Mountain Studies Institute
SAN JUAN MOUNTAINS, COLORADO

Animas River 2015 Benthic Macroinvertebrate (BMI) Report
Gold King Mine Release Monitoring

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List of Abbreviations and Acronyms

BMI	Benthic Macroinvertebrate
CDPHE	Colorado Department of Public Health and Environment
EPA	Environmental Protection Agency
HBI	Hilsenhoff Biotic Index *(see table 2)*
MMI	Multi-metric Index *(see table 2)*
MSI	Mountain Studies Institute

1. Executive Summary

The Gold King Mine release occurred on August 5th, 2015 and caused mine wastewater to enter Cement Creek and ultimately the Animas and San Juan Rivers. The release caused a severe, but brief spike in metal concentrations in the Animas River, raising concerns about potential impacts to aquatic life. The incident occurred in a highly mineralized zone of the San Juan Mountains where high metal concentrations from natural and mine-related sources have contributed to a long history of degraded water quality in the Animas River watershed.

Mountain Studies Institute (MSI) surveyed benthic macroinvertebrate (BMI) populations along the Animas River from Silverton to Durango and analyzed potential impacts to these populations at two temporal scales. First, we assessed the immediate survival of BMI populations at three locations on the Animas River. Then, using data from fifteen locations in the Animas River watershed, we compared observations of BMI populations from the fall of 2014, prior to the Gold King Mine release, to observations from the fall of 2015, approximately two months after the release.

Our objective was to determine whether BMI populations in the Animas River were impacted by the Gold King Mine release. Specifically, we investigated: 1) whether the Gold King Mine release negatively affected BMI community composition; 2) whether species known to be sensitive to metal contamination were impacted as a result of the Gold King Mine release; and 3) whether the Gold King Mine release caused a change in metal concentrations in the tissue of BMIs.

Our data suggest:

- During the Gold King Mine release, aluminum concentrations in the Animas River in Durango surpassed the Colorado Department of Health and Environment (CDPHE) acute (short-term) water quality standard for aquatic life (MSI 2016). However, BMI populations in the Animas River from Silverton to Durango appear to have largely survived exposure to high metal concentrations associated with the Gold King Mine release. Additionally, Colorado Parks and Wildlife data indicate that fish populations in the Animas River were not impacted by the Gold King Mine release (White 2016).

- We found no evidence that BMI families known to be sensitive to metal contamination (Heptageniidae, Ephemerellidae, and Taeniopterygidae) were extirpated as a result of the Gold King Mine release.

- BMI community composition and structure do not appear to have been altered by the Gold King Mine release. We found no statistically significant difference in any BMI community health metric between 2014 and 2015, indicating that the Gold King Mine release did not consistently alter BMI community structure at surveyed sites in the Animas River.

- The Gold King Mine release does not appear to have caused an increase in the macroinvertebrate tissue concentration of most metals and minerals. However, copper tissue concentrations were higher in 2015 than in 2014 at all sites affected by the Gold King Mine release. Additionally, at a sampling site below Silverton on the Animas River (site A72), aluminum and iron tissue concentrations were higher in 2015 than in 2014.

In conclusion, the 2015 BMI data do not indicate that there were substantial impacts to BMI communities from the Gold King release, with the exception of elevated tissue concentrations of copper, aluminum, and iron at some sites. However, these findings should be interpreted within the historical context of metal contamination within the Animas River watershed. BMI communities have long been stressed by long-term exposure to mine-related impacts and other factors prior to the Gold King Mine release (EPA 2015). BMI species that are most sensitive to metal contamination (Heptageniidae, Ephemerellidae, and Taeniopterygidae) are either absent or occur at a low diversity in large portions of the Animas River, which reduces the ability to detect an impact from the Gold King Mine release. It is possible that we could have seen a greater impact to aquatic life from the Gold King Mine release in parts of the Animas River if the resident aquatic life had not already been impacted by long-term exposure to metals. Although we found no evidence of lethal impacts to aquatic life, sub-lethal impacts, such as reduced reproduction potential are possible and should be examined by assessing the survival of subsequent generations of fish and BMIs.

2. Introduction

On August 5, 2015, a plume of water containing high metal concentrations was released from the Gold King Mine into Cement Creek and ultimately the Animas and San Juan Rivers. The circumstances of the release (USBR 2015) and its impacts to water quality (MSI 2016) have been reported elsewhere. This report details impacts to the benthic macroinvertebrate (BMI) community within the first three months following the release. Data were collected for this research by Mountain Studies Institute (MSI) with financial support from the Environmental Protection Agency (EPA).

The Gold King Mine release caused a severe, but brief spike in the total and dissolved concentration of metals and minerals downstream of the Gold King Mine. For example, when the plume of mine wastewater reached Durango, Colorado, the total concentration of several metals (including aluminum, iron, lead, copper, and zinc) in the Animas River increased by 500%, but returned to pre-release levels within 24 hours (MSI 2016). As the plume moved downstream, the mine wastewater was diluted and as pH increased, metals were transformed from a dissolved to a particulate state. EPA (2016) estimates that most of the total metal load carried within the wastewater was deposited in the Animas riverbed prior to reaching the San Juan River. Possible impacts from the Gold King Mine release on aquatic life include short term exposure to the elevated metals within the wastewater plume itself, as well as longer term impacts from aquatic life

interacting with potentially contaminated sediment that was deposited during the release.

The Gold King Mine release occurred in a highly mineralized zone of the San Juan Mountains where high metal concentrations from natural and mine-related sources have contributed to a long history of degraded water quality in the Animas River. Extensive research has been conducted on the impacts to aquatic life, including BMIs, from the legacy of historic mining in the upper portion of the Upper Animas watershed (Anderson 2000; Anderson 2007a; Courtney and Clements 2002; Smith 1976; etc.). Prior to the Gold King Mine release, the EPA (2015) evaluated the potential risks to the environment from metal contamination of water and sediments in the Upper Animas watershed. Their research concluded that due to elevated metal concentrations, fish have largely been eliminated in the Animas River from the confluence with Mineral Creek to the confluence with Elk Creek, and that BMI communities are impaired in the Animas River from Silverton to Baker's Bridge. Anderson (2007b) documented a decline in BMI diversity in 2003 and 2005 in the Animas River from Baker's Bridge to Durango and attributed the decline to multiple stressors including metal concentrations, habitat degradation, sediment, and excessive nutrients.

There is an abundance of research describing the effects of metal-contaminated water on aquatic life (e.g., Besser and Leib 2001; Brinkman and Johnston 2008; Brinkman and Johnston 2012; Clements 1994; Farag et al. 2007; Iwasaki et al. 2009; Nehring 1976; Schmidt et al. 2002; Vuori 1995; Warnick and Bell 1969; Yuichi et al. 2009). Elevated metal concentrations can cause direct and indirect effects on aquatic life. For example, the precipitation of iron on body surfaces of aquatic organisms can damage gills and interfere with respiration and osmoregulation (Vuori 1995). Aquatic organisms can also be exposed to metals through ingestion of sediment and suspended particles, or by uptake of metals dissolved in solution (John and Leventhal 1995; Luoma 1983). Toxicity varies greatly between metals, but dissolved metals are generally more biologically available and thus pose a greater threat to aquatic life than metals in a solid state (Luoma 1983). Precipitation of metals on river substrate can indirectly affect aquatic life by smothering potential habitat, filling interstitial spaces, preventing the growth of aquatic vegetation, and altering food resources (Vuori 1995).

2.1 Objectives

The Gold King Mine release caused a severe, but brief, spike in concentrations of several metals in the Animas River, raising concern about potential impacts to aquatic life. Concentrations of aluminum in the Animas River in Durango surpassed Colorado Department of Public Health and Environment (CDPHE) aquatic life acute (short-term) water quality standards during the release (MSI 2016). MSI surveyed BMI populations along the Animas River from above Silverton to Durango and analyzed potential impacts to these populations at two temporal scales. First, we assessed the immediate survival of BMI populations at three locations on the Animas River. Then, using data from fifteen locations in the Animas River watershed, we compared observations of BMI populations

from the fall of 2014, prior to the Gold King Mine release, to observations from the fall of 2015. In this report, we address the following questions:

1) Did the Gold King Mine release negatively affect BMI community health?
2) Were species known to be sensitive to metal contamination impacted as a result of the Gold King Mine release?
3) Did the Gold King Mine release cause a change in metal concentrations in the tissue of BMIs?

3. Methods

3.1 Monitoring Locations

We collected macroinvertebrate samples from fifteen sites along the mainstem and tributaries of the Animas River from above Silverton to downstream of Durango, Colorado (see map in Appendix A). The Gold King Mine release caused a plume of mine waste water to enter Cement Creek and then the Animas River at a location downstream of A68, but upstream of A72. Sites on the Animas River upstream of Cement Creek, including A68, were not exposed to the Gold King Mine release. Animas River tributaries, such as Elk Creek and Cascade Creek, were not exposed to the Gold King Mine release.

All sites except Rotary Park and Oxbow Park have previously been sampled for BMIs by various organizations (e.g., Anderson 2000; Anderson 2007b; EPA 2015; Roberts 2015). Previous data include those collected in the fall of 2014, the year prior to the Gold King Mine release, which allowed for before/after data comparisons (Table 1).

3.2 Sampling Methodology

3.2.1 BMI Community Sampling in 2014 and 2015

In order to allow direct comparison to historical Animas River BMI dataset, we replicated a BMI sampling method (to the greatest extent possible) that was developed by Chester Anderson and used previously within the Animas River watershed (Anderson 2007a; personal communication). Anderson's method utilized and modified protocols developed by the EPA (Barbour et al. 1999) and CDPHE (CDPHE 2010a).

Anderson (2007a) assessed a variety of BMI sampling methods and determined that the most appropriate method for use in the Animas River was a targeted riffle method that utilized a modified rectangular dip net coupled with a dolphin bucket. The size of the net opening was 46 cm by 25 cm or 0.115 m^2 (178 in^2). In 2014 and 2015, we implemented this methodology using the same rectangular dip net used in Anderson's previous Animas River BMI sampling. We collected each sample by placing the net securely on the bottom of the river with the net opening facing upstream. A biologist stood downstream of the net and disturbed the substrate on the river bottom that was immediately upstream of the net. We lifted and scrubbed rocks and gravel by hand for approximately 90 seconds to ensure that BMIs would be dislodged and drift downstream into the net

opening. For each sample, we disturbed an area of approximately 0.115 m^2 of substrate identical to the size of the net opening. For each site, we obtained five samples diagonally across riffle habitat within an approximately 100 meter-long section of the river. We then composited the five samples into a single sample container. In total, 0.575 m^2 (890 in^2) of riffle habitat comprised the sample at each site (0.115m^2 x 5 samples). Two locations did not have existing historical BMI data, Rotary Park and Oxbow Park. For these two locations, we used a sampling protocol that was identical to the methodology outlined above, except that we increased the area of habitat sampled to more closely follow the EPA protocol described in Barbour and others (1999). At Rotary Park, we used a triangular dip net to collect twenty samples from a 50 meter-long section of river. We composited the twenty samples into a single sample container representing 0.8 m^2 (1240 in^2) of riffle habitat. At Oxbow Park, we used a modified rectangular dip net coupled with a dolphin bucket to collect twenty samples from a 100 meter-long section of depositional habitat. Following the methodology of Barbour and others (1999), we sampled a greater area of substrate at Oxbow Park since it was depositional habitat instead of riffle habitat. We composited the 20 samples from Oxbow Park into a single sample container representing 3.0 m^2 of depositional habitat.

We choose to replicate Anderson's sampling method using a rectangular dip net in order to keep sampling methodologies consistent across years. Using a hess or surber sampler may provide a more precise measure of BMI density, but since we sampled a consistent amount of habitat at each site, we can look at the relative difference of BMI density or abundance among sites.

3.2.2 BMI Tissue Sampling in 2014 and 2015

After community sampling was complete, we collected a second BMI sample from each site to analyze for tissue metal concentrations. We collected specimens in a similar manner as described in section 3.2.1. Using forceps and a fine mesh net, we triple rinsed each specimen in deionized water before combining all specimens into a community composite sample for each site. To meet laboratory analysis requirements, we attempted to collect at least two grams of wet weight BMI tissue for each site. We kept samples cold (between 2-6 degrees Celsius) and shipped on ice to EPA Region 8 laboratory for analysis.

3.3 Laboratory Methods

3.3.1 BMI Community Samples

Samples collected in 2014 and on August 6, 7, and 8, 2015 were identified by Timberline Aquatics in Fort Collins, Colorado (www.timberlineaquatics.com).

All other 2015 samples were identified by Scott Roberts (aquatic ecologist, MSI) and Dr. Michael Bogan (aquatic ecologist, University of Arizona). We sub-sampled each field sample using a rotating drum splitter until a minimum of 500 organisms was obtained. Using a 10x microscope, we identified organisms to the lowest practical taxonomic level

based on Merrit and Cummings (1996). Dr. Bogan identified all Chironomidae and Acari taxa and served as a second taxonomist for our quality assurance program by independently verifying at least 10% of all taxa.

3.3.2 BMI Tissue Samples

Tissue metal concentrations were analyzed by the EPA Region 8 laboratory in Golden, Colorado using EPA analytical methods EPA 200.2, 200.7, and 200.8. The entire body of BMIs were analyzed, which included metals in internal organs, on gill surfaces, and elsewhere in the body.

3.4 Data Analysis

3.4.1 Data Preparation

Historical datasets that have been identified by different taxonomists are often problematic to analyze. For example, different taxonomists may identify organisms to varying taxonomic levels (e.g., order, family, sub-family, genus), which can result in ambiguous taxonomic identifications. For this study, we implemented a method of resolving ambiguous taxonomic identifications described by Cuffney and others (2007). For example, if some specimens were identified to species (e.g., *Eukiefferiella brehmi*), but other specimens were only identified to genus (e.g., *Eukiefferiella*), we used the coarser level of identification (e.g., genus instead of species) so that samples were comparable.

3.4.2 BMI Metrics

A number of metrics have been developed to assess the composition and health of BMI communities (Table 2). Many of these metrics can also be used as evidence of the overall condition of the habitat and water quality of an aquatic system. Table 2 presents BMI metrics in order of their applicability to BMI communities that are exposed to elevated metal concentrations.

3.4.3 Ecological Data Application System (EDAS)

We utilized the Ecological Data Application System (EDAS) developed by CDPHE to standardize data and calculate metrics including the Colorado Multi-metric Index (MMI). In order to eliminate potential bias from differing sample sizes, EDAS employs an algorithm to subsample all samples to a fixed count of 300 individuals. All metrics discussed in this report and depicted in Figures 1-12 are based on the subsampled data.

3.4.4 Statistical Analysis

Using JMP statistical software (JMP 2013), we conducted paired t-tests to determine whether any changes in BMI metrics from 2014 to 2015 were consistent across all sites that were exposed to the Gold King Mine release.

4. Results

4.1 BMI Community Composition

4.1.1 Initial Survival

On August 6th, approximately ten hours before the Gold King Mine plume arrived in Durango, we collected BMI samples from the Animas River at two sites: 32nd Street and Rotary Park. We collected follow-up samples at four sites (32nd Street, Rotary Park, A72, and A68) approximately 24-hours and 1-week after the Gold King Mine release.

Rotary Park, 32nd Street, and A72 are downstream of the Gold King Mine and thus potentially were affected by the release. Site A68 is upstream of Cement Creek and served as a reference site that was not exposed to the Gold King Mine release.

Durango Initial Survival Results

There is no indication that the Gold King Mine release impacted initial taxa richness, EPT taxa richness, or the richness of metal sensitive mayfly families (Ephemerellidae and Heptageniidae) at the Durango sampling sites, 32nd Street and Rotary Park (Figures 1, 2, and 3). At these two sites we found that an ephemerellid mayfly, *Drunella grandis* was present in all samples collected after the Gold King Mine release, indicating that this metal-sensitive species had survived exposure to the Gold King Mine plume. Taxa richness and EPT richness did not decline immediately following the Gold King Mine release, which suggests that all taxa survived initial exposure to the Gold King Mine plume at 32nd Street and Rotary Park.

EPT richness did decrease at Rotary Park from five taxa on August 7th to four taxa on August 13th, driven by a single *Isoperla* stonefly individual that was collected on August 7th, but not on August 13th (Appendix C). *Isoperla* is rare in the Durango stretch of the Animas River and was not captured at Rotary Park on August 6th prior to the Gold King Mine release or in any other samples from adjacent sites (32nd Street, Above Lightner Creek, or Purple Cliffs) in 2014 or 2015. Due to the rarity and singular occurrence of *Isoperla,* we cannot confidently attribute the decrease of one EPT taxon from August 7th to August 13th to the Gold King Mine release.

In addition to richness measures, we examined BMI abundance among sites to assess whether the Gold King Mine release caused mortality of a subset of BMI population (Figure 4). To test this possibility, we compared BMI abundances on August 6th, prior to the Gold King Mine release's arrival in Durango, to August 13th, approximately one week after the Gold King Mine release. We found no evidence that any BMI taxon, including *Drunella grandis* (a taxon sensitive to metal contamination), consistently decreased in abundance from August 6th to August 13th at either Rotary Park or 32nd Street. We found a small decrease in overall BMI abundance at 32nd Street, but a large increase in BMI abundance at Rotary Park. Most of the dominant taxa increased in abundance from August 6th to August 13th. The only decreases in abundance that occurred during this

time period were for *Eukiefferiella* and *Brachycentrus* at 32nd Street, but these same taxa increased in abundance at Rotary Park (Appendix C).

Silverton Initial Survival Results

The initial survival data from A72 in Silverton are more limited than the data from Rotary Park and 32nd Street in Durango. We were not able to collect a BMI sample from A72 (located below Cement Creek in the Animas River) immediately prior to the Gold King Mine release, so we could not assess the immediate impacts using before and after BMI data as we were able to do for the Rotary Park and 32nd Street sites. We did find that taxa richness and EPT richness increased from August 8th to August 12th at A72, indicating that the BMI population did not decline in health over this time period (Figures 1 and 2). Mayfly families known to be sensitive to elevated metals (Heptageniidae and Ephemerellidae) did not occur at A72 at any date in 2014 or 2015. Thus, we cannot use those families as indicators of Gold King Mine release impacts.

Initial Survival Conclusions

Within the immediate seven days following the Gold King Mine release, we found no evidence that the BMI community in the Durango stretch of the Animas River was negatively impacted by the release. These data indicate that the Gold King Mine release does not appear to have caused any extirpations or decreases in abundances of any taxa known to be sensitive to metals. It is important to note that A72, Rotary Park, and 32nd Street were already considered impaired in 2014 by the Colorado Multi-metric index before the Gold King Mine release occurred (Figure 5). Additionally, taxa that are thought to be most sensitive to metal contamination were largely absent from these sites before the release. This suggests that the BMI population at these sites, and especially at A72, may already be impacted by long-term exposure to metal contamination, which reduces our ability to detect further impacts that may have resulted from the Gold King Mine release.

4.1.2 Depositional Habitat at Oxbow Park

Depositional Habitat at Oxbow Park

Most BMI assessments in the Animas River watershed have historically focused on riffle habitat. Following the Gold King Mine release, there was concern that impacts to aquatic life could have occurred in depositional habitat as well as riffle habitat, especially in locations where sediment potentially containing high concentrations of metals were deposited. In order to assess the survival of the benthic community in depositional habitat, we established a new BMI monitoring location at Oxbow Park, specifically targeting the depositional habitat along the margin of a bend in the Animas River.

We conducted a BMI survey at Oxbow Park on September 18, 2015, when the benthic community would have been exposed to sediment deposited during the Gold King Mine plume for over one month. The community had a density of approximately 2,498

individuals per square meter and was dominated by Diptera taxa. We do not have BMI data from Oxbow Park prior to the Gold King Mine release so we cannot conclusively determine how the Gold King Mine release may have impacted the benthic community at this site. However, the presence of 19 distinct taxa at a density comparable to riffle habitat indicates that the sediment deposited during the Gold King Mine release likely did not result in complete widespread mortality within depositional habitat.

4.1.3 BMI community composition in 2014 (pre-Gold King Mine release) compared to 2015 (post-Gold King Mine release)

We calculated a number of metrics describing the BMI population before (fall of 2014) and after (fall of 2015) the Gold King Mine release at sites that were and were not exposed to the Gold King Mine release. We put these results in context of reference sites that were not exposed to the Gold King Mine release (Figures 5-12). Although some sites showed changing measures of BMI community composition, these changes are not attributable to the Gold King Mine release, because similar changes to BMI community composition also occurred in reference sites.

The use of reference sites is particularly important to BMI studies because of the temporally dynamic nature of BMI populations. Examining changes in BMI community health at a single site could result in misleading conclusions. For example, from 2014 to 2015, EPT richness declined at A72. Since A72 was exposed to the Gold King Mine release, one may inappropriately conclude that the decline was solely attributable to the Gold King Mine release. However, EPT richness declined at a similar magnitude from 2014 to 2015 at three sites that were not exposed to the Gold King Mine release (A55, A60 and A68). Because this decline in EPT richness occurred at sites that were exposed to the Gold King Mine release as well as sites that were not exposed, this decline cannot be solely attributed to the Gold King Mine release.

In order to determine whether any changes in BMI populations from 2014 to 2015 were consistent across all sites that were exposed to the Gold King Mine release, we used a statistical technique called a paired t-test. We found no statistically significant difference in any BMI metric between 2014 and 2015, indicating that the Gold King Mine release did not consistently alter BMI community health or structure at surveyed sites in the Animas River. Table 3 presents p values for MMI, Total Richness, EPT Richness, HBI, and total BMI abundance.

Sensitive Family Richness

There was no decline in the richness of BMI families known to be sensitive to elevated metals (Heptageniidae, Ephemerellidae, and Taeniopterygidae) between 2014 and 2015 at any site affected by the Gold King Mine release (Figures 9, 10, 11). Site A68, located upstream of Cement Creek and unaffected by the Gold King Mine release, is the only site to have a decline in richness of any of these sensitive families.

Orthocladiinae Richness

Orthocladiinae midges, which are known to be tolerant of metal contamination, increased in richness from 2014 to 2015 at several sites exposed to the Gold King Mine release (Figure 12). However, Orthocladiinae richness also increased from 2014 to 2015 at Elk and Cascade Creeks, which were not exposed to the Gold King Mine release. This indicates that the increase in Orthocladiinae richness is likely attributable to a phenomena occurring throughout the watershed and unrelated to the Gold King Mine release.

MMI Impairment

The Colorado Multi-metric Index (MMI) indicates that many sites in the Animas River watershed are impaired (Figure 5). Impairment was generally consistent between 2014 and 2015. However, the BMI community health at three sites degraded from being in attainment in 2014 to being impaired in 2015: A73EC, A60, and James Ranch. Of these three sites, James Ranch was the only site exposed to the Gold King Mine release. Since A73EC and A60 were not exposed to the Gold King Mine release, but exhibited a similar decline in BMI health as James Ranch, it cannot be concluded that the Gold King Mine release singularly caused the decline at James Ranch. The temporal fluctuations in MMI scores could instead be due to seasonal or annual variability.

The general spatial pattern of BMI community composition in the Animas River watershed was unaltered by the Gold King Mine release. In both 2014 and 2015, BMI community health declined from A55 to A68 and further declined at site A72 located, downstream of Cement and Mineral Creeks. Then, BMI community health improved from A72 to James Ranch, but degraded again in the Durango stretch of the Animas River. These spatial patterns persist across years indicating that prior to the Gold King Mine release, BMI communities in the upper portion of the Animas watershed have been stressed by long-term exposure to mine-related impacts (EPA 2015) and BMI communities in the lower portion of the watershed have been stressed by multiple factors including metals, habitat degradation, sediment, and excessive nutrients (Anderson 2007b).

4.2 BMI Tissue Metal Concentrations

We used a paired t-test to determine if there was a difference in tissue metal concentrations from 2014 to 2015 that was consistent across all sites exposed to the Gold King Mine release. Table 4 presents p values for aluminum, cadmium, copper, iron, manganese, lead, and zinc. The Gold King Mine release does not appear to have caused an increase in the macroinvertebrate tissue concentration of most metals and minerals (Figures 1-24 in Appendix B). However, copper tissue concentrations were higher in 2015 than in 2014 at all sites affected by the Gold King Mine release (i.e., reference sites and sites upstream of Cement Creek did not have higher copper tissue concentrations in 2015, but sites downstream of Cement Creek did have higher copper tissue concentrations in 2015) (Figure 10 in Appendix B). Aluminum and

iron tissue concentrations were higher in 2015 than in 2014 at all sites affected by the Gold King Mine release except at A73 (Animas, above Elk Creek). The observation of higher aluminum and iron tissue concentrations in 2015 compared to 2014 is most pronounced at A72 (Figures 1 and 11 in Appendix B).

The higher and more persistent increase in copper tissue concentrations relative to other metals could be attributable to the high proportion of copper that historically has occurred in water draining the Gold King Mine. USGS data from 2012 indicates that approximately 40% of the copper load from the Silverton area originates from the Gold King Mine (Runkel et al. 2016). Data collected one week after the Gold King Mine release from Cement Creek indicates that dissolved copper increased more than any other metal when compared to observations from 2009-2014 (Runkel et al. 2016). Similarly, copper in stream sediment in the Animas River below Silverton increased more than any other metal following the Gold King Mine release (Runkel et al. 2016). It is known that copper increases in BMI tissue proportionally to copper levels in sediment and the water column (Goodyear and McNeill 2009).

In addition to these temporal observations, there were several spatial patterns of tissue concentrations that generally occurred in both 2014 and 2015:

1) Decrease in tissue concentrations from A55 to A56: *Al, Ba, Cd, Cu, Mn, Zn*

2) Increase in tissue concentrations from A56 to A68: *Al, Cd, Cu, Fe, Pb*

3) Increase in tissue concentrations from A68 to A72: *Al, Fe*

4) Decrease in tissue concentrations from A68 to A72: *Cd, Mn, Pb, Zn*

5) Elevated tissue concentrations (higher relative to nearest sites: Baker's Bridge, James Ranch, 32nd Street, Purple Cliffs) in BMI inhabiting the depositional habitat at Oxbow Park: *Al, Ba, Fe, K, Pb*

6) Elevated tissue concentrations in the Durango area (higher relative to sites upstream in the Animas River Canyon: A73, A75D, Baker's Bridge): *As, Ba, Ca, Cr, Co, Mg, Mn, Ni, Pb*

5. Conclusions, Research Recommendations, and Further Questions

2015 Animas River BMI data suggest the following conclusions:

- During the Gold King Mine release, concentrations of aluminum in the Animas River in Durango surpassed the CDPHE acute (short-term) water quality standard for aquatic life (MSI 2016). However, BMI populations in the Animas River from Silverton to Durango appear to have largely survived exposure to high metal concentrations associated with the Gold King Mine release. Additionally,

Colorado Parks and Wildlife data indicate that fish populations in the Animas River were not impacted by the Gold King Mine release (White 2016).

- We found no evidence that BMI families known to be sensitive to metal contamination (Heptageniidae, Ephemerellidae, and Taeniopterygidae) were extirpated as a result of the Gold King Mine release.

- BMI community composition and structure do not appear to have been altered by the Gold King Mine release. We found no statistically significant difference in any BMI community health metric between 2014 and 2015, indicating that the Gold King Mine release did not consistently alter BMI community structure at surveyed sites in the Animas River.

- The Gold King Mine release does not appear to have caused an increase in the macroinvertebrate tissue concentration of most metals and minerals. However, copper tissue concentrations were higher in 2015 than in 2014 at all sites affected by the Gold King Mine release. Additionally, at A72, aluminum and iron tissue concentrations were higher in 2015 than in 2014.

In conclusion, the 2015 data do not indicate that there were substantial impacts to BMI communities from the Gold King Mine release, with the exception of elevated tissue concentrations of copper, aluminum, and iron at some sites. The elevated tissue concentrations warrant further research. To date, impacts to BMIs from aqueous metal concentrations have generally been assessed in relation to the larval stage. However, recent research indicates that BMIs may be more sensitive to metal concentrations at later life stages, such as during metamorphosis or emergence. Wesner and others (2014) demonstrate that aqueous zinc concentrations that are not lethal to mayfly larvae become lethal during metamorphosis. They documented that with increasing aqueous zinc concentrations, mayflies had reduced body size, reduced wingpad development, and a reduced rate of survival during the transition to subimago and imago life stages. Wesner and others (2014) and Schmidt and other (2013) suggest that water quality standards need to be reevaluated to protect not just the larval life stage, but also the adult life stage. Although we found no evidence of lethal impacts to aquatic life, sub-lethal impacts, such as reduced reproduction potential, are possible and should be examined by assessing the survival of subsequent generation of fish and BMIs.

The level of metals in macroinvertebrate tissue reflect the overall bioavailability of metals in a system (Kiffney and Clements 1993). We found higher levels of copper in BMI tissue following the Gold King Mine release, which may indicate a greater bioavailability of copper in the Animas River. However, Goodyear and McNeill (2009) report that copper does not biomagnify across BMI feeding guilds. Metal concentrations in fish tissue collected from the Animas River in the fall of 2015 were found to be at similar levels to fish in other Colorado rivers (CDPHE 2015).

The 2015 BMI data do not demonstrate a negative impact of the Gold King Mine release to BMI initial survival, sensitive taxa abundance, or community health indices. However, these findings should be interpreted within the historical context of metal contamination within the Animas watershed. BMI communities in the Animas River have long been stressed by long-term exposure to mine-related impacts and other stressors (Anderson 2007b; EPA 2015; Smith 1976). BMI species that are most sensitive to metal contamination are either absent or occur at a low diversity in large portions of the Animas River (e.g., Heptageniidae does not occur at A72 or at sites in the Durango stretch of the Animas River), which reduces the ability to detect an impact from the Gold King Mine release. It is possible that we could have seen a greater impact to aquatic life from the Gold King Mine release in parts of the Animas River if the resident aquatic life had not already been impacted by long-term exposure to metals.

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7. Tables

Table 1. Benthic macroinvertebrate monitoring sites (from north to south) and collection dates for 2014 and 2015.

Water Body	Site Name	2014	2015			
		Fall 2014	Prior to Gold King Mine release	~24 hours after Gold King Mine release	~1 week after Gold King Mine release	Fall 2015
Animas River	A55 - Howardsville	9/24				9/23
Animas River	A60 - Below Arrastra	9/25				9/23
Animas River	A68 - Above Cement	9/25		8/8	8/12	9/23
Animas River	A72 - Below Silverton	9/25		8/8	8/12	9/23
Elk Cr	A73EC - Above Animas	10/16				10/15
Animas River	A73 - Above Elk	10/16				10/15
Cascade Cr	A75CC - Above Animas	10/16				10/15
Animas River	A75D - Above Cascade	10/16				10/15
Animas River	Baker's Bridge	9/26				9/21
Animas River	James Ranch	9/26				9/21
Animas River	Oxbow Park					9/18
Animas River	32nd Street	9/26	8/6	8/7	8/13	9/22
Animas River	Rotary Park		8/6	8/7	8/13	9/20
Animas River	Above Lightner	9/26				9/20
Animas River	Purple Cliffs	9/26				9/22

Note: Community data was collected on all dates listed. Tissue data was collected on dates/sites highlighted in light blue.

