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*Title*

# Evaluation of Aquatic Macroinvertebrate Communities and Habitats in Mortandad Canyon

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# Evaluation of Aquatic Macroinvertebrate Communities and Habitats in Mortandad Canyon

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## Introduction

This evaluation of aquatic macroinvertebrate communities and habitats was part of the biological investigations planned by the Los Alamos National Laboratory (LANL or the Laboratory) Environmental Stewardship Division Remediation Services Project for Mortandad Canyon, as documented in LANL (2005). This plan indicated that rapid bioassessments using US Environmental Protection Agency (EPA) protocols (Barbour et al. 1999) would be conducted in the spring and fall at sites in Mortandad Canyon with persistent flow. The habitat assessments that are included in the protocol provide background information about physical aspects of site condition, while the aquatic macroinvertebrate community evaluations provide information about biological responses to site condition.

## Methods

We performed habitat assessments and sampled aquatic macroinvertebrates at two study reaches in Mortandad Canyon and one reach in Effluent Canyon that had sufficient flow to potentially support the development of aquatic invertebrate communities (Table 1). Two reaches in Ten Site Canyon were visited in June and September 2005, but were not sampled due to lack of water. Reach M2W was sampled in June but was not sampled in September due to lack of water.

**Table 1. Reach locations, descriptions, and dates for habitat assessments and macroinvertebrate sampling.**

| Location and description of reach | Reach ID | Dates Sampled |
|---|---|---|
| Effluent Canyon downstream of Technical Area (TA) 55 | E1W | 6/21/2005 and 9/26/2005 |
| Mortandad Canyon downstream from Diamond Drive | M1W | 6/21/2005 and 9/26/2005 |
| Mortandad Canyon immediately downstream of E200 gaging station | M2W | 6/21/2005; habitat assessments only on 9/26/2005 |
| Ten Site Canyon near head of canyon | TS1C | Habitat assessments only on 9/26/2005 |
| Ten Site Canyon downstream of TA-35 sewage lagoon outfall | TS2C | Habitat assessments only on 9/26/2005 |

For habitat evaluations, we sampled in a 50-m reach at each site using the US EPA Rapid Bioassessment Protocol (RBP) for high-gradient streams (Barbour et al. 1999). The RBP habitat assessment involves scoring each site based on 10 parameters related to habitat quality, including watershed characteristics, riparian vegetation, instream features, aquatic vegetation, and benthic substrate (Appendix A). The scores for each parameter are summed to arrive at an overall habitat assessment score for a site. We also used portions of the Arizona Department of Environmental Quality's site assessment protocol (Appendix B) to provide complementary information about physical characteristics and habitat at the sites. We did not collect habitat data at sites TS1C and TS2C in June due to absence of flow. Although there was still no flow in September, we collected habitat data for reference.

Physical/chemical data (temperature, pH, conductivity, and dissolved oxygen) were collected using a YSI Multiparameter Water-Quality Meter. We did not collect pH data in June due to

probe malfunction. Benthic macroinvertebrates acquire oxygen from water through gills, trachea, or simple diffusion, and are adversely affected by reduced levels of dissolved oxygen. US EPA aquatic life water quality criteria for ambient dissolved oxygen in coldwater systems stipulate that the daily minimum should be 4 mg/l (or up to 8 mg/l for early life stages) (EPA 1986). The sensitivity of different taxa to low levels of dissolved oxygen varies widely. The US EPA criterion for pH is 6.5–9 (EPA 2006). Conductivity increases with the amount of dissolved salts in the water, and elevated conductivity is an indicator of pollution. Similarly, human impacts on streams typically raise the average and maximum temperature of the water above the tolerance limit of many taxa. There is also an inverse relationship between water temperature and the saturation point of dissolved oxygen; the higher the temperature, the less oxygen available to aquatic organisms.

