sp.				
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis	3	2	3	**32**
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.	5		2	**28**
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.	14	13	10	**144**
Diamesa sp.	2	2		**16**
Eukiefferiella sp.	21	24	19	**249**
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	3	2	1	**24**
Pagastia sp.	2	1	6	**35**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.	1	1	1	**12**
Synorthocladius sp.				
Thienemannimyia genus group				
Tvetenia sp.	49	57	41	**570**

Table A4. cont. Macroinvertebrate data collected from site DRD on 19 April 2022.

Other Diptera				
Atherix pachypus				
Bibiocephala sp.				
Chelifera/Neoplasta sp.				
Clinocera sp.				
Wiedemannia sp.				
Simulium sp.	10	15	10	**136**
Antocha sp.				
Coleoptera				
Heterlimnius corpulentus			1	**4**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.				
Protzia sp.				
Sperchon sp.				
Torrenticola sp.				
Polycelis coronata	3		4	**28**
Enchytraeidae	1	2		**12**
Totals	**254**	**250**	**258**	**2962**
Shannon Weaver Diversity				**2.25**
Calculated Evenness				**0.539**
EPT				**6**
% EPT				**57.61%**
Density				**2,962**
% Non-Insect				**1.31%**
% Shredder/Scraper				**2.49%**
Taxa Richness				**18**
# Ephemeroptera Taxa				**2**
# Plecoptera Taxa				**2**
# Trichoptera Taxa				**2**
% Ephemeroptera individuals				**55.64%**
% Plectopera individuals				**0.39%**
% Trichoptera individuals				**1.57%**
# Ephemeroptera individuals				**424**
# Plectopera individuals				**3**
# Trichoptera individuals				**12**
Percent Chironomidae				**36.35%**
Clinger Taxa				**7**
% Clinger				**8.27%**
Percent Tolerant Organisms				**9.58%**
# Intolerant Taxa				**7**
Density Hydropsychidae				**16**
Ephemeroptera (estimated #/m²)				**1,644**
Plecoptera (estimated #/m²)				**12**
Trichoptera (estimated #/m²)				**48**
Other (estimated #/m²)				**1,258**

Table A5. Macroinvertebrate data collected from site Blue 3 on 19 April 2022.

Blue River				
Blue 3		Sample		
19 April 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Baetis tricaudatus	74	47	143	**1024**
Diphetor hageni				
Drunella grandis	2	1	2	**20**
Ephemerella dorothea infrequens				
Cinygmula sp.	3	2		**20**
Epeorus longimanus	24	11	13	**187**
Plecoptera				
Chloroperlidae	2		1	**12**
Sweltsa sp.			4	**16**
Prostoia besametsa	4	2	8	**55**
Zapada oregonensis			1	**4**
Claassenia sabulosa				
Cultus sp.				
Diura knowltoni				
Isoperla sp.				
Isoperla fulva		2	1	**12**
Kogotus modestus				
Megarcys signata				
Skwala americana				
Taenionema sp.		1		**4**
Trichoptera				
Brachycentrus americanus	1			**4**
Brachycentrus occidentalis	18	6	35	**229**
Micrasema bactro				
Glossosoma sp.	2			**8**
Arctopsyche grandis	19	3	12	**132**
Hydropsyche cockerelli				
Hydropsyche oslari				
Lepidostoma sp.				
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis	1			**4**
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.	24	3	13	**156**
Diamesa sp.				
Eukiefferiella sp.	15	2	6	**90**
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.		1	3	**16**
Pagastia sp.	12	2	9	**90**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.	1		3	**16**
Synorthocladius sp.				
Thienemannimyia genus group				
Tvetenia sp.	9	1	2	**47**

Table A5. cont. Macroinvertebrate data collected from site Blue 3 on 19 April 2022.

Other Diptera				
Atherix pachypus				
Bibiocephala sp.				
Chelifera/Neoplasta sp.				
Clinocera sp.				
Wiedemannia sp.				
Simulium sp.				
Antocha sp.	2			**8**
Coleoptera				
Heterlimnius corpulentus	8	2	7	**66**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	2		2	**16**
Protzia sp.				
Sperchon sp.				
Torrenticola sp.				
Polycelis coronata	2	1	12	**59**
Enchytraeidae	8	2	3	**51**
Totals	**233**	**89**	**280**	**2346**
Shannon Weaver Diversity				**3.13**
Calculated Evenness				**0.666**
EPT				**15**
% EPT				**73.92%**
Density				**2,346**
% Non-Insect				**5.32%**
% Shredder/Scraper				**12.62%**
Taxa Richness				**26**
# Ephemeroptera Taxa				**4**
# Plecoptera Taxa				**6**
# Trichoptera Taxa				**5**
% Ephemeroptera individuals				**53.49%**
% Plectopera individuals				**4.32%**
% Trichoptera individuals				**16.11%**
# Ephemeroptera individuals				**322**
# Plectopera individuals				**26**
# Trichoptera individuals				**97**
Percent Chironomidae				**17.61%**
Clinger Taxa				**16**
% Clinger				**33.72%**
Percent Tolerant Organisms				**7.31%**
# Intolerant Taxa				**16**
Density Hydropsychidae				**132**
Ephemeroptera (estimated #/m²)				**1,251**
Plecoptera (estimated #/m²)				**103**
Trichoptera (estimated #/m²)				**377**
Other (estimated #/m²)				**615**

Table A6. Macroinvertebrate data collected from site D 5 on 19 April 2022.

Blue River				
D 5		Sample		
19 April 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Baetis tricaudatus	57	119	110	**1109**
Diphetor hageni		1		**4**
Drunella grandis		2		**8**
Ephemerella dorothea infrequens				
Cinygmula sp.	12	8	13	**128**
Epeorus longimanus	16	34	43	**361**
Plecoptera				
Chloroperlidae	3			**12**
Sweltsa sp.	15	4	16	**136**
Prostoia besametsa	1	5	3	**35**
Zapada oregonensis				
Claassenia sabulosa				
Cultus sp.				
Diura knowltoni				
Isoperla sp.				
Isoperla fulva				
Kogotus modestus				
Megarcys signata				
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus				
Brachycentrus occidentalis	13	37	39	**345**
Micrasema bactro				
Glossosoma sp.		5		**20**
Arctopsyche grandis	1	5	5	**43**
Hydropsyche cockerelli				
Hydropsyche oslari				
Lepidostoma sp.	1	7	3	**43**
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.	95	134	149	**1466**
Diamesa sp.	4	7	10	**82**
Eukiefferiella sp.	26	50	25	**392**
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	97	57	46	**776**
Pagastia sp.	31	34	26	**353**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.	51	37	61	**578**
Synorthocladius sp.	2	3	1	**24**
Thienemannimyia genus group				
Tvetenia sp.		2	3	**20**

Table A6. cont. Macroinvertebrate data collected from site D 5 on 19 April 2022.

Other Diptera				
Atherix pachypus				
Bibiocephala sp.				
Chelifera/Neoplasta sp.				
Clinocera sp.				
Wiedemannia sp.				
Simulium sp.		1		**4**
Antocha sp.	4	6	2	**47**
Coleoptera				
Heterlimnius corpulentus	18	3	21	**163**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	1	1	1	**12**
Protzia sp.			1	**4**
Sperchon sp.	1			**4**
Torrenticola sp.				
Polycelis coronata	16	6	20	**163**
Enchytraeidae	1		8	**35**
Totals	**466**	**568**	**606**	**6367**
Shannon Weaver Diversity				**3.52**
Calculated Evenness				**0.732**
EPT				**12**
% EPT				**35.24%**
Density				**6,367**
% Non-Insect				**3.41%**
% Shredder/Scraper				**9.33%**
Taxa Richness				**28**
# Ephemeroptera Taxa				**5**
# Plecoptera Taxa				**3**
# Trichoptera Taxa				**4**
% Ephemeroptera individuals				**25.30%**
% Plectopera individuals				**2.87%**
% Trichoptera individuals				**7.07%**
# Ephemeroptera individuals				**415**
# Plectopera individuals				**47**
# Trichoptera individuals				**116**
Percent Chironomidae				**57.99%**
Clinger Taxa				**15**
% Clinger				**27.68%**
Percent Tolerant Organisms				**19.21%**
# Intolerant Taxa				**13**
Density Hydropsychidae				**43**
Ephemeroptera (estimated #/m²)				**1,610**
Plecoptera (estimated #/m²)				**183**
Trichoptera (estimated #/m²)				**451**
Other (estimated #/m²)				**4,123**

Table A7. Macroinvertebrate data collected from site Blue 2 on 19 April 2022.

Blue River				
Blue 2		Sample		
19 April 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Baetis tricaudatus	45	34	43	**473**
Diphetor hageni				
Drunella grandis		1	8	**35**
Ephemerella dorothea infrequens				
Cinygmula sp.	5	2	8	**59**
Epeorus longimanus	38	66	55	**617**
Plecoptera				
Chloroperlidae				
Sweltsa sp.			8	**32**
Prostoia besametsa				
Zapada oregonensis				
Claassenia sabulosa				
Cultus sp.				
Diura knowltoni				
Isoperla sp.				
Isoperla fulva			1	**4**
Kogotus modestus				
Megarcys signata				
Skwala americana				
Taenionema sp.		1		**4**
Trichoptera				
Brachycentrus americanus	1		2	**12**
Brachycentrus occidentalis	3	8	12	**90**
Micrasema bactro				
Glossosoma sp.	1	33	2	**140**
Arctopsyche grandis	4	5	28	**144**
Hydropsyche cockerelli			1	**4**
Hydropsyche oslari				
Lepidostoma sp.			11	**43**
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis				
Oligophlebodes sp.		1		**4**
Diptera				
Chironomidae				
Brillia sp.				
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.	65	45	44	**597**
Diamesa sp.	5		9	**55**
Eukiefferiella sp.	26	24	65	**446**
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	9	1	47	**221**
Pagastia sp.	11	7	27	**175**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.	5		4	**35**
Synorthocladius sp.	1			**4**
Thienemannimyia genus group			4	**16**
Tvetenia sp.	1		2	**12**

Table A7. cont. Macroinvertebrate data collected from site Blue 2 on 19 April 2022.

Other Diptera				
Atherix pachypus				
Bibiocephala sp.				
Chelifera/Neoplasta sp.		1	1	**8**
Clinocera sp.				
Wiedemannia sp.				
Simulium sp.			1	**4**
Antocha sp.	1	1	5	**28**
Coleoptera				
Heterlimnius corpulentus	1	1	9	**43**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.		1	3	**16**
Protzia sp.			1	**4**
Sperchon sp.			1	**4**
Torrenticola sp.				
Polycelis coronata	1	1	10	**47**
Enchytraeidae				
Totals	**223**	**233**	**412**	**3376**
Shannon Weaver Diversity				**3.61**
Calculated Evenness				**0.729**
EPT				**14**
% EPT				**49.19%**
Density				**3,376**
% Non-Insect				**2.07%**
% Shredder/Scraper				**26.73%**
Taxa Richness				**31**
# Ephemeroptera Taxa				**4**
# Plecoptera Taxa				**3**
# Trichoptera Taxa				**7**
% Ephemeroptera individuals				**35.14%**
% Plectopera individuals				**1.15%**
% Trichoptera individuals				**12.90%**
# Ephemeroptera individuals				**305**
# Plectopera individuals				**10**
# Trichoptera individuals				**112**
Percent Chironomidae				**46.31%**
Clinger Taxa				**18**
% Clinger				**36.87%**
Percent Tolerant Organisms				**20.51%**
# Intolerant Taxa				**15**
Density Hydropsychidae				**148**
Ephemeroptera (estimated #/m²)				**1,184**
Plecoptera (estimated #/m²)				**40**
Trichoptera (estimated #/m²)				**437**
Other (estimated #/m²)				**1,715**

Table A8. Macroinvertebrate data collected from site Blue 1 on 19 April 2022.