Table 2. BMI Metrics, in order of their applicability for metal exposure.

BMI Metric	Metric Description	Justification and Source
Heptageniidae Richness	Total # of unique taxa units (richness) that are members of the Heptageniidae family of mayflies.	Heptageniid mayflies are particularly sensitive to elevated metals in the Animas River (Courtney and Clements 2002) and elsewhere in Colorado and the Rocky Mountains (Kiffney and Clements 1993; Clements and Kiffney 1995; Clements et al. 2000; Besser and Leib 2001; Carlisle and Clements 2003). *Epeorus* occurs at lower abundances on contaminated substrate from the Animas River (Courtney and Clements 2002).
Ephemerellidae Richness	Total # of unique taxa units (richness) that are members of the Ephemerellidae family of mayflies.	Ephemerellid mayflies are particularly sensitive to elevated metals in Animas River water and contaminated substrate, especially *Drunella doddsi* (Courtney and Clements 2002), and at other locations (Kiffney and Clements 1993; Besser and Leib 2001; Clark and Clements 2006).
Taeniopterygidae Richness	Total # of unique taxa units (richness) that are members of the Taeniopterygidae family of winter stoneflies.	Taeniopterygid stoneflies are particularly sensitive to elevated metals in Animas River water and contaminated substrate (Courtney and Clements 2002) and elsewhere in Colorado (Carlisle and Clements 2005).
Orthocladiinae Richness	Total # of unique taxa units (richness) that are members of the Orthocladiinae sub-family of midges.	Taxa in this subfamily are known to be particularly tolerant of elevated metals (Clements 1994).
EPT Richness	Total # of unique taxa units that are members of the orders Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly).	EPT taxa are generally considered to be sensitive to degraded water quality, including elevated metals (Maret et al. 2003). Ephemeroptera are more sensitive to metals than Plecoptera or Trichoptera (Clements et al. 2000).
Taxa Richness	Total # of distinct taxa units.	Taxa richness has been found to be reduced in streams with elevated metal concentrations (Maret et al. 2003).

Table 2 (cont.)

BMI Metric	Metric Description, Justification, and Source
Hilsenhoff Biotic Index (HBI)	HBI is an index of the overall tolerance of a community to degraded water quality and is based on taxon-specific tolerance values and their relative abundance within the sample (Hilsenhoff 1987). The index value ranges from 0 (more sensitive) to 10 (more tolerant).
Multi-metric Index (MMI)	MMI is a bioassessment tool developed by Colorado Water Quality Control Division and the Environmental Protection Agency (CDPHE 2010b). MMI quantifies the extent to which biological communities may have been altered by environmental stressors. MMI scores are evaluated in context to MMI scores from known reference sites and stressed sites in Colorado. CDPHE (2010b) provides MMI thresholds that can be used to evaluate whether a water body is in attainment or impairment of designated aquatic life use. A MMI score that is below the attainment threshold is evidence that the site is not supportive of aquatic life use. Additional metrics (e.g., HBI) are used to determine whether a site with a MMI score that falls between the attainment and impairment threshold should be considered impaired. The attainment threshold varies according to the biotype that the water body is located in. See CDPHE 2010b for more details.

Table 3. Results of paired t-test analysis of BMI metrics for sites exposed to the Gold King Mine plume.

Metric	Fall 2014 Mean	Fall 2015 Mean	Degrees of Freedom	P Value
MMI	42.275	41	7.0	0.6911
Total Richness	16.875	18.375	7.0	0.4178
EPT Richness	6.875	7.125	7.0	0.6845
HBI	3.176	3.65	7.0	0.2937
Total BMI Density or Abundance (#/m^2)	2137	6796	7.0	0.12

Note: We performed statistical tests for eight sites that were sampled in 2014 and 2015 and that were exposed to the Gold King Mine plume: A72, A73, A75D, Baker's Bridge, James Ranch, 32nd Street, Above Lightner Creek, and Purple Cliffs.

Table 4. Results of paired t-test analysis of tissue metal concentrations for sites exposed to the Gold King Mine plume.

Metal	Fall 2014 Mean	Fall 2015 Mean	Degrees of Freedom	P Value
Aluminum	176.1	246	3	0.1624
Cadmium	299.5	271.25	3.0	0.6378
Copper	7820	23875	3.0	0.0339
Iron	574.5	805.5	3	0.1484
Manganese	44.275	22.925	3	0.9862
Lead	1435	1230	3	0.7009
Zinc	67.85	77.85	3	0.276

Note: We performed statistical tests for four sites that were sampled in 2014 and 2015 and that were exposed to the Gold King Mine plume: A72, A73, A75D, and Baker's Bridge. Red text indicates a statistical significant difference in tissue concentrations between 2014 and 2015.

8. Figures

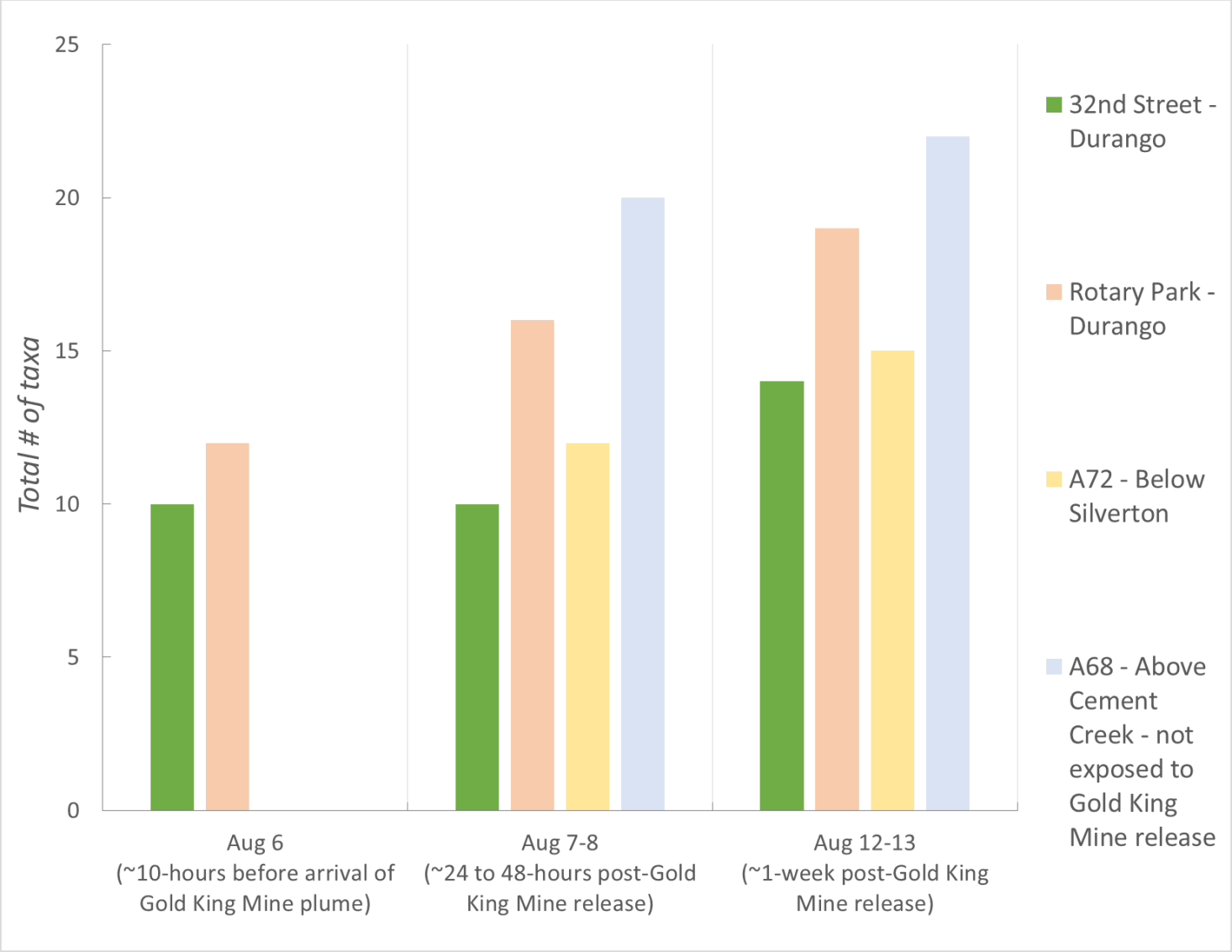

Figure 1: Taxa richness.
Note: see table 2 for an explanation of indices.

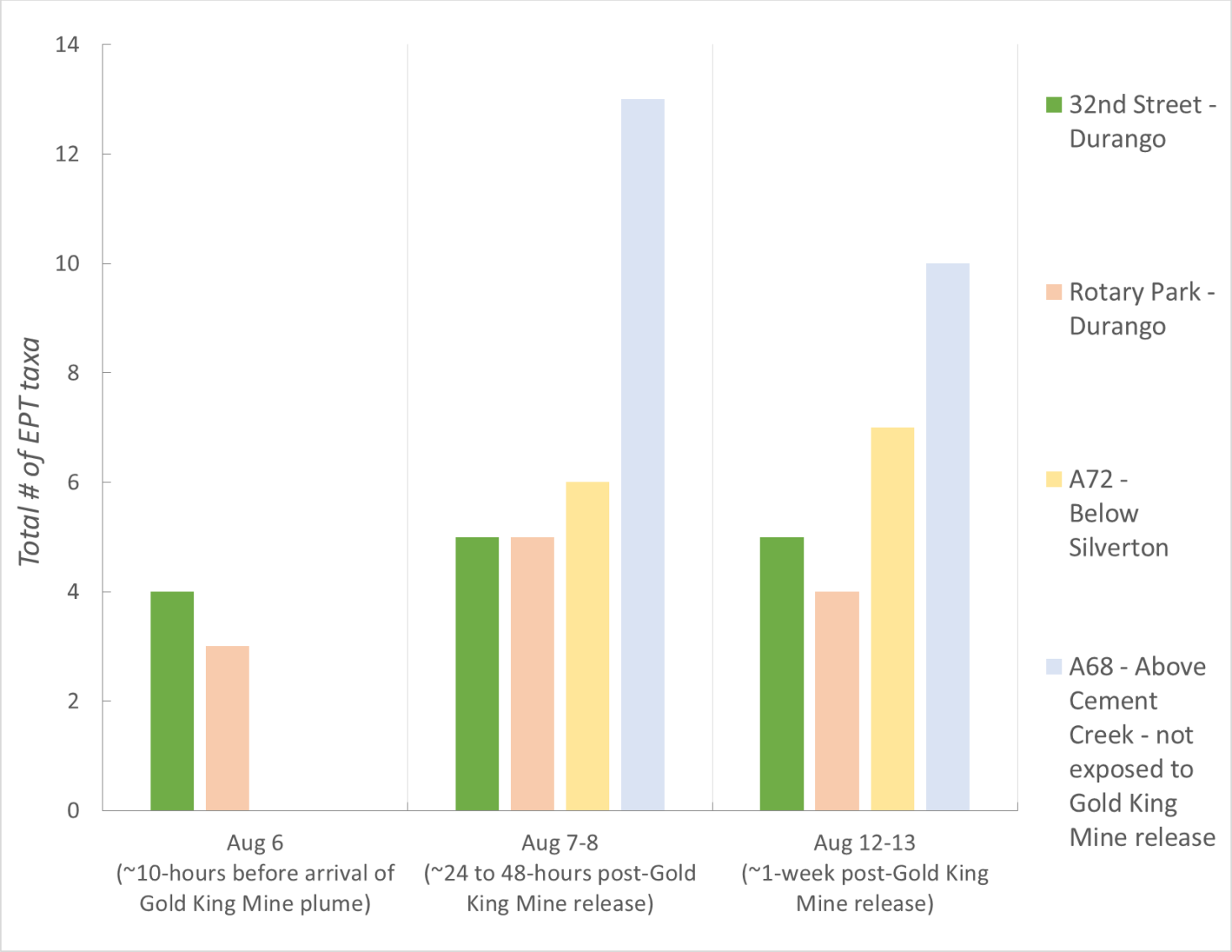

Figure 2: EPT taxa richness (Ephemeroptera, Plecoptera, and Trichoptera).
Note: see table 2 for an explanation of indices.

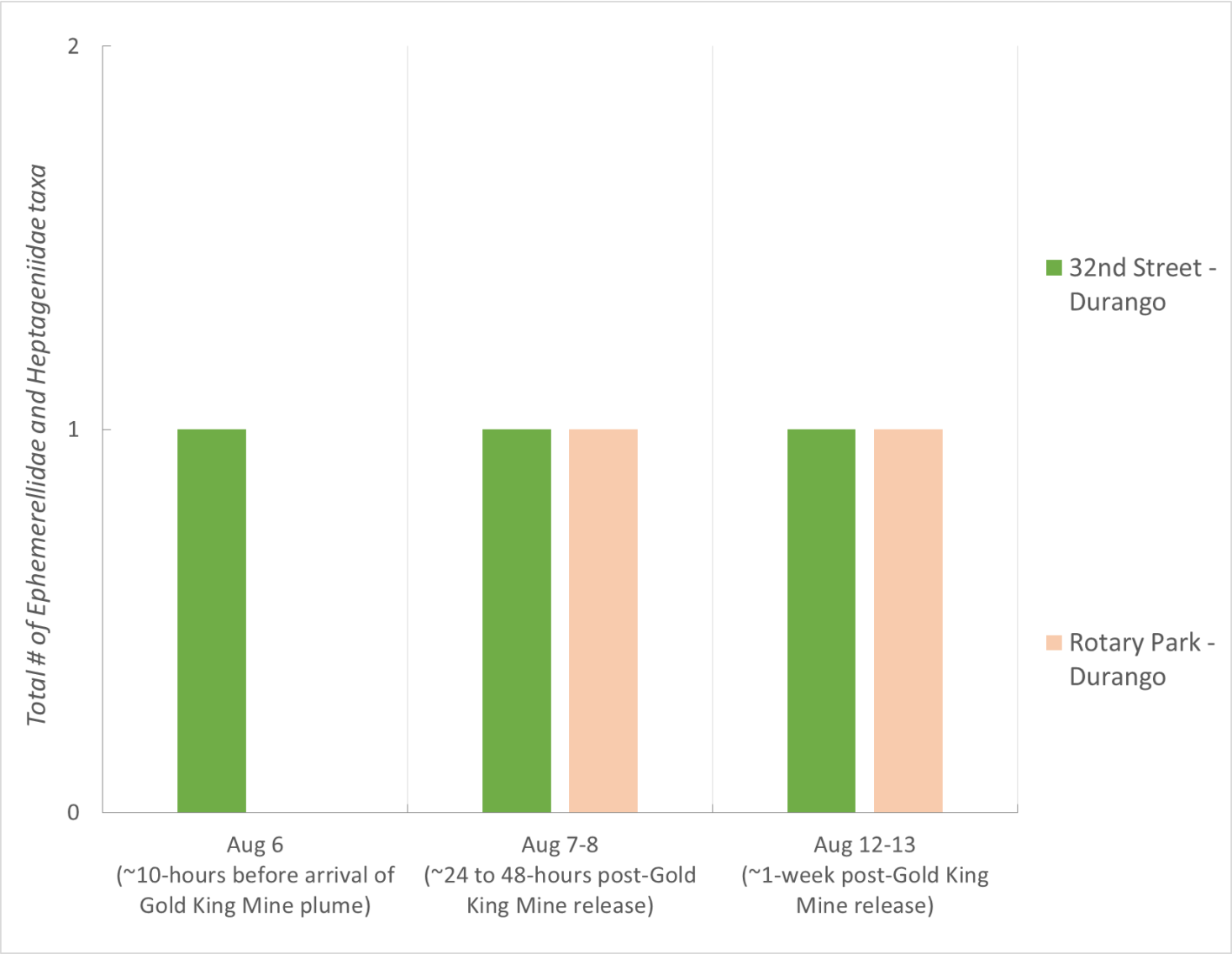

Figure 3: Ephemerellidae and Heptageniidae mayfly taxa richness.
Note: see table 2 for an explanation of indices.

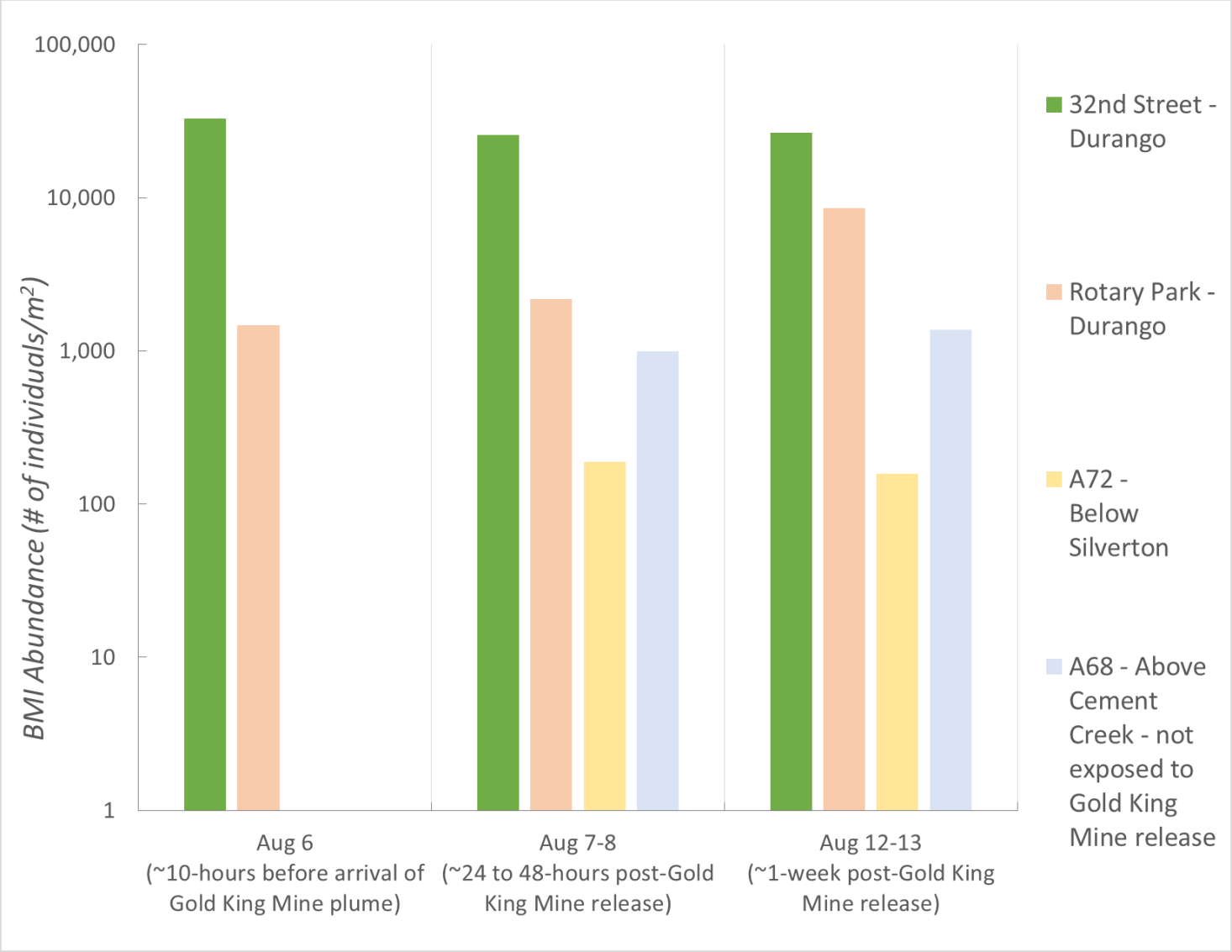

Figure 4: BMI Abundance (# of individuals per m²).
Note: see table 2 for an explanation of indices.

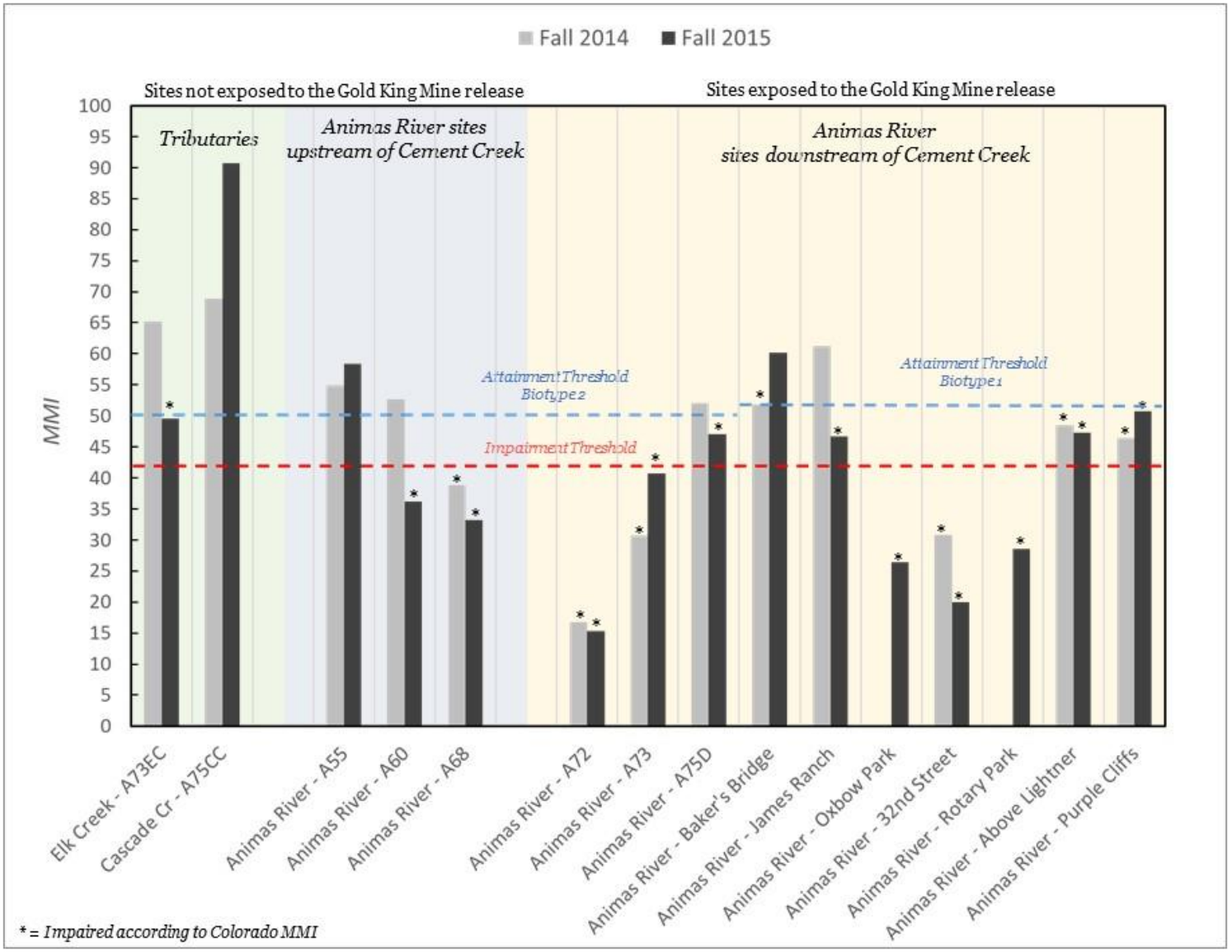

Figure 5: Colorado Multi-Metric Index (MMI) in 2014 and 2015.
Note: see table 2 for an explanation of indices.

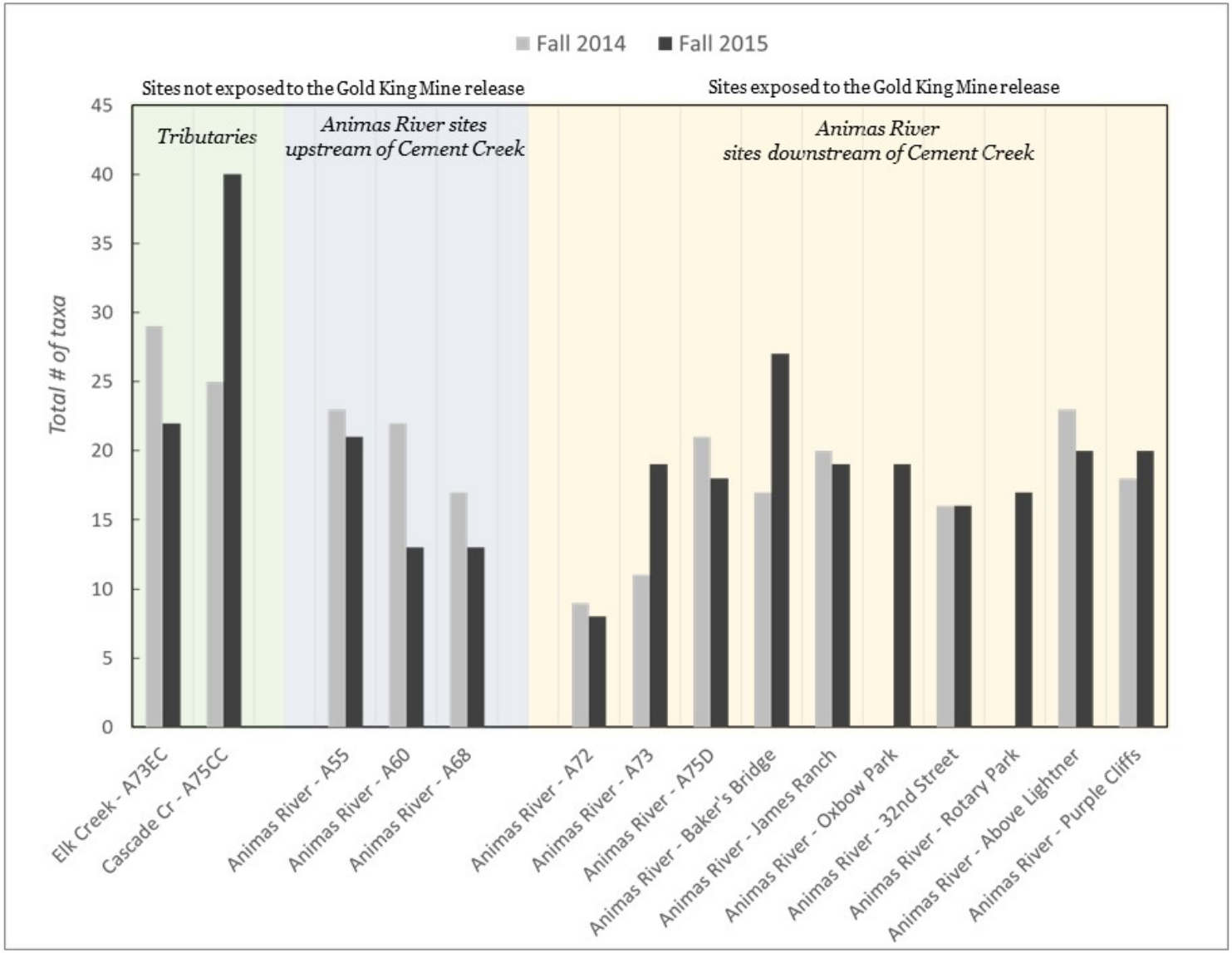

Figure 6: Taxa richness in 2014 and 2015.
Note: see table 2 for an explanation of indices.

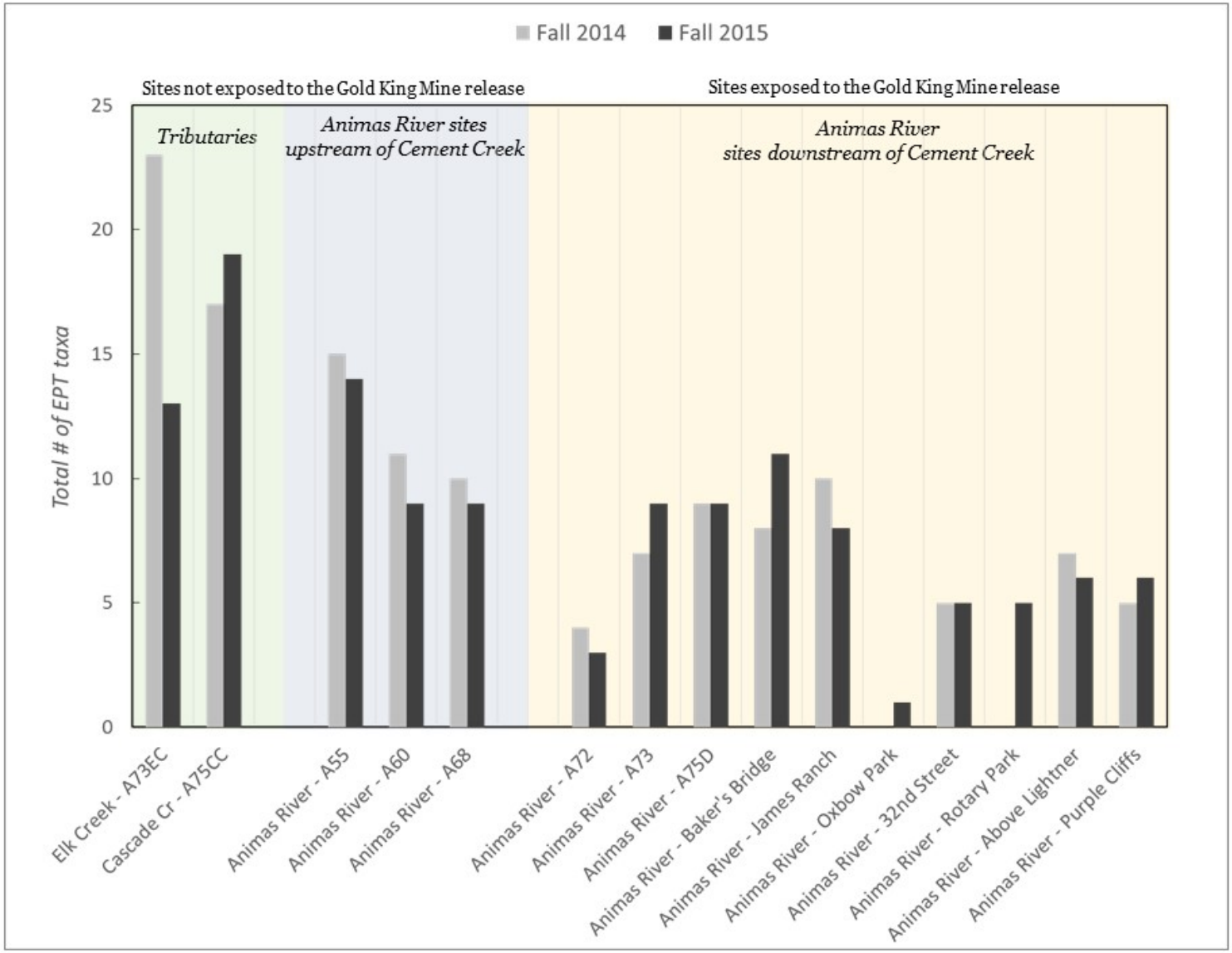

Figure 7: EPT (Ephemeroptera, Plecoptera, and Trichoptera) richness in 2014 and 2015.
Note: see table 2 for an explanation of indices.