Our work plan specified that a Hess sampler be used for macroinvertebrate sampling where sufficient water depth and velocity permitted its use. The Hess sampler provides data that can be analyzed using the New Mexico Environment Department's Stream Condition Index (SCI), which is a statistically validated multi-metric index for estimating stream condition based on various characteristics of macroinvertebrate assemblages (e.g. diversity, number of taxa). The SCI compares test sites to a reference condition, which is based on a group of minimally impacted reference sites that are physically, chemically, and biologically similar to the test sites and that account for the natural variability in aquatic communities among sites (Reynoldson et al. 1997, Hughes 1995). The reference condition for the SCI is based on historical data from New Mexico streams (Jacobi 2006, personal communication). The SCI was developed using macroinvertebrate data from Hess samples, and is only valid for evaluating samples collected using the same method. Because of the possibility of encountering low-flow conditions, our work plan specified that dip net samples would be collected in the event that the Hess could not be used. Dip net samples are useful for determining taxonomic composition at a site and can be used to sample a greater variety of habitats than a Hess sampler, but cannot be reliably evaluated with the SCI or other macroinvertebrate metrics.

We were unable to use the Hess sampler due to insufficient flow at all sites for both sampling periods, and instead collected macroinvertebrate samples in the 50-m reach using a D-frame aquatic dip net (0.3 m wide with a 500-μm mesh). Per Barbour et al. (1999), sampling was semi-quantitative with effort standardized by taking 20 sweeps or "jabs" of the dip net at each site. In order to avoid bias in the types of substrates sampled, we first visually identified the types of habitats present (riffles, runs, pools, submerged vegetation) and estimated their percentage in the reach. We then sampled those habitats in proportion to their occurrence. Macroinvertebrate samples were preserved in 99% ethanol and submitted to a taxonomic laboratory (Utah State University) for sorting and identification. The sorting and identification protocols are included in Appendix C.

## Results

Habitat assessment scores, physical/chemical data, and macroinvertebrate sample data are presented in Tables 2–4. Detailed information for macroinvertebrate samples can be found in Appendix C. Results for individual sites are presented below.

Effluent Canyon downstream of TA-55 (E1W):

The channel in Effluent Canyon was narrow and shallow with low flow velocity. Water appearance at E1W was clear with an oily sheen for both sampling periods. The water had a sulfurous odor. There was no indication of recent flooding during the June site visit, but there was evidence of flows greater than bankfull width when the site was visited in September. During both June and September, filamentous algae covered approximately 75% of the stream bed. The algae were decomposing in September. The reach was primarily a shallow run with embeddedness of 100%. The habitat score at this site was low due to lack of substrate favorable for colonization by macroinvertebrates, high proportion of fine sediments, and lack of complexity in the velocity/depth regime.

The June macroinvertebrate sample was dominated by taxa in the Chironomidae (midge) family, particularly from the subfamily Chironominae. Chironomids comprised 25% of the 16 taxa and approximately 85% of the approximately 1023 individuals in the sample. The September macroinvertebrate sample contained 12 taxa but only 76 individuals. Chironomids comprised 25% of the 12 taxa, and Ostracoda (bivalve microcrustaceans) comprised approximately 66% of the individuals in the September sample.

Dissolved oxygen levels were relatively low for maintenance of aquatic life at the E1W reach in June and very low in September. Temperature, conductivity, and pH all fell within normal ranges.

Mortandad Canyon downstream from Diamond Drive (M1W):

The reach at M1W consists primarily of a series of step-pools connected by a channel with very low flow. The water at M1W appeared turbid with a light brown color, and an oily sheen was present on the surface. There was no abnormal odor detected. A heavy growth of upland grass species was present in the channel. The percent of filamentous algae covering the streambed increased from approximately 5% in June to 30% in September. Low habitat scores at this site reflect the near absence of flow in the channel, lack of riffle habitat, lack of complexity in the velocity/depth regime, sediment deposition, and lack of substrate favorable for colonization by macroinvertebrates.

The June macroinvertebrate sample was dominated by taxa in the Chironomidae family, particularly from the subfamily Chironominae. Chironomids comprised 25% of the 16 taxa and 92% of the approximately 10,545 individuals in the sample. The September sample contained 25 taxa and approximately 687 individuals. Chironomids numerically dominated the September sample (71%) but comprised only 16% of the taxa.