Blue River				
Blue 1		Sample		
19 April 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Baetis tricaudatus	47	47	27	**469**
Diphetor hageni				
Drunella grandis	2	2	1	**20**
Ephemerella dorothea infrequens		1		**4**
Cinygmula sp.	15	13	17	**175**
Epeorus longimanus	51	76	74	**780**
Plecoptera				
Chloroperlidae		1		**4**
Sweltsa sp.	11	6	4	**82**
Prostoia besametsa	1	2		**12**
Zapada oregonensis		1		**4**
Claassenia sabulosa				
Cultus sp.				
Diura knowltoni				
Isoperla sp.				
Isoperla fulva	1	1	2	**16**
Kogotus modestus				
Megarcys signata				
Skwala americana			2	**8**
Taenionema sp.				
Trichoptera				
Brachycentrus americanus	3	2	4	**35**
Brachycentrus occidentalis			3	**12**
Micrasema bactro	1			**4**
Glossosoma sp.				
Arctopsyche grandis	5	14	10	**113**
Hydropsyche cockerelli				
Hydropsyche oslari				
Lepidostoma sp.	35	39	43	**454**
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis		1	1	**8**
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.	13	31	7	**198**
Diamesa sp.	1		3	**16**
Eukiefferiella sp.	12	44	17	**283**
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	4	10	9	**90**
Pagastia sp.	2	7	3	**47**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.	8	3	4	**59**
Synorthocladius sp.				
Thienemannimyia genus group				
Tvetenia sp.		2	1	**12**

Table A8. cont. Macroinvertebrate data collected from site Blue 1 on 19 April 2022.

Other Diptera				
Atherix pachypus				
Bibiocephala sp.			1	**4**
Chelifera/Neoplasta sp.				
Clinocera sp.				
Wiedemannia sp.				
Simulium sp.			1	**4**
Antocha sp.		1		**4**
Coleoptera				
Heterlimnius corpulentus	2	1	1	**16**
Optioservus sp.	1			**4**
Miscellaneous (Non-insects)				
Lebertia sp.	1	1	2	**16**
Protzia sp.	1	2		**12**
Sperchon sp.			1	**4**
Torrenticola sp.				
Polycelis coronata	6	13	8	**105**
Enchytraeidae				
Totals	**223**	**321**	**246**	**3074**
Shannon Weaver Diversity				**3.51**
Calculated Evenness				**0.696**
EPT				**17**
% EPT				**71.65%**
Density				**3,074**
% Non-Insect				**4.43%**
% Shredder/Scraper				**47.47%**
Taxa Richness				**33**
# Ephemeroptera Taxa				**5**
# Plecoptera Taxa				**6**
# Trichoptera Taxa				**6**
% Ephemeroptera individuals				**47.22%**
% Plectopera individuals				**4.05%**
% Trichoptera individuals				**20.38%**
# Ephemeroptera individuals				**373**
# Plectopera individuals				**32**
# Trichoptera individuals				**161**
Percent Chironomidae				**22.91%**
Clinger Taxa				**22**
% Clinger				**42.66%**
Percent Tolerant Organisms				**13.16%**
# Intolerant Taxa				**19**
Density Hydropsychidae				**113**
Ephemeroptera (estimated #/m²)				**1,448**
Plecoptera (estimated #/m²)				**126**
Trichoptera (estimated #/m²)				**626**
Other (estimated #/m²)				**874**

Table A9. Macroinvertebrate data collected from site SCR on 19 April 2022.

Blue River				
SCR		Sample		
19 April 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Baetis tricaudatus	7	20	20	**183**
Diphetor hageni	5	2	5	**47**
Drunella grandis	5	16	26	**183**
Ephemerella dorothea infrequens		1	1	**8**
Cinygmula sp.	10	10	17	**144**
Epeorus longimanus	36	52	70	**613**
Plecoptera				
Chloroperlidae		1		**4**
Sweltsa sp.	3	1	1	**20**
Prostoia besametsa				
Zapada oregonensis				
Claassenia sabulosa				
Cultus sp.				
Diura knowltoni				
Isoperla sp.				
Isoperla fulva	1	2	2	**20**
Kogotus modestus				
Megarcys signata				
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus	1	2	2	**20**
Brachycentrus occidentalis	40	93	120	**981**
Micrasema bactro				
Glossosoma sp.	2	5	3	**39**
Arctopsyche grandis	3	6	20	**113**
Hydropsyche cockerelli				
Hydropsyche oslari				
Lepidostoma sp.	243	100	308	**2524**
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.	3	7	23	**128**
Diamesa sp.			4	**16**
Eukiefferiella sp.	4	11	23	**148**
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	25	10	48	**322**
Pagastia sp.	4	5	35	**171**
Parametriocnemus sp.			1	**4**
Polypedilum sp.			2	**8**
Rheocricotopus sp.	5	5	8	**70**
Synorthocladius sp.				
Thienemannimyia genus group	3	4	4	**43**
Tvetenia sp.	1		3	**16**

Table A9. cont. Macroinvertebrate data collected from site SCR on 19 April 2022.

Other Diptera				
Atherix pachypus	1		28	**113**
Bibiocephala sp.				
Chelifera/Neoplasta sp.	5	1	2	**32**
Clinocera sp.			1	**4**
Wiedemannia sp.				
Simulium sp.			1	**4**
Antocha sp.	3		5	**32**
Coleoptera				
Heterlimnius corpulentus	36	7	19	**241**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	2	1	6	**35**
Protzia sp.				
Sperchon sp.	1	3	5	**35**
Torrenticola sp.				
Polycelis coronata	38	11	24	**283**
Enchytraeidae				
Totals	**487**	**376**	**837**	**6604**
Shannon Weaver Diversity				**3.34**
Calculated Evenness				**0.663**
EPT				**14**
% EPT				**74.24%**
Density				**6,604**
% Non-Insect				**5.35%**
% Shredder/Scraper				**53.24%**
Taxa Richness				**33**
# Ephemeroptera Taxa				**6**
# Plecoptera Taxa				**3**
# Trichoptera Taxa				**5**
% Ephemeroptera individuals				**17.82%**
% Plectopera individuals				**0.65%**
% Trichoptera individuals				**55.76%**
# Ephemeroptera individuals				**303**
# Plectopera individuals				**11**
# Trichoptera individuals				**948**
Percent Chironomidae				**14.00%**
Clinger Taxa				**16**
% Clinger				**38.47%**
Percent Tolerant Organisms				**8.18%**
# Intolerant Taxa				**15**
Density Hydropsychidae				**113**
Ephemeroptera (estimated #/m²)				**1,178**
Plecoptera (estimated #/m²)				**44**
Trichoptera (estimated #/m²)				**3,677**
Other (estimated #/m²)				**1,705**

Table A10. Macroinvertebrate data collected from site BRC on 19 April 2022.

Blue River				
BRC		Sample		
19 April 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Baetis tricaudatus	26	20	56	**396**
Diphetor hageni		2	2	**16**
Drunella grandis	1	1		**8**
Ephemerella dorothea infrequens	12	27	56	**369**
Cinygmula sp.		1		**4**
Epeorus longimanus	43	50	47	**543**
Plecoptera				
Chloroperlidae				
Sweltsa sp.				
Prostoia besametsa				
Zapada oregonensis				
Claassenia sabulosa	4	7	5	**63**
Cultus sp.	1		2	**12**
Diura knowltoni				
Isoperla sp.				
Isoperla fulva		2	4	**24**
Kogotus modestus		1		**4**
Megarcys signata				
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus	4	3	18	**97**
Brachycentrus occidentalis	16	4	17	**144**
Micrasema bactro				
Glossosoma sp.	12	16	53	**314**
Arctopsyche grandis	2	2	9	**51**
Hydropsyche cockerelli	7	8	18	**128**
Hydropsyche oslari			14	**55**
Lepidostoma sp.	51	31	31	**438**
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis		1	1	**8**
Oligophlebodes sp.	9	1	3	**51**
Diptera				
Chironomidae				
Brillia sp.				
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.		8	12	**78**
Diamesa sp.				
Eukiefferiella sp.	4	2	9	**59**
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	12	6	3	**82**
Pagastia sp.	3	4	3	**39**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.	2		1	**12**
Synorthocladius sp.				
Thienemannimyia genus group	1	1		**8**
Tvetenia sp.	1	1	3	**20**

Table A10. cont. Macroinvertebrate data collected from site BRC on 19 April 2022.

Other Diptera				
Atherix pachypus				
Bibiocephala sp.				
Chelifera/Neoplasta sp.	2	1	1	**16**
Clinocera sp.				
Wiedemannia sp.			1	**4**
Simulium sp.	1		5	**24**
Antocha sp.			1	**4**
Coleoptera				
Heterlimnius corpulentus	17	10	3	**117**
Optioservus sp.	1	2	5	**32**
Miscellaneous (Non-insects)				
Lebertia sp.	2	1		**12**
Protzia sp.	1	1	1	**12**
Sperchon sp.	6	1	3	**39**
Torrenticola sp.		1		**4**
Polycelis coronata	5	4		**35**
Enchytraeidae				
Totals	**246**	**220**	**387**	**3322**
Shannon Weaver Diversity				**4.04**
Calculated Evenness				**0.775**
EPT				**19**
% EPT				**82.18%**
Density				**3,322**
% Non-Insect				**3.05%**
% Shredder/Scraper				**41.97%**
Taxa Richness				**37**
# Ephemeroptera Taxa				**6**
# Plecoptera Taxa				**4**
# Trichoptera Taxa				**9**
% Ephemeroptera individuals				**40.33%**
% Plectopera individuals				**3.05%**
% Trichoptera individuals				**38.80%**
# Ephemeroptera individuals				**344**
# Plectopera individuals				**26**
# Trichoptera individuals				**331**
Percent Chironomidae				**8.91%**
Clinger Taxa				**25**
% Clinger				**64.13%**
Percent Tolerant Organisms				**6.21%**
# Intolerant Taxa				**17**
Density Hydropsychidae				**234**
Ephemeroptera (estimated #/m²)				**1,336**
Plecoptera (estimated #/m²)				**103**
Trichoptera (estimated #/m²)				**1,286**
Other (estimated #/m²)				**597**

Appendix B

Benthic Macroinvertebrate Data – Summer 2022

Table B1. Macroinvertebrate data collected from site BRaFG on 12 August 2022.

Blue River				
BRaFG		Sample		
12 August 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	6	5	2	**51**
Baetis flavistriga	40	35	35	**427**
Baetis tricaudatus	39	50	45	**520**
Diphetor hageni			2	**8**
Drunella doddsii				
Drunella grandis				
Serratella tibialis				
Cinygmula sp.				
Epeorus deceptivus	1	2	4	**28**
Epeorus longimanus	1	1	3	**20**
Tricorythodes explicatus				
Paraleptophlebia sp.				
Plecoptera				
Chloroperlidae				
Suwallia sp.				
Sweltsa sp.				
Zapada cinctipes				
Zapada oregonensis group				
Claassenia sabulosa				
Perlodidae	9	1	2	**47**
Isoperla sp.				
Isoperla fulva				
Megarcys signata				
Skwala americana				
Trichoptera				
Brachycentrus americanus	13	1	3	**66**
Brachycentrus occidentalis				
Micrasema bactro				
Glossosoma sp.				
Arctopsyche grandis	1			**4**
Hydropsyche cockerelli				
Ochrotrichia sp.				
Lepidostoma sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.	17	12	9	**148**
Diamesa sp.	1			**4**
Eukiefferiella sp.	5	11	4	**78**
Heleniella sp.				
Heterotrissocladius sp.				
Hydrobaenus sp.				
Micropsectra/*Tanytarsus* sp.	6	6	6	**70**
Nanocladius sp.				
Pagastia sp.	5	4		**35**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.	2	1	2	**20**
Rheotanytarsus sp.				
Stempellinella sp.				
Synorthocladius sp.				
Thienemanniella sp.				
Thienemannimyia genus group				
Tvetenia sp.	7	45	20	**280**

Table B1. cont. Macroinvertebrate data collected from site BRaFG on 12 August 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.				
Clinocera sp.			1	**4**
Simulium sp.	3	135	155	**1136**
Antocha sp.				
Dicranota sp.				
Tipula sp.			2	**8**
Coleoptera				
Heterlimnius corpulentus	15	7	5	**105**
Optioservus sp.				
Zaitzevia parvula				
Miscellaneous (Non-insects)				
Atractides sp.				
Hygrobates sp.			1	**4**
Lebertia sp.	14	4	7	**97**
Protzia sp.				
Sperchon sp.	5	3		**32**
Torrenticola sp.				
Polycelis coronata	24	20	26	**272**
Pisidium sp.				
Enchytraeidae				
Lumbricidae				
Naididae				
Totals	**214**	**343**	**334**	**3464**
Shannon Weaver Diversity				**3.25**
Calculated Evenness				**0.710**
EPT				**9**
% EPT				**33.78%**
Density				**3,464**
% Non-Insect				**11.67%**
% Shredder/Scraper				**1.57%**
Taxa Richness				**24**
# Ephemeroptera Taxa				**6**
# Plecoptera Taxa				**1**
# Trichoptera Taxa				**2**
% Ephemeroptera individuals				**30.42%**
% Plectopera individuals				**1.35%**
% Trichoptera individuals				**2.02%**
# Ephemeroptera individuals				**271**
# Plectopera individuals				**12**
# Trichoptera individuals				**18**
Percent Chironomidae				**18.29%**
Clinger Taxa				**11**
% Clinger				**45.01%**
Percent Tolerant Organisms				**8.08%**
# Intolerant Taxa				**7**
Density Hydropsychidae				**4**
Ephemeroptera (estimated #/m²)				**1,054**
Plecoptera (estimated #/m²)				**47**
Trichoptera (estimated #/m²)				**70**
Other (estimated #/m²)				**2,293**

Table B2. Macroinvertebrate data collected from site UBR on 12 August 2022.