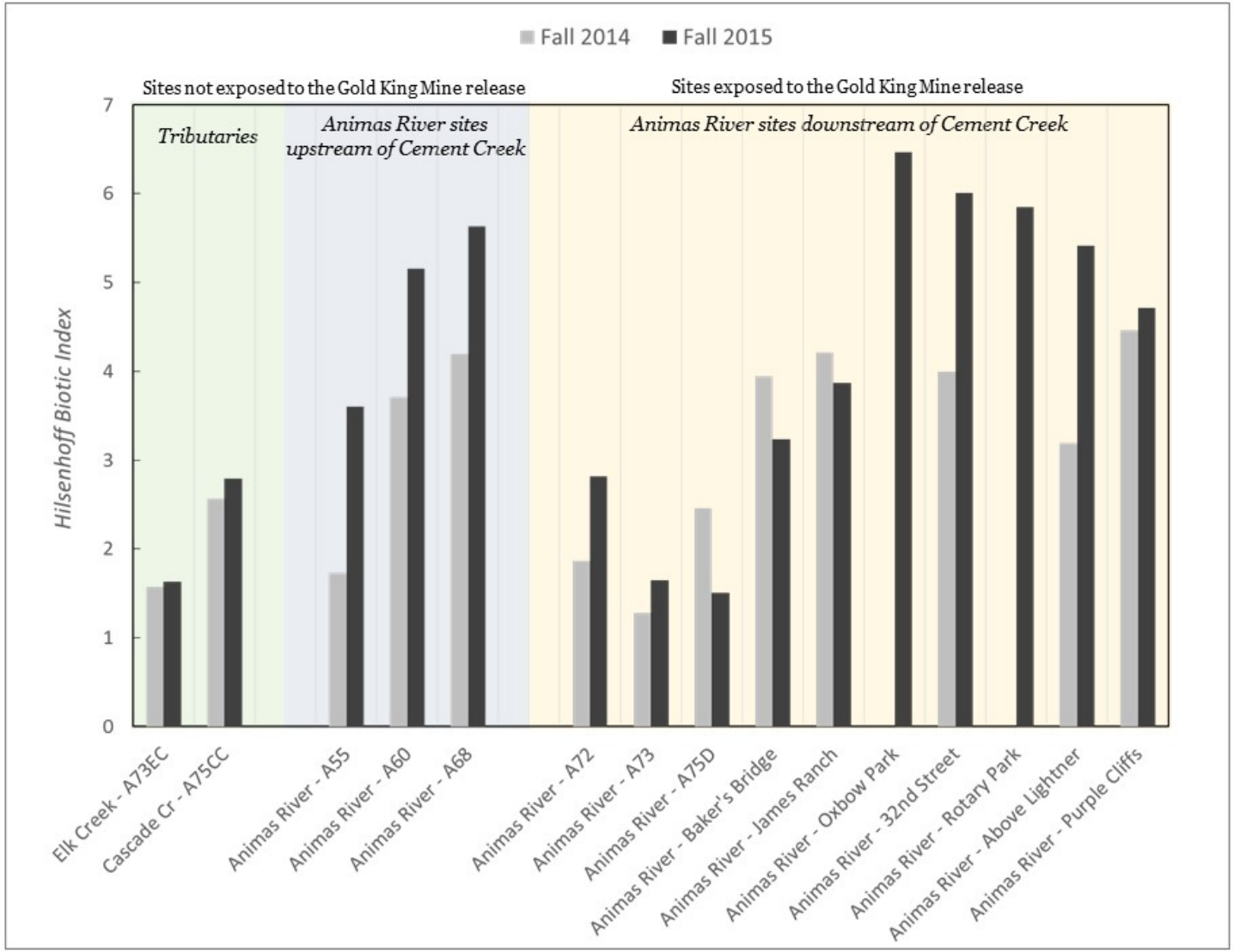

Figure 8: Hilsenoff Biotic Index (HBI) in 2014 and 2015.

Note: HBI is an index of the overall tolerance of a community to degraded water quality. Higher values indicated communities more tolerant of degraded water quality. See table 2.

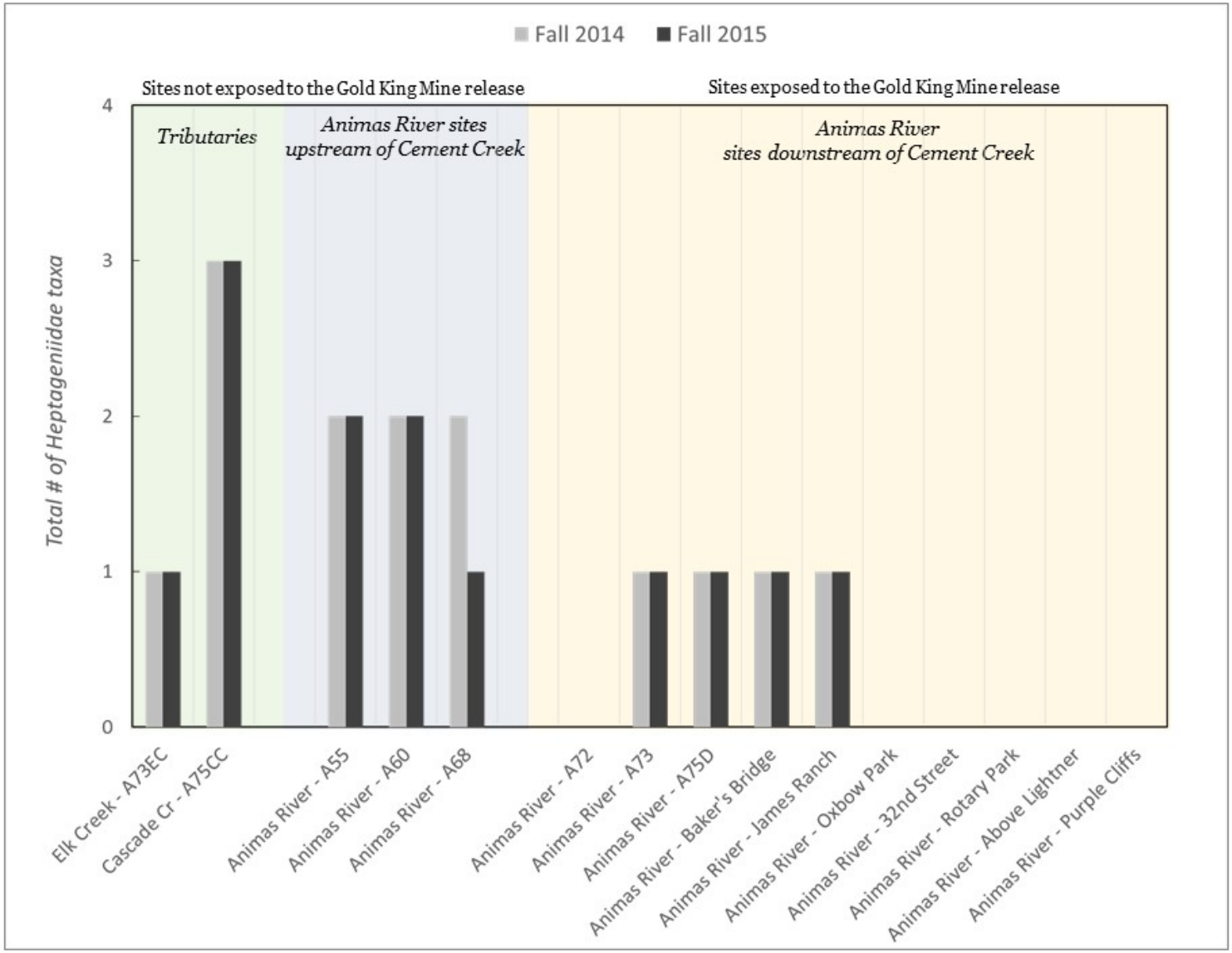

Figure 9: Heptageniidae mayfly taxa richness in 2014 and2015.
Note: see table 2 for an explanation of indices.

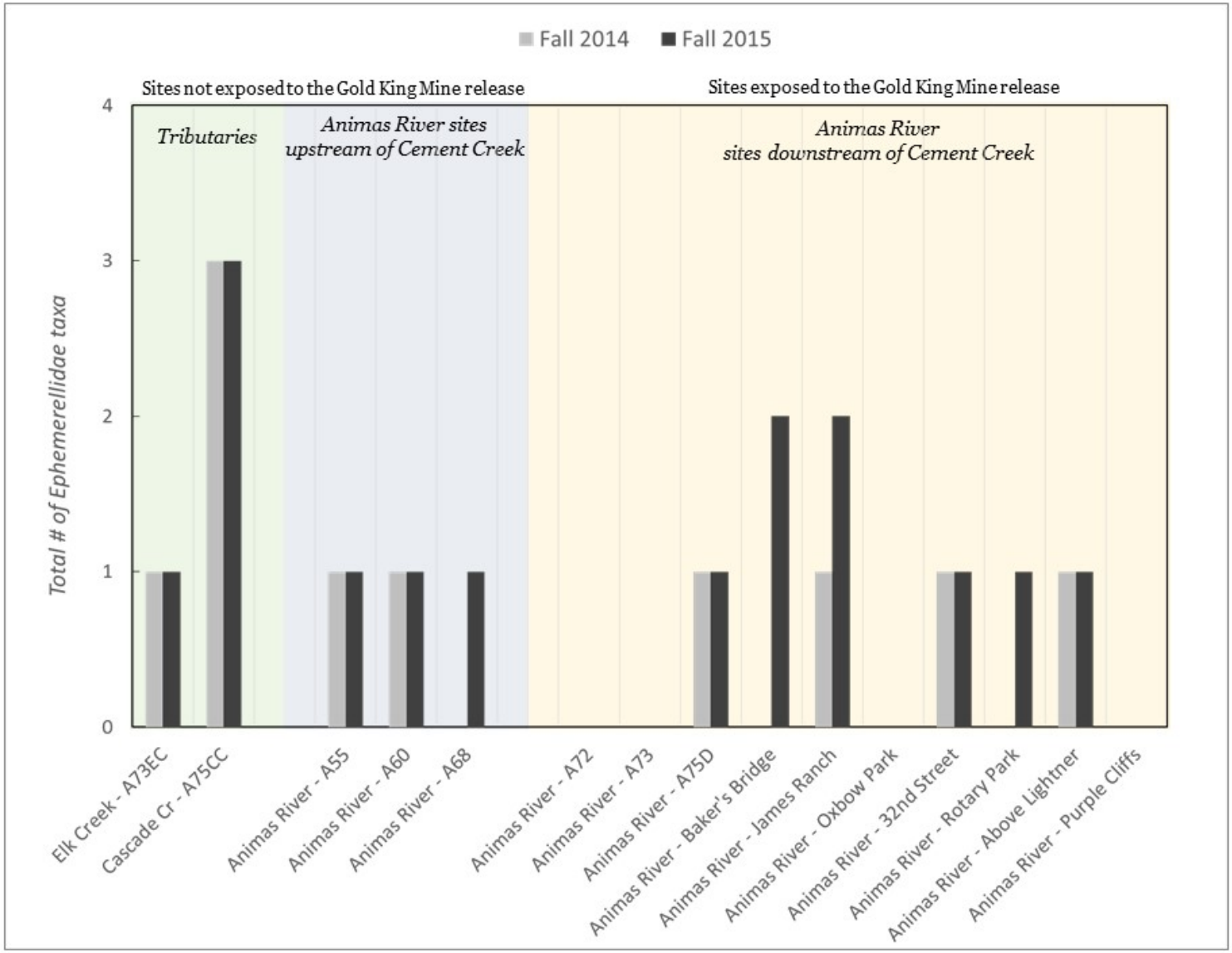

Figure 10: Ephemerellidae mayfly taxa richness in 2014 and 2015.
Note: see table 2 for an explanation of indices.

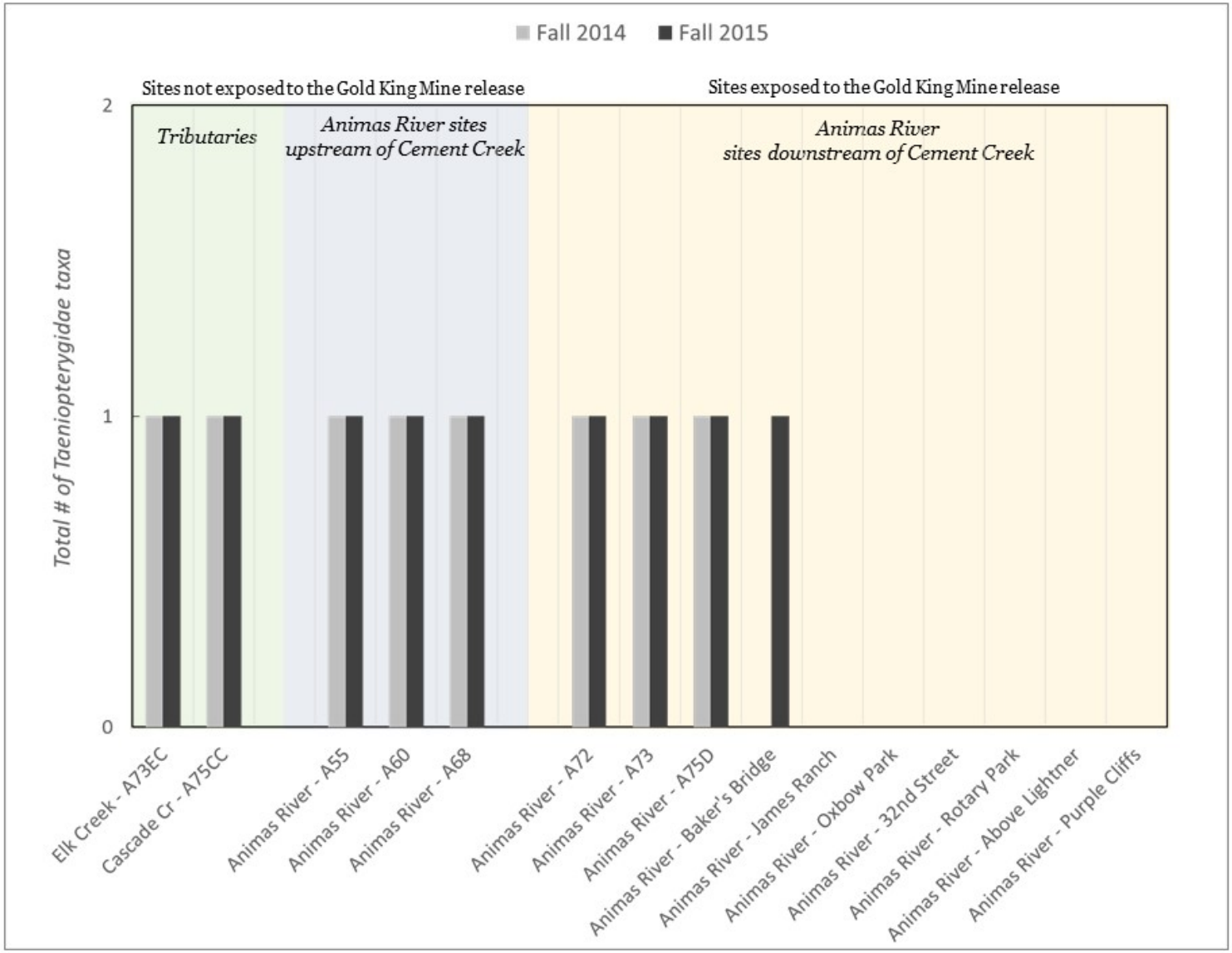

Figure 11: Taeniopterygidae stonefly taxa richness in 2014 and 2015.
Note: see table 2 for an explanation of indices.

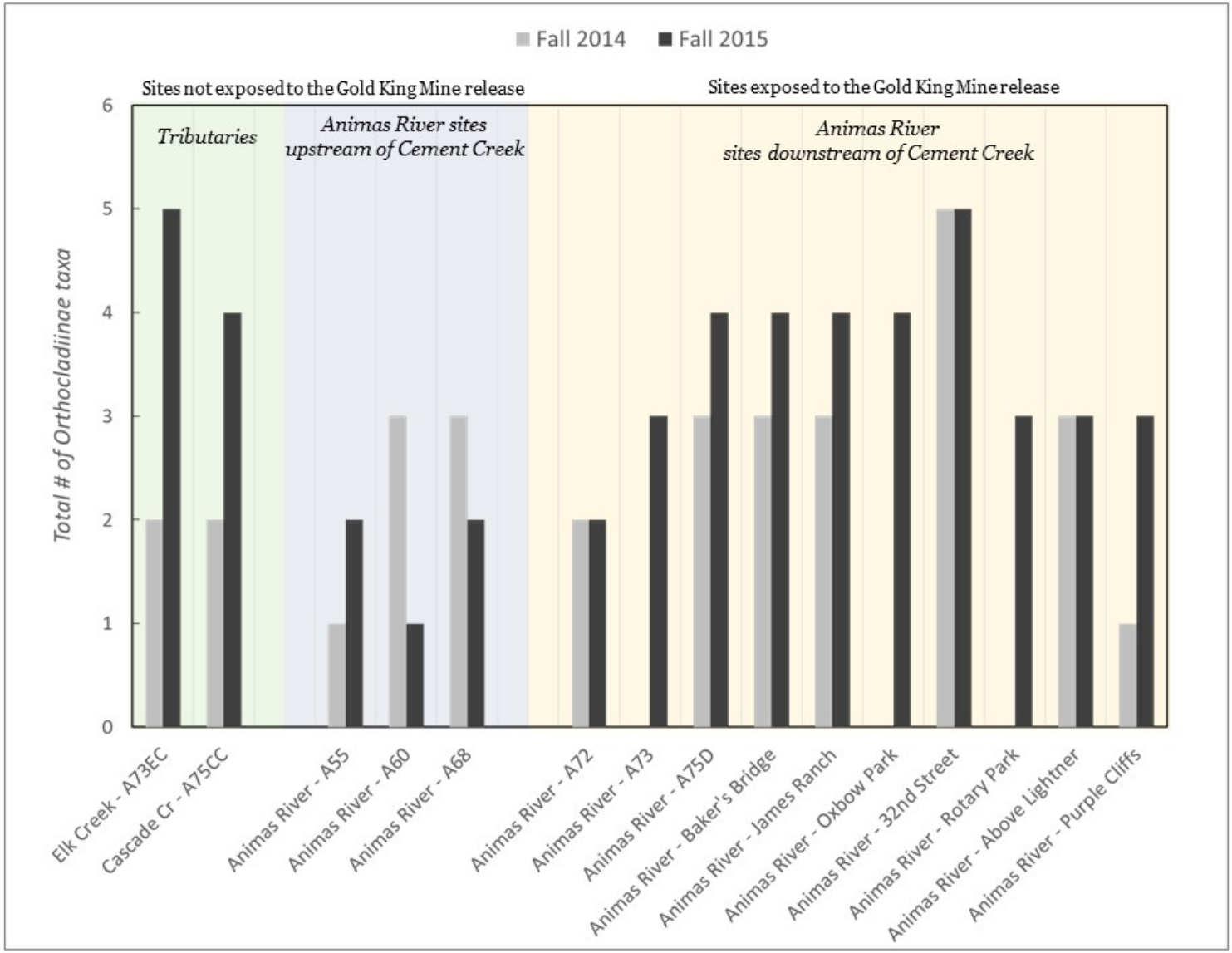

Figure 12: Orthocladiinae midge taxa richness in 2014 and 2015.
Note: see table 2 for an explanation of indices.

Appendix A – Map of Animas River benthic macroinvertebrate monitoring locations

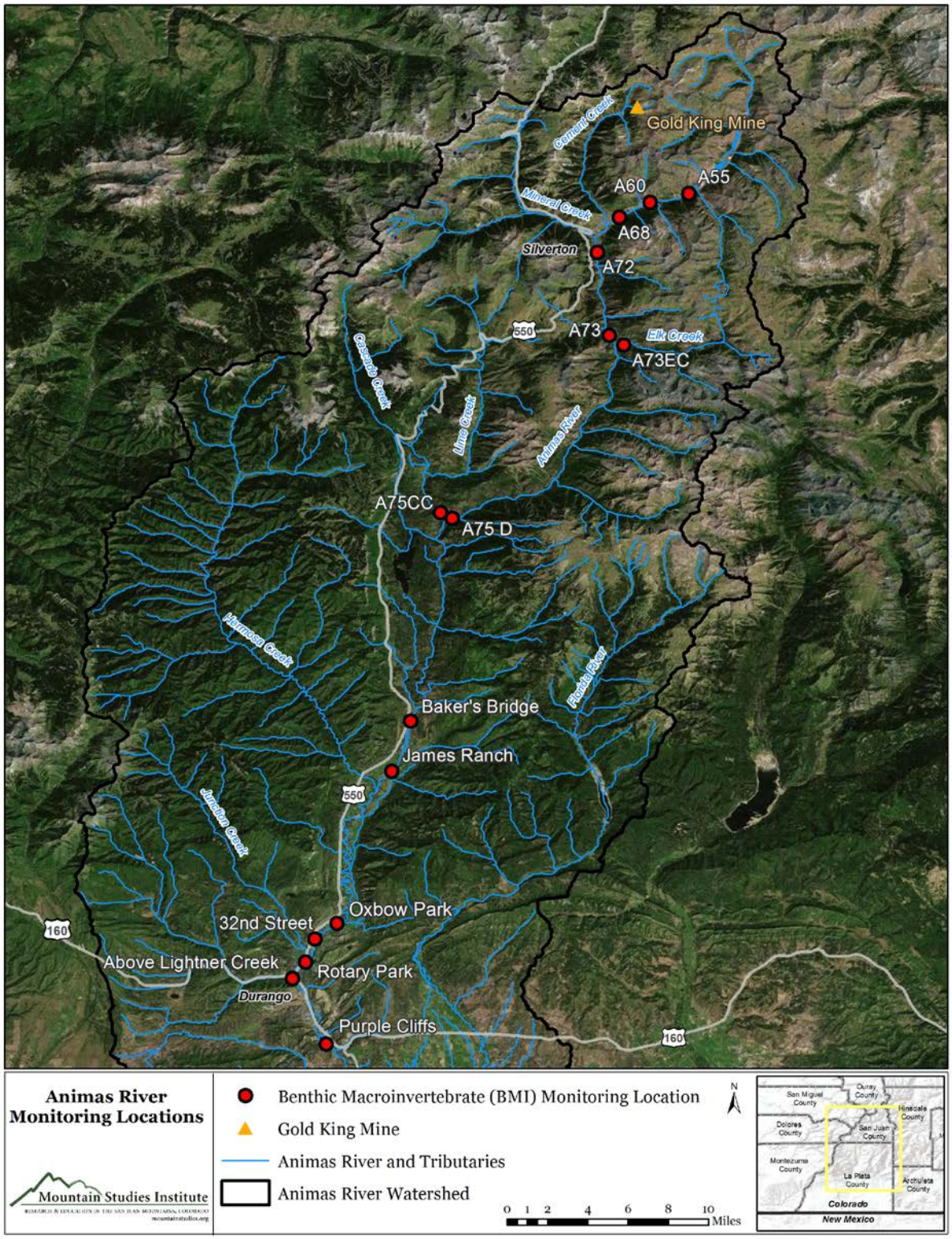

Figure 1: BMI monitoring locations

Appendix B – Benthic macroinvertebrate tissue concentrations

Figure 1

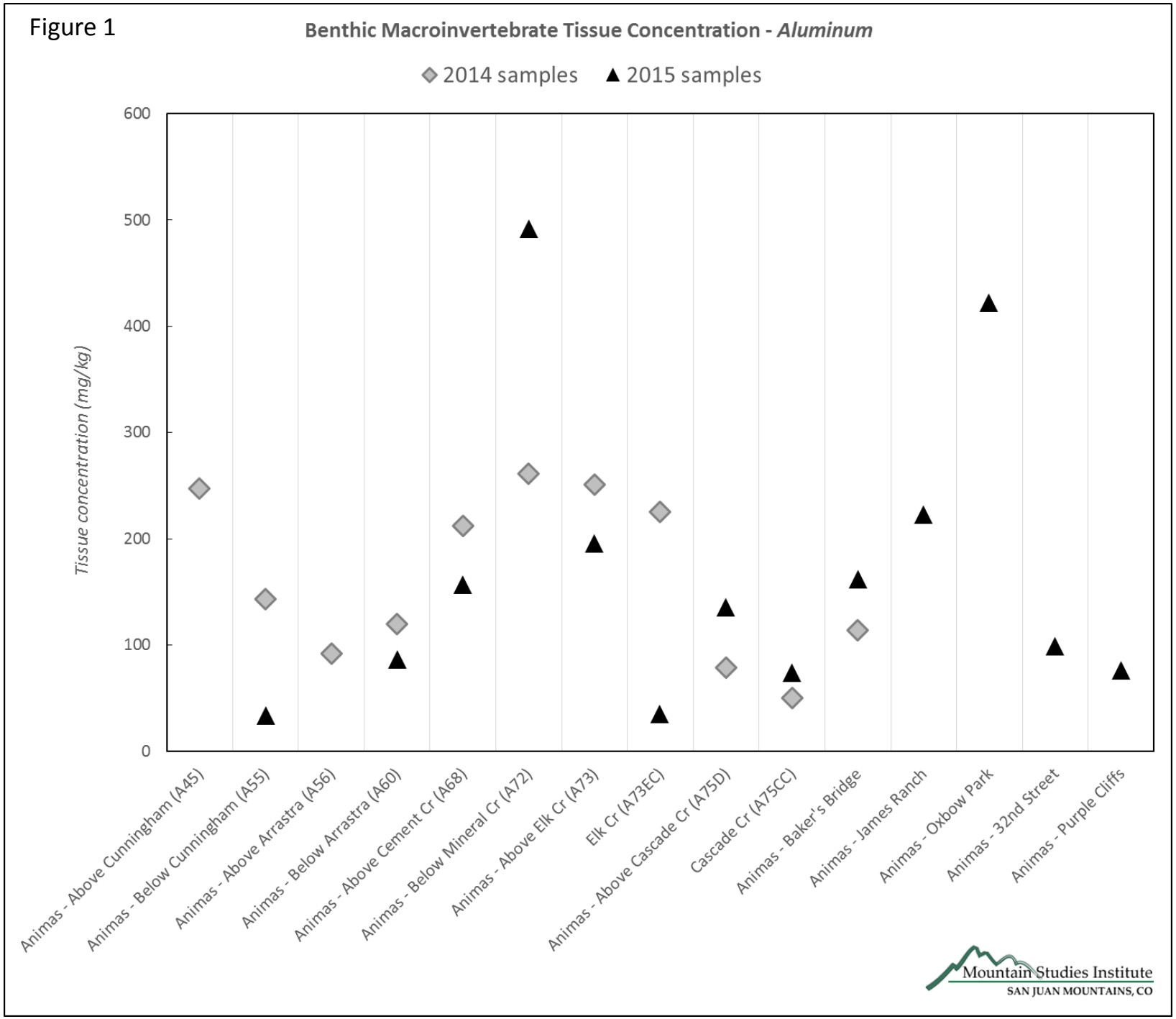
Benthic Macroinvertebrate Tissue Concentration - *Aluminum*
2014 samples
2015 samples
Tissue concentration (mg/kg)
600
500
400
300
200
100
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 2

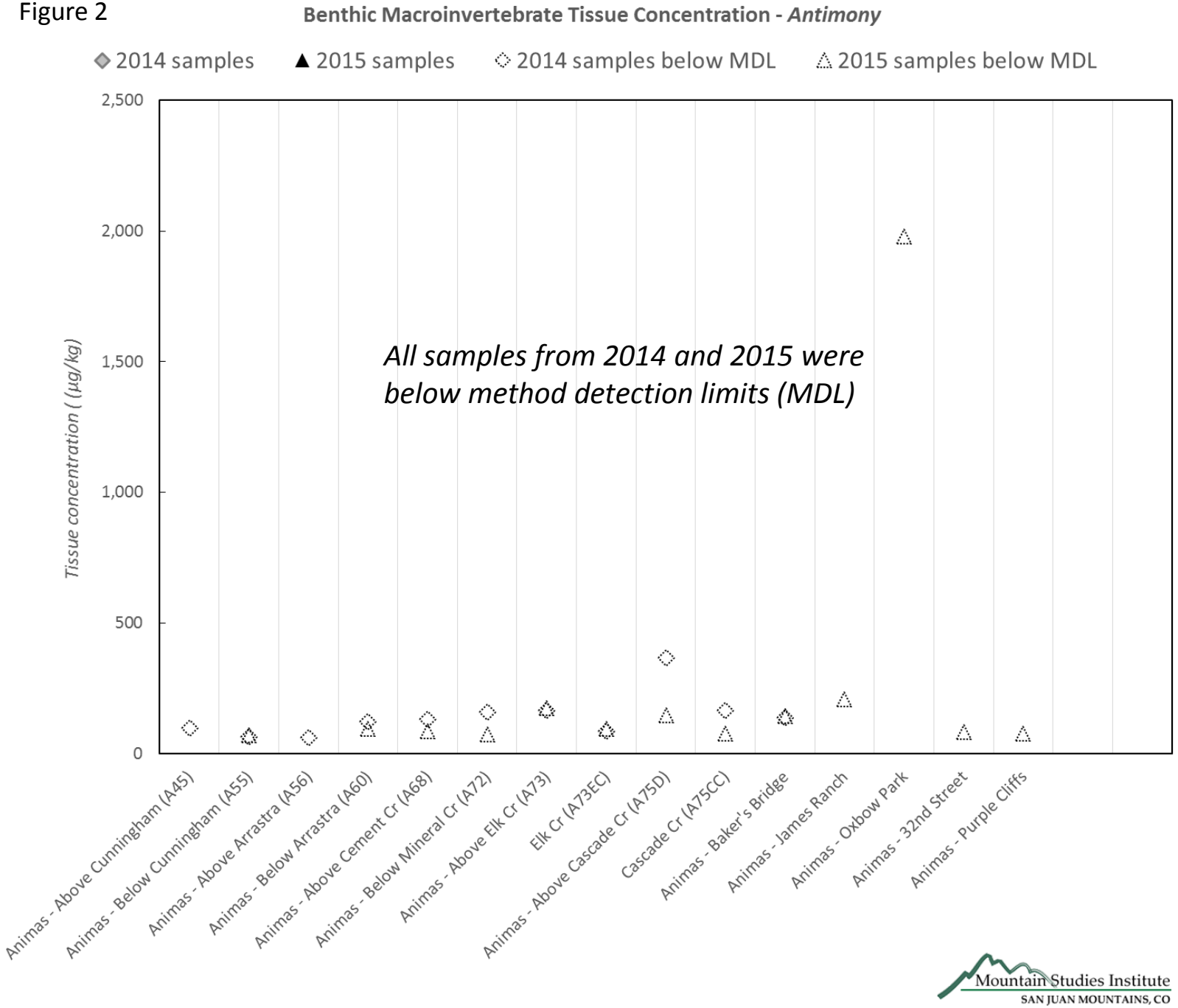
Benthic Macroinvertebrate Tissue Concentration - Antimony
2014 samples
2015 samples
2014 samples below MDL
2015 samples below MDL
Tissue concentration ((µg/kg)
2,500
2,000
1,500
1,000
500
0
All samples from 2014 and 2015 were below method detection limits (MDL)
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 3