Dissolved oxygen levels were relatively low at the M1W reach in both June and September. Temperature, conductivity, and pH all fell within normal ranges.

Mortandad Canyon immediately downstream of E200 gaging station (M2W):

The stream reach at M2W consists of a small pool just downstream of the gaging station with a narrow, shallow riffle downstream of the pool. The pool was approximately 8 in. (20 cm) deep in June but had filled with sediment by September. The water was clear with a normal odor in June.

In September, we noted evidence of over-bank flooding. The decrease in the overall habitat score between June and September was due to lowered scores for parameters that measure impacts of sedimentation on instream habitats.

The June macroinvertebrate sample was dominated by taxa in the Chironomidae family, particularly from the subfamily Chironominae. Chironomids comprised 33% of the 12 taxa and 69% of the 48 individuals in the June sample.

Dissolved oxygen levels were relatively low at the M2W reach in both June and September. Temperature, conductivity, and pH all fell within normal ranges.

Ten Site Canyon near head of canyon (TS1C):

The stream reach at TS1C was dry during both sampling events. We performed a habitat assessment in September and noted evidence of over-bank flow. This reach received very low scores for all habitat parameters except for degree of channel alteration and riparian zone width.

Ten Site Canyon downstream of TA-35 sewage lagoon outfall (TS2C):

The stream reach at TS2C was dry during both sampling events. We performed a habitat assessment in September and noted evidence of over-bank flow. This stream reach is dominated by bedrock and received low to very low scores for all habitat parameters except for degree of channel alteration, bank stability, vegetative protection, and riparian zone width.

**Table 2. Habitat assessment scores.**

| Parameter | Reach ID | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | E1W | | M1W | | M2W | | TS1C | TS2C |
| | 6/21/05 | 9/26/05 | 6/21/05 | 9/26/05 | 6/21/05 | 9/26/05 | 9/26/05 | 9/26/05 |
| **Epifaunal Substrate & Cover** | 1/20 | 3/20 | 6/20 | 8/20 | 11/20 | 3/20 | 1/20 | 3/20 |
| **Embeddedness** | 0/20 | 1/20 | 8/20 | 5/20 | 10/20 | 3/20 | 1/20 | 1/20 |
| **Velocity/Depth Regime** | 1/20 | 3/20 | 6/20 | 6/20 | 0/20 | 0/20 | 0/20 | 0/20 |
| **Sediment Deposition** | 1/20 | 4/20 | 8/20 | 5/20 | 8/20 | 1/20 | 2/20 | 6/20 |
| **Channel Flow Status** | 6/20 | 14/20 | 1/20 | 4/20 | 1/20 | 1/20 | 0/20 | 0/20 |
| **Channel Alteration** | 18/20 | 17/20 | 13/20 | 17/20 | 13/20 | 15/20 | 19/20 | 20/20 |
| **Frequency of Riffles** | 1/20 | 1/20 | 1/20 | 3/20 | 16/20 | 2/20 | 1/20 | 1/20 |
| **Bank Stability** | | | | | | | | |
| **Left Bank** | 8/10 | 8/10 | 9/10 | 8/10 | 5/10 | 8/10 | 2/10 | 9/10 |
| **Right Bank** | 8/10 | 8/10 | 7/10 | 8/10 | 8/10 | 8/10 | 4/10 | 9/10 |
| **Vegetative Bank Protection** | | | | | | | | |
| **Left Bank** | 9/10 | 9/10 | 9/10 | 9/10 | 9/10 | 7/10 | 2/10 | 6/10 |
| **Right Bank** | 9/10 | 9/10 | 9/10 | 9/10 | 9/10 | 7/10 | 4/10 | 6/10 |
| **Riparian Vegetative Zone** | | | | | | | | |
| **Left Bank** | 10/10 | 10/10 | 9/10 | 10/10 | 9/10 | 10/10 | 10/10 | 10/10 |
| **Right Bank** | 9/10 | 10/10 | 9/10 | 10/10 | 9/10 | 10/10 | 10/10 | 10/10 |
| **Habitat Assessment Score** | **81/200** | **97/200** | **95/200** | **102/200** | **108/200** | **75/200** | **56/200** | **81/200** |