Blue River				
UBR		Sample		
12 August 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	4	2	1	**28**
Baetis flavistriga	9	8	2	**74**
Baetis tricaudatus	41	62	44	**570**
Diphetor hageni				
Drunella doddsii				
Drunella grandis				
Serratella tibialis				
Cinygmula sp.				
Epeorus deceptivus				
Epeorus longimanus	5	19	19	**167**
Tricorythodes explicatus			1	**4**
Paraleptophlebia sp.				
Plecoptera				
Chloroperlidae				
Suwallia sp.				
Sweltsa sp.	4	2	2	**32**
Zapada cinctipes		1		**4**
Zapada oregonensis group	1			**4**
Claassenia sabulosa				
Perlodidae	2	4	1	**28**
Isoperla sp.				
Isoperla fulva				
Megarcys signata				
Skwala americana				
Trichoptera				
Brachycentrus americanus	19	23	57	**384**
Brachycentrus occidentalis				
Micrasema bactro				
Glossosoma sp.				
Arctopsyche grandis	3	5	2	**39**
Hydropsyche cockerelli				
Ochrotrichia sp.	1	1		**8**
Lepidostoma sp.	1	1		**8**
Rhyacophila brunnea		2		**8**
Rhyacophila coloradensis				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.				
Corynoneura sp.	1			**4**
Cricotopus/Orthocladius sp.	19	2	4	**97**
Diamesa sp.				
Eukiefferiella sp.	5	4	3	**47**
Heleniella sp.				
Heterotrissocladius sp.				
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	47	49	57	**594**
Nanocladius sp.				
Pagastia sp.	6	3	1	**39**
Parametriocnemus sp.				
Polypedilum sp.			1	**4**
Rheocricotopus sp.	17	10	3	**117**
Rheotanytarsus sp.				
Stempellinella sp.		1	1	**8**
Synorthocladius sp.				
Thienemanniella sp.				
Thienemannimyia genus group				
Tvetenia sp.	4	43	13	**233**

Table B2. cont. Macroinvertebrate data collected from site UBR on 12 August 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.	1			**4**
Clinocera sp.				
Simulium sp.	3		51	**210**
Antocha sp.				
Dicranota sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	27	4	15	**179**
Optioservus sp.				
Zaitzevia parvula				
Miscellaneous (Non-insects)				
Atractides sp.				
Hygrobates sp.				
Lebertia sp.				
Protzia sp.				
Sperchon sp.				
Torrenticola sp.				
Polycelis coronata	7	10	7	**94**
Pisidium sp.				
Enchytraeidae	5		3	**32**
Lumbricidae				
Naididae				
Totals	**232**	**256**	**288**	**3020**
Shannon Weaver Diversity				**3.63**
Calculated Evenness				**0.754**
EPT				**14**
% EPT				**44.97%**
Density				**3,020**
% Non-Insect				**4.12%**
% Shredder/Scraper				**6.19%**
Taxa Richness				**28**
# Ephemeroptera Taxa				**5**
# Plecoptera Taxa				**4**
# Trichoptera Taxa				**5**
% Ephemeroptera individuals				**27.96%**
% Plectopera individuals				**2.19%**
% Trichoptera individuals				**14.82%**
# Ephemeroptera individuals				**217**
# Plectopera individuals				**17**
# Trichoptera individuals				**115**
Percent Chironomidae				**37.89%**
Clinger Taxa				**9**
% Clinger				**37.76%**
Percent Tolerant Organisms				**22.42%**
# Intolerant Taxa				**11**
Density Hydropsychidae				**39**
Ephemeroptera (estimated #/m²)				**843**
Plecoptera (estimated #/m²)				**68**
Trichoptera (estimated #/m²)				**447**
Other (estimated #/m²)				**1,662**

Table B3. Macroinvertebrate data collected from site Blue 5 on 12 August 2022.

Blue River				
Blue 5		Sample		
12 August 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.				
Baetis flavistriga				
Baetis tricaudatus	59	148	46	**981**
Diphetor hageni				
Drunella doddsii				
Drunella grandis				
Serratella tibialis				
Cinygmula sp.				
Epeorus deceptivus				
Epeorus longimanus	2			**8**
Tricorythodes explicatus				
Paraleptophlebia sp.				
Plecoptera				
Chloroperlidae				
Suwallia sp.		2		**8**
Sweltsa sp.				
Zapada cinctipes				
Zapada oregonensis group				
Claassenia sabulosa				
Perlodidae	1	1		**8**
Isoperla sp.				
Isoperla fulva				
Megarcys signata				
Skwala americana				
Trichoptera				
Brachycentrus americanus	1			**4**
Brachycentrus occidentalis				
Micrasema bactro				
Glossosoma sp.				
Arctopsyche grandis				
Hydropsyche cockerelli				
Ochrotrichia sp.				
Lepidostoma sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis	1	1		**8**
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/Orthocladius sp.	2		1	**12**
Diamesa sp.			1	**4**
Eukiefferiella sp.	34	21	4	**229**
Heleniella sp.				
Heterotrissocladius sp.				
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	1	4	2	**28**
Nanocladius sp.				
Pagastia sp.	15	41	21	**299**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.				
Rheotanytarsus sp.				
Stempellinella sp.				
Synorthocladius sp.			1	**4**
Thienemanniella sp.				
Thienemannimyia genus group				
Tvetenia sp.	3	5		**32**

Table B3. cont. Macroinvertebrate data collected from site Blue 5 on 12 August 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.				
Clinocera sp.				
Simulium sp.	3	3		**24**
Antocha sp.				
Dicranota sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	3			**12**
Optioservus sp.				
Zaitzevia parvula				
Miscellaneous (Non-insects)				
Atractides sp.				
Hygrobates sp.				
Lebertia sp.				
Protzia sp.				
Sperchon sp.				
Torrenticola sp.				
Polycelis coronata	1	6	5	**47**
Pisidium sp.				
Enchytraeidae				
Lumbricidae				
Naididae				
Totals	**126**	**232**	**81**	**1708**
Shannon Weaver Diversity				**2.02**
Calculated Evenness				**0.504**
EPT				**6**
% EPT				**59.68%**
Density				**1,708**
% Non-Insect				**2.73%**
% Shredder/Scraper				**0.46%**
Taxa Richness				**16**
# Ephemeroptera Taxa				**2**
# Plecoptera Taxa				**2**
# Trichoptera Taxa				**2**
% Ephemeroptera individuals				**58.09%**
% Plectopera individuals				**0.91%**
% Trichoptera individuals				**0.68%**
# Ephemeroptera individuals				**255**
# Plectopera individuals				**4**
# Trichoptera individuals				**3**
Percent Chironomidae				**35.54%**
Clinger Taxa				**7**
% Clinger				**4.10%**
Percent Tolerant Organisms				**15.03%**
# Intolerant Taxa				**8**
Density Hydropsychidae				**0**
Ephemeroptera (estimated #/m²)				**989**
Plecoptera (estimated #/m²)				**16**
Trichoptera (estimated #/m²)				**12**
Other (estimated #/m²)				**691**

Table B4. Macroinvertebrate data collected from site DRD on 12 August 2022.

Blue River				
DRD		Sample		
12 August 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	4	7	4	**59**
Baetis flavistriga				
Baetis tricaudatus	32	93	55	**698**
Diphetor hageni		1		**4**
Drunella doddsii				
Drunella grandis				
Serratella tibialis		1		**4**
Cinygmula sp.				
Epeorus deceptivus	2	2		**16**
Epeorus longimanus	1	5		**24**
Tricorythodes explicatus				
Paraleptophlebia sp.				
Plecoptera				
Chloroperlidae				
Suwallia sp.			2	**8**
Sweltsa sp.				
Zapada cinctipes				
Zapada oregonensis group				
Claassenia sabulosa				
Perlodidae		3		**12**
Isoperla sp.				
Isoperla fulva				
Megarcys signata	2	4		**24**
Skwala americana				
Trichoptera				
Brachycentrus americanus	1	3	1	**20**
Brachycentrus occidentalis				
Micrasema bactro				
Glossosoma sp.				
Arctopsyche grandis				
Hydropsyche cockerelli				
Ochrotrichia sp.				
Lepidostoma sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.		2		**8**
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/Orthocladius sp.		1		**4**
Diamesa sp.				
Eukiefferiella sp.	2	10	2	**55**
Heleniella sp.				
Heterotrissocladius sp.				
Hydrobaenus sp.			1	**4**
Micropsectra/Tanytarsus sp.		4	1	**20**
Nanocladius sp.				
Pagastia sp.	4	6	7	**66**
Parametriocnemus sp.		1		**4**
Polypedilum sp.		2		**8**
Rheocricotopus sp.		1	1	**8**
Rheotanytarsus sp.				
Stempellinella sp.				
Synorthocladius sp.				
Thienemanniella sp.				
Thienemannimyia genus group				
Tvetenia sp.	1	15	4	**78**

Table B4. cont. Macroinvertebrate data collected from site DRD on 12 August 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.				
Clinocera sp.				
Simulium sp.	1	34	7	**163**
Antocha sp.				
Dicranota sp.				
Tipula sp.			1	**4**
Coleoptera				
Heterlimnius corpulentus		1	1	**8**
Optioservus sp.				
Zaitzevia parvula				
Miscellaneous (Non-insects)				
Atractides sp.				
Hygrobates sp.				
Lebertia sp.			1	**4**
Protzia sp.				
Sperchon sp.				
Torrenticola sp.				
Polycelis coronata	1	13	3	**66**
Pisidium sp.				
Enchytraeidae				
Lumbricidae				
Naididae				
Totals	**51**	**209**	**91**	**1369**
Shannon Weaver Diversity				**2.79**
Calculated Evenness				**0.600**
EPT				**10**
% EPT				**63.53%**
Density				**1,369**
% Non-Insect				**5.13%**
% Shredder/Scraper				**4.56%**
Taxa Richness				**25**
# Ephemeroptera Taxa				**6**
# Plecoptera Taxa				**3**
# Trichoptera Taxa				**1**
% Ephemeroptera individuals				**58.97%**
% Plectopera individuals				**3.13%**
% Trichoptera individuals				**1.42%**
# Ephemeroptera individuals				**207**
# Plectopera individuals				**11**
# Trichoptera individuals				**5**
Percent Chironomidae				**18.52%**
Clinger Taxa				**11**
% Clinger				**21.08%**
Percent Tolerant Organisms				**5.98%**
# Intolerant Taxa				**9**
Density Hydropsychidae				**0**
Ephemeroptera (estimated #/m²)				**805**
Plecoptera (estimated #/m²)				**44**
Trichoptera (estimated #/m²)				**20**
Other (estimated #/m²)				**500**

Table B5. Macroinvertebrate data collected from site Blue 3 on 12 August 2022.