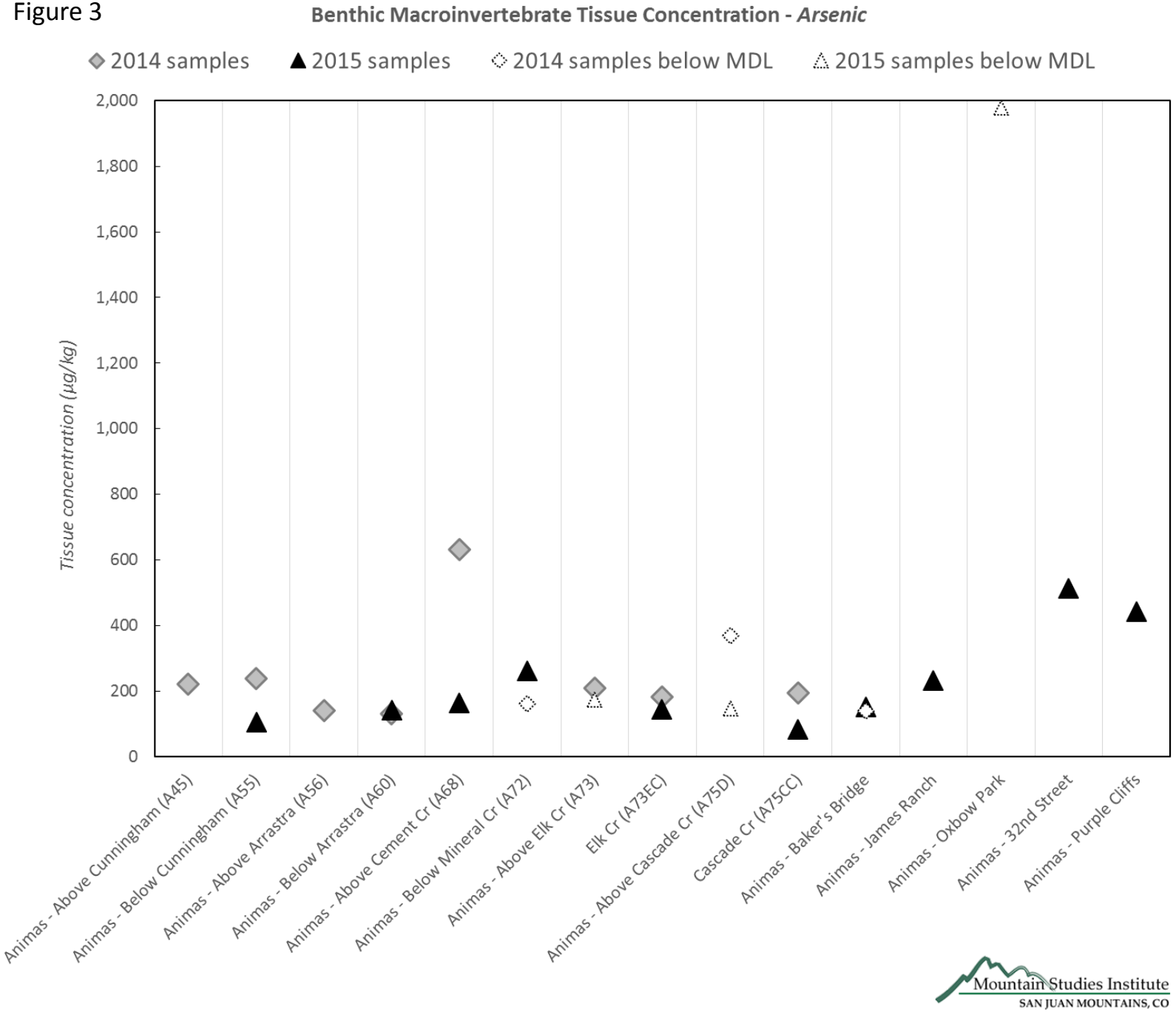
Benthic Macroinvertebrate Tissue Concentration - Arsenic
2014 samples
2015 samples
2014 samples below MDL
2015 samples below MDL
Tissue concentration (µg/kg)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 4

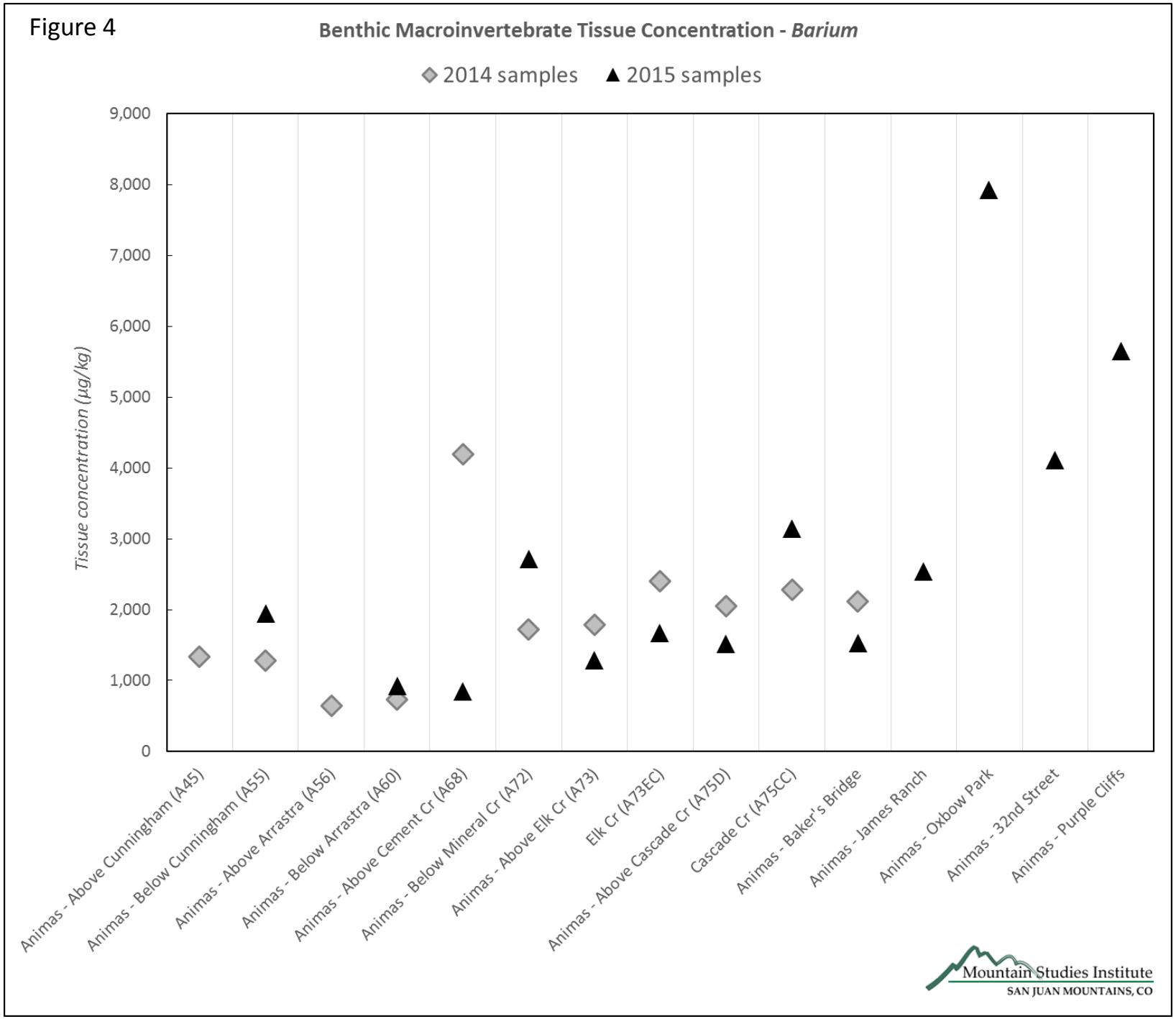
Benthic Macroinvertebrate Tissue Concentration - Barium
2014 samples
2015 samples
Tissue concentration (µg/kg)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 5

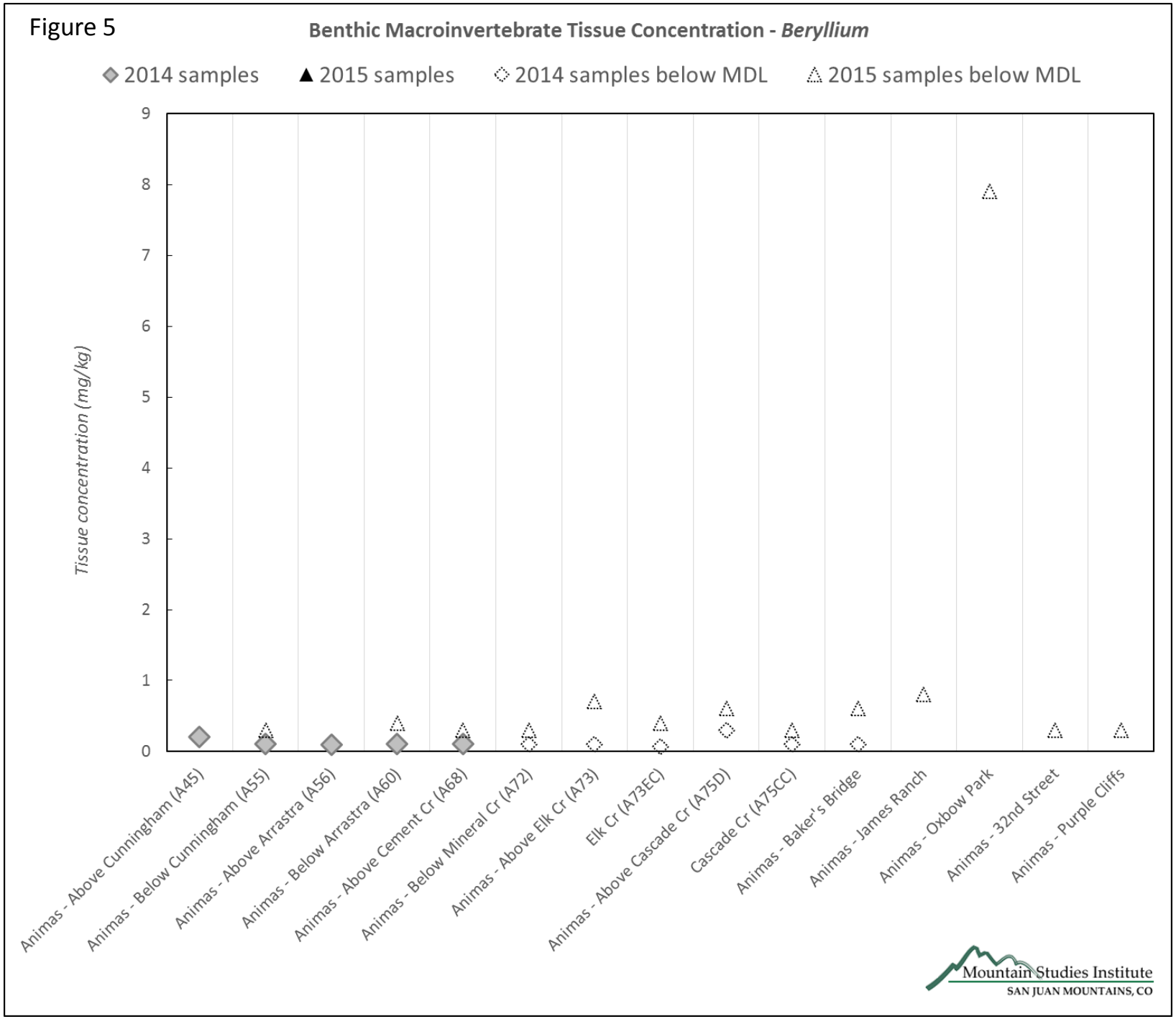
Benthic Macroinvertebrate Tissue Concentration - *Beryllium*
2014 samples
2015 samples
2014 samples below MDL
2015 samples below MDL
Tissue concentration (mg/kg)
0
1
2
3
4
5
6
7
8
9
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 6

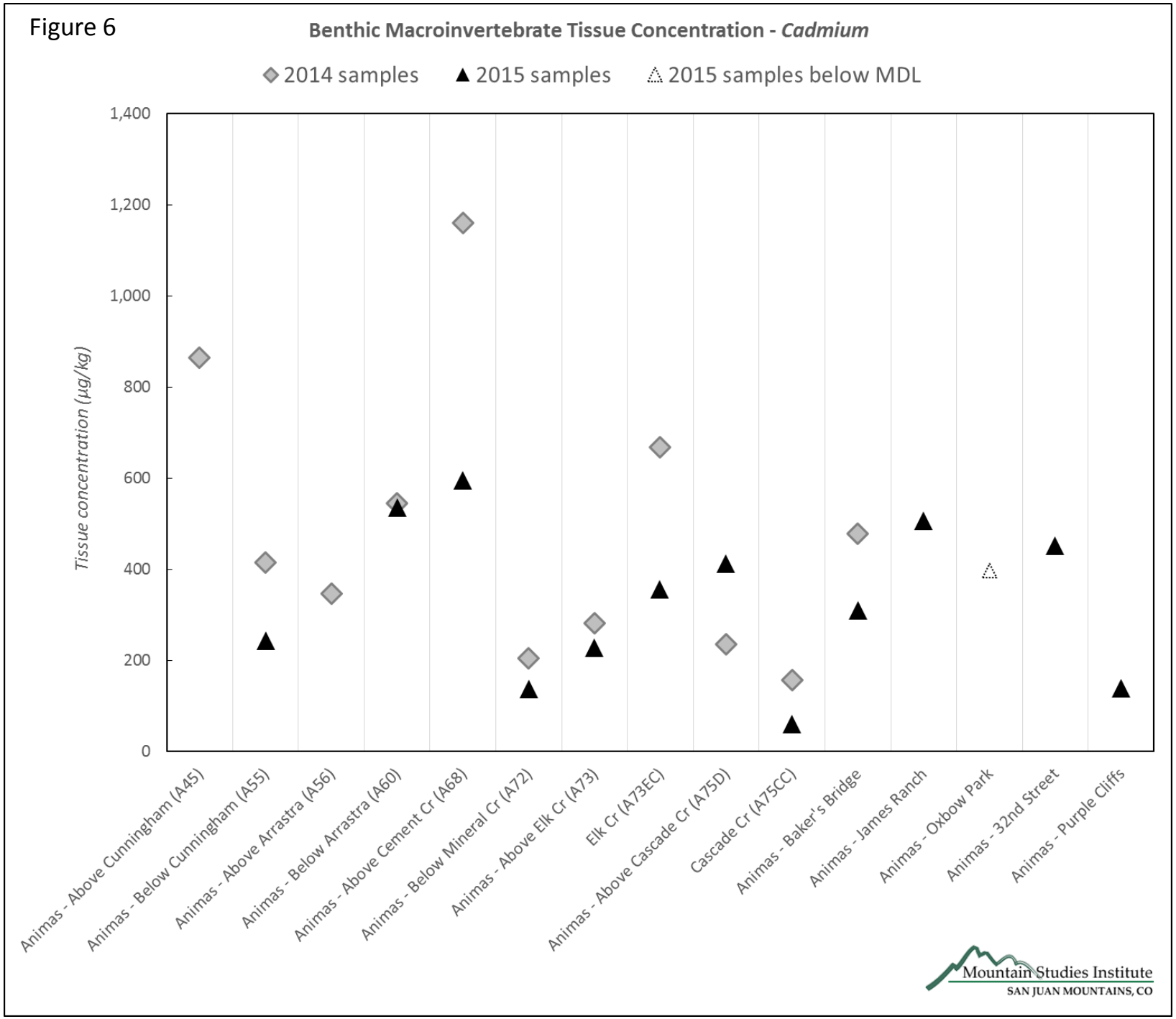
Benthic Macroinvertebrate Tissue Concentration - Cadmium
2014 samples
2015 samples
2015 samples below MDL
Tissue concentration (µg/kg)
1,400
1,200
1,000
800
600
400
200
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 7

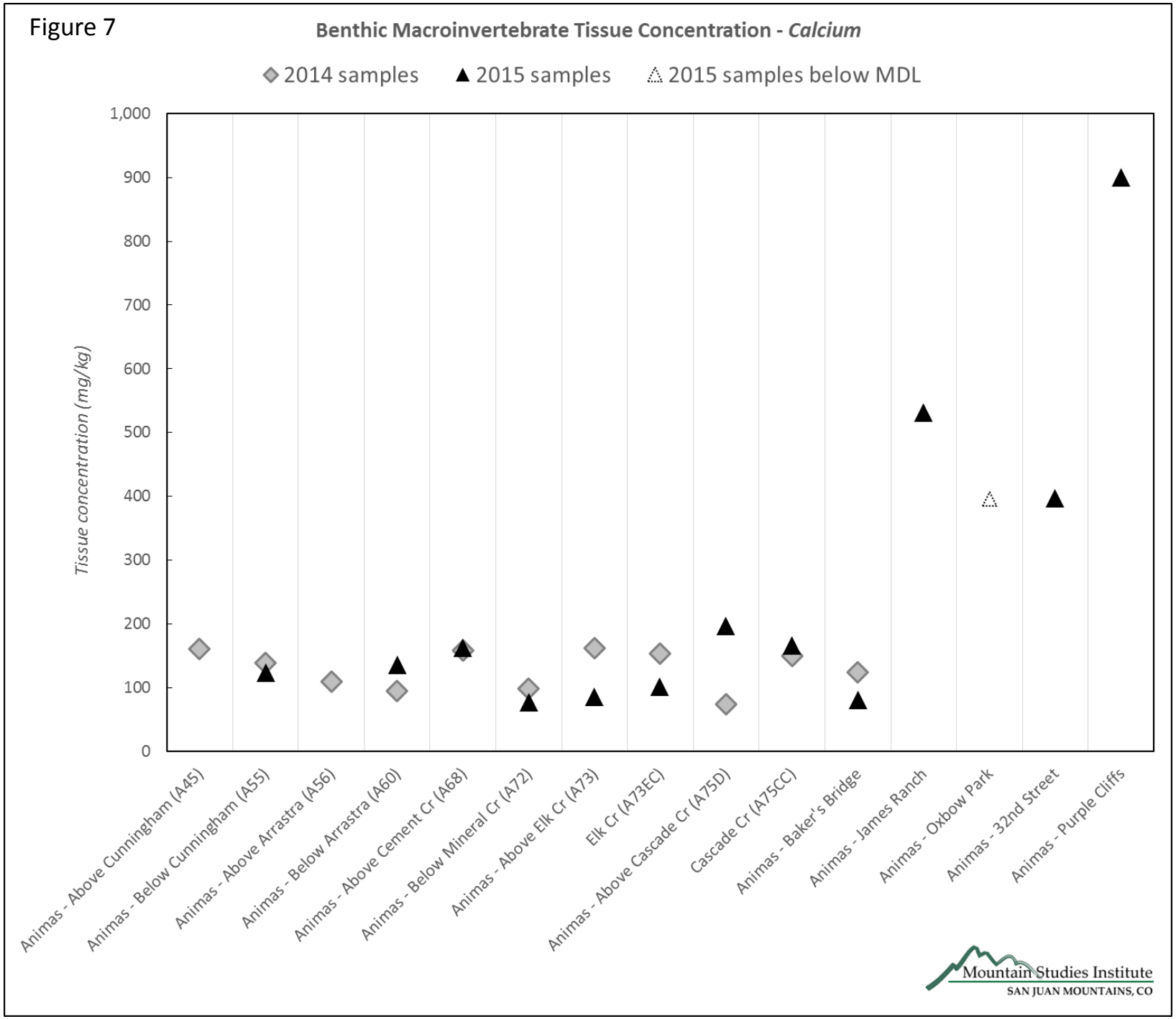
Benthic Macroinvertebrate Tissue Concentration - *Calcium*
2014 samples
2015 samples
2015 samples below MDL
Tissue concentration (mg/kg)
1,000
900
800
700
600
500
400
300
200
100
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 8

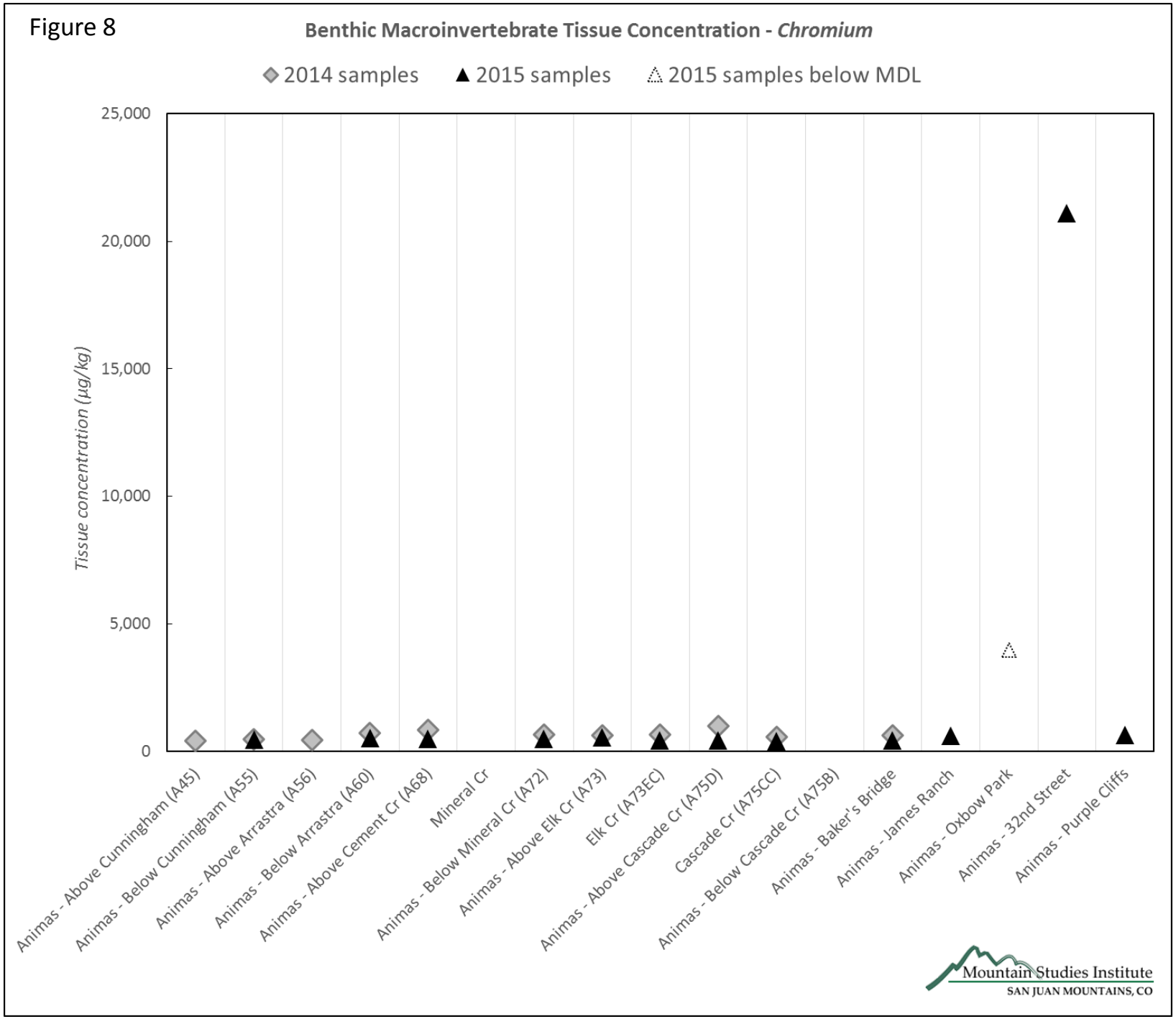
Benthic Macroinvertebrate Tissue Concentration - *Chromium*
2014 samples
2015 samples
2015 samples below MDL
Tissue concentration (µg/kg)
25,000
20,000
15,000
10,000
5,000
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Mineral Cr
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Below Cascade Cr (A75B)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 9

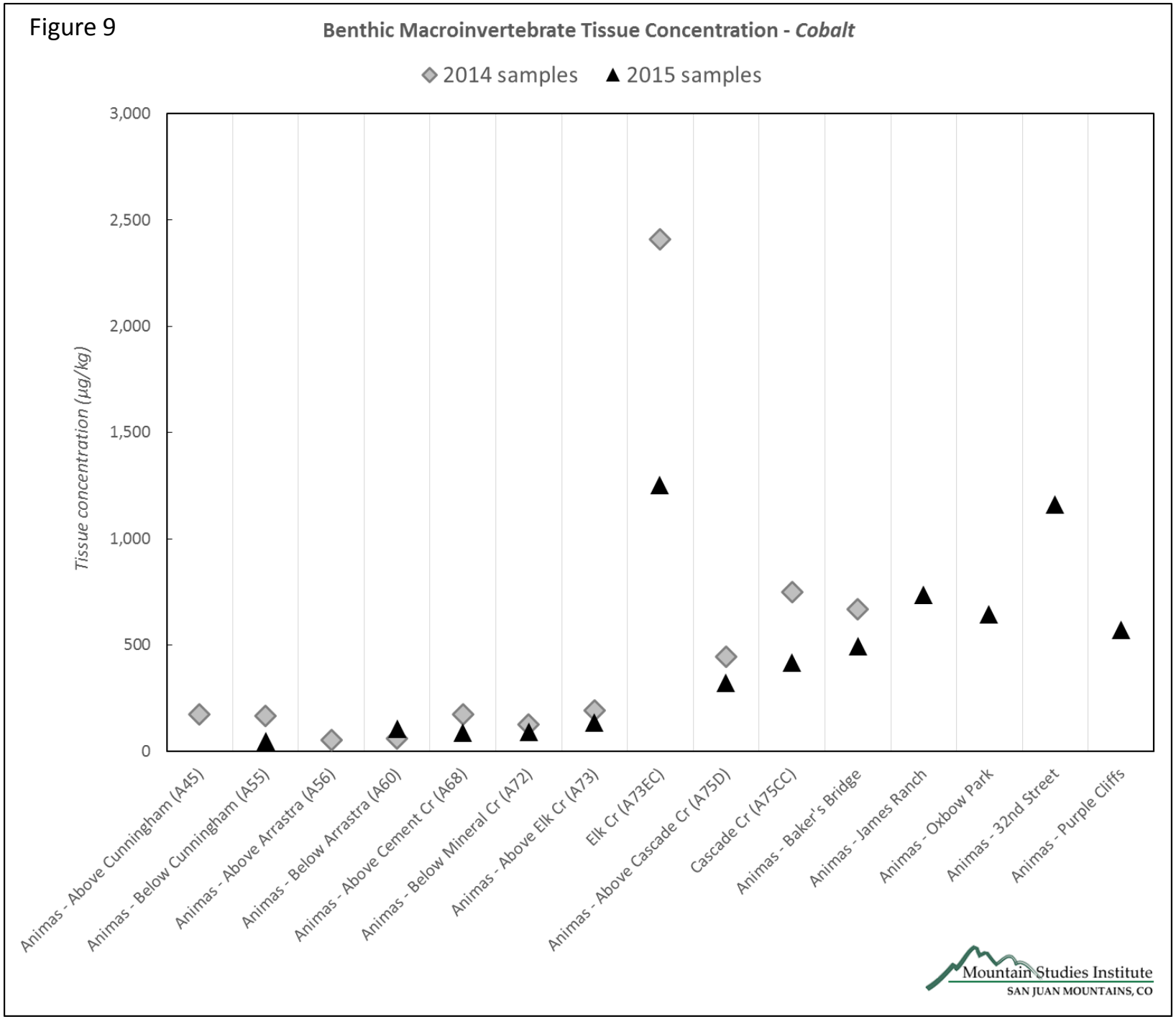
Benthic Macroinvertebrate Tissue Concentration - Cobalt
2014 samples
2015 samples
Tissue concentration (µg/kg)
3,000
2,500
2,000
1,500
1,000
500
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 10

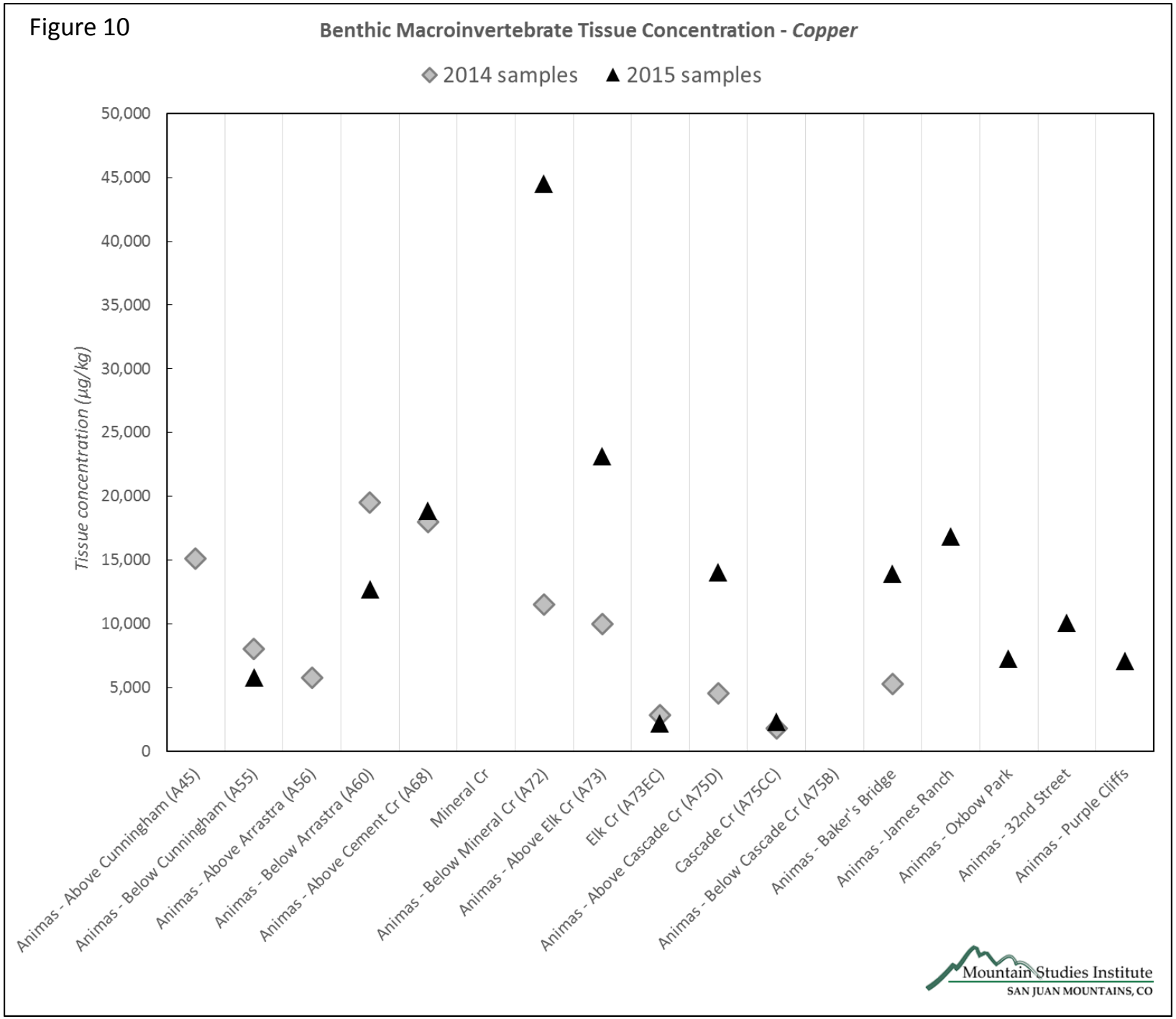
Benthic Macroinvertebrate Tissue Concentration - Copper
2014 samples
2015 samples
Tissue concentration (µg/kg)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Mineral Cr
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Below Cascade Cr (A75B)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 11