**Table 3. Physical/chemical parameters.**

| | Reach ID | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | E1W | | M1W | | M2W | | TS1C | TS2C |
| | 6/21/05 | 9/26/05 | 6/21/05 | 9/26/05 | 6/21/05 | 9/26/05 | 9/26/05 | 9/26/05 |
| **Temperature (°C)** | 15.1 | 12.7 | 18.3 | 12.9 | 16.6 | -- | -- | -- |
| **Dissolved Oxygen (mg/l)** | 4.61 | 1.10 | 4.05 | 3.24 | 4.59 | -- | -- | -- |
| **Dissolved Oxygen (% saturation)** | 45.9 | 11.1 | 43.3 | 25.8 | 46.9 | -- | -- | -- |
| **Conductivity (µmos/cm)** | 335 | 309 | 3 | 220 | 311 | -- | -- | -- |
| **pH** | -- | 6.9 | -- | 7.0 | -- | -- | -- | -- |

**Table 4. Macroinvertebrate sample abundance and number of taxa.**

| | Reach ID | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | E1W | | M1W | | M2W | | TS1C | TS2C |
| **Sampling Date** | 6/21/05 | 9/26/05 | 6/21/05 | 9/26/05 | 6/21/05 | 9/26/05 | 9/26/05 | 9/26/05 |
| **Percent of Sample Processed** | 63% | 100% | 6% | 100% | 100% | -- | -- | -- |
| **Number of Individuals Identified** | 647 | 76 | 720 | 687 | 48 | -- | -- | -- |
| **Number of Taxa** | 16 | 12 | 16 | 25 | 12 | -- | -- | -- |
| **Estimated Total Number of Individuals in Entire Sample** | 1023 | 76 | 10,545 | 687 | 48 | -- | -- | -- |

## Discussion

Effluent Canyon downstream of TA-55 (E1W):

The dominance of Chironomidae and Ostracoda at E1W is likely due to the high proportion of fine sediments, low dissolved oxygen levels, low flow, and lack of habitat complexity for that reach. Chironomids tend to be tolerant of low oxygen conditions and are favored by fine sediments that provide habitat for the larvae to create burrows and tubes (Merritt and Cummins 1996). Fine sediments also provide a food source for chironomids and ostracods, which are generally collector-gatherers or collector-filterers (Merrit and Cummins 1996, Wisseman 1996). Ostracods are also tolerant of low oxygen conditions and either swim above the sediment surface or crawl on sediment surface in slow current (Merrit and Cummins 1996). Decreases in macroinvertebrate abundance from June to September could be due to natural variation, low oxygen conditions, displacement from high flows, or other unknown factors.

The abundance of algae at the E1W site indicates abnormally elevated nutrient levels in the water. Excessive algal growth and algal decomposition deplete oxygen levels, and algal decomposition is also likely to be the source of the sulfurous odor at that site.

Mortandad Canyon downstream from Diamond Drive (M1W):

The dominance of chironomids at the M1W site is probably related to the prevalent habitat of pools containing fine sediment. The increase in algal growth from June to September could be

related to nutrients carried to the channel in storm water runoff. Heavy growth of upland grass species in the channel suggests that low flow conditions have persisted at this site. Decreases in macroinvertebrate abundance from June to September could be due to natural variation, low oxygen conditions, displacement from high flows, or other unknown factors.

Mortandad Canyon immediately downstream of E200 gaging station (M2W):

The dominance of chironomids at the M2W site is probably related to the presence of fine sediments in the single pool, which dominated the available habitat. Low flows in the channel would also tend to favor chironomids over less tolerant taxa. Low macroinvertebrate abundance could be due to natural variation, habitat limitations, or other unknown factors.