Blue River				
Blue 3		Sample		
12 August 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	34	54	47	**524**
Baetis flavistriga				
Baetis tricaudatus	40	42	68	**582**
Diphetor hageni				
Drunella doddsii				
Drunella grandis	4	10	5	**74**
Serratella tibialis		2		**8**
Cinygmula sp.				
Epeorus deceptivus	5	6	2	**51**
Epeorus longimanus	2	1	2	**20**
Tricorythodes explicatus				
Paraleptophlebia sp.				
Plecoptera				
Chloroperlidae			3	**12**
Suwallia sp.	1		6	**28**
Sweltsa sp.	7	1	9	**66**
Zapada cinctipes				
Zapada oregonensis group	1	1		**8**
Claassenia sabulosa				
Perlodidae			2	**8**
Isoperla sp.	1	4		**20**
Isoperla fulva				
Megarcys signata	2		3	**20**
Skwala americana				
Trichoptera				
Brachycentrus americanus	1	1		**8**
Brachycentrus occidentalis	282	282	229	**3074**
Micrasema bactro				
Glossosoma sp.				
Arctopsyche grandis	10	13	4	**105**
Hydropsyche cockerelli				
Ochrotrichia sp.				
Lepidostoma sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.	96	61	14	**663**
Diamesa sp.				
Eukiefferiella sp.	68	30	28	**489**
Heleniella sp.		1		**4**
Heterotrissocladius sp.				
Hydrobaenus sp.				
Micropsectra/*Tanytarsus* sp.	86	66	120	**1055**
Nanocladius sp.			2	**8**
Pagastia sp.	51	38	24	**438**
Parametriocnemus sp.				
Polypedilum sp.			1	**4**
Rheocricotopus sp.	25	9	25	**229**
Rheotanytarsus sp.				
Stempellinella sp.	1			**4**
Synorthocladius sp.				
Thienemanniella sp.				
Thienemannimyia genus group				
Tvetenia sp.	43	96	41	**698**

Table B5. cont. Macroinvertebrate data collected from site Blue 3 on 12 August 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.				
Clinocera sp.				
Simulium sp.	35	46	178	**1004**
Antocha sp.				
Dicranota sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	24	22	41	**338**
Optioservus sp.				
Zaitzevia parvula				
Miscellaneous (Non-insects)				
Atractides sp.	1			**4**
Hygrobates sp.				
Lebertia sp.	5	7	4	**63**
Protzia sp.	1			**4**
Sperchon sp.	1			**4**
Torrenticola sp.				
Polycelis coronata	13	25	21	**229**
Pisidium sp.				
Enchytraeidae		1		**4**
Lumbricidae	6	9	21	**140**
Naididae				
Totals	**846**	**828**	**900**	**9990**
Shannon Weaver Diversity				**3.51**
Calculated Evenness				**0.685**
EPT				**16**
% EPT				**46.11%**
Density				**9,990**
% Non-Insect				**4.47%**
% Shredder/Scraper				**1.55%**
Taxa Richness				**35**
# Ephemeroptera Taxa				**6**
# Plecoptera Taxa				**7**
# Trichoptera Taxa				**3**
% Ephemeroptera individuals				**12.59%**
% Plectopera individuals				**1.59%**
% Trichoptera individuals				**31.93%**
# Ephemeroptera individuals				**324**
# Plectopera individuals				**41**
# Trichoptera individuals				**822**
Percent Chironomidae				**35.98%**
Clinger Taxa				**19**
% Clinger				**50.78%**
Percent Tolerant Organisms				**17.64%**
# Intolerant Taxa				**17**
Density Hydropsychidae				**105**
Ephemeroptera (estimated #/m²)				**1,259**
Plecoptera (estimated #/m²)				**162**
Trichoptera (estimated #/m²)				**3,187**
Other (estimated #/m²)				**5,382**

Table B6. Macroinvertebrate data collected from site D 5 on 12 August 2022.

Blue River				
D 5		Sample		
12 August 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	29	23	21	**283**
Baetis flavistriga				
Baetis tricaudatus	146	231	233	**2365**
Diphetor hageni		1		**4**
Drunella doddsii				
Drunella grandis		1		**4**
Serratella tibialis		1		**4**
Cinygmula sp.				
Epeorus deceptivus				
Epeorus longimanus	2		5	**28**
Tricorythodes explicatus				
Paraleptophlebia sp.				
Plecoptera				
Chloroperlidae				
Suwallia sp.				
Sweltsa sp.	1	5	4	**39**
Zapada cinctipes				
Zapada oregonensis group				
Claassenia sabulosa				
Perlodidae	1			**4**
Isoperla sp.				
Isoperla fulva			1	**4**
Megarcys signata				
Skwala americana		1		**4**
Trichoptera				
Brachycentrus americanus		1	1	**8**
Brachycentrus occidentalis	354	678	635	**6462**
Micrasema bactro				
Glossosoma sp.		2	1	**12**
Arctopsyche grandis	18	25	39	**318**
Hydropsyche cockerelli				
Ochrotrichia sp.		3		**12**
Lepidostoma sp.	2	5		**28**
Rhyacophila brunnea				
Rhyacophila coloradensis				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.	12	12	36	**233**
Corynoneura sp.				
Cricotopus/Orthocladius sp.	15	45	40	**388**
Diamesa sp.		1		**4**
Eukiefferiella sp.	20	84	71	**679**
Heleniella sp.				
Heterotrissocladius sp.				
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	510	994	991	**9671**
Nanocladius sp.				
Pagastia sp.	38	121	52	**818**
Parametriocnemus sp.				
Polypedilum sp.				
Rheocricotopus sp.		31	4	**136**
Rheotanytarsus sp.				
Stempellinella sp.			1	**4**
Synorthocladius sp.	13	52	11	**295**
Thienemanniella sp.				
Thienemannimyia genus group	3	7	3	**51**
Tvetenia sp.	51	181	173	**1570**

Table B6. cont. Macroinvertebrate data collected from site D 5 on 12 August 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.			1	**4**
Clinocera sp.				
Simulium sp.	1978	780	2151	**19028**
Antocha sp.				
Dicranota sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	9	51	22	**318**
Optioservus sp.				
Zaitzevia parvula				
Miscellaneous (Non-insects)				
Atractides sp.				
Hygrobates sp.				
Lebertia sp.		4	2	**24**
Protzia sp.				
Sperchon sp.	1	1	2	**16**
Torrenticola sp.				
Polycelis coronata	23	120	47	**737**
Pisidium sp.				
Enchytraeidae				
Lumbricidae	1	2	1	**16**
Naididae				
Totals	**3227**	**3463**	**4548**	**43571**
Shannon Weaver Diversity				**2.51**
Calculated Evenness				**0.493**
EPT				**16**
% EPT				**21.98%**
Density				**43,571**
% Non-Insect				**1.82%**
% Shredder/Scraper				**0.16%**
Taxa Richness				**34**
# Ephemeroptera Taxa				**6**
# Plecoptera Taxa				**4**
# Trichoptera Taxa				**6**
% Ephemeroptera individuals				**6.17%**
% Plectopera individuals				**0.12%**
% Trichoptera individuals				**15.70%**
# Ephemeroptera individuals				**693**
# Plectopera individuals				**13**
# Trichoptera individuals				**1764**
Percent Chironomidae				**31.79%**
Clinger Taxa				**16**
% Clinger				**60.55%**
Percent Tolerant Organisms				**23.88%**
# Intolerant Taxa				**15**
Density Hydropsychidae				**318**
Ephemeroptera (estimated #/m²)				**2,688**
Plecoptera (estimated #/m²)				**51**
Trichoptera (estimated #/m²)				**6,840**
Other (estimated #/m²)				**33,992**

Table B7. Macroinvertebrate data collected from site Blue 2 on 12 August 2022.

Blue River				
Blue 2		Sample		
12 August 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	4	2	6	**47**
Baetis flavistriga	18	14	49	**314**
Baetis tricaudatus	186	55	113	**1373**
Diphetor hageni			2	**8**
Drunella doddsii	1			**4**
Drunella grandis	2	6	2	**39**
Serratella tibialis				
Cinygmula sp.			2	**8**
Epeorus deceptivus			1	**4**
Epeorus longimanus	4		1	**20**
Tricorythodes explicatus				
Paraleptophlebia sp.			1	**4**
Plecoptera				
Chloroperlidae				
Suwallia sp.				
Sweltsa sp.		6	11	**66**
Zapada cinctipes		1		**4**
Zapada oregonensis group				
Claassenia sabulosa				
Perlodidae				
Isoperla sp.				
Isoperla fulva				
Megarcys signata				
Skwala americana	1			**4**
Trichoptera				
Brachycentrus americanus	2	2	1	**20**
Brachycentrus occidentalis	79	50	37	**644**
Micrasema bactro				
Glossosoma sp.	2	3	2	**28**
Arctopsyche grandis	36	6	4	**179**
Hydropsyche cockerelli				
Ochrotrichia sp.		4	2	**24**
Lepidostoma sp.	8	19	53	**311**
Rhyacophila brunnea				
Rhyacophila coloradensis				
Oligophlebodes sp.			2	**8**
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.	3	3	6	**47**
Corynoneura sp.				
Cricotopus/Orthocladius sp.	26	71	23	**466**
Diamesa sp.				
Eukiefferiella sp.	31	79	13	**477**
Heleniella sp.				
Heterotrissocladius sp.				
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	74	67	351	**1907**
Nanocladius sp.	1			**4**
Pagastia sp.	26	70	13	**423**
Parametriocnemus sp.		1		**4**
Polypedilum sp.	1		4	**20**
Rheocricotopus sp.		3	15	**70**
Rheotanytarsus sp.				
Stempellinella sp.	3	7	44	**210**
Synorthocladius sp.	11	5	17	**128**
Thienemanniella sp.				
Thienemannimyia genus group	3	4	10	**66**
Tvetenia sp.	43	24	17	**326**

Table B7. cont. Macroinvertebrate data collected from site Blue 2 on 12 August 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.				
Clinocera sp.				
Simulium sp.	712	360	294	**5295**
Antocha sp.				
Dicranota sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	9	9	41	**229**
Optioservus sp.				
Zaitzevia parvula				
Miscellaneous (Non-insects)				
Atractides sp.				
Hygrobates sp.				
Lebertia sp.	3		11	**55**
Protzia sp.				
Sperchon sp.	1	2	3	**24**
Torrenticola sp.				
Polycelis coronata	1	3	5	**35**
Pisidium sp.				
Enchytraeidae				
Lumbricidae				
Naididae				
Totals	**1291**	**876**	**1156**	**12895**
Shannon Weaver Diversity				**3.15**
Calculated Evenness				**0.600**
EPT				**20**
% EPT				**24.07%**
Density				**12,895**
% Non-Insect				**0.87%**
% Shredder/Scraper				**3.43%**
Taxa Richness				**38**
# Ephemeroptera Taxa				**10**
# Plecoptera Taxa				**3**
# Trichoptera Taxa				**7**
% Ephemeroptera individuals				**14.11%**
% Plectopera individuals				**0.57%**
% Trichoptera individuals				**9.39%**
# Ephemeroptera individuals				**469**
# Plectopera individuals				**19**
# Trichoptera individuals				**312**
Percent Chironomidae				**32.17%**
Clinger Taxa				**17**
% Clinger				**51.61%**
Percent Tolerant Organisms				**19.11%**
# Intolerant Taxa				**18**
Density Hydropsychidae				**179**
Ephemeroptera (estimated #/m²)				**1,821**
Plecoptera (estimated #/m²)				**74**
Trichoptera (estimated #/m²)				**1,214**
Other (estimated #/m²)				**9,786**

Table B8. Macroinvertebrate data collected from site Blue 1 on 12 August 2022.