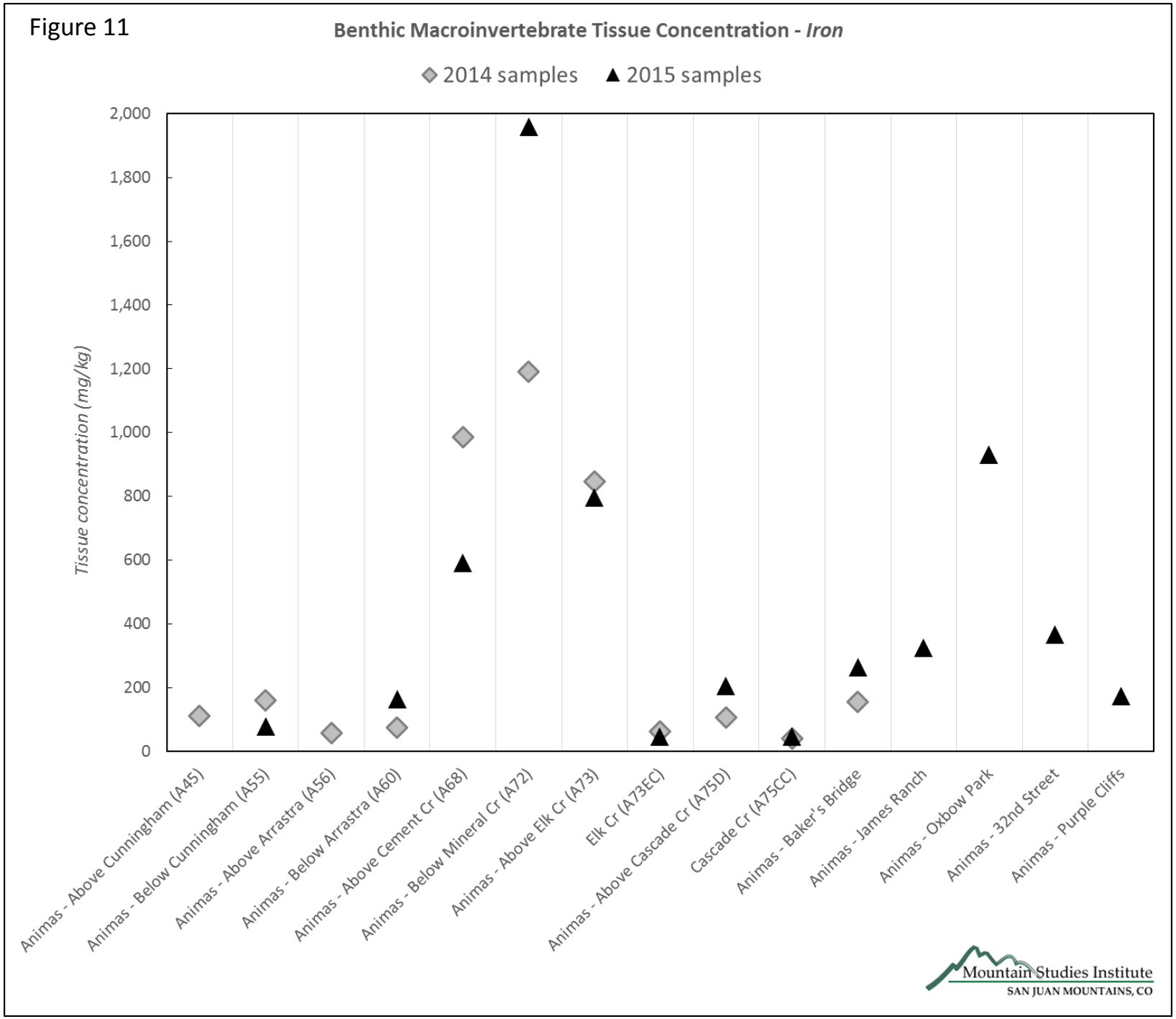
Benthic Macroinvertebrate Tissue Concentration - Iron
2014 samples
2015 samples
Tissue concentration (mg/kg)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 12

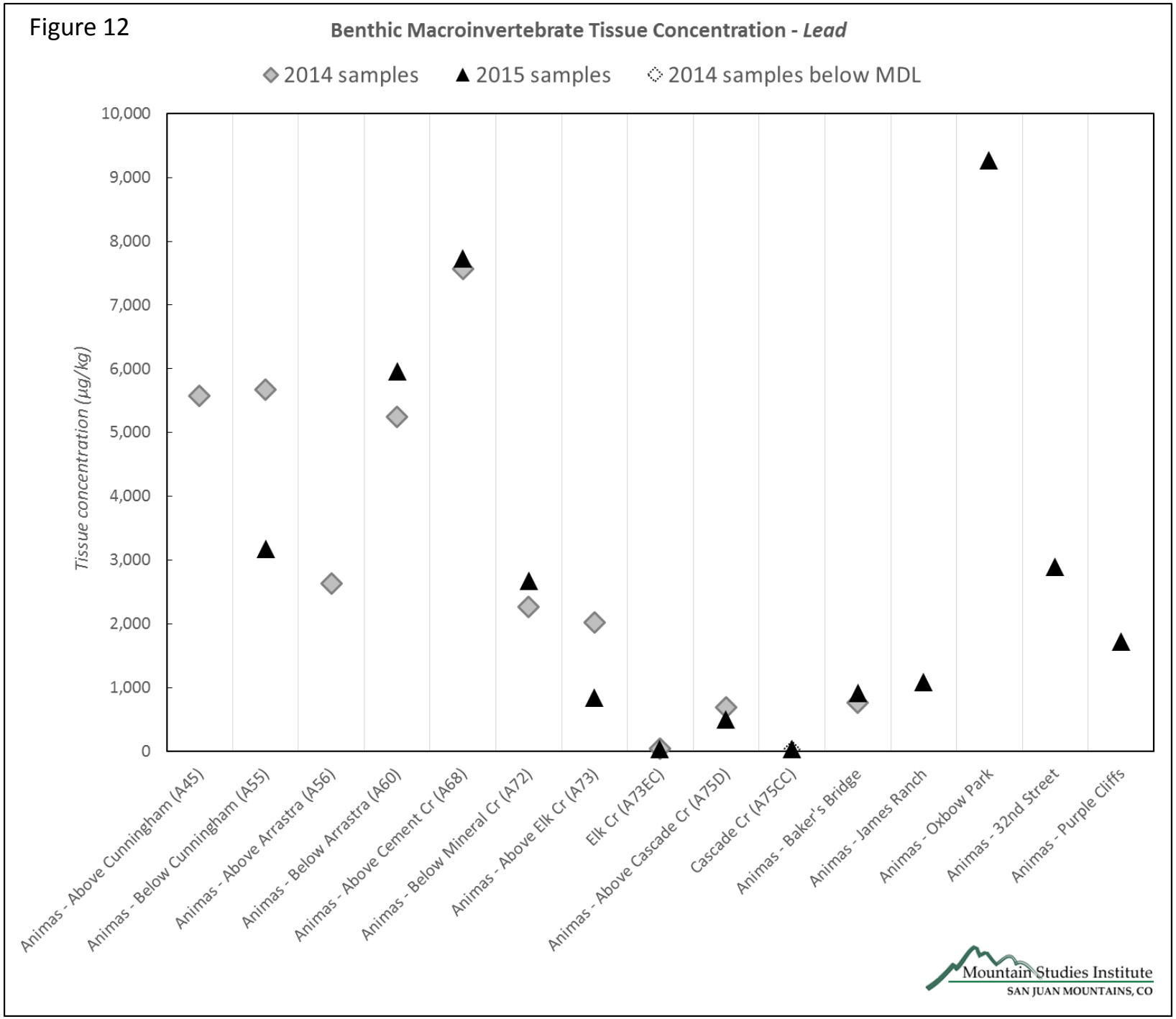
Benthic Macroinvertebrate Tissue Concentration - Lead
2014 samples
2015 samples
2014 samples below MDL
Tissue concentration (µg/kg)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 13

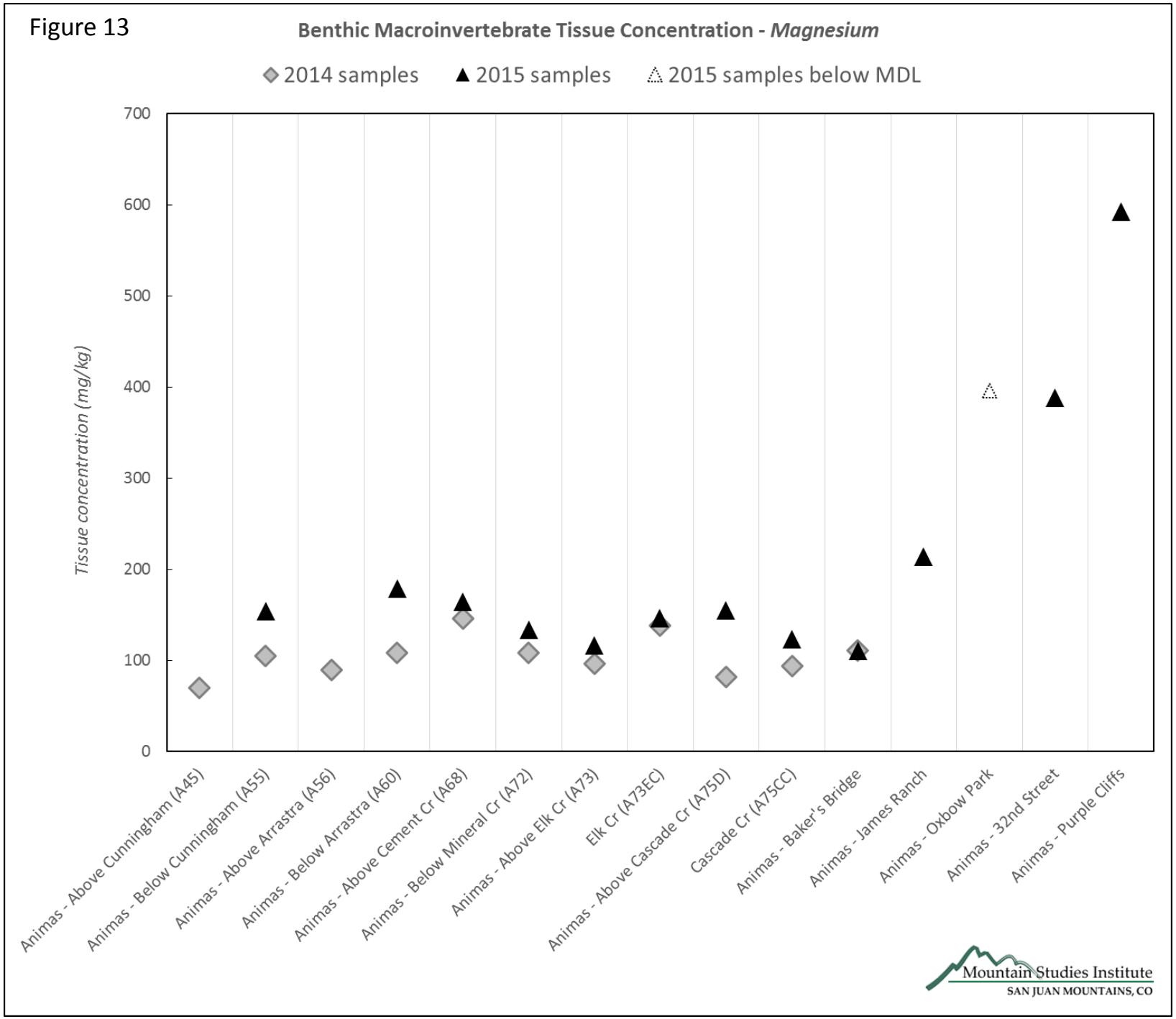
Benthic Macroinvertebrate Tissue Concentration - *Magnesium*
2014 samples
2015 samples
2015 samples below MDL
Tissue concentration (mg/kg)
700
600
500
400
300
200
100
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 14

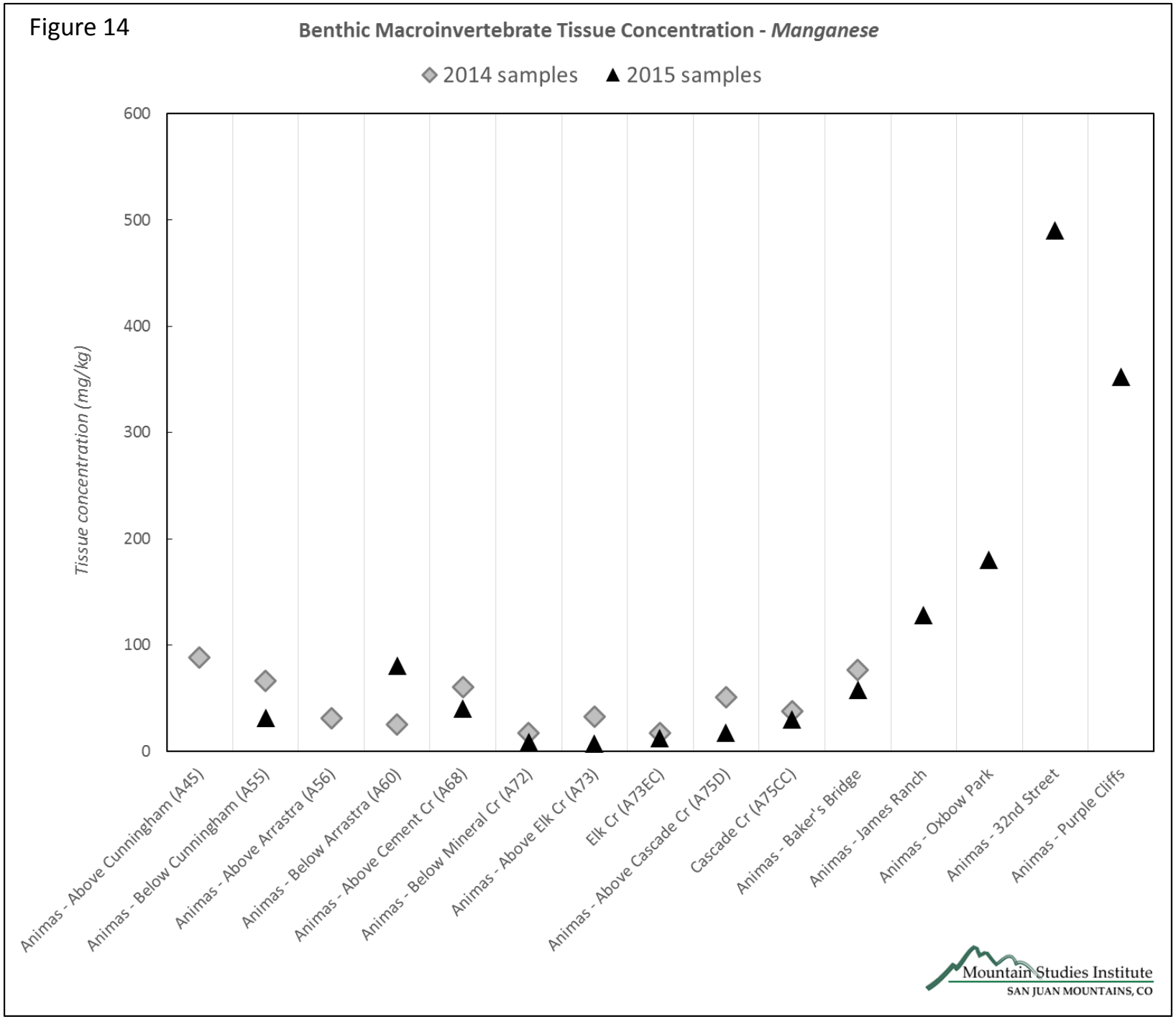
Benthic Macroinvertebrate Tissue Concentration - *Manganese*
2014 samples
2015 samples
Tissue concentration (mg/kg)
600
500
400
300
200
100
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 15

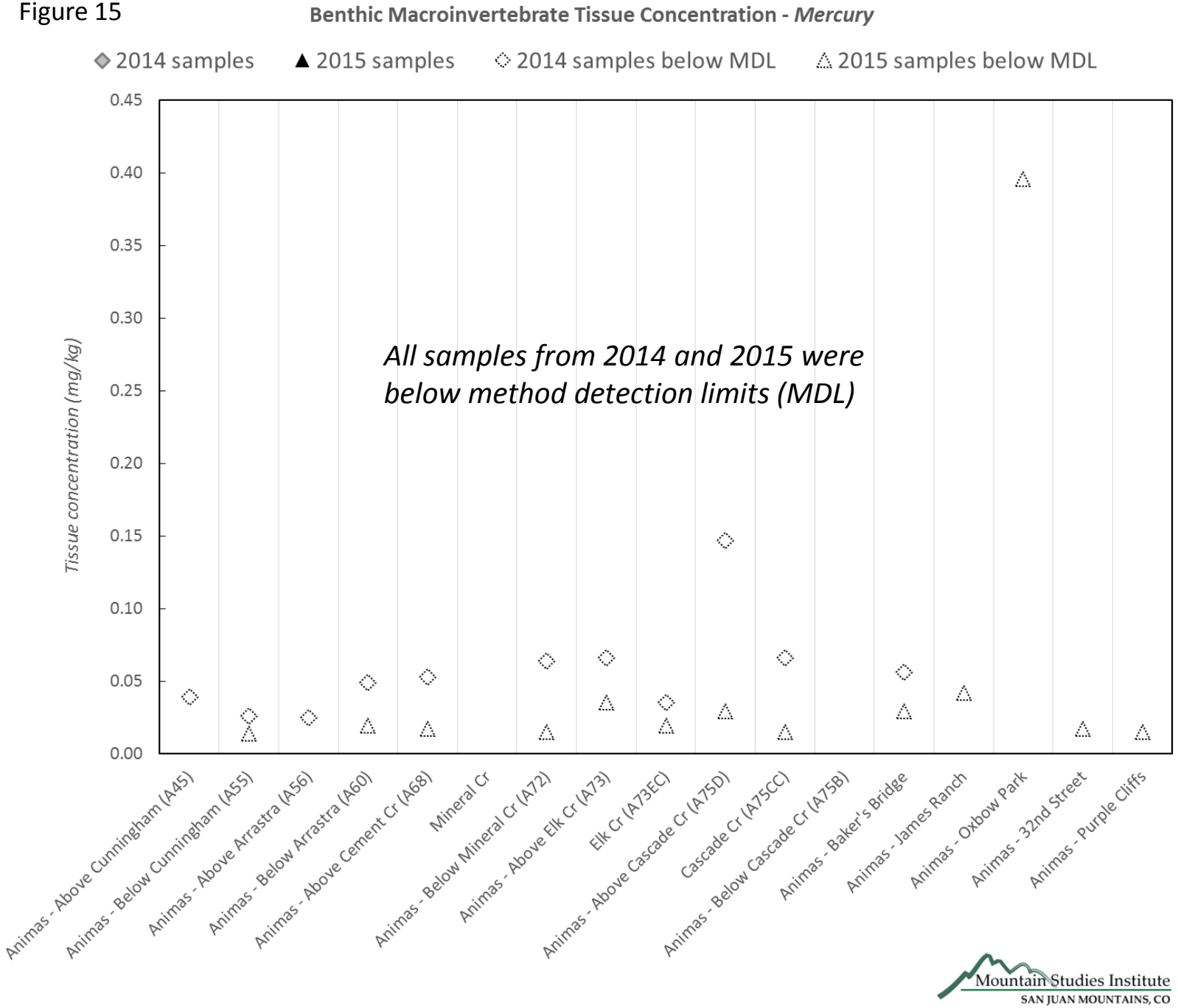
Benthic Macroinvertebrate Tissue Concentration - Mercury
2014 samples
2015 samples
2014 samples below MDL
2015 samples below MDL
Tissue concentration (mg/kg)
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
All samples from 2014 and 2015 were below method detection limits (MDL)
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Mineral Cr
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Below Cascade Cr (A75B)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 16

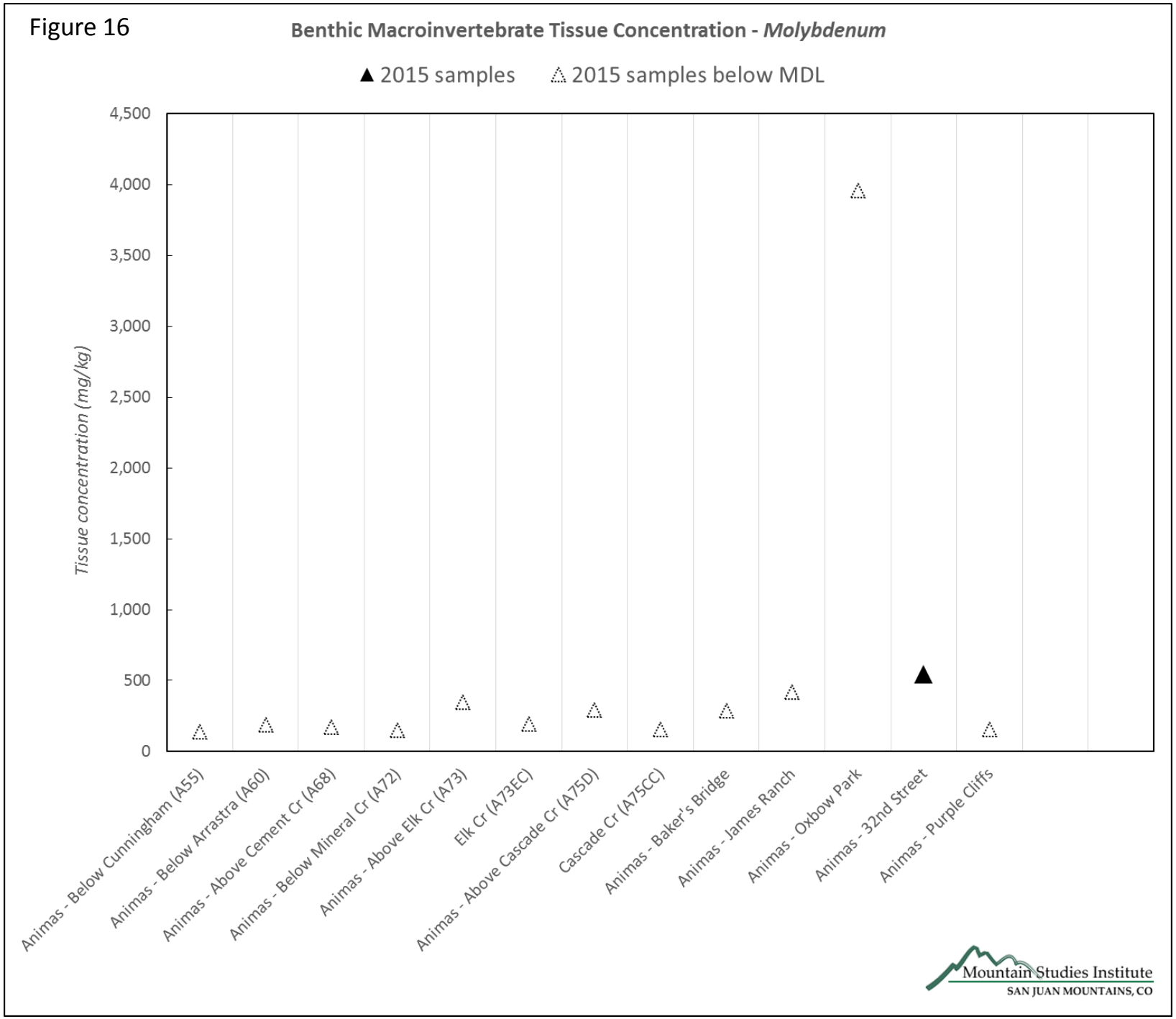
Benthic Macroinvertebrate Tissue Concentration - *Molybdenum*
▲ 2015 samples
△ 2015 samples below MDL
Tissue concentration (mg/kg)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Animas - Below Cunningham (A55)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 17

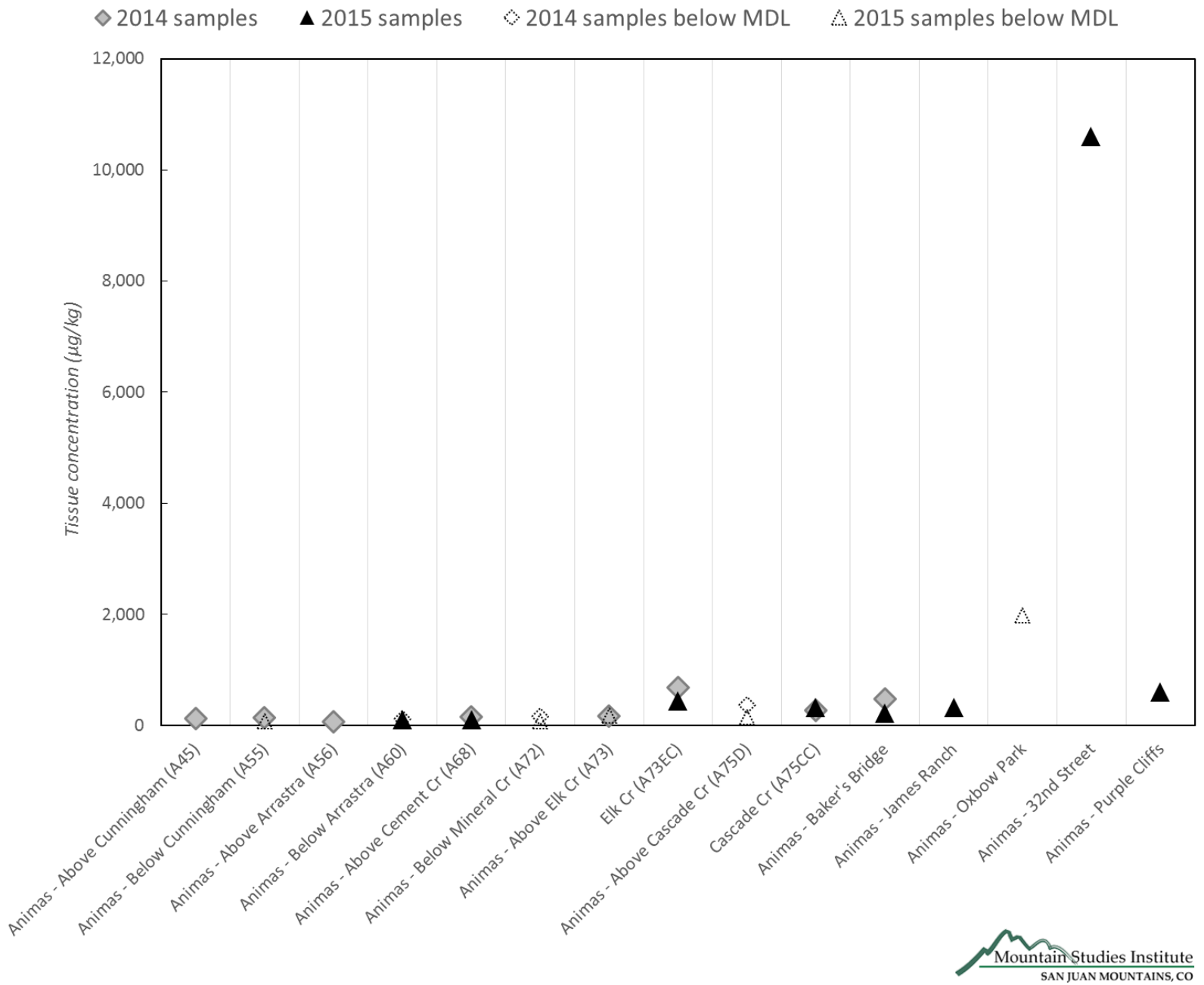
Benthic Macroinvertebrate Tissue Concentration - *Nickel*
2014 samples
2015 samples
2014 samples below MDL
2015 samples below MDL
Tissue concentration (µg/kg)
12,000
10,000
8,000
6,000
4,000
2,000
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 18

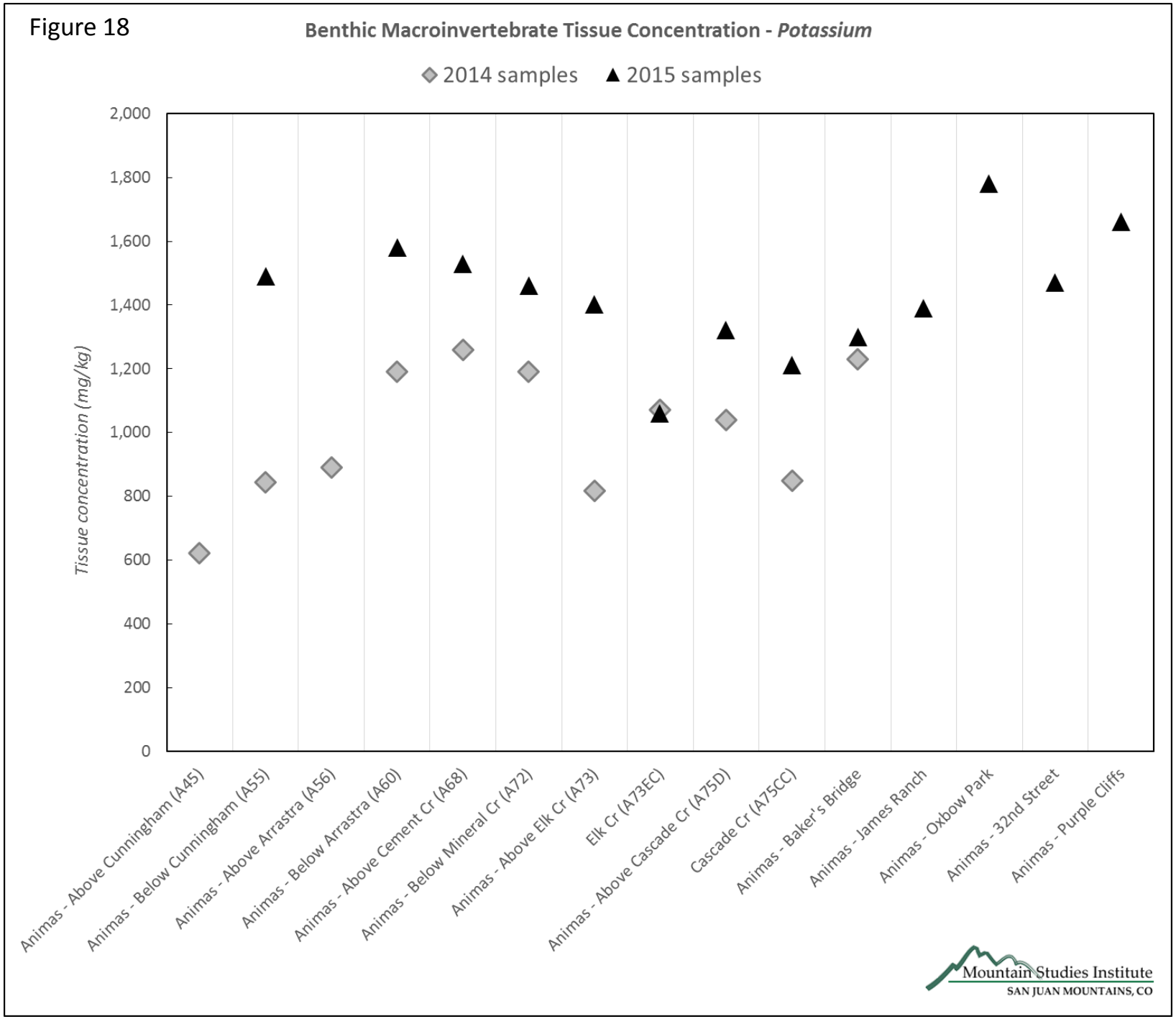
Benthic Macroinvertebrate Tissue Concentration - *Potassium*
2014 samples
2015 samples
Tissue concentration (mg/kg)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 19