Ten Site Canyon near head of canyon (TS1C) and Ten Site Canyon downstream of TA-35 sewage lagoon outfall (TS2C):

Life cycles for aquatic macroinvertebrates range from a few weeks to several years, and the dry periods of ephemeral reaches such as TS1C and TS2C are unsuitable for long-lived or sensitive taxa. Macroinvertebrate communities that are able to develop during wet periods can be washed out during high flow events. We rated the biotic potential of the TS1C site to be very low due to the lack of surface flow and poor habitats related to sedimentation and habitat instability. The TS2C reach is primarily made up of bedrock, which does not provide adequate habitat for most aquatic macroinvertebrates even if flow is present.

## Conclusions

Macroinvertebrate data, habitat scores, and dissolved oxygen levels at sites E1W, M1W, and M2W suggest that these sites are marginal for sustaining a diverse community of aquatic life. However, existing protocols for aquatic macroinvertebrate sampling and habitat assessments are based on expectations for perennial streams and have inherent biases that tend to rate ephemeral or effluent-dependent streams as being degraded. Because it is not well understood what constitutes a reference condition for habitat or biota in ephemeral or effluent-dependent streams, it is not possible to determine how the condition of these sites compares to minimally impacted sites with similar hydrology. The biological importance of these systems also needs further study. The Arid West Water Quality Research Program has an active research program aimed at addressing these and other questions (see AWWQRP 2006).

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## References

AWWQRP (Arid West Water Quality Research Program). 2006. Developing Water Quality Criteria for the Arid West. http://www.co.pima.az.us/wwm/wqrp/bg/index_bg.htm. Accessed May 24, 2006.

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish. Second Edition. EPA 841-B-99-002. US Environmental Protection Agency; Office of Water; Washington DC.

EPA (United States Environmental Protection Agency). 1986. Ambient Water Quality Criteria for Dissolved Oxygen. EPA 440/5-86-003. National Technical Information Service, Springfield, VA.

EPA (United States Environmental Protection Agency). 2006. Current National Recommended Water Quality Criteria. http://www.epa.gov/waterscience/criteria/wqcriteria.html#F2. Accessed May 24, 2006.

Hughes, R.M. 1995. Defining Acceptable Biological Status by Comparing with Reference Conditions. Pages 31–47 in W.S. Davis and T.P. Simon (eds.), *Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making.* Lewis Publishers, Boca Raton, FL.

LANL (Los Alamos National Laboratory). 2005. Mortandad Canyon Biota Investigation Work Plan. Los Alamos National Laboratory document LA-UR-05-2231, Los Alamos, New Mexico.

Merritt, R.W. and K.W. Cummins (eds.). 1996. *An Introduction to the Aquatic Insects of North America*, 3rd edition. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Reynoldson, T.B., R.H. Norris, V.H. Resh, K.E. Day, and D.M. Rosenberg. 1997. The Reference Condition: A Comparison of Multimetric and Multivariate Approaches to Assess Water-Quality Impairment using Benthic Macroinvertebrates. Journal of the North American Benthological Society 16(4):833–852.

Wisseman, R.W. 1996. Version 1.0. Unpublished ecological coding attributes for freshwater invertebrate taxa in western North America.

## Appendix A

### HABITAT ASSESSMENT FIELD DATA SHEET - HIGH GRADIENT STREAMS

| | |
|---|---|
| STREAM NAME | LOCATION |
| STATION # _____ RIVERMILE _____ | STREAM CLASS |
| LAT _____ LONG _____ | RIVER BASIN |
| STORET # | AGENCY |
| INVESTIGATORS | |
| FORM COMPLETED BY | DATE _____ TIME _____ AM PM / REASON FOR SURVEY |

Parameters to be evaluated in sampling reach

| Habitat Parameter | Condition Category | | | |
|---|---|---|---|---|
| | Optimal | Suboptimal | | Poor |
| 1. Epifaunal Substrate & Available Cover | Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient). | 40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). | | Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking. |
| SCORE | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| 2. Embeddedness | Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. | Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. | Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. | Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. |
| SCORE | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| 3. Velocity/Depth Regime | All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m). | Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). | Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low). | Dominated by 1 velocity