Blue River				
Blue 1		Sample		
12 August 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.			1	**4**
Acentrella sp.	2	3	1	**24**
Baetis flavistriga	23	10	19	**202**
Baetis tricaudatus	134	129	109	**1442**
Diphetor hageni	6		5	**43**
Drunella doddsii			1	**4**
Drunella grandis	6	3	5	**55**
Serratella tibialis			1	**4**
Cinygmula sp.				
Epeorus deceptivus				
Epeorus longimanus		8		**32**
Tricorythodes explicatus				
Paraleptophlebia sp.				
Plecoptera				
Chloroperlidae				
Suwallia sp.				
Sweltsa sp.	2	2	14	**70**
Zapada cinctipes	5	2	2	**35**
Zapada oregonensis group	2			**8**
Claassenia sabulosa				
Perlodidae	10	2	8	**78**
Isoperla sp.				
Isoperla fulva				
Megarcys signata				
Skwala americana	1	1	1	**12**
Trichoptera				
Brachycentrus americanus	9	2	3	**55**
Brachycentrus occidentalis	47	10	50	**415**
Micrasema bactro	2			**8**
Glossosoma sp.	6	3		**35**
Arctopsyche grandis	52	29	34	**446**
Hydropsyche cockerelli				
Ochrotrichia sp.	3	1	1	**20**
Lepidostoma sp.	261	137	294	**2683**
Rhyacophila brunnea				
Rhyacophila coloradensis	1	1		**8**
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.	5	9	2	**63**
Corynoneura sp.				
Cricotopus/Orthocladius sp.	9	5	5	**74**
Diamesa sp.				
Eukiefferiella sp.	21	16	11	**187**
Heleniella sp.				
Heterotrissocladius sp.				
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	304	97	228	**2438**
Nanocladius sp.				
Pagastia sp.	18	7	26	**198**
Parametriocnemus sp.				
Polypedilum sp.	5		2	**28**
Rheocricotopus sp.	7	6	10	**90**
Rheotanytarsus sp.				
Stempellinella sp.	28	11	39	**303**
Synorthocladius sp.	8	1	5	**55**
Thienemanniella sp.				
Thienemannimyia genus group	6	6	7	**74**
Tvetenia sp.	48	39	43	**504**

Table B8. cont. Macroinvertebrate data collected from site Blue 1 on 12 August 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.	1			**4**
Clinocera sp.				
Simulium sp.	281	1256	85	**6287**
Antocha sp.	1			**4**
Dicranota sp.	1		2	**12**
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	38	8	41	**338**
Optioservus sp.				
Zaitzevia parvula				
Miscellaneous (Non-insects)				
Atractides sp.				
Hygrobates sp.				
Lebertia sp.	7	4	9	**78**
Protzia sp.				
Sperchon sp.	3	2	3	**32**
Torrenticola sp.				
Polycelis coronata	12	5	48	**252**
Pisidium sp.		1		**4**
Enchytraeidae	1			**4**
Lumbricidae				
Naididae			1	**4**
Totals	**1376**	**1816**	**1116**	**16716**
Shannon Weaver Diversity				**3.13**
Calculated Evenness				**0.574**
EPT				**22**
% EPT				**33.98%**
Density				**16,716**
% Non-Insect				**2.23%**
% Shredder/Scraper				**17.27%**
Taxa Richness				**44**
# Ephemeroptera Taxa				**9**
# Plecoptera Taxa				**5**
# Trichoptera Taxa				**8**
% Ephemeroptera individuals				**10.82%**
% Plectopera individuals				**1.21%**
% Trichoptera individuals				**21.96%**
# Ephemeroptera individuals				**466**
# Plectopera individuals				**52**
# Trichoptera individuals				**946**
Percent Chironomidae				**24.00%**
Clinger Taxa				**19**
% Clinger				**47.86%**
Percent Tolerant Organisms				**16.43%**
# Intolerant Taxa				**22**
Density Hydropsychidae				**446**
Ephemeroptera (estimated #/m²)				**1,810**
Plecoptera (estimated #/m²)				**203**
Trichoptera (estimated #/m²)				**3,670**
Other (estimated #/m²)				**11,033**

Table B9. Macroinvertebrate data collected from site SCR on 12 August 2022.

Blue River				
SCR		Sample		
12 August 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	3	10	4	**66**
Baetis flavistriga				
Baetis tricaudatus	118	141	105	**1411**
Diphetor hageni	8	14	9	**121**
Drunella doddsii				
Drunella grandis	92	74	50	**838**
Serratella tibialis				
Cinygmula sp.				
Epeorus deceptivus				
Epeorus longimanus	2	2	2	**24**
Tricorythodes explicatus				
Paraleptophlebia sp.				
Plecoptera				
Chloroperlidae				
Suwallia sp.				
Sweltsa sp.	11	9	6	**101**
Zapada cinctipes	3	3		**24**
Zapada oregonensis group				
Claassenia sabulosa		1	1	**8**
Perlodidae				
Isoperla sp.	3	11	3	**66**
Isoperla fulva				
Megarcys signata				
Skwala americana	2	2	2	**24**
Trichoptera				
Brachycentrus americanus	7	17	6	**117**
Brachycentrus occidentalis	48	40	25	**438**
Micrasema bactro				
Glossosoma sp.	8	2	2	**47**
Arctopsyche grandis	18	15	28	**237**
Hydropsyche cockerelli			7	**28**
Ochrotrichia sp.	2		1	**12**
Lepidostoma sp.	306	222	61	**2283**
Rhyacophila brunnea				
Rhyacophila coloradensis				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.			1	**4**
Corynoneura sp.				
Cricotopus/*Orthocladius* sp.	96	83	41	**853**
Diamesa sp.				
Eukiefferiella sp.	30	12	22	**249**
Heleniella sp.				
Heterotrissocladius sp.		1		**4**
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	389	667	284	**5194**
Nanocladius sp.				
Pagastia sp.	32	35	33	**388**
Parametriocnemus sp.	1	6	5	**47**
Polypedilum sp.	1			**4**
Rheocricotopus sp.	21	20	1	**163**
Rheotanytarsus sp.				
Stempellinella sp.	33	87	21	**547**
Synorthocladius sp.	1	2	2	**20**
Thienemanniella sp.				
Thienemannimyia genus group	18	21	10	**190**
Tvetenia sp.	49	65	41	**601**

Table B9. cont. Macroinvertebrate data collected from site SCR on 12 August 2022.

Other Diptera				
Atherix pachypus	7	6	10	**90**
Chelifera/Neoplasta sp.		1		**4**
Clinocera sp.		1		**4**
Simulium sp.	35	17	59	**431**
Antocha sp.	2	1		**12**
Dicranota sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	25	24	53	**396**
Optioservus sp.			2	**8**
Zaitzevia parvula				
Miscellaneous (Non-insects)				
Atractides sp.				
Hygrobates sp.			1	**4**
Lebertia sp.	8	4	3	**59**
Protzia sp.				
Sperchon sp.	7		2	**35**
Torrenticola sp.	1		1	**8**
Polycelis coronata	16	29	25	**272**
Pisidium sp.	1			**4**
Enchytraeidae	1	1		**8**
Lumbricidae				
Naididae				
Totals	**1405**	**1646**	**929**	**15444**
Shannon Weaver Diversity				**3.56**
Calculated Evenness				**0.651**
EPT				**17**
% EPT				**37.84%**
Density				**15,444**
% Non-Insect				**2.51%**
% Shredder/Scraper				**20.90%**
Taxa Richness				**44**
# Ephemeroptera Taxa				**5**
# Plecoptera Taxa				**5**
# Trichoptera Taxa				**7**
% Ephemeroptera individuals				**15.93%**
% Plectopera individuals				**1.43%**
% Trichoptera individuals				**20.48%**
# Ephemeroptera individuals				**634**
# Plectopera individuals				**57**
# Trichoptera individuals				**815**
Percent Chironomidae				**53.54%**
Clinger Taxa				**20**
% Clinger				**19.10%**
Percent Tolerant Organisms				**36.03%**
# Intolerant Taxa				**18**
Density Hydropsychidae				**265**
Ephemeroptera (estimated #/m²)				**2,460**
Plecoptera (estimated #/m²)				**223**
Trichoptera (estimated #/m²)				**3,162**
Other (estimated #/m²)				**9,599**

Table B10. Macroinvertebrate data collected from site BRC on 12 August 2022.

Blue River				
BRC		Sample		
12 August 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	3	2	4	**35**
Baetis flavistriga				
Baetis tricaudatus	43	154	96	**1136**
Diphetor hageni		1	1	**8**
Drunella doddsii				
Drunella grandis	9	25	33	**260**
Serratella tibialis				
Cinygmula sp.				
Epeorus deceptivus				
Epeorus longimanus				
Tricorythodes explicatus				
Paraleptophlebia sp.			2	**8**
Plecoptera				
Chloroperlidae				
Suwallia sp.				
Sweltsa sp.	1	1	9	**43**
Zapada cinctipes	1			**4**
Zapada oregonensis group				
Claassenia sabulosa	3	4	1	**32**
Perlodidae		5	6	**43**
Isoperla sp.				
Isoperla fulva		2		**8**
Megarcys signata				
Skwala americana	1			**4**
Trichoptera				
Brachycentrus americanus		2	4	**24**
Brachycentrus occidentalis	1	8	6	**59**
Micrasema bactro				
Glossosoma sp.	46	26	58	**504**
Arctopsyche grandis	7	21	15	**167**
Hydropsyche cockerelli	16	137	68	**857**
Ochrotrichia sp.	7		1	**32**
Lepidostoma sp.	10	15	22	**183**
Rhyacophila brunnea				
Rhyacophila coloradensis	1	5	1	**28**
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/Orthocladius sp.	11	19	23	**206**
Diamesa sp.				
Eukiefferiella sp.	9	5	6	**78**
Heleniella sp.				
Heterotrissocladius sp.				
Hydrobaenus sp.				
Micropsectra/Tanytarsus sp.	6	12	30	**187**
Nanocladius sp.				
Pagastia sp.	11	5	16	**125**
Parametriocnemus sp.				
Polypedilum sp.	2	8	1	**43**
Rheocricotopus sp.		1		**4**
Rheotanytarsus sp.	1			**4**
Stempellinella sp.	1		2	**12**
Synorthocladius sp.				
Thienemanniella sp.	1	1		**8**
Thienemannimyia genus group		4	7	**43**
Tvetenia sp.	3	30	8	**159**

Table B10. cont. Macroinvertebrate data collected from site BRC on 12 August 2022.

Other Diptera				
Atherix pachypus		1	2	**12**
Chelifera/Neoplasta sp.			1	**4**
Clinocera sp.				
Simulium sp.	5	23	34	**241**
Antocha sp.	1		1	**8**
Dicranota sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	3	1	9	**51**
Optioservus sp.	6	14	41	**237**
Zaitzevia parvula			1	**4**
Miscellaneous (Non-insects)				
Atractides sp.				
Hygrobates sp.				
Lebertia sp.				
Protzia sp.		1		**4**
Sperchon sp.	2	2	4	**32**
Torrenticola sp.			1	**4**
Polycelis coronata	1	5	11	**66**
Pisidium sp.				
Enchytraeidae				
Lumbricidae				
Naididae				
Totals	**212**	**540**	**525**	**4967**
Shannon Weaver Diversity				**3.91**
Calculated Evenness				**0.729**
EPT				**19**
% EPT				**69.22%**
Density				**4,967**
% Non-Insect				**2.11%**
% Shredder/Scraper				**24.82%**
Taxa Richness				**41**
# Ephemeroptera Taxa				**5**
# Plecoptera Taxa				**6**
# Trichoptera Taxa				**8**
% Ephemeroptera individuals				**29.21%**
% Plectopera individuals				**2.66%**
% Trichoptera individuals				**37.35%**
# Ephemeroptera individuals				**373**
# Plectopera individuals				**34**
# Trichoptera individuals				**477**
Percent Chironomidae				**17.46%**
Clinger Taxa				**22**
% Clinger				**52.47%**
Percent Tolerant Organisms				**6.11%**
# Intolerant Taxa				**18**
Density Hydropsychidae				**1,024**
Ephemeroptera (estimated #/m²)				**1,447**
Plecoptera (estimated #/m²)				**134**
Trichoptera (estimated #/m²)				**1,854**
Other (estimated #/m²)				**1,532**

Appendix C

Benthic Macroinvertebrate Data – Fall 2022

Table C1. Macroinvertebrate data collected from site BRaFG on 25 October 2022.

Blue River				
BRaFG		Sample		
25 October 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.	1			**4**
Acentrella sp.				
Baetis tricaudatus	127	87	101	**1221**
Diphetor hageni				
Drunella doddsii				
Drunella grandis				
Ephemerella dorothea infrequens				
Cinygmula sp.				
Epeorus longimanus				
Rhithrogena sp.				
Paraleptophlebia sp.				
Plecoptera				
Capnia sp.	1	4	2	**28**
Chloroperlidae			2	**8**
Sweltsa sp.				
Prostoia besametsa	1		1	**8**
Zapada cinctipes				
Zapada oregonensis group				
Claassenia sabulosa				
Diura knowltoni				
Isoperla sp.	12	7	6	**97**
Isoperla fulva				
Megarcys signata		1		**4**
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus	89	47	22	**613**
Brachycentrus occidentalis				
Micrasema bactro				
Culoptila sp.				
Glossosoma sp.				
Arctopsyche grandis				
Hydropsyche cockerelli				
Lepidostoma sp.				
Hesperophylax sp.	2	2		**16**
Rhyacophila brunnea				
Rhyacophila coloradensis				
Rhyacophila sibirica group				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.	2			**8**
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/Orthocladius sp.		1		**4**
Diamesa sp.			3	**12**
Eukiefferiella sp.			1	**4**
Heterotrissocladius sp.	2			**8**
Limnophyes sp.		1		**4**
Micropsectra/Tanytarsus sp.	1	1		**8**
Microtendipes sp.				
Nanocladius sp.				
Pagastia sp.	8	1	6	**59**
Parametriocnemus sp.				
Polypedilum sp.	1			**4**
Pseudorthocladius sp.				
Rheocricotopus sp.	4	1		**20**
Synorthocladius sp.				
Thienemannimyia genus group	1			**4**
Tvetenia sp.	3			**12**