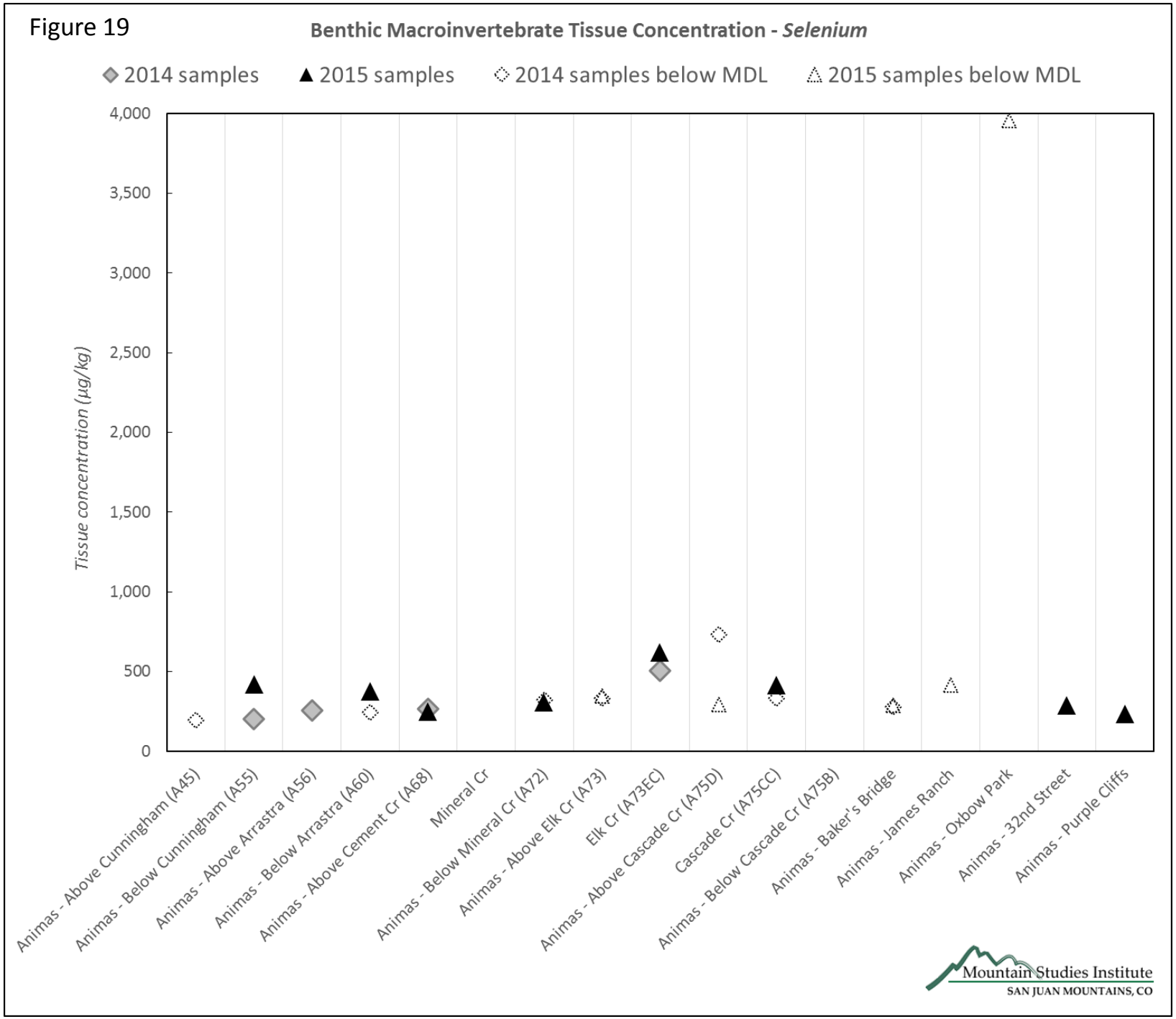
Benthic Macroinvertebrate Tissue Concentration - Selenium
2014 samples
2015 samples
2014 samples below MDL
2015 samples below MDL
Tissue concentration (µg/kg)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Mineral Cr
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Below Cascade Cr (A75B)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 20

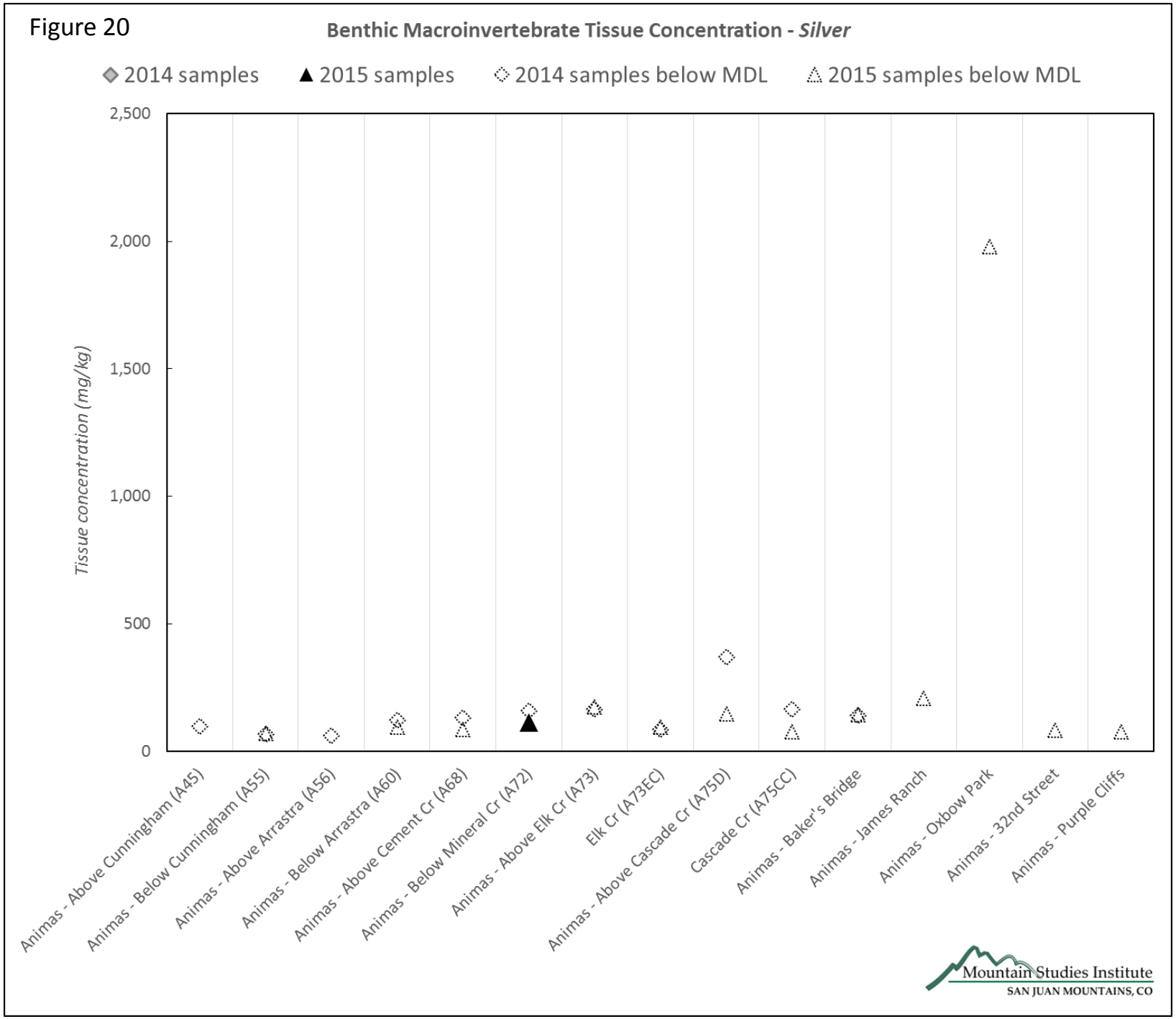
Benthic Macroinvertebrate Tissue Concentration - Silver
2014 samples
2015 samples
2014 samples below MDL
2015 samples below MDL
Tissue concentration (mg/kg)
2,500
2,000
1,500
1,000
500
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 21

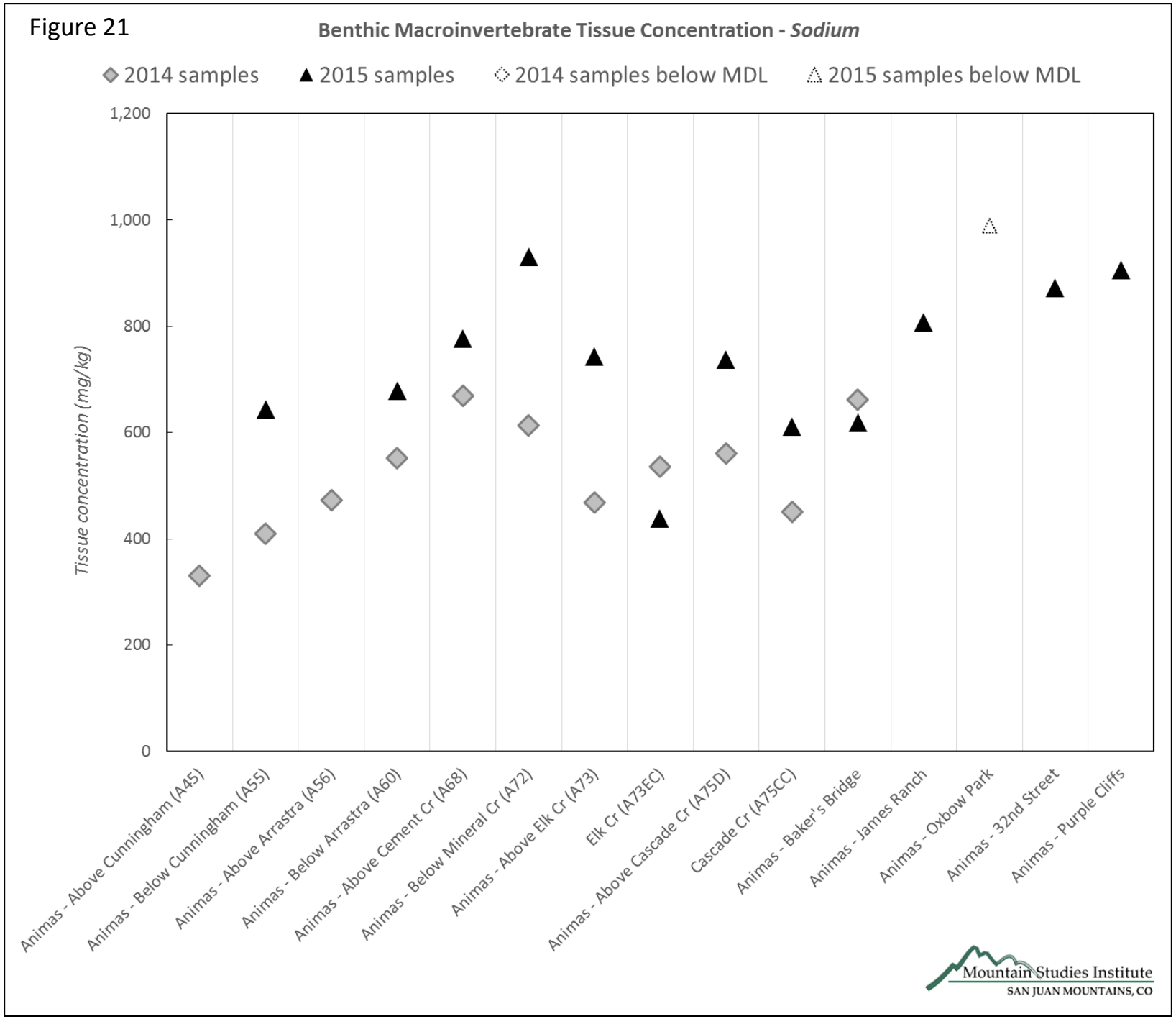
Benthic Macroinvertebrate Tissue Concentration - *Sodium*
2014 samples
2015 samples
2014 samples below MDL
2015 samples below MDL
Tissue concentration (mg/kg)
1,200
1,000
800
600
400
200
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Figure 22

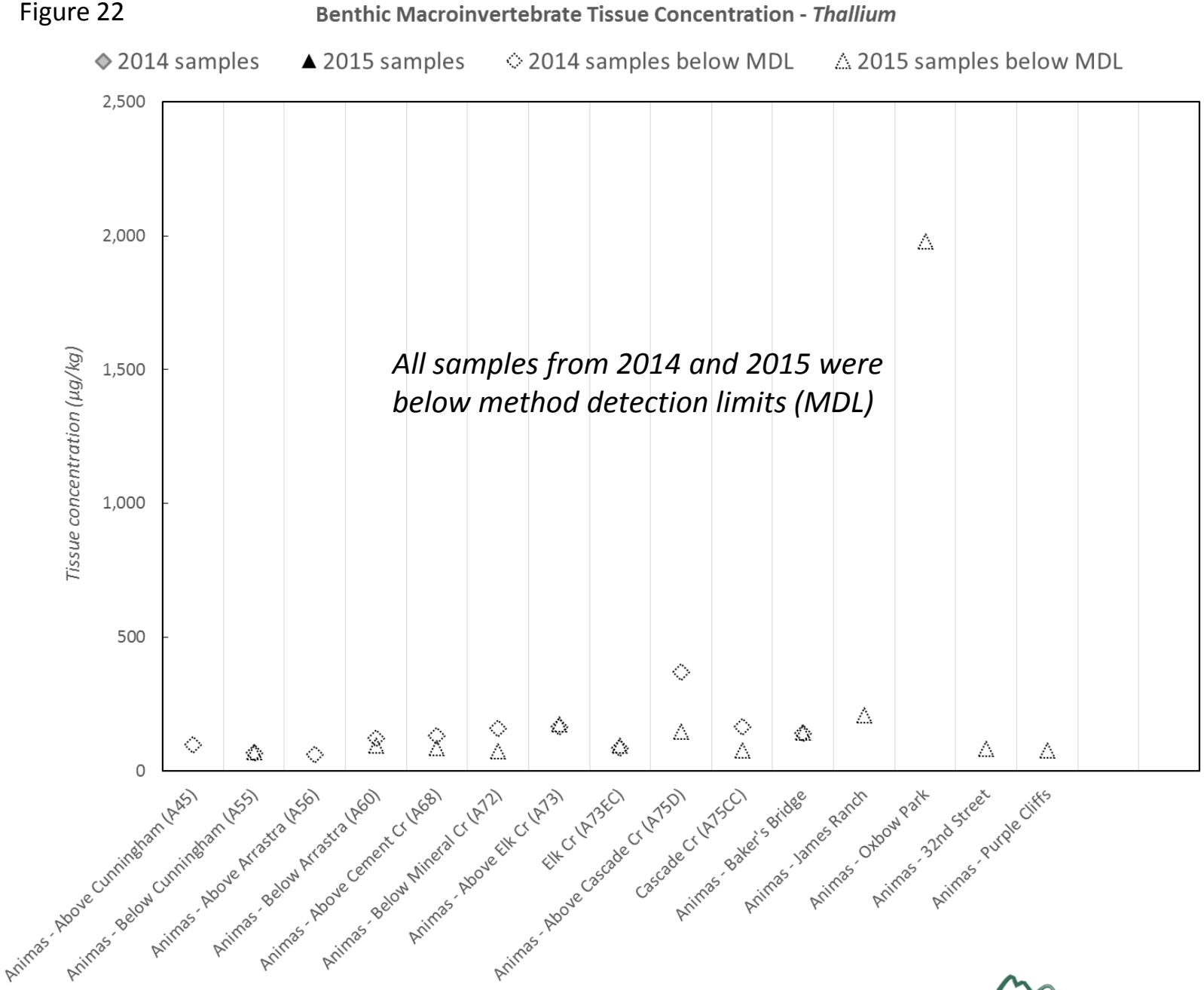

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Figure 23

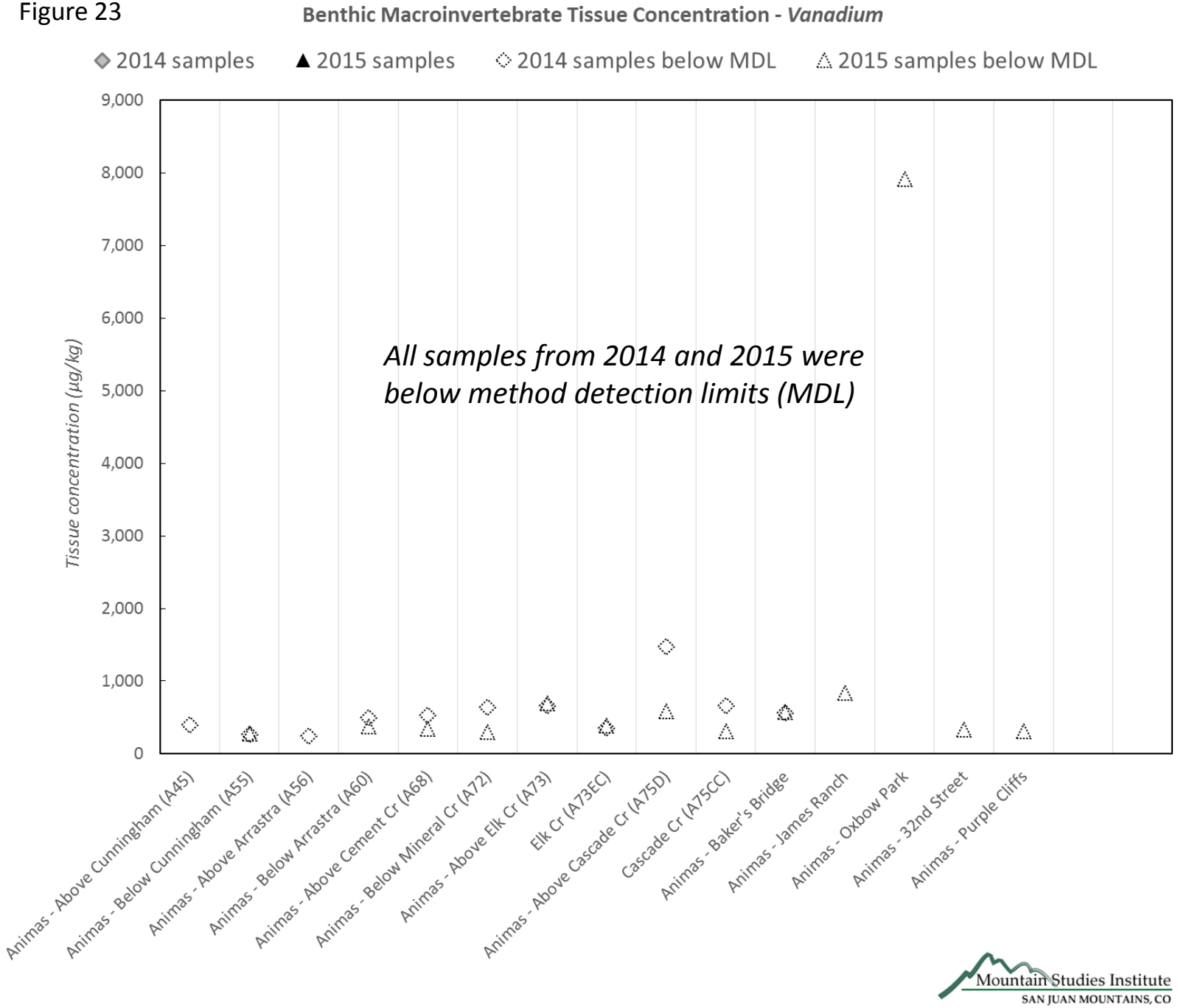

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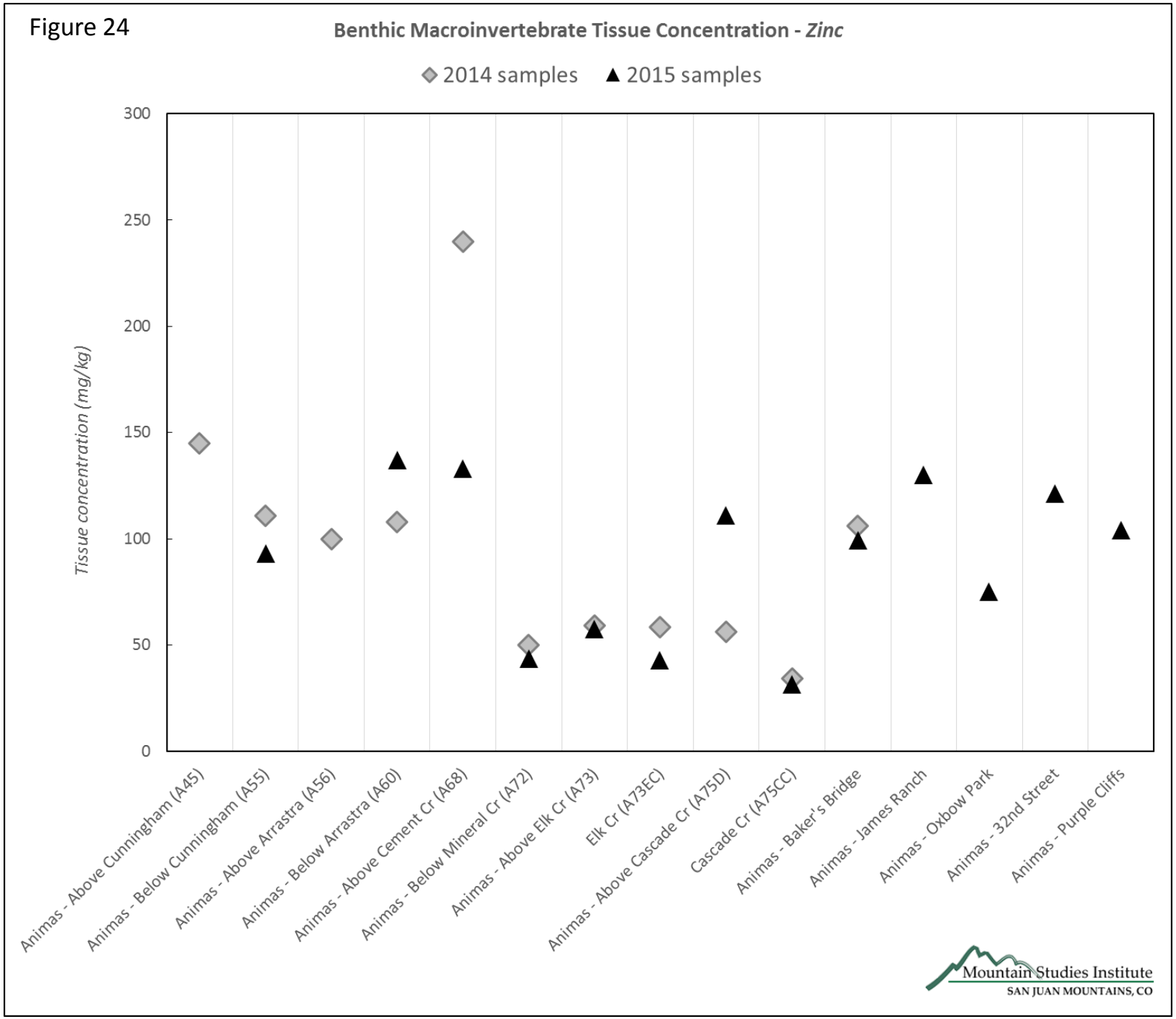
Figure 24


Benthic Macroinvertebrate Tissue Concentration - Zinc
2014 samples
2015 samples
Tissue concentration (mg/kg)
300
250
200
150
100
50
0
Animas - Above Cunningham (A45)
Animas - Below Cunningham (A55)
Animas - Above Arrastra (A56)
Animas - Below Arrastra (A60)
Animas - Above Cement Cr (A68)
Animas - Below Mineral Cr (A72)
Animas - Above Elk Cr (A73)
Elk Cr (A73EC)
Animas - Above Cascade Cr (A75D)
Cascade Cr (A75CC)
Animas - Baker's Bridge
Animas - James Ranch
Animas - Oxbow Park
Animas - 32nd Street
Animas - Purple Cliffs
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Appendix C – Benthic macroinvertebrate taxa observed in 2015

These are the unadjusted lab bench counts. As described in Section 3.3, we later subsampled these unadjusted counts to meet Colorado Multi-metric Index (MMI) parameters. Additionally, we adjusted the taxonomic resolution of some taxa to allow comparison between 2014 and 2015 data.

Animas River		A55		9/23/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	27
		Ephemerellidae	Drunella_doddsii	76
		Heptageniidae	Epeorus	8
		Heptageniidae	Rhithrogena	28
	Plecoptera	Capniidae	Capnia	1
		Chloroperlidae	Sweltsa	2
		Nemouridae	Nemouridae_(not_zapada)	5
		Nemouridae	Zapada	26
		Perlodidae	Megarcys	3
		Taeniopterygidae	Taenionema	40
	Trichoptera	Hydropsychidae	Arctopsyche	40
		Lepidostomatidae	Lepidostoma	4
		Rhyacophilidae	Rhyacophila_brunnea	3
		Rhyacophilidae	Rhyacophila_hyalinata	8
	Diptera	Ceratopogonidae	Probezzia	1
		Chironomidae	Cricotopus_Orthocladius	2
		Chironomidae	Diamesa	1
		Chironomidae	Eukiefferiella_gracei	1
		Chironomidae	Tanytarsus	1
		Empididae	Chelifera	1
		Simuliidae	Prosimulium	11
		Simuliidae	Simulium	224
Arachnida	Trombidiformes	Lebertiidae	Lebertia	17
		Sperchonidae	Sperchon	5
Turbellaria			Turbellaria	12
			Nematoda	2

Total Count	549
Fraction Processed	37.5%
Area Sampled	0.575 m^2

Animas River		A60		9/23/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	24
		Ephemerellidae	Drunella_doddsii	11
		Heptageniidae	Epeorus	8
		Heptageniidae	Rhithrogena	7
	Plecoptera	Capniidae	Capnia	1
		Chloroperlidae	Sweltsa	1
		Nemouridae	Zapada	18
		Taeniopterygidae	Taenionema	25
	Trichoptera	Hydropsychidae	Arctopsyche	14
		Rhyacophilidae	Rhyacophila_hyalinata	8
		Rhyacophilidae	Rhyacophila_vofixa	1
	Diptera	Ceratopogonidae	Probezzia	2
		Chironomidae	Cricotopus_Orthocladius	29
		Simuliidae	Simulium	477
Arachnida	Trombidiformes	Feltriidae	Feltria	1
		Lebertiidae	Lebertia	1
		Sperchonidae	Sperchon	1
Turbellaria			Turbellaria	3

Total Count	632
Fraction Processed	18.8%
Area Sampled	0.575 m^2

Animas River		A68		8/8/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	186
		Ephemerellidae	Drunella_coloradensis	1
		Ephemerellidae	Drunella_doddsii	14
		Heptageniidae	Cinygmula	1
		Heptageniidae	Epeorus	36
		Heptageniidae	Rhithrogena	10
	Plecoptera	Chloroperlidae	Chloroperlidae	2
		Chloroperlidae	Suwallia	1
		Nemouridae	Zapada	11
		Perlodidae	Megarcys	1
	Trichoptera	Arctopsychidae	Arctopsyche_grandis	7
		Rhyacophilidae	Rhyacophila_brunnea	1
		Rhyacophilidae	Rhyacophila_coloradensis	2
		Rhyacophilidae	Rhyacophila_sibirica	1
	Diptera	Chironomidae	Cricotopus_Orthocladius	20
		Chironomidae	Eukiefferiella	4
		Chironomidae	Pagastia	1
		Simuliidae	Prosimulium	2
		Tipulidae	Dicranota	1
Arachnida	Trombidiformes	Lebertiidae	Lebertia	2
Turbellaria	Tricladida	Planariidae	Polycelis	1

Total Count	305
Fraction Processed	53.3%
Area Sampled	0.575 m^2

Animas River	A68			8/12/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	290
		Ephemerellidae	Drunella_doddsii	16
		Heptageniidae	Epeorus	40
		Heptageniidae	Rhithrogena	44
	Plecoptera	Capniidae	Capniidae	2
		Chloroperlidae	Suwallia	7
		Chloroperlidae	Sweltsa	3
		Nemouridae	Nemouridae_(not_zapada)	7
		Nemouridae	Zapada	5
		Perlodidae	Megarcys	1
	Trichoptera	Hydropsychidae	Arctopsyche	7
		Rhyacophilidae	Rhyacophila_coloradensis	1
	Diptera	Ceratopogonidae	Probezzia	13
		Chironomidae	Apedilum	1
		Chironomidae	Cricotopus_Nostococladius	9
		Chironomidae	Cricotopus_Orthocladius	93
		Chironomidae	Eukiefferiella_claripennis	7
		Chironomidae	Limnophyes	2
		Chironomidae	Micropsectra	3
		Chironomidae	Phaenopsectra	1
		Chironomidae	Rheocricotopus	1
		Simuliidae	Prosimulium	19
		Simuliidae	Simulium	12
		Tipulidae	Dicranota	1
Arachnida	Trombidiformes	Lebertiidae	Lebertia	2
		Sperchonidae	Sperchon	2
Oligochaeta			Oligochaeta	2

Total Count	591
Fraction Processed	75.0%
Area Sampled	0.575 m^2

Animas River		A68		9/23/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	3
		Ephemerellidae	Drunella_doddsii	1
		Heptageniidae	Rhithrogena	4
	Plecoptera	Chloroperlidae	Sweltsa	2
		Nemouridae	Zapada	2
		Perlodidae	Megarcys	4
		Taeniopterygidae	Taenionema	16
	Trichoptera	Hydropsychidae	Arctopsyche	11
		Rhyacophilidae	Rhyacophila_sibirica	1
	Diptera	Ceratopogonidae	Probezzia	8
		Chironomidae	Cricotopus_Orthocladius	12
		Chironomidae	Eukiefferiella_claripennis	6
		Chironomidae	Eukiefferiella_gracei	3
		Simuliidae	Prosimulium	256
		Simuliidae	Simulium	171
Arachnida	Trombidiformes	Lebertiidae	Lebertia	1
			Nematoda	6