Table C1. cont. Macroinvertebrate data collected from site BRaFG on 25 October 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.			1	**4**
Wiedemannia sp.				
Lispoides aequifrons				
Pericoma sp.			1	**4**
Simulium sp.	2	1	2	**20**
Antocha sp.				
Dicranota sp.				
Hexatoma sp.				
Tipula sp.	1			**4**
Coleoptera				
Heterlimnius corpulentus	28	13	17	**225**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	27	21	17	**252**
Protzia sp.				
Sperchon sp.	11	8	5	**94**
Torrenticola sp.		1		**4**
Physa sp.				
Gyraulus sp.	3	1		**16**
Crangonyx sp.				
Caecidotea sp.	1			**4**
Pisidium sp.				
Polycelis coronata	77	27	53	**609**
Enchytraeidae	1			**4**
Naididae				
Nematoda				
Totals	**406**	**225**	**240**	**3386**
Shannon Weaver Diversity				**2.87**
Calculated Evenness				**0.569**
EPT				**9**
% EPT				**59.13%**
Density				**3,386**
% Non-Insect				**29.05%**
% Shredder/Scraper				**2.41%**
Taxa Richness				**33**
# Ephemeroptera Taxa				**2**
# Plecoptera Taxa				**5**
# Trichoptera Taxa				**2**
% Ephemeroptera individuals				**36.28%**
% Plectopera individuals				**4.25%**
% Trichoptera individuals				**18.60%**
# Ephemeroptera individuals				**316**
# Plectopera individuals				**37**
# Trichoptera individuals				**162**
Percent Chironomidae				**4.25%**
Clinger Taxa				**11**
% Clinger				**39.72%**
Percent Tolerant Organisms				**11.48%**
# Intolerant Taxa				**10**
Density Hydropsychidae				**0**
Ephemeroptera (estimated #/m²)				**1,225**
Plecoptera (estimated #/m²)				**145**
Trichoptera (estimated #/m²)				**629**
Other (estimated #/m²)				**1,387**

Table C2. Macroinvertebrate data collected from site UBR on 25 October 2022.

Blue River				
UBR		Sample		
25 October 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	1		1	**8**
Baetis tricaudatus	40	73	60	**671**
Diphetor hageni			2	**8**
Drunella doddsii				
Drunella grandis				
Ephemerella dorothea infrequens				
Cinygmula sp.	12	16	38	**256**
Epeorus longimanus	51	89	65	**795**
Rhithrogena sp.				
Paraleptophlebia sp.				
Plecoptera				
Capnia sp.				
Chloroperlidae				
Sweltsa sp.	6	5	12	**90**
Prostoia besametsa		3	1	**16**
Zapada cinctipes				
Zapada oregonensis group				
Claassenia sabulosa				
Diura knowltoni	1	1		**8**
Isoperla sp.	4	5	5	**55**
Isoperla fulva		2	4	**24**
Megarcys signata				
Skwala americana	2	1	1	**16**
Taenionema sp.				
Trichoptera				
Brachycentrus americanus	39	45	45	**501**
Brachycentrus occidentalis				
Micrasema bactro				
Culoptila sp.				
Glossosoma sp.				
Arctopsyche grandis	10	13	14	**144**
Hydropsyche cockerelli				
Lepidostoma sp.			1	**4**
Hesperophylax sp.				
Rhyacophila brunnea	2	4	2	**32**
Rhyacophila coloradensis	2		1	**12**
Rhyacophila sibirica group				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.				
Corynoneura sp.			1	**4**
Cricotopus/Orthocladius sp.	5	2	5	**47**
Diamesa sp.	2	2	8	**47**
Eukiefferiella sp.	2	2	4	**32**
Heterotrissocladius sp.				
Limnophyes sp.				
Micropsectra/Tanytarsus sp.		1	1	**8**
Microtendipes sp.				
Nanocladius sp.				
Pagastia sp.	9	11	46	**256**
Parametriocnemus sp.			1	**4**
Polypedilum sp.			1	**4**
Pseudorthocladius sp.				
Rheocricotopus sp.			3	**12**
Synorthocladius sp.				
Thienemannimyia genus group				
Tvetenia sp.		1	2	**12**

Table C2. cont. Macroinvertebrate data collected from site UBR on 25 October 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.				
Wiedemannia sp.				
Lispoides aequifrons				
Pericoma sp.				
Simulium sp.		1		**4**
Antocha sp.	6	2	11	**74**
Dicranota sp.			1	**4**
Hexatoma sp.				
Tipula sp.		1		**4**
Coleoptera				
Heterlimnius corpulentus	29	46	90	**640**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	2		5	**28**
Protzia sp.				
Sperchon sp.			1	**4**
Torrenticola sp.		1		**4**
Physa sp.				
Gyraulus sp.				
Crangonyx sp.				
Caecidotea sp.				
Pisidium sp.			2	**8**
Polycelis coronata	5	12	24	**159**
Enchytraeidae	3	5	48	**218**
Naididae				
Nematoda				
Totals	**233**	**344**	**506**	**4213**
Shannon Weaver Diversity				**3.65**
Calculated Evenness				**0.701**
EPT				**16**
% EPT				**62.70%**
Density				**4,213**
% Non-Insect				**9.97%**
% Shredder/Scraper				**25.85%**
Taxa Richness				**37**
# Ephemeroptera Taxa				**5**
# Plecoptera Taxa				**6**
# Trichoptera Taxa				**5**
% Ephemeroptera individuals				**41.37%**
% Plectopera individuals				**4.89%**
% Trichoptera individuals				**16.44%**
# Ephemeroptera individuals				**448**
# Plectopera individuals				**53**
# Trichoptera individuals				**178**
Percent Chironomidae				**10.06%**
Clinger Taxa				**18**
% Clinger				**62.33%**
Percent Tolerant Organisms				**7.20%**
# Intolerant Taxa				**16**
Density Hydropsychidae				**144**
Ephemeroptera (estimated #/m²)				**1,738**
Plecoptera (estimated #/m²)				**209**
Trichoptera (estimated #/m²)				**693**
Other (estimated #/m²)				**1,573**

Table C3. Macroinvertebrate data collected from site Blue 5 on 26 October 2022.

Blue River				
Blue 5		Sample		
26 October 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	1	1	4	**24**
Baetis tricaudatus	12	18	20	**194**
Diphetor hageni				
Drunella doddsii				
Drunella grandis				
Ephemerella dorothea infrequens			1	**4**
Cinygmula sp.				
Epeorus longimanus				
Rhithrogena sp.				
Paraleptophlebia sp.				
Plecoptera				
Capnia sp.				
Chloroperlidae				
Sweltsa sp.		1	1	**8**
Prostoia besametsa			1	**4**
Zapada cinctipes				
Zapada oregonensis group				
Claassenia sabulosa				
Diura knowltoni				
Isoperla sp.			1	**4**
Isoperla fulva				
Megarcys signata				
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus				
Brachycentrus occidentalis				
Micrasema bactro				
Culoptila sp.				
Glossosoma sp.				
Arctopsyche grandis				
Hydropsyche cockerelli				
Lepidostoma sp.				
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis				
Rhyacophila sibirica group				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.	1			**4**
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/Orthocladius sp.	4	7	21	**125**
Diamesa sp.	2	7	20	**113**
Eukiefferiella sp.	24	12	27	**245**
Heterotrissocladius sp.				
Limnophyes sp.				
Micropsectra/Tanytarsus sp.	3	3	1	**28**
Microtendipes sp.				
Nanocladius sp.				
Pagastia sp.	6	17	19	**163**
Parametriocnemus sp.				
Polypedilum sp.	1			**4**
Pseudorthocladius sp.				
Rheocricotopus sp.				
Synorthocladius sp.				
Thienemannimyia genus group				
Tvetenia sp.	62	84	86	**900**

Table C3. cont. Macroinvertebrate data collected from site Blue 5 on 26 October 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.				
Wiedemannia sp.				
Lispoides aequifrons	3	2	7	**47**
Pericoma sp.				
Simulium sp.	2	26	50	**303**
Antocha sp.				
Dicranota sp.			1	**4**
Hexatoma sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus		1		**4**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.				
Protzia sp.				
Sperchon sp.				
Torrenticola sp.				
Physa sp.				
Gyraulus sp.				
Crangonyx sp.		1		**4**
Caecidotea sp.				
Pisidium sp.				
Polycelis coronata	18	18	68	**404**
Enchytraeidae				
Naididae				
Nematoda	1			**4**
Totals	**140**	**198**	**328**	**2590**
Shannon Weaver Diversity				**2.96**
Calculated Evenness				**0.674**
EPT				**6**
% EPT				**9.16%**
Density				**2,590**
% Non-Insect				**15.92%**
% Shredder/Scraper				**0.45%**
Taxa Richness				**21**
# Ephemeroptera Taxa				**3**
# Plecoptera Taxa				**3**
# Trichoptera Taxa				**0**
% Ephemeroptera individuals				**8.56%**
% Plectopera individuals				**0.60%**
% Trichoptera individuals				**0.00%**
# Ephemeroptera individuals				**57**
# Plectopera individuals				**4**
# Trichoptera individuals				**0**
Percent Chironomidae				**61.11%**
Clinger Taxa				**5**
% Clinger				**12.31%**
Percent Tolerant Organisms				**10.66%**
# Intolerant Taxa				**7**
Density Hydropsychidae				**0**
Ephemeroptera (estimated #/m²)				**222**
Plecoptera (estimated #/m²)				**16**
Trichoptera (estimated #/m²)				**0**
Other (estimated #/m²)				**2,352**

Table C4. Macroinvertebrate data collected from site DRD on 26 October 2022.

Blue River				
DRD		Sample		
26 October 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	4	1	12	**66**
Baetis tricaudatus	40	16	49	**407**
Diphetor hageni				
Drunella doddsii				
Drunella grandis		1	4	**20**
Ephemerella dorothea infrequens				
Cinygmula sp.				
Epeorus longimanus				
Rhithrogena sp.				
Paraleptophlebia sp.				
Plecoptera				
Capnia sp.				
Chloroperlidae				
Sweltsa sp.				
Prostoia besametsa				
Zapada cinctipes				
Zapada oregonensis group				
Claassenia sabulosa				
Diura knowltoni				
Isoperla sp.	1			**4**
Isoperla fulva				
Megarcys signata		1	1	**8**
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus				
Brachycentrus occidentalis				
Micrasema bactro				
Culoptila sp.				
Glossosoma sp.				
Arctopsyche grandis	2		5	**28**
Hydropsyche cockerelli				
Lepidostoma sp.				
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis				
Rhyacophila sibirica group				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.	1		2	**12**
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/Orthocladius sp.	7	7	16	**117**
Diamesa sp.	1	2	3	**24**
Eukiefferiella sp.	1		3	**16**
Heterotrissocladius sp.				
Limnophyes sp.				
Micropsectra/Tanytarsus sp.	3		3	**24**
Microtendipes sp.				
Nanocladius sp.				
Pagastia sp.	6	2	7	**59**
Parametriocnemus sp.				
Polypedilum sp.				
Pseudorthocladius sp.				
Rheocricotopus sp.				
Synorthocladius sp.	1			**4**
Thienemannimyia genus group				
Tvetenia sp.	6		9	**59**

Table C4. cont. Macroinvertebrate data collected from site DRD on 26 October 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.				
Wiedemannia sp.				
Lispoides aequifrons				
Pericoma sp.				
Simulium sp.				
Antocha sp.				
Dicranota sp.				
Hexatoma sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	3	1	3	**28**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	2		2	**16**
Protzia sp.			1	**4**
Sperchon sp.			1	**4**
Torrenticola sp.				
Physa sp.				
Gyraulus sp.				
Crangonyx sp.				
Caecidotea sp.				
Pisidium sp.				
Polycelis coronata	4	2	8	**55**
Enchytraeidae	1	1		**8**
Naididae				
Nematoda				
Totals	**83**	**34**	**129**	**963**
Shannon Weaver Diversity				**3.07**
Calculated Evenness				**0.710**
EPT				**6**
% EPT				**55.69%**
Density				**963**
% Non-Insect				**8.94%**
% Shredder/Scraper				**3.25%**
Taxa Richness				**20**
# Ephemeroptera Taxa				**3**
# Plecoptera Taxa				**2**
# Trichoptera Taxa				**1**
% Ephemeroptera individuals				**51.63%**
% Plectopera individuals				**1.22%**
% Trichoptera individuals				**2.85%**
# Ephemeroptera individuals				**127**
# Plectopera individuals				**3**
# Trichoptera individuals				**7**
Percent Chironomidae				**32.52%**
Clinger Taxa				**8**
% Clinger				**11.38%**
Percent Tolerant Organisms				**7.32%**
# Intolerant Taxa				**7**
Density Hydropsychidae				**28**
Ephemeroptera (estimated #/m²)				**493**
Plecoptera (estimated #/m²)				**12**
Trichoptera (estimated #/m²)				**28**
Other (estimated #/m²)				**430**

Table C5. Macroinvertebrate data collected from site Blue 3 on 26 October 2022.