Total Count	501
Fraction Processed	12.5%
Area Sampled	0.575 m^2

Animas River		A72		8/8/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	2
	Plecoptera	Nemouridae	Zapada	73
		Perlodidae	Isoperla	1
	Trichoptera	Arctopsychidae	Arctopsyche_grandis	19
		Rhyacophilidae	Rhyacophila_brunnea	1
		Rhyacophilidae	Rhyacophila_hyalinata	1
	Diptera	Chironomidae	Brillia	1
		Chironomidae	Chaetocladius	3
		Chironomidae	Cricotopus_Orthocladius	4
		Chironomidae	Heleniella	2
		Chironomidae	Tvetenia	1
		Simuliidae	Prosimulium	1

Total Count	109
Fraction Processed	100.0%
Area Sampled	0.575 m^2

Animas River		A72		8/12/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	7
	Plecoptera	Chloroperlidae	Sweltsa	2
		Nemouridae	Zapada	28
		Perlodidae	Isoperla	2
	Trichoptera	Brachycentridae	Brachycentrus	2
		Hydropsychidae	Arctopsyche	40
		Rhyacophilidae	Rhyacophila_brunnea	1
	Diptera	Chironomidae	Cricotopus_Orthocladius	1
		Chironomidae	Heleniella	1
		Chironomidae	Limnophyes	2
		Chironomidae	Tvetenia_bavarica	1
		Simuliidae	Prosimulium	1
Arachnida	Trombidiformes	Hydryphantoidea	Protzia	1
		Hygrobatidae	Atractides	1
		Lebertiidae	Lebertia	1

Total Count	91
Fraction Processed	100.0%
Area Sampled	0.575 m^2

Animas River		A72		9/23/2015
Class	Order	Family	Taxon	Count
Insecta	Plecoptera	Nemouridae	Zapada	23
		Taeniopterygidae	Taenionema	2
	Trichoptera	Hydropsychidae	Arctopsyche	37
	Diptera	Ceratopogonidae	Probezzia	5
		Chironomidae	Chaetocladius	1
		Chironomidae	Cricotopus_Orthocladius	2
		Simuliidae	Prosimulium	4
		Simuliidae	Simulium	10
Arachnida	Trombidiformes	Lebertiidae	Lebertia	5

Total Count	89
Fraction Processed	100.0%
Area Sampled	0.575 m^2

Animas River	A73	10/15/2015		
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	2
		Heptageniidae	Rhithrogena	5
	Plecoptera	Nemouridae	Nemouridae_(not_zapada)	2
		Nemouridae	Zapada	30
		Taeniopterygidae	Taenionema	5
	Trichoptera	Brachycentridae	Brachycentrus	1
		Hydropsychidae	Arctopsyche	120
		Rhyacophilidae	Rhyacophila_angelita	1
		Rhyacophilidae	Rhyacophila_hyalinata	2
	Diptera	Blephariceridae	Bibiocephala	2
		Ceratopogonidae	Probezzia	4
		Chironomidae	Chaetocladius	1
		Chironomidae	Cricotopus_Orthocladius	3
		Chironomidae	Eukiefferiella_brehmi	1
		Chironomidae	Micropsectra	1
		Simuliidae	Simulium	4
Arachnida	Trombidiformes	Lebertiidae	Lebertia	4
		Sperchonidae	Sperchon	1
Turbellaria			Turbellaria	1

Total Count	189
Fraction Processed	100.0%
Area Sampled	0.575 m^2

Elk Creek		A73EC		10/15/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	5
		Ephemerellidae	Drunella_doddsii	62
		Heptageniidae	Rhithrogena	82
	Plecoptera	Chloroperlidae	Sweltsa	6
		Nemouridae	Zapada	38
		Perlodidae	Isoperla	1
		Perlodidae	Megarcys	1
		Perlodidae	Perlodidae	12
		Taeniopterygidae	Taenionema	315
	Trichoptera	Hydropsychidae	Arctopsyche	2
		Limnephilidae	Limnephilidae	1
		Rhyacophilidae	Rhyacophila_brunnea	8
		Rhyacophilidae	Rhyacophila_hyalinata	1
		Rhyacophilidae	Rhyacophila_sibirica	6
		Rhyacophilidae	Rhyacophila_vofixa	2
	Diptera	Chironomidae	Brillia	1
		Chironomidae	Chaetocladius	2
		Chironomidae	Cricotopus_Orthocladius	1
		Chironomidae	Eukiefferiella_brehmi	1
		Chironomidae	Eukiefferiella_gracei	5
		Chironomidae	Micropsectra	3
		Chironomidae	Tvetenia_discoloripes	7
		Empididae	Clinocera	2
		Simuliidae	Prosimulium	2
		Tipulidae	Dicranota	1
Oligochaeta			Oligochaeta	3

Total Count	570
Fraction Processed	28.1%
Area Sampled	0.575 m^2

Animas River		A75D		10/15/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	1
		Ephemerellidae	Drunella_doddsii	2
		Heptageniidae	Rhithrogena	31
	Plecoptera	Capniidae	Capnia	1
		Chloroperlidae	Suwallia	1
		Nemouridae	Zapada	2
		Perlidae	Hesperoperla	2
		Taeniopterygidae	Taenionema	23
	Trichoptera	Hydropsychidae	Arctopsyche	25
	Diptera	Blephariceridae	Bibiocephala	8
		Chironomidae	Brillia	1
		Chironomidae	Chaetocladius	6
		Chironomidae	Cricotopus_Orthocladius	3
		Chironomidae	Eukiefferiella_claripennis	4
		Chironomidae	Eukiefferiella_gracei	1
		Empididae	Neoplasta	2
		Simuliidae	Simulium	1
Arachnida	Trombidiformes	Lebertiidae	Lebertia	1
		Sperchonidae	Sperchon	3

Total Count	118
Fraction Processed	100.0%
Area Sampled	0.575 m^2

Cascade Creek		A75CC		10/15/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Ameletidae	Ameletus	1
		Baetidae	Baetis	52
		Ephemerellidae	Drunella_doddsii	29
		Ephemerellidae	Drunella_grandis	6
		Ephemerellidae	Ephemerella	6
		Heptageniidae	Cinygmula	7
		Heptageniidae	Epeorus	65
		Heptageniidae	Rhithrogena	20
	Plecoptera	Capniidae	Capnia	14
		Chloroperlidae	Sweltsa	6
		Nemouridae	Nemouridae_(not_zapada)	48
		Perlidae	Hesperoperla	8
		Perlodidae	Isoperla	2
		Perlodidae	Skwala	2
		Taeniopterygidae	Taenionema	5
	Trichoptera	Brachycentridae	Brachycentrus	1
		Hydropsychidae	Arctopsyche	45
		Hydropsychidae	Hydropsyche	47
		Rhyacophilidae	Rhyacophila_sibirica	6
	Coleoptera	Elmidae	Heterlimnius	2
	Diptera	Blephariceridae	Bibiocephala	1
		Ceratopogonidae	Probezzia	1
		Chironomidae	Cricotopus_Orthocladius	6
		Chironomidae	Diamesa	14
		Chironomidae	Eukiefferiella_brehmi	3
		Chironomidae	Eukiefferiella_gracei	5
		Chironomidae	Heterotrissocladius_marcidus	1
		Chironomidae	Micropsectra	4
		Chironomidae	Pagastia	2
		Chironomidae	Polypedilum_aviceps	1
		Chironomidae	Tanytarsus	2
		Chironomidae	Tvetenia_bavarica	3
		Empididae	Clinocera	2
		Empididae	Neoplasta	1
		Empididae	Wiedemannia	2
		Simuliidae	Prosimulium	1
		Tipulidae	Antocha	3
		Tipulidae	Hexatoma	4
Arachnida	Trombidiformes	Lebertiidae	Lebertia	1
		Sperchonidae	Sperchon	4
Oligochaeta			Oligochaeta	52
Ostracoda			Ostracoda	5
Turbellaria			Turbellaria	5
			Nematoda	1

Total Count	496
Fraction Processed	15.6%
Area Sampled	0.575 m^2

Animas River	Bakers Bridge	9/21/2015		
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	146
		Ephemerellidae	Drunella_doddsii	6
		Ephemerellidae	Drunella_grandis	3
		Heptageniidae	Rhithrogena	10
	Plecoptera	Capniidae	Capnia	1
		Chloroperlidae	Sweltsa	1
		Perlidae	Hesperoperla	1
		Perlodidae	Cultus	3
		Taeniopterygidae	Taenionema	2
	Trichoptera	Brachycentridae	Brachycentrus	7
		Hydropsychidae	Arctopsyche	158
		Hydropsychidae	Hydropsyche	24
	Diptera	Athericidae	Atherix	2
		Blephariceridae	Bibiocephala	3
		Chironomidae	Chaetocladius	17
		Chironomidae	Cricotopus_Orthocladius	12
		Chironomidae	Eukiefferiella_brehmi	5
		Chironomidae	Eukiefferiella_claripennis	19
		Chironomidae	Eukiefferiella_gracei	4
		Chironomidae	Heterotrissocladius_marcidus	1
		Chironomidae	Micropsectra	3
		Chironomidae	Pagastia	7
		Chironomidae	Parametriocnemus	1
		Empididae	Neoplasta	1
		Empididae	Wiedemannia	6
		Simuliidae	Prosimulium	2
		Simuliidae	Simulium	10
Arachnida	Trombidiformes	Hygrobatidae	Atractides	1
		Hygrobatidae	Hygrobates	2
		Lebertiidae	Lebertia	24
		Sperchonidae	Sperchon	19
Oligochaeta			Oligochaeta	1
Ostracoda			Ostracoda	2
Turbellaria			Turbellaria	1

Total Count	505
Fraction Processed	75.0%
Area Sampled	0.575 m^2

Animas River	James Ranch	9/21/2015		
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	202
		Ephemerellidae	Drunella_doddsii	3
		Ephemerellidae	Drunella_grandis	1
		Heptageniidae	Rhithrogena	1
	Plecoptera	Chloroperlidae	Sweltsa	1
	Trichoptera	Brachycentridae	Brachycentrus	40
		Hydropsychidae	Arctopsyche	8
		Hydropsychidae	Hydropsyche	6
	Diptera	Blephariceridae	Bibiocephala	6
		Chironomidae	Chaetocladius	1
		Chironomidae	Cricotopus_Orthocladius	11
		Chironomidae	Cricotopus_trifascia	1
		Chironomidae	Diamesa	1
		Chironomidae	Eukiefferiella_claripennis	14
		Chironomidae	Eukiefferiella_gracei	6
		Simuliidae	Prosimulium	6
		Simuliidae	Simulium	4
		Tipulidae	Dicranota	1
Arachnida	Trombidiformes	Hygrobatidae	Atractides	2
		Lebertiidae	Lebertia	3
		Sperchonidae	Sperchon	6

Total Count	324
Fraction Processed	100.0%
Area Sampled	0.575 m^2

Animas River	Oxbow Park	9/18/2015		
Class	Order	Family	Taxon	Count
Insecta	Trichoptera	Brachycentridae	Brachycentrus	3
	Diptera	unknown	Diptera	1
		Ceratopogonidae	Stilobezzia	3
		Chironomidae	Apedilum	12
		Chironomidae	Cricotopus_Orthocladius	209
		Chironomidae	Micropsectra	45
		Chironomidae	Monodiamesa	115
		Chironomidae	Odontomesa	8
		Chironomidae	Parametriocnemus	8
		Chironomidae	Phaenopsectra	33
		Chironomidae	Polypedilum_laetum	12
		Chironomidae	Polypedilum_scalaenum	21
		Chironomidae	Potthastia_gaedii	29
		Chironomidae	Robackia	4
		Chironomidae	Tanytarsus	12
		Chironomidae	Thiennemannimyia	4
		Chironomidae	Tvetenia_bavarica	4
		Empididae	Hemerodromia	1
		Tipulidae	Hexatoma	1
		Tipulidae	Limnophila	1
Arachnida	Trombidiformes	Lebertiidae	Lebertia	1
Gastropoda	Basommatophora	Physidae	Physa	1

Total Count	528
Fraction Processed	7.0%
Area Sampled	0.575 m^2

Animas River	32nd St			8/6/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	15
		Ephemerellidae	Drunella_grandis	1
	Trichoptera	Brachycentridae	Brachycentrus	290
		Hydropsychidae	Hydropsyche	2
	Diptera	Chironomidae	Cricotopus_Orthocladius	11
		Chironomidae	Eukiefferiella	177
		Chironomidae	Pagastia	1
		Chironomidae	Thiennemannimyia	3
		Simuliidae	Simulium	2
Arachnida	Trombidiformes	Lebertiidae	Lebertia	2
Oligochaeta			Oligochaeta	1

Total Count	505
Fraction Processed	2.7%
Area Sampled	0.575 m^2

Animas River	32nd St	8/7/2015		
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	19
		Ephemerellidae	Drunella_grandis	2
	Plecoptera	Nemouridae	Zapada	2
	Trichoptera	Brachycentridae	Brachycentrus	263
		Hydropsychidae	Hydropsyche	2
	Diptera	Chironomidae	Cricotopus_Orthocladius	7
		Chironomidae	Eukiefferiella	90
		Chironomidae	Pagastia	1
		Chironomidae	Thiennemannimyia	5
		Simuliidae	Simulium	2

Total Count	393
Fraction Processed	2.7%
Area Sampled	0.575 m^2

Animas River		32nd St		8/13/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	28
		Ephemerellidae	Drunella_grandis	2
	Plecoptera	Nemouridae	Zapada	1
	Trichoptera	Brachycentridae	Brachycentrus	231
		Hydropsychidae	Hydropsyche	5
		Hydroptilidae	Hydroptila	1
	Diptera	Chironomidae	Cricotopus_Orthocladius	79
		Chironomidae	Eukiefferiella_claripennis	27
		Chironomidae	Eukiefferiella_devonica	97
		Chironomidae	Eukiefferiella_gracei	44
		Chironomidae	Pagastia	2
		Chironomidae	Thienemanniella_fusca	2
		Chironomidae	Thiennemannimyia	6
		Simuliidae	Prosimulium	1
		Simuliidae	Simulium	3
Arachnida	Trombidiformes	Hygrobatidae	Atractides	2
		Sperchonidae	Sperchon	1
Oligochaeta			Oligochaeta	6

Total Count	538
Fraction Processed	3.5%
Area Sampled	0.575 m^2

Animas River	32nd St	9/22/2015		
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	14
		Ephemerellidae	Drunella_grandis	5
	Trichoptera	Brachycentridae	Brachycentrus	131
		Hydropsychidae	Hydropsyche	26
		Leptoceridae	Oecetis	2
	Diptera	Chironomidae	Cricotopus_Orthocladius	139
		Chironomidae	Eukiefferiella_devonica	189
		Chironomidae	Eukiefferiella_gracei	107
		Chironomidae	Microtendipes_pedellus	3
		Chironomidae	Pagastia	1
		Chironomidae	Parametriocnemus	3
		Chironomidae	Potthastia_gaedii	4
		Chironomidae	Thiennemannimyia	1
		Chironomidae	Tvetenia_bavarica	2
		Empididae	Clinocera	3
Arachnida	Trombidiformes	Lebertiidae	Lebertia	2
		Sperchonidae	Sperchon	2
Gastropoda	Basommatophora	Physidae	Physa	2
Oligochaeta			Oligochaeta	12

Total Count	648
Fraction Processed	4.7%
Area Sampled	0.575 m^2

Animas River	Rotary Park			8/6/2015
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	67
	Trichoptera	Brachycentridae	Brachycentrus	145
		Hydropsychidae	Hydropsyche	3
	Diptera	Chironomidae	Cricotopus_Orthocladius	24
		Chironomidae	Eukiefferiella	51
		Chironomidae	Potthastia_gaedii	1
		Chironomidae	Thiennemannimyia	3
		Empididae	Chelifera	3
		Simuliidae	Simulium	10
Arachnida	Trombidiformes	Lebertiidae	Lebertia	3
		Sperchonidae	Sperchon	1
			Nematoda	2

Total Count	313
Fraction Processed	26.7%
Area Sampled	0.8 m^2

Animas River	Rotary Park	8/7/2015		
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	169
		Ephemerellidae	Drunella_grandis	1
	Plecoptera	Perlodidae	Isoperla	1
	Trichoptera	Brachycentridae	Brachycentrus	87
		Hydropsychidae	Hydropsyche	1
	Coleoptera	Dryopidae	Helichus	2
	Diptera	Chironomidae	Cardiocladius	1
		Chironomidae	Cricotopus_Orthocladius	33
		Chironomidae	Eukiefferiella	21
		Chironomidae	Thiennemannimyia	2
		Chironomidae	Tvetenia	2
		Empididae	Chelifera	3
		Simuliidae	Simulium	25
Arachnida	Trombidiformes	Lebertiidae	Lebertia	1
		Sperchonidae	Sperchon	1
			Nematoda	1

Total Count	351
Fraction Processed	20.0%
Area Sampled	0.8 m^2

Animas River	Rotary Park	8/13/2015		
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	127
		Ephemerellidae	Drunella_grandis	1
	Plecoptera	Nemouridae	Amphinemura	1
	Trichoptera	Brachycentridae	Brachycentrus	130
		Hydropsychidae	Hydropsyche	10
	Diptera	Ceratopogonidae	Probezzia	2
		Chironomidae	Cricotopus_Orthocladius	52
		Chironomidae	Eukiefferiella_brehmi	14
		Chironomidae	Eukiefferiella_gracei	84
		Chironomidae	Heterotrissocladius_marcidus	2
		Chironomidae	Micropsectra	10
		Chironomidae	Pagastia	2
		Chironomidae	Parakiefferiella	28
		Chironomidae	Phaenopsectra	10
		Chironomidae	Potthastia_gaedii	4
		Chironomidae	Thiennemannimyia	2
		Empididae	Neoplasta	1
		Simuliidae	Prosimulium	23
		Simuliidae	Simulium	7
Arachnida	Trombidiformes	Hygrobatidae	Atractides	2
		Lebertiidae	Lebertia	6
		Torrenticolidae	Torrenticola	11
Oligochaeta			Oligochaeta	4

Total Count	533
Fraction Processed	7.8%
Area Sampled	0.8 m^2

Animas River	Rotary Park	9/20/2015		
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	76
		Ephemerellidae	Drunella_grandis	2
	Trichoptera	Brachycentridae	Brachycentrus	29
		Hydropsychidae	Hydropsyche	87
		Hydroptilidae	Hydroptila	5
	Diptera	Chironomidae	Cricotopus_Orthocladius	64
		Chironomidae	Eukiefferiella_devonica	144
		Chironomidae	Eukiefferiella_gracei	48
		Chironomidae	Microtendipes_pedellus	5
		Chironomidae	Polypedilum_aviceps	2
		Chironomidae	Potthastia_gaedii	2
		Chironomidae	Tvetenia_bavarica	9
		Simuliidae	Simulium	26
		Simuliidae	Prosimulium	18
		Empididae	Wiedemannia	1
Arachnida	Trombidiformes	Hygrobatidae	Atractides	5
		Sperchonidae	Sperchon	3
		Torrenticolidae	Torrenticola	1
Oligochaeta			Oligochaeta	8

Total Count	535
Fraction Processed	7.8%
Area Sampled	0.8 m^2

Animas River	Abv Lightner	9/20/2015		
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	103
		Ephemerellidae	Drunella_grandis	1
		Leptohyphidae	Tricorythodes	2
	Plecoptera	Perlodidae	Perlodidae	1
		Pteronarcyidae	Pteronarcys	1
	Trichoptera	Brachycentridae	Brachycentrus	14
		Hydropsychidae	Hydropsyche	161
		Hydroptilidae	Ochrotrichia	1
	Coleoptera	Elmidae	Zaitzevia	2
	Diptera	Chironomidae	Cricotopus_Orthocladius	14
		Chironomidae	Cricotopus_trifascia	4
		Chironomidae	Eukiefferiella_brehmi	5
		Chironomidae	Eukiefferiella_devonica	20
		Chironomidae	Eukiefferiella_gracei	36
		Chironomidae	Micropsectra	2
		Chironomidae	Microtendipes_pedellus	1
		Chironomidae	Monodiamesa	1
		Chironomidae	Polypedilum_aviceps	1
		Chironomidae	Polypedilum_laetum	1
		Empididae	Clinocera	4
		Empididae	Wiedemannia	2
		Simuliidae	Prosimulium	15
		Simuliidae	Simulium	34
		Tipulidae	Hexatoma	1
Arachnida	Trombidiformes	Hygrobatidae	Atractides	13
		Lebertiidae	Lebertia	2
		Sperchonidae	Sperchon	4
		Torrenticolidae	Torrenticola	8
Oligochaeta			Oligochaeta	88
			Nematoda	2

Total Count	544
Fraction Processed	8.2%
Area Sampled	0.575 m^2

Animas River	Purple Cliffs	9/22/2015		
Class	Order	Family	Taxon	Count
Insecta	Ephemeroptera	Baetidae	Baetis	141
		Leptohyphidae	Tricorythodes	8
	Plecoptera	Perlodidae	Cultus	2
		Pteronarcyidae	Pteronarcys	2
	Trichoptera	Brachycentridae	Brachycentrus	8
		Hydropsychidae	Hydropsyche	243
	Coleoptera	Elmidae	Optioservus	4
	Coleoptera	Elmidae	Zaitzevia	2
	Diptera	Athericidae	Atherix	3
		Chironomidae	Apedilum	2
		Chironomidae	Cricotopus_Orthocladius	10
		Chironomidae	Cricotopus_trifascia	3
		Chironomidae	Eukiefferiella_devonica	23
		Chironomidae	Eukiefferiella_gracei	25
		Chironomidae	Tvetenia_bavarica	1
		Simuliidae	Prosimulium	41
		Simuliidae	Simulium	61
	Lepidoptera	Crambidae	Petrophila	1
Arachnida	Trombidiformes	Hygrobatidae	Atractides	2
		Lebertiidae	Lebertia	1
		Sperchonidae	Sperchon	4
		Torrenticolidae	Torrenticola	1
			Nematoda	1

Total Count	589
Fraction Processed	6.3%
Area Sampled	0.575 m^2

Appendix D – Colorado Multi-metric Index (MMI) scores for 2014 and 2015 benthic macroinvertebrate data

Colorado Department of Public Health and Environment

Water Quality Control Division

Benthic Macroinvertebrate Bioassessment Report

StationID:	**A55**	Sample Date:	9/24/2014
Waterbody Name:	**Animas River**		
Location:	A55		
Latitude:	37.8324720668	Reference Status:	Not Reference or Degraded
Longitude:	-107.601697735	BenSampID: 8	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	54.9

Metric Name	Metric Value	Metric Score
Total Taxa:	20	55.6
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	10	N/A
Chironomidae Pct:	2.6	N/A
Sensitive Plains Fammilies Pct:	29.7	N/A
Predator+ Shredder Taxa:	7	50.0
Clinger Taxa:	9	52.9
Clinger Taxa adjuested with Elevation:	9	N/A
Insect Taxa:	16	N/A
Non-Insct % of taxa:	20.0	N/A
Ephemeroptera Pct:	39.9	55.4
BeckBI:	20.0	60.6
Dominant01 Taxon Pct:	16.5	N/A
Sprawler Pct:	7.3	N/A

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Colorado Department of Public Health and Environment

Water Quality Control Division

Benthic Macroinvertebrate Bioassessment Report

StationID:	**A55**	Sample Date:	9/23/2015
Waterbody Name:	**Animas River**		
Location:	A55		
Latitude:	37.8324720668	Reference Status:	Not Reference or Degraded
Longitude:	-107.601697735	BenSampID: 9	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	58.4

Metric Name	Metric Value	Metric Score
Total Taxa:	20	55.6
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	10	N/A
Chironomidae Pct:	1.2	N/A
Sensitive Plains Fammilies Pct:	13.1	N/A
Predator+ Shredder Taxa:	10	71.4
Clinger Taxa:	11	64.7
Clinger Taxa adjuested with Elevation:	11	N/A
Insect Taxa:	17	N/A
Non-Insct % of taxa:	15.0	N/A
Ephemeroptera Pct:	24.2	33.5
BeckBI:	22.0	66.7
Dominant01 Taxon Pct:	43.4	N/A
Sprawler Pct:	9.5	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A56**	Sample Date:	9/24/2014
Waterbody Name:	**Animas River**		
Location:	A56		
Latitude:	37.827549121	Reference Status:	Not Reference or Degraded
Longitude:	-107.624175819	BenSampID: 10	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	48.9

Metric Name	Metric Value	Metric Score
Total Taxa:	18	50.0
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	11	N/A
Chironomidae Pct:	2.5	N/A
Sensitive Plains Fammilies Pct:	22.2	N/A
Predator+ Shredder Taxa:	8	57.1
Clinger Taxa:	10	58.8
Clinger Taxa adjuested with Elevation:	10	N/A
Insect Taxa:	17	N/A
Non-Insct % of taxa:	5.6	N/A
Ephemeroptera Pct:	10.8	15.0
BeckBI:	21.0	63.6
Dominant01 Taxon Pct:	59.0	N/A
Sprawler Pct:	2.9	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A60**			Sample Date:	9/25/2014
Waterbody Name:	**Animas River**				
Location:	A60				
Latitude:	37.8263686994	Reference Status:	Not Reference or Degraded		
Longitude:	-107.629155173	BenSampID: 11		RepNum: 1	
Biotype:	2				

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	52.6

Metric Name	Metric Value	Metric Score
Total Taxa:	22	61.1
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	9	N/A
Chironomidae Pct:	17.7	N/A
Sensitive Plains Fammilies Pct:	20.5	N/A
Predator+ Shredder Taxa:	8	57.1
Clinger Taxa:	11	64.7
Clinger Taxa adjuested with Elevation:	11	N/A
Insect Taxa:	19	N/A
Non-Insct % of taxa:	13.6	N/A
Ephemeroptera Pct:	11.9	16.6
BeckBI:	21.0	63.6
Dominant01 Taxon Pct:	32.8	N/A
Sprawler Pct:	8.2	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A60**	Sample Date:	9/23/2015
Waterbody Name:	**Animas River**		
Location:	A60		
Latitude:	37.8263686994	Reference Status:	Not Reference or Degraded
Longitude:	-107.629155173	BenSampID: 12	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	36.2

Metric Name	Metric Value	Metric Score
Total Taxa:	13	36.1
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	7	N/A
Chironomidae Pct:	4.6	N/A
Sensitive Plains Fammilies Pct:	4.0	N/A
Predator+ Shredder Taxa:	6	42.9
Clinger Taxa:	7	41.2
Clinger Taxa adjuested with Elevation:	7	N/A
Insect Taxa:	12	N/A
Non-Insct % of taxa:	7.7	N/A
Ephemeroptera Pct:	9.0	12.5
BeckBI:	16.0	48.5
Dominant01 Taxon Pct:	76.2	N/A
Sprawler Pct:	4.0	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A68**	Sample Date:	9/25/2014
Waterbody Name:	**Animas River**		
Location:	A68		
Latitude:	37.8119669773	Reference Status:	Not Reference or Degraded
Longitude:	-107.658669685	BenSampID: 13	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	38.8

Metric Name	Metric Value	Metric Score
Total Taxa:	17	47.2
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	8	N/A
Chironomidae Pct:	31.4	N/A
Sensitive Plains Fammilies Pct:	10.1	N/A
Predator+ Shredder Taxa:	5	35.7
Clinger Taxa:	7	41.2
Clinger Taxa adjuested with Elevation:	7	N/A
Insect Taxa:	15	N/A
Non-Insct % of taxa:	11.8	N/A
Ephemeroptera Pct:	15.5	21.6
BeckBI:	16.0	48.5
Dominant01 Taxon Pct:	31.4	N/A
Sprawler Pct:	8.8	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A68**	Sample Date:	8/8/2015
Waterbody Name:	**Animas River**		
Location:	A68		
Latitude:	37.8119669773	Reference Status:	Not Reference or Degraded
Longitude:	-107.658669685	BenSampID: 14	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	61.9

Metric Name	Metric Value	Metric Score
Total Taxa:	17	47.2
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	8	N/A
Chironomidae Pct:	8.2	N/A
Sensitive Plains Fammilies Pct:	6.2	N/A
Predator+ Shredder Taxa:	6	42.9
Clinger Taxa:	10	58.8
Clinger Taxa adjuested with Elevation:	10	N/A
Insect Taxa:	15	N/A
Non-Insct % of taxa:	11.8	N/A
Ephemeroptera Pct:	81.3	100.0
BeckBI:	20.0	60.6
Dominant01 Taxon Pct:	61.0	N/A
Sprawler Pct:	1.6	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A68**	Sample Date:	8/12/2015
Waterbody Name:	**Animas River**		
Location:	A68		
Latitude:	37.8119669773	Reference Status:	Not Reference or Degraded
Longitude:	-107.658669685	BenSampID: 15	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	65.7

Metric Name	Metric Value	Metric Score
Total Taxa:	22	61.1
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	9	N/A
Chironomidae Pct:	21.5	N/A
Sensitive Plains Fammilies Pct:	4.7	N/A
Predator+ Shredder Taxa:	9	64.3
Clinger Taxa:	12	70.6
Clinger Taxa adjuested with Elevation:	12	N/A
Insect Taxa:	19	N/A
Non-Insct % of taxa:	13.6	N/A
Ephemeroptera Pct:	62.8	87.1
BeckBI:	15.0	45.5
Dominant01 Taxon Pct:	46.5	N/A
Sprawler Pct:	3.8	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A68**	Sample Date:	9/23/2015
Waterbody Name:	**Animas River**		
Location:	A68		
Latitude:	37.8119669773	Reference Status:	Not Reference or Degraded
Longitude:	-107.658669685	BenSampID: 16	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	33.2

Metric Name	Metric Value	Metric Score
Total Taxa:	14	38.9
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	7	N/A
Chironomidae Pct:	4.3	N/A
Sensitive Plains Fammilies Pct:	2.5	N/A
Predator+ Shredder Taxa:	5	35.7
Clinger Taxa:	8	47.1
Clinger Taxa adjuested with Elevation:	8	N/A
Insect Taxa:	13	N/A
Non-Insct % of taxa:	7.1	N/A
Ephemeroptera Pct:	1.5	2.1
BeckBI:	14.0	42.4
Dominant01 Taxon Pct:	84.6	N/A
Sprawler Pct:	4.9	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**CC49**	Sample Date:	9/25/2014
Waterbody Name:	**Cement Cr**		
Location:	CC49		
Latitude:	37.8101820497	Reference Status:	Not Reference or Degraded
Longitude:	-107.660769119	BenSampID: 34	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	1.1

Metric Name	Metric Value	Metric Score
Total Taxa:	2	5.6
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	0	N/A
Chironomidae Pct:	100.0	N/A
Sensitive Plains Fammilies Pct:	0.0	N/A
Predator+ Shredder Taxa:	0	0.0
Clinger Taxa:	0	0.0
Clinger Taxa adjuested with Elevation:	0	N/A
Insect Taxa:	2	N/A
Non-Insct % of taxa:	0.0	N/A
Ephemeroptera Pct:	0.0	0.0
BeckBI:	0.0	0.0
Dominant01 Taxon Pct:	80.0	N/A
Sprawler Pct:	20.0	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**M34**	Sample Date:	9/25/2014
Waterbody Name:	**Mineral Cr**		
Location:	M34		
Latitude:	37.8027940275	Reference Status:	Not Reference or Degraded
Longitude:	-107.672739503	BenSampID: 37	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	25.2