Blue River				
Blue 3		Sample		
26 October 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	1	2		**12**
Baetis tricaudatus	54	44	74	**667**
Diphetor hageni	1			**4**
Drunella doddsii		1		**4**
Drunella grandis	6	2	6	**55**
Ephemerella dorothea infrequens		1		**4**
Cinygmula sp.	9	1	9	**74**
Epeorus longimanus		1	1	**8**
Rhithrogena sp.				
Paraleptophlebia sp.				
Plecoptera				
Capnia sp.				
Chloroperlidae				
Sweltsa sp.	6	4	14	**94**
Prostoia besametsa				
Zapada cinctipes	4		2	**24**
Zapada oregonensis group			3	**12**
Claassenia sabulosa				
Diura knowltoni				
Isoperla sp.	3		1	**16**
Isoperla fulva				
Megarcys signata	2	2	1	**20**
Skwala americana				
Taenionema sp.			1	**4**
Trichoptera				
Brachycentrus americanus		1		**4**
Brachycentrus occidentalis	67	14	61	**551**
Micrasema bactro				
Culoptila sp.				
Glossosoma sp.		1		**4**
Arctopsyche grandis	25	15	63	**400**
Hydropsyche cockerelli				
Lepidostoma sp.				
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis	2		2	**16**
Rhyacophila sibirica group				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.	1		3	**16**
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/Orthocladius sp.	10	4	7	**82**
Diamesa sp.				
Eukiefferiella sp.	5	7	9	**82**
Heterotrissocladius sp.				
Limnophyes sp.			1	**4**
Micropsectra/Tanytarsus sp.	5	1	8	**55**
Microtendipes sp.				
Nanocladius sp.				
Pagastia sp.	27	3	17	**183**
Parametriocnemus sp.				
Polypedilum sp.				
Pseudorthocladius sp.				
Rheocricotopus sp.				
Synorthocladius sp.				
Thienemannimyia genus group				
Tvetenia sp.	1		3	**16**

Table C5. cont. Macroinvertebrate data collected from site Blue 3 on 26 October 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.				
Wiedemannia sp.				
Lispoides aequifrons				
Pericoma sp.				
Simulium sp.				
Antocha sp.	1			**4**
Dicranota sp.				
Hexatoma sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	38	22	68	**497**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	4	6	3	**51**
Protzia sp.				
Sperchon sp.				
Torrenticola sp.				
Physa sp.				
Gyraulus sp.				
Crangonyx sp.				
Caecidotea sp.				
Pisidium sp.				
Polycelis coronata	18	23	47	**342**
Enchytraeidae	19	13	44	**295**
Naididae				
Nematoda	2			**8**
Totals	**311**	**168**	**448**	**3608**
Shannon Weaver Diversity				**3.62**
Calculated Evenness				**0.723**
EPT				**19**
% EPT				**54.69%**
Density				**3,608**
% Non-Insect				**19.31%**
% Shredder/Scraper				**5.50%**
Taxa Richness				**32**
# Ephemeroptera Taxa				**8**
# Plecoptera Taxa				**6**
# Trichoptera Taxa				**5**
% Ephemeroptera individuals				**22.98%**
% Plectopera individuals				**4.64%**
% Trichoptera individuals				**27.08%**
# Ephemeroptera individuals				**213**
# Plectopera individuals				**43**
# Trichoptera individuals				**251**
Percent Chironomidae				**12.08%**
Clinger Taxa				**16**
% Clinger				**47.46%**
Percent Tolerant Organisms				**13.48%**
# Intolerant Taxa				**18**
Density Hydropsychidae				**400**
Ephemeroptera (estimated #/m²)				**828**
Plecoptera (estimated #/m²)				**170**
Trichoptera (estimated #/m²)				**975**
Other (estimated #/m²)				**1,635**

Table C6. Macroinvertebrate data collected from site D 5 on 26 October 2022.

Blue River				
D 5		Sample		
26 October 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	1	1	3	**20**
Baetis tricaudatus	181	111	170	**1791**
Diphetor hageni	3	1	4	**32**
Drunella doddsii				
Drunella grandis	1	3	6	**39**
Ephemerella dorothea infrequens				
Cinygmula sp.	66	58	26	**582**
Epeorus longimanus	28	18	3	**190**
Rhithrogena sp.				
Paraleptophlebia sp.				
Plecoptera				
Capnia sp.				
Chloroperlidae		1		**4**
Sweltsa sp.	14	19	4	**144**
Prostoia besametsa		1		**4**
Zapada cinctipes			2	**8**
Zapada oregonensis group				
Claassenia sabulosa				
Diura knowltoni				
Isoperla sp.				
Isoperla fulva		3	3	**24**
Megarcys signata				
Skwala americana		1		**4**
Taenionema sp.				
Trichoptera				
Brachycentrus americanus			4	**16**
Brachycentrus occidentalis	208	135	332	**2617**
Micrasema bactro				
Culoptila sp.				
Glossosoma sp.	11	1		**47**
Arctopsyche grandis	24	6	30	**233**
Hydropsyche cockerelli	1	1		**8**
Lepidostoma sp.	25	9	7	**159**
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis		2		**8**
Rhyacophila sibirica group				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/Orthocladius sp.	45	49	49	**555**
Diamesa sp.	8	11	9	**109**
Eukiefferiella sp.	17	18	60	**369**
Heterotrissocladius sp.				
Limnophyes sp.				
Micropsectra/Tanytarsus sp.	2	2	4	**32**
Microtendipes sp.			1	**4**
Nanocladius sp.				
Pagastia sp.	59	88	127	**1063**
Parametriocnemus sp.				
Polypedilum sp.	10	2	13	**97**
Pseudorthocladius sp.				
Rheocricotopus sp.				
Synorthocladius sp.	1	1	1	**12**
Thienemannimyia genus group		2	39	**159**
Tvetenia sp.			1	**4**

Table C6. cont. Macroinvertebrate data collected from site D 5 on 26 October 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.	2		1	**12**
Wiedemannia sp.				
Lispoides aequifrons				
Pericoma sp.				
Simulium sp.	6	2	2	**39**
Antocha sp.	7	18	17	**163**
Dicranota sp.				
Hexatoma sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	36	87	36	**617**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	12	13	11	**140**
Protzia sp.	2	3	1	**24**
Sperchon sp.	1		1	**8**
Torrenticola sp.				
Physa sp.	1	3	2	**24**
Gyraulus sp.				
Crangonyx sp.			1	**4**
Caecidotea sp.				
Pisidium sp.				
Polycelis coronata	50	121	321	**1907**
Enchytraeidae		4		**16**
Naididae				
Nematoda		1	4	**20**
Totals	**822**	**796**	**1295**	**11308**
Shannon Weaver Diversity				**3.57**
Calculated Evenness				**0.666**
EPT				**19**
% EPT				**52.45%**
Density				**11,308**
% Non-Insect				**18.95%**
% Shredder/Scraper				**10.16%**
Taxa Richness				**41**
# Ephemeroptera Taxa				**6**
# Plecoptera Taxa				**6**
# Trichoptera Taxa				**7**
% Ephemeroptera individuals				**23.48%**
% Plectopera individuals				**1.65%**
% Trichoptera individuals				**27.33%**
# Ephemeroptera individuals				**684**
# Plectopera individuals				**48**
# Trichoptera individuals				**796**
Percent Chironomidae				**21.25%**
Clinger Taxa				**20**
% Clinger				**42.19%**
Percent Tolerant Organisms				**5.42%**
# Intolerant Taxa				**18**
Density Hydropsychidae				**241**
Ephemeroptera (estimated #/m²)				**2,654**
Plecoptera (estimated #/m²)				**188**
Trichoptera (estimated #/m²)				**3,088**
Other (estimated #/m²)				**5,378**

Table C7. Macroinvertebrate data collected from site Blue 2 on 26 October 2022.

Blue River				
Blue 2		Sample		
26 October 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	2	1	2	**20**
Baetis tricaudatus	218	215	95	**2047**
Diphetor hageni	5	6	3	**55**
Drunella doddsii		1		**4**
Drunella grandis	7	9	8	**94**
Ephemerella dorothea infrequens				
Cinygmula sp.	12	20	41	**283**
Epeorus longimanus	36	22	26	**326**
Rhithrogena sp.				
Paraleptophlebia sp.				
Plecoptera				
Capnia sp.				
Chloroperlidae				
Sweltsa sp.	6	10	10	**101**
Prostoia besametsa	1	1		**8**
Zapada cinctipes	2			**8**
Zapada oregonensis group				
Claassenia sabulosa				
Diura knowltoni				
Isoperla sp.				
Isoperla fulva	2	3	3	**32**
Megarcys signata				
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus	20	14	4	**148**
Brachycentrus occidentalis	52	45	35	**512**
Micrasema bactro			1	**4**
Culoptila sp.				
Glossosoma sp.	7	15	8	**117**
Arctopsyche grandis	7	8	9	**94**
Hydropsyche cockerelli			1	**4**
Lepidostoma sp.	49	182	80	**1206**
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis				
Rhyacophila sibirica group		2		**8**
Oligophlebodes sp.		2	2	**16**
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/Orthocladius sp.	30	43	25	**380**
Diamesa sp.	14	10	1	**97**
Eukiefferiella sp.	64	91	38	**749**
Heterotrissocladius sp.			2	**8**
Limnophyes sp.				
Micropsectra/Tanytarsus sp.	1	3	1	**20**
Microtendipes sp.		3	2	**20**
Nanocladius sp.				
Pagastia sp.	76	91	41	**807**
Parametriocnemus sp.				
Polypedilum sp.	2	10	8	**78**
Pseudorthocladius sp.			1	**4**
Rheocricotopus sp.				
Synorthocladius sp.				
Thienemannimyia genus group	5	17	12	**132**
Tvetenia sp.	1	1		**8**

Table C7. cont. Macroinvertebrate data collected from site Blue 2 on 26 October 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.	2	4		**24**
Wiedemannia sp.				
Lispoides aequifrons				
Pericoma sp.				
Simulium sp.	11	2	5	**70**
Antocha sp.	10	21	12	**167**
Dicranota sp.				
Hexatoma sp.		1		**4**
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	14	49	18	**314**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	4	17	7	**109**
Protzia sp.		1	2	**12**
Sperchon sp.		4	1	**20**
Torrenticola sp.			1	**4**
Physa sp.				
Gyraulus sp.				
Crangonyx sp.				
Caecidotea sp.				
Pisidium sp.				
Polycelis coronata	1	20	16	**144**
Enchytraeidae				
Naididae				
Nematoda			1	**4**
Totals	**661**	**944**	**522**	**8262**
Shannon Weaver Diversity				**3.83**
Calculated Evenness				**0.711**
EPT				**20**
% EPT				**61.59%**
Density				**8,262**
% Non-Insect				**3.53%**
% Shredder/Scraper				**25.95%**
Taxa Richness				**42**
# Ephemeroptera Taxa				**7**
# Plecoptera Taxa				**4**
# Trichoptera Taxa				**9**
% Ephemeroptera individuals				**34.27%**
% Plectopera individuals				**1.79%**
% Trichoptera individuals				**25.53%**
# Ephemeroptera individuals				**729**
# Plectopera individuals				**38**
# Trichoptera individuals				**543**
Percent Chironomidae				**27.88%**
Clinger Taxa				**22**
% Clinger				**28.58%**
Percent Tolerant Organisms				**11.05%**
# Intolerant Taxa				**21**
Density Hydropsychidae				**98**
Ephemeroptera (estimated #/m²)				**2,829**
Plecoptera (estimated #/m²)				**149**
Trichoptera (estimated #/m²)				**2,109**
Other (estimated #/m²)				**3,175**

Table C8. Macroinvertebrate data collected from site Blue 1 on 26 October 2022.