Metric Name	Metric Value	Metric Score
Total Taxa:	12	33.3
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	6	N/A
Chironomidae Pct:	9.8	N/A
Sensitive Plains Fammilies Pct:	76.5	N/A
Predator+ Shredder Taxa:	3	21.4
Clinger Taxa:	6	35.3
Clinger Taxa adjuested with Elevation:	6	N/A
Insect Taxa:	11	N/A
Non-Insct % of taxa:	8.3	N/A
Ephemeroptera Pct:	3.9	5.4
BeckBI:	10.0	30.3
Dominant01 Taxon Pct:	60.8	N/A
Sprawler Pct:	3.9	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A72**	Sample Date:	9/25/2014
Waterbody Name:	**Animas River**		
Location:	A72		
Latitude:	37.7903505179	Reference Status:	Not Reference or Degraded
Longitude:	-107.667461366	BenSampID: 17	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	16.8

Metric Name	Metric Value	Metric Score
Total Taxa:	9	25.0
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	3	N/A
Chironomidae Pct:	41.4	N/A
Sensitive Plains Fammilies Pct:	50.9	N/A
Predator+ Shredder Taxa:	3	21.4
Clinger Taxa:	3	17.6
Clinger Taxa adjuested with Elevation:	3	N/A
Insect Taxa:	8	N/A
Non-Insct % of taxa:	11.1	N/A
Ephemeroptera Pct:	3.4	4.8
BeckBI:	5.0	15.2
Dominant01 Taxon Pct:	37.9	N/A
Sprawler Pct:	0.9	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A72**			Sample Date:	8/8/2015
Waterbody Name:	**Animas River**				
Location:	A72				
Latitude:	37.7903505179	Reference Status:	Not Reference or Degraded		
Longitude:	-107.667461366	BenSampID:	18	RepNum:	1
Biotype:	2				

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	23.1

Metric Name	Metric Value	Metric Score
Total Taxa:	11	30.6
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	3	N/A
Chironomidae Pct:	10.1	N/A
Sensitive Plains Fammilies Pct:	84.4	N/A
Predator+ Shredder Taxa:	4	28.6
Clinger Taxa:	5	29.4
Clinger Taxa adjuested with Elevation:	5	N/A
Insect Taxa:	11	N/A
Non-Insct % of taxa:	0.0	N/A
Ephemeroptera Pct:	1.8	2.5
BeckBI:	8.0	24.2
Dominant01 Taxon Pct:	67.0	N/A
Sprawler Pct:	5.5	N/A

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Water Quality Control Division

Benthic Macroinvertebrate Bioassessment Report

StationID:	**A72**	Sample Date:	8/12/2015
Waterbody Name:	**Animas River**		
Location:	A72		
Latitude:	37.7903505179	Reference Status:	Not Reference or Degraded
Longitude:	-107.667461366	BenSampID: 19	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	31.9

Metric Name	Metric Value	Metric Score
Total Taxa:	15	41.7
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	4	N/A
Chironomidae Pct:	5.5	N/A
Sensitive Plains Fammilies Pct:	74.7	N/A
Predator+ Shredder Taxa:	5	35.7
Clinger Taxa:	7	41.2
Clinger Taxa adjuested with Elevation:	7	N/A
Insect Taxa:	12	N/A
Non-Insct % of taxa:	20.0	N/A
Ephemeroptera Pct:	7.7	10.7
BeckBI:	10.0	30.3
Dominant01 Taxon Pct:	44.0	N/A
Sprawler Pct:	2.2	N/A

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Water Quality Control Division

Benthic Macroinvertebrate Bioassessment Report

StationID:	**A72**	Sample Date:	9/23/2015
Waterbody Name:	**Animas River**		
Location:	A72		
Latitude:	37.7903505179	Reference Status:	Not Reference or Degraded
Longitude:	-107.667461366	BenSampID: 20	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	15.3

Metric Name	Metric Value	Metric Score
Total Taxa:	8	22.2
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	2	N/A
Chironomidae Pct:	3.4	N/A
Sensitive Plains Fammilies Pct:	67.4	N/A
Predator+ Shredder Taxa:	3	21.4
Clinger Taxa:	3	17.6
Clinger Taxa adjuested with Elevation:	3	N/A
Insect Taxa:	7	N/A
Non-Insct % of taxa:	12.5	N/A
Ephemeroptera Pct:	0.0	0.0
BeckBI:	5.0	15.2
Dominant01 Taxon Pct:	41.6	N/A
Sprawler Pct:	3.4	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A73**			Sample Date:	10/16/2014
Waterbody Name:	**Animas River**				
Location:	A73				
Latitude:	37.7223674033	Reference Status:	Not Reference or Degraded		
Longitude:	-107.654794503	BenSampID:	21	RepNum:	1
Biotype:	2				

Predictive Model Results

O/E (p>half):	

Model Test:

Multimetric Index Model Results

MMI:	30.7

Metric Name	Metric Value	Metric Score
Total Taxa:	11	30.6
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	5	N/A
Chironomidae Pct:	0.0	N/A
Sensitive Plains Fammilies Pct:	84.5	N/A
Predator+ Shredder Taxa:	6	42.9
Clinger Taxa:	7	41.2
Clinger Taxa adjuested with Elevation:	7	N/A
Insect Taxa:	10	N/A
Non-Insct % of taxa:	9.1	N/A
Ephemeroptera Pct:	3.9	5.4
BeckBI:	11.0	33.3
Dominant01 Taxon Pct:	71.3	N/A
Sprawler Pct:	3.9	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A73**	Sample Date:	10/15/2015
Waterbody Name:	**Animas River**		
Location:	A73		
Latitude:	37.7223674033	Reference Status:	Not Reference or Degraded
Longitude:	-107.654794503	BenSampID: 22	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	40.7

Metric Name	Metric Value	Metric Score
Total Taxa:	18	50.0
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	5	N/A
Chironomidae Pct:	3.2	N/A
Sensitive Plains Fammilies Pct:	80.0	N/A
Predator+ Shredder Taxa:	7	50.0
Clinger Taxa:	9	52.9
Clinger Taxa adjuested with Elevation:	9	N/A
Insect Taxa:	15	N/A
Non-Insct % of taxa:	16.7	N/A
Ephemeroptera Pct:	3.7	5.1
BeckBI:	15.0	45.5
Dominant01 Taxon Pct:	63.2	N/A
Sprawler Pct:	4.7	N/A

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Water Quality Control Division

Benthic Macroinvertebrate Bioassessment Report

StationID:	**A73EC**	Sample Date:	10/16/2014
Waterbody Name:	**Elk Creek**		
Location:	A73EC		
Latitude:	37.7219537783	Reference Status:	Not Reference or Degraded
Longitude:	-107.653665537	BenSampID: 23	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	65.2

Metric Name	Metric Value	Metric Score
Total Taxa:	24	66.7
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	11	N/A
Chironomidae Pct:	0.9	N/A
Sensitive Plains Fammilies Pct:	6.5	N/A
Predator+ Shredder Taxa:	11	78.6
Clinger Taxa:	10	58.8
Clinger Taxa adjuested with Elevation:	10	N/A
Insect Taxa:	23	N/A
Non-Insct % of taxa:	4.2	N/A
Ephemeroptera Pct:	18.1	25.1
BeckBI:	32.0	97.0
Dominant01 Taxon Pct:	62.6	N/A
Sprawler Pct:	65.3	N/A

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Colorado Department of Public Health and Environment

Water Quality Control Division

Benthic Macroinvertebrate Bioassessment Report

StationID:	**A73EC**	Sample Date:	10/15/2015
Waterbody Name:	**Elk Creek**		
Location:	A73EC		
Latitude:	37.7219537783	Reference Status:	Not Reference or Degraded
Longitude:	-107.653665537	BenSampID: 24	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	49.5

Metric Name	Metric Value	Metric Score
Total Taxa:	19	52.8
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	8	N/A
Chironomidae Pct:	3.7	N/A
Sensitive Plains Fammilies Pct:	6.5	N/A
Predator+ Shredder Taxa:	6	42.9
Clinger Taxa:	11	64.7
Clinger Taxa adjuested with Elevation:	11	N/A
Insect Taxa:	18	N/A
Non-Insct % of taxa:	5.3	N/A
Ephemeroptera Pct:	27.8	38.5
BeckBI:	16.0	48.5
Dominant01 Taxon Pct:	53.7	N/A
Sprawler Pct:	56.5	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A75D**	Sample Date:	10/16/2014
Waterbody Name:	**Animas River**		
Location:	A75D		
Latitude:	37.5977572032	Reference Status:	Not Reference or Degraded
Longitude:	-107.775841795	BenSampID: 27	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	52.0

Metric Name	Metric Value	Metric Score
Total Taxa:	21	58.3
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	7	N/A
Chironomidae Pct:	16.3	N/A
Sensitive Plains Fammilies Pct:	34.2	N/A
Predator+ Shredder Taxa:	10	71.4
Clinger Taxa:	7	41.2
Clinger Taxa adjuested with Elevation:	7	N/A
Insect Taxa:	19	N/A
Non-Insct % of taxa:	9.5	N/A
Ephemeroptera Pct:	24.8	34.3
BeckBI:	18.0	54.5
Dominant01 Taxon Pct:	32.7	N/A
Sprawler Pct:	7.4	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A75D**			Sample Date:	10/15/2015
Waterbody Name:	**Animas River**				
Location:	A75D				
Latitude:	37.5977572032	Reference Status:	Not Reference or Degraded		
Longitude:	-107.775841795	BenSampID:	28	RepNum:	1
Biotype:	2				

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	47.1

Metric Name	Metric Value	Metric Score
Total Taxa:	18	50.0
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	8	N/A
Chironomidae Pct:	12.7	N/A
Sensitive Plains Fammilies Pct:	22.9	N/A
Predator+ Shredder Taxa:	7	50.0
Clinger Taxa:	8	47.1
Clinger Taxa adjuested with Elevation:	8	N/A
Insect Taxa:	16	N/A
Non-Insct % of taxa:	11.1	N/A
Ephemeroptera Pct:	28.8	40.0
BeckBI:	16.0	48.5
Dominant01 Taxon Pct:	26.3	N/A
Sprawler Pct:	28.8	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A75CC**	Sample Date:	10/16/2014
Waterbody Name:	**Cascade Cr**		
Location:	A75CC		
Latitude:	37.5981202572	Reference Status:	Not Reference or Degraded
Longitude:	-107.776257719	BenSampID: 25	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	68.9

Metric Name	Metric Value	Metric Score
Total Taxa:	24	66.7
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	13	N/A
Chironomidae Pct:	13.5	N/A
Sensitive Plains Fammilies Pct:	15.8	N/A
Predator+ Shredder Taxa:	9	64.3
Clinger Taxa:	12	70.6
Clinger Taxa adjuested with Elevation:	12	N/A
Insect Taxa:	21	N/A
Non-Insct % of taxa:	12.5	N/A
Ephemeroptera Pct:	54.9	76.2
BeckBI:	22.0	66.7
Dominant01 Taxon Pct:	24.0	N/A
Sprawler Pct:	0.7	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**A75CC**	Sample Date:	10/15/2015
Waterbody Name:	**Cascade Cr**		
Location:	A75CC		
Latitude:	37.5981202572	Reference Status:	Not Reference or Degraded
Longitude:	-107.776257719	BenSampID: 26	RepNum: 1
Biotype:	2		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	90.7

Metric Name	Metric Value	Metric Score
Total Taxa:	39	100.0
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	14	N/A
Chironomidae Pct:	9.2	N/A
Sensitive Plains Fammilies Pct:	28.6	N/A
Predator+ Shredder Taxa:	14	100.0
Clinger Taxa:	19	100.0
Clinger Taxa adjuested with Elevation:	19	N/A
Insect Taxa:	34	N/A
Non-Insct % of taxa:	12.8	N/A
Ephemeroptera Pct:	38.7	53.7
BeckBI:	33.0	100.0
Dominant01 Taxon Pct:	14.5	N/A
Sprawler Pct:	16.5	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**BB**	Sample Date:	9/26/2014
Waterbody Name:	**Animas River**		
Location:	Baker's Bridge		
Latitude:	37.4537742657	Reference Status:	Not Reference or Degraded
Longitude:	-107.801439102	BenSampID: 32	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	51.8

Metric Name	Metric Value	Metric Score
Total Taxa:	17	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	5	46.3
Chironomidae Pct:	4.0	95.8
Sensitive Plains Fammilies Pct:	22.4	36.3
Predator+ Shredder Taxa:	6	42.9
Clinger Taxa:	6	N/A
Clinger Taxa adjuested with Elevation:	6	31.2
Insect Taxa:	15	N/A
Non-Insct % of taxa:	11.8	58.1
Ephemeroptera Pct:	52.9	N/A
BeckBI:	13.0	N/A
Dominant01 Taxon Pct:	52.0	N/A
Sprawler Pct:	4.5	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**BB**	Sample Date:	9/21/2015
Waterbody Name:	**Animas River**		
Location:	Baker's Bridge		
Latitude:	37.4537742657	Reference Status:	Not Reference or Degraded
Longitude:	-107.801439102	BenSampID: 33	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	60.2

Metric Name	Metric Value	Metric Score
Total Taxa:	27	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	7	67.7
Chironomidae Pct:	15.0	79.1
Sensitive Plains Fammilies Pct:	35.3	57.1
Predator+ Shredder Taxa:	10	71.4
Clinger Taxa:	10	N/A
Clinger Taxa adjuested with Elevation:	10	65.2
Insect Taxa:	21	N/A
Non-Insct % of taxa:	22.2	20.9
Ephemeroptera Pct:	31.6	N/A
BeckBI:	22.0	N/A
Dominant01 Taxon Pct:	30.9	N/A
Sprawler Pct:	10.3	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**JamesRanch**	Sample Date:	9/26/2014
Waterbody Name:	**Animas River**		
Location:	James Ranch		
Latitude:	37.4178220265	Reference Status:	Not Reference or Degraded
Longitude:	-107.814819189	BenSampID: 35	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	61.2

Metric Name	Metric Value	Metric Score
Total Taxa:	20	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	7	69.6
Chironomidae Pct:	8.9	88.4
Sensitive Plains Fammilies Pct:	14.9	24.0
Predator+ Shredder Taxa:	10	71.4
Clinger Taxa:	10	N/A
Clinger Taxa adjuested with Elevation:	10	67.0
Insect Taxa:	17	N/A
Non-Insct % of taxa:	15.0	46.6
Ephemeroptera Pct:	45.2	N/A
BeckBI:	14.0	N/A
Dominant01 Taxon Pct:	44.2	N/A
Sprawler Pct:	2.0	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**JamesRanch**	Sample Date:	9/21/2015
Waterbody Name:	**Animas River**		
Location:	James Ranch		
Latitude:	37.4178220265	Reference Status:	Not Reference or Degraded
Longitude:	-107.814819189	BenSampID: 36	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	46.7

Metric Name	Metric Value	Metric Score
Total Taxa:	18	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	4	37.5
Chironomidae Pct:	10.5	86.0
Sensitive Plains Fammilies Pct:	4.6	7.5
Predator+ Shredder Taxa:	7	50.0
Clinger Taxa:	9	N/A
Clinger Taxa adjuested with Elevation:	9	58.5
Insect Taxa:	15	N/A
Non-Insct % of taxa:	16.7	40.7
Ephemeroptera Pct:	63.9	N/A
BeckBI:	16.0	N/A
Dominant01 Taxon Pct:	62.3	N/A
Sprawler Pct:	7.1	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**Oxbow**			Sample Date:	9/18/2015
Waterbody Name:	**Animas River**				
Location:	Oxbow				
Latitude:	37.3085703236	Reference Status:	Not Reference or Degraded		
Longitude:	-107.854423811	BenSampID:	38	RepNum:	1
Biotype:	1				

Predictive Model Results

O/E (p>half):		Model Test:	

Multimetric Index Model Results

MMI:	26.4

Metric Name	Metric Value	Metric Score
Total Taxa:	18	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	0	0.0
Chironomidae Pct:	97.8	0.0
Sensitive Plains Fammilies Pct:	0.6	1.0
Predator+ Shredder Taxa:	6	42.9
Clinger Taxa:	6	N/A
Clinger Taxa adjuested with Elevation:	6	34.6
Insect Taxa:	17	N/A
Non-Insct % of taxa:	5.6	80.2
Ephemeroptera Pct:	0.0	N/A
BeckBI:	4.0	N/A
Dominant01 Taxon Pct:	39.4	N/A
Sprawler Pct:	4.1	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**32nd**	Sample Date:	7/31/2014
Waterbody Name:	**Animas River**		
Location:	32nd Street		
Latitude:	37.2972735526	Reference Status:	Not Reference or Degraded
Longitude:	-107.870279816	BenSampID: 1	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	32.5

Metric Name	Metric Value	Metric Score
Total Taxa:	7	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	2	18.0
Chironomidae Pct:	8.8	88.5
Sensitive Plains Fammilies Pct:	0.0	0.0
Predator+ Shredder Taxa:	3	21.4
Clinger Taxa:	4	N/A
Clinger Taxa adjuested with Elevation:	4	17.7
Insect Taxa:	6	N/A
Non-Insct % of taxa:	14.3	49.1
Ephemeroptera Pct:	3.0	N/A
BeckBI:	4.0	N/A
Dominant01 Taxon Pct:	86.6	N/A
Sprawler Pct:	0.6	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**32nd**	Sample Date:	9/26/2014
Waterbody Name:	**Animas River**		
Location:	32nd Street		
Latitude:	37.2972735526	Reference Status:	Not Reference or Degraded
Longitude:	-107.870279816	BenSampID: 2	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	30.8

Metric Name	Metric Value	Metric Score
Total Taxa:	16	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	2	18.0
Chironomidae Pct:	23.6	66.0
Sensitive Plains Fammilies Pct:	2.4	3.9
Predator+ Shredder Taxa:	6	42.9
Clinger Taxa:	7	N/A
Clinger Taxa adjuested with Elevation:	7	43.2
Insect Taxa:	12	N/A
Non-Insct % of taxa:	25.0	11.0
Ephemeroptera Pct:	28.4	N/A
BeckBI:	7.0	N/A
Dominant01 Taxon Pct:	40.8	N/A
Sprawler Pct:	20.2	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**32nd**	Sample Date:	8/6/2015
Waterbody Name:	**Animas River**		
Location:	32nd Street		
Latitude:	37.2972735526	Reference Status:	Not Reference or Degraded
Longitude:	-107.870279816	BenSampID: 3	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	27.8

Metric Name	Metric Value	Metric Score
Total Taxa:	10	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	2	18.0
Chironomidae Pct:	37.8	44.4
Sensitive Plains Fammilies Pct:	0.6	1.0
Predator+ Shredder Taxa:	3	21.4
Clinger Taxa:	4	N/A
Clinger Taxa adjuested with Elevation:	4	17.7
Insect Taxa:	9	N/A
Non-Insct % of taxa:	10.0	64.4
Ephemeroptera Pct:	3.7	N/A
BeckBI:	7.0	N/A
Dominant01 Taxon Pct:	56.7	N/A
Sprawler Pct:	35.3	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**32nd**	Sample Date:	8/7/2015
Waterbody Name:	**Animas River**		
Location:	32nd Street		
Latitude:	37.2972735526	Reference Status:	Not Reference or Degraded
Longitude:	-107.870279816	BenSampID: 4	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	39.8

Metric Name	Metric Value	Metric Score
Total Taxa:	10	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	3	28.7
Chironomidae Pct:	27.0	60.8
Sensitive Plains Fammilies Pct:	1.0	1.6
Predator+ Shredder Taxa:	3	21.4
Clinger Taxa:	5	N/A
Clinger Taxa adjuested with Elevation:	5	26.2
Insect Taxa:	10	N/A
Non-Insct % of taxa:	0.0	100.0
Ephemeroptera Pct:	5.3	N/A
BeckBI:	8.0	N/A
Dominant01 Taxon Pct:	66.1	N/A
Sprawler Pct:	25.0	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**32nd**	Sample Date:	8/13/2015
Waterbody Name:	**Animas River**		
Location:	32nd Street		
Latitude:	37.2972735526	Reference Status:	Not Reference or Degraded
Longitude:	-107.870279816	BenSampID: 5	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	24.3

Metric Name	Metric Value	Metric Score
Total Taxa:	14	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	3	28.7
Chironomidae Pct:	47.3	29.8
Sensitive Plains Fammilies Pct:	0.9	1.5
Predator+ Shredder Taxa:	5	35.7
Clinger Taxa:	5	N/A
Clinger Taxa adjuested with Elevation:	5	26.2
Insect Taxa:	11	N/A
Non-Insct % of taxa:	21.4	23.7
Ephemeroptera Pct:	5.7	N/A
BeckBI:	8.0	N/A
Dominant01 Taxon Pct:	43.4	N/A
Sprawler Pct:	32.2	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**32nd**	Sample Date:	9/22/2015
Waterbody Name:	**Animas River**		
Location:	32nd Street		
Latitude:	37.2972735526	Reference Status:	Not Reference or Degraded
Longitude:	-107.870279816	BenSampID: 6	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	20.0

Metric Name	Metric Value	Metric Score
Total Taxa:	16	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	2	18.0
Chironomidae Pct:	71.7	0.0
Sensitive Plains Fammilies Pct:	3.4	5.5
Predator+ Shredder Taxa:	4	28.6
Clinger Taxa:	6	N/A
Clinger Taxa adjuested with Elevation:	6	34.7
Insect Taxa:	13	N/A
Non-Insct % of taxa:	18.8	33.3
Ephemeroptera Pct:	2.2	N/A
BeckBI:	7.0	N/A
Dominant01 Taxon Pct:	45.5	N/A
Sprawler Pct:	46.8	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**RotaryPark**	Sample Date:	8/6/2015
Waterbody Name:	**Animas River**		
Location:	Rotary Park		
Latitude:	37.2806911143	Reference Status:	Not Reference or Degraded
Longitude:	-107.876728959	BenSampID: 42	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	19.0

Metric Name	Metric Value	Metric Score
Total Taxa:	12	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	1	7.4
Chironomidae Pct:	25.2	63.5
Sensitive Plains Fammilies Pct:	1.0	1.6
Predator+ Shredder Taxa:	3	21.4
Clinger Taxa:	3	N/A
Clinger Taxa adjuested with Elevation:	3	9.3
Insect Taxa:	9	N/A
Non-Insct % of taxa:	25.0	11.0
Ephemeroptera Pct:	21.4	N/A
BeckBI:	3.0	N/A
Dominant01 Taxon Pct:	46.3	N/A
Sprawler Pct:	17.3	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**RotaryPark**	Sample Date:	8/7/2015
Waterbody Name:	**Animas River**		
Location:	Rotary Park		
Latitude:	37.2806911143	Reference Status:	Not Reference or Degraded
Longitude:	-107.876728959	BenSampID: 43	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	38.7

Metric Name	Metric Value	Metric Score
Total Taxa:	16	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	3	28.8
Chironomidae Pct:	16.9	76.3
Sensitive Plains Fammilies Pct:	0.3	0.5
Predator+ Shredder Taxa:	7	50.0
Clinger Taxa:	7	N/A
Clinger Taxa adjuested with Elevation:	7	43.4
Insect Taxa:	13	N/A
Non-Insct % of taxa:	18.8	33.3
Ephemeroptera Pct:	48.6	N/A
BeckBI:	6.0	N/A
Dominant01 Taxon Pct:	48.3	N/A
Sprawler Pct:	7.1	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**RotaryPark**	Sample Date:	8/13/2015
Waterbody Name:	**Animas River**		
Location:	Rotary Park		
Latitude:	37.2806911143	Reference Status:	Not Reference or Degraded
Longitude:	-107.876728959	BenSampID: 44	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	27.8

Metric Name	Metric Value	Metric Score
Total Taxa:	19	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	2	18.1
Chironomidae Pct:	39.2	42.2
Sensitive Plains Fammilies Pct:	2.2	3.5
Predator+ Shredder Taxa:	6	42.9
Clinger Taxa:	6	N/A
Clinger Taxa adjuested with Elevation:	6	34.9
Insect Taxa:	15	N/A
Non-Insct % of taxa:	21.1	25.1
Ephemeroptera Pct:	24.4	N/A
BeckBI:	7.0	N/A
Dominant01 Taxon Pct:	24.7	N/A
Sprawler Pct:	25.0	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**RotaryPark**	Sample Date:	9/20/2015
Waterbody Name:	**Animas River**		
Location:	Rotary Park		
Latitude:	37.2806911143	Reference Status:	Not Reference or Degraded
Longitude:	-107.876728959	BenSampID: 45	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	28.6

Metric Name	Metric Value	Metric Score
Total Taxa:	17	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	2	18.1
Chironomidae Pct:	51.5	23.3
Sensitive Plains Fammilies Pct:	17.2	27.8
Predator+ Shredder Taxa:	6	42.9
Clinger Taxa:	7	N/A
Clinger Taxa adjuested with Elevation:	7	43.4
Insect Taxa:	13	N/A
Non-Insct % of taxa:	23.5	16.2
Ephemeroptera Pct:	15.5	N/A
BeckBI:	5.0	N/A
Dominant01 Taxon Pct:	33.0	N/A
Sprawler Pct:	34.4	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**AAbvLightner**	Sample Date:	8/1/2014
Waterbody Name:	**Animas River**		
Location:	Above Lightner		
Latitude:	37.2689292145	Reference Status:	Not Reference or Degraded
Longitude:	-107.886295206	BenSampID: 29	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	38.2

Metric Name	Metric Value	Metric Score
Total Taxa:	24	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	2	18.8
Chironomidae Pct:	19.3	72.5
Sensitive Plains Fammilies Pct:	1.6	2.5
Predator+ Shredder Taxa:	8	57.1
Clinger Taxa:	11	N/A
Clinger Taxa adjuested with Elevation:	11	78.0
Insect Taxa:	17	N/A
Non-Insct % of taxa:	29.2	0.0
Ephemeroptera Pct:	26.2	N/A
BeckBI:	7.0	N/A
Dominant01 Taxon Pct:	25.2	N/A
Sprawler Pct:	6.5	N/A

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Colorado Department of Public Health and Environment

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**AAbvLightner**	Sample Date:	9/26/2014
Waterbody Name:	**Animas River**		
Location:	Above Lightner		
Latitude:	37.2689292145	Reference Status:	Not Reference or Degraded
Longitude:	-107.886295206	BenSampID: 30	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	48.5

Metric Name	Metric Value	Metric Score
Total Taxa:	23	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	4	40.2
Chironomidae Pct:	4.7	94.8
Sensitive Plains Fammilies Pct:	13.8	22.3
Predator+ Shredder Taxa:	9	64.3
Clinger Taxa:	10	N/A
Clinger Taxa adjuested with Elevation:	10	69.5
Insect Taxa:	15	N/A
Non-Insct % of taxa:	34.8	0.0
Ephemeroptera Pct:	15.5	N/A
BeckBI:	8.0	N/A
Dominant01 Taxon Pct:	54.5	N/A
Sprawler Pct:	3.2	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**AAbvLightner**	Sample Date:	9/20/2015
Waterbody Name:	**Animas River**		
Location:	Above Lightner		
Latitude:	37.2689292145	Reference Status:	Not Reference or Degraded
Longitude:	-107.886295206	BenSampID: 31	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	47.3

Metric Name	Metric Value	Metric Score
Total Taxa:	20	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	4	40.2
Chironomidae Pct:	15.0	79.2
Sensitive Plains Fammilies Pct:	29.6	47.9
Predator+ Shredder Taxa:	9	64.3
Clinger Taxa:	8	N/A
Clinger Taxa adjuested with Elevation:	8	52.5
Insect Taxa:	14	N/A
Non-Insct % of taxa:	30.0	0.0
Ephemeroptera Pct:	19.6	N/A
BeckBI:	6.0	N/A
Dominant01 Taxon Pct:	29.6	N/A
Sprawler Pct:	11.2	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**PurpleCliffs**	Sample Date:	7/31/2014
Waterbody Name:	**Animas River**		
Location:	Purple Cliffs		
Latitude:	37.2218892105	Reference Status:	Not Reference or Degraded
Longitude:	-107.862038473	BenSampID: 39	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	40.2

Metric Name	Metric Value	Metric Score
Total Taxa:	16	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	1	10.3
Chironomidae Pct:	17.1	75.9
Sensitive Plains Fammilies Pct:	15.3	24.7
Predator+ Shredder Taxa:	4	28.6
Clinger Taxa:	7	N/A
Clinger Taxa adjuested with Elevation:	7	46.1
Insect Taxa:	14	N/A
Non-Insct % of taxa:	12.5	55.5
Ephemeroptera Pct:	48.3	N/A
BeckBI:	6.0	N/A
Dominant01 Taxon Pct:	48.3	N/A
Sprawler Pct:	7.0	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**PurpleCliffs**	Sample Date:	9/26/2014
Waterbody Name:	**Animas River**		
Location:	Purple Cliffs		
Latitude:	37.2218892105	Reference Status:	Not Reference or Degraded
Longitude:	-107.862038473	BenSampID: 40	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	46.4

Metric Name	Metric Value	Metric Score
Total Taxa:	18	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	3	31.7
Chironomidae Pct:	5.9	93.0
Sensitive Plains Fammilies Pct:	34.9	56.5
Predator+ Shredder Taxa:	6	42.9
Clinger Taxa:	8	N/A
Clinger Taxa adjuested with Elevation:	8	54.6
Insect Taxa:	12	N/A
Non-Insct % of taxa:	33.3	0.0
Ephemeroptera Pct:	31.1	N/A
BeckBI:	6.0	N/A
Dominant01 Taxon Pct:	34.3	N/A
Sprawler Pct:	6.2	N/A

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Benthic Macroinvertebrate Bioassessment Report

StationID:	**PurpleCliffs**	Sample Date:	9/22/2015
Waterbody Name:	**Animas River**		
Location:	Purple Cliffs		
Latitude:	37.2218892105	Reference Status:	Not Reference or Degraded
Longitude:	-107.862038473	BenSampID: 41	RepNum: 1
Biotype:	1		

Predictive Model Results

O/E (p>half):	Model Test:

Multimetric Index Model Results

MMI:	50.7

Metric Name	Metric Value	Metric Score
Total Taxa:	20	N/A
Ephemeroptera + Plecoptera Taxa (adjusted with Elevation):	4	42.4
Chironomidae Pct:	10.5	86.0
Sensitive Plains Fammilies Pct:	42.6	68.9
Predator+ Shredder Taxa:	7	50.0
Clinger Taxa:	7	N/A
Clinger Taxa adjuested with Elevation:	7	46.1
Insect Taxa:	15	N/A
Non-Insct % of taxa:	25.0	11.0
Ephemeroptera Pct:	23.8	N/A
BeckBI:	10.0	N/A
Dominant01 Taxon Pct:	41.0	N/A
Sprawler Pct:	9.3	N/A

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