Blue River				
Blue 1		Sample		
26 October 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.	3	2	2	**28**
Baetis tricaudatus	135	59	203	**1539**
Diphetor hageni	31	13	4	**187**
Drunella doddsii				
Drunella grandis	3	6	6	**59**
Ephemerella dorothea infrequens	1	1		**8**
Cinygmula sp.	134	102	73	**1198**
Epeorus longimanus	116	107	82	**1183**
Rhithrogena sp.			1	**4**
Paraleptophlebia sp.		1	1	**8**
Plecoptera				
Capnia sp.	2		1	**12**
Chloroperlidae				
Sweltsa sp.	10		10	**78**
Prostoia besametsa		1		**4**
Zapada cinctipes	1		2	**12**
Zapada oregonensis group	2			**8**
Claassenia sabulosa				
Diura knowltoni				
Isoperla sp.				
Isoperla fulva	4	2	10	**63**
Megarcys signata	2			**8**
Skwala americana	3		1	**16**
Taenionema sp.			1	**4**
Trichoptera				
Brachycentrus americanus	12	4	16	**125**
Brachycentrus occidentalis	4	5	8	**66**
Micrasema bactro				
Culoptila sp.				
Glossosoma sp.	6	3	9	**70**
Arctopsyche grandis	15	10	34	**229**
Hydropsyche cockerelli		1	2	**12**
Lepidostoma sp.	205	176	71	**1752**
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis	1		2	**12**
Rhyacophila sibirica group				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.			1	**4**
Corynoneura sp.				
Cricotopus/Orthocladius sp.	27	58	68	**594**
Diamesa sp.	11	21	62	**365**
Eukiefferiella sp.	20	6	40	**256**
Heterotrissocladius sp.				
Limnophyes sp.				
Micropsectra/Tanytarsus sp.	1			**4**
Microtendipes sp.				
Nanocladius sp.	1			**4**
Pagastia sp.	10	9	7	**101**
Parametriocnemus sp.	1			**4**
Polypedilum sp.	5	1	4	**39**
Pseudorthocladius sp.				
Rheocricotopus sp.	1			**4**
Synorthocladius sp.				
Thienemannimyia genus group	1	2	2	**20**
Tvetenia sp.				

Table C8. cont. Macroinvertebrate data collected from site Blue 1 on 26 October 2022.

Other Diptera				
Atherix pachypus				
Chelifera/Neoplasta sp.				
Wiedemannia sp.				
Lispoides aequifrons				
Pericoma sp.				
Simulium sp.	1	1	60	**241**
Antocha sp.	4	2	3	**35**
Dicranota sp.				
Hexatoma sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	20	14	15	**190**
Optioservus sp.				
Miscellaneous (Non-insects)				
Lebertia sp.	1	6	3	**39**
Protzia sp.		1		**4**
Sperchon sp.	1			**4**
Torrenticola sp.				
Physa sp.				
Gyraulus sp.				
Crangonyx sp.				
Caecidotea sp.				
Pisidium sp.				
Polycelis coronata	26	8	35	**268**
Enchytraeidae				
Naididae				
Nematoda				
Totals	**821**	**622**	**839**	**8861**
Shannon Weaver Diversity				**3.67**
Calculated Evenness				**0.676**
EPT				**25**
% EPT				**75.46%**
Density				**8,861**
% Non-Insect				**3.55%**
% Shredder/Scraper				**49.08%**
Taxa Richness				**43**
# Ephemeroptera Taxa				**9**
# Plecoptera Taxa				**9**
# Trichoptera Taxa				**7**
% Ephemeroptera individuals				**47.59%**
% Plectopera individuals				**2.28%**
% Trichoptera individuals				**25.59%**
# Ephemeroptera individuals				**1086**
# Plectopera individuals				**52**
# Trichoptera individuals				**584**
Percent Chironomidae				**15.73%**
Clinger Taxa				**23**
% Clinger				**40.36%**
Percent Tolerant Organisms				**3.46%**
# Intolerant Taxa				**24**
Density Hydropsychidae				**241**
Ephemeroptera (estimated #/m²)				**4,214**
Plecoptera (estimated #/m²)				**205**
Trichoptera (estimated #/m²)				**2,266**
Other (estimated #/m²)				**2,176**

Table C9. Macroinvertebrate data collected from site SCR on 25 October 2022.

Blue River				
SCR		Sample		
25 October 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.		1	1	**8**
Baetis tricaudatus	20	7	38	**252**
Diphetor hageni	9		21	**117**
Drunella doddsii				
Drunella grandis	70	50	47	**648**
Ephemerella dorothea infrequens	3	2	44	**190**
Cinygmula sp.	7	7	68	**318**
Epeorus longimanus	21	24	104	**578**
Rhithrogena sp.				
Paraleptophlebia sp.		1		**4**
Plecoptera				
Capnia sp.				
Chloroperlidae				
Sweltsa sp.	2	1	10	**51**
Prostoia besametsa				
Zapada cinctipes	1			**4**
Zapada oregonensis group				
Claassenia sabulosa	3	1	3	**28**
Diura knowltoni				
Isoperla sp.				
Isoperla fulva	6	3	1	**39**
Megarcys signata				
Skwala americana	2	3	3	**32**
Taenionema sp.				
Trichoptera				
Brachycentrus americanus	19	25	4	**187**
Brachycentrus occidentalis	4	29	3	**140**
Micrasema bactro				
Culoptila sp.				
Glossosoma sp.	15	15		**117**
Arctopsyche grandis	8	11	2	**82**
Hydropsyche cockerelli	7	6	3	**63**
Lepidostoma sp.	44	56	365	**1803**
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis	1			**4**
Rhyacophila sibirica group				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/Orthocladius sp.	14	2	1	**66**
Diamesa sp.	3			**12**
Eukiefferiella sp.	18	12	2	**125**
Heterotrissocladius sp.				
Limnophyes sp.				
Micropsectra/Tanytarsus sp.	1		9	**39**
Microtendipes sp.				
Nanocladius sp.				
Pagastia sp.	35	23	9	**260**
Parametriocnemus sp.				
Polypedilum sp.	6	1	5	**47**
Pseudorthocladius sp.			2	**8**
Rheocricotopus sp.				
Synorthocladius sp.			2	**8**
Thienemannimyia genus group	5	2	14	**82**
Tvetenia sp.			1	**4**

Table C9. cont. Macroinvertebrate data collected from site SCR on 25 October 2022.

Other Diptera				
Atherix pachypus	19	7	53	**307**
Chelifera/Neoplasta sp.	6	5	5	**63**
Wiedemannia sp.	1			**4**
Lispoides aequifrons				
Pericoma sp.				
Simulium sp.	6	4		**39**
Antocha sp.	15	18	2	**136**
Dicranota sp.				
Hexatoma sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	18	9	49	**295**
Optioservus sp.			1	**4**
Miscellaneous (Non-insects)				
Lebertia sp.	1	1	16	**70**
Protzia sp.			1	**4**
Sperchon sp.	2	1	11	**55**
Torrenticola sp.				
Physa sp.				
Gyraulus sp.				
Crangonyx sp.				
Caecidotea sp.				
Pisidium sp.				
Polycelis coronata	46	16	55	**454**
Enchytraeidae				
Naididae				
Nematoda				
Totals	**438**	**343**	**955**	**6747**
Shannon Weaver Diversity				**4.05**
Calculated Evenness				**0.757**
EPT				**20**
% EPT				**69.18%**
Density				**6,747**
% Non-Insect				**8.64%**
% Shredder/Scraper				**52.25%**
Taxa Richness				**41**
# Ephemeroptera Taxa				**8**
# Plecoptera Taxa				**5**
# Trichoptera Taxa				**7**
% Ephemeroptera individuals				**31.39%**
% Plectopera individuals				**2.25%**
% Trichoptera individuals				**35.54%**
# Ephemeroptera individuals				**545**
# Plectopera individuals				**39**
# Trichoptera individuals				**617**
Percent Chironomidae				**9.62%**
Clinger Taxa				**20**
% Clinger				**44.87%**
Percent Tolerant Organisms				**4.32%**
# Intolerant Taxa				**21**
Density Hydropsychidae				**145**
Ephemeroptera (estimated #/m²)				**2,115**
Plecoptera (estimated #/m²)				**154**
Trichoptera (estimated #/m²)				**2,396**
Other (estimated #/m²)				**2,082**

Table C10. Macroinvertebrate data collected from site BRC on 25 October 2022.

Blue River				
BRC		Sample		
25 October 2022	1	2	3	**Estimated #/m²**
Ephemeroptera				
Ameletus sp.				
Acentrella sp.				
Baetis tricaudatus	17	37	25	**307**
Diphetor hageni				
Drunella doddsii				
Drunella grandis	3	1	4	**32**
Ephemerella dorothea infrequens	16	28	31	**291**
Cinygmula sp.	6	1	6	**51**
Epeorus longimanus		2		**8**
Rhithrogena sp.				
Paraleptophlebia sp.				
Plecoptera				
Capnia sp.				
Chloroperlidae				
Sweltsa sp.				
Prostoia besametsa				
Zapada cinctipes				
Zapada oregonensis group				
Claassenia sabulosa	1	9	5	**59**
Diura knowltoni				
Isoperla sp.				
Isoperla fulva	1	2	1	**16**
Megarcys signata				
Skwala americana				
Taenionema sp.				
Trichoptera				
Brachycentrus americanus	1	2	2	**20**
Brachycentrus occidentalis				
Micrasema bactro				
Culoptila sp.			1	**4**
Glossosoma sp.	106	166	228	**1938**
Arctopsyche grandis	5	1	2	**32**
Hydropsyche cockerelli	28	23	24	**291**
Lepidostoma sp.	4	5	3	**47**
Hesperophylax sp.				
Rhyacophila brunnea				
Rhyacophila coloradensis		1	1	**8**
Rhyacophila sibirica group				
Oligophlebodes sp.				
Diptera				
Chironomidae				
Brillia sp.				
Cardiocladius sp.				
Corynoneura sp.				
Cricotopus/Orthocladius sp.		1	2	**12**
Diamesa sp.				
Eukiefferiella sp.	4	4	2	**39**
Heterotrissocladius sp.	1			**4**
Limnophyes sp.				
Micropsectra/Tanytarsus sp.		1	1	**8**
Microtendipes sp.			1	**4**
Nanocladius sp.				
Pagastia sp.	1		1	**8**
Parametriocnemus sp.				
Polypedilum sp.				
Pseudorthocladius sp.		1	1	**8**
Rheocricotopus sp.				
Synorthocladius sp.				
Thienemannimyia genus group		1	6	**28**
Tvetenia sp.	1			**4**

Table C10. cont. Macroinvertebrate data collected from site BRC on 25 October 2022.

Other Diptera				
Atherix pachypus	1			**4**
Chelifera/Neoplasta sp.		2		**8**
Wiedemannia sp.				
Lispoides aequifrons				
Pericoma sp.				
Simulium sp.	34	113	26	**671**
Antocha sp.	7	3	8	**70**
Dicranota sp.				
Hexatoma sp.				
Tipula sp.				
Coleoptera				
Heterlimnius corpulentus	5	4	12	**82**
Optioservus sp.		2	6	**32**
Miscellaneous (Non-insects)				
Lebertia sp.		1		**4**
Protzia sp.			1	**4**
Sperchon sp.	1	1	2	**16**
Torrenticola sp.				
Physa sp.	1			**4**
Gyraulus sp.				
Crangonyx sp.				
Caecidotea sp.				
Pisidium sp.				
Polycelis coronata	1	2	2	**20**
Enchytraeidae	1			**4**
Naididae	1			**4**
Nematoda				
Totals	**247**	**414**	**404**	**4142**
Shannon Weaver Diversity				**2.83**
Calculated Evenness				**0.547**
EPT				**14**
% EPT				**75.02%**
Density				**4,142**
% Non-Insect				**1.31%**
% Shredder/Scraper				**51.17%**
Taxa Richness				**36**
# Ephemeroptera Taxa				**5**
# Plecoptera Taxa				**2**
# Trichoptera Taxa				**7**
% Ephemeroptera individuals				**16.62%**
% Plectopera individuals				**1.78%**
% Trichoptera individuals				**56.62%**
# Ephemeroptera individuals				**177**
# Plectopera individuals				**19**
# Trichoptera individuals				**603**
Percent Chironomidae				**2.72%**
Clinger Taxa				**20**
% Clinger				**87.79%**
Percent Tolerant Organisms				**1.97%**
# Intolerant Taxa				**17**
Density Hydropsychidae				**323**
Ephemeroptera (estimated #/m²)				**689**
Plecoptera (estimated #/m²)				**75**
Trichoptera (estimated #/m²)				**2,340**
Other (estimated #/m²)				**1,038**

Timberline Aquatics, Inc.
4219 Table Mountain Place, Suite A
Fort Collins, Colorado 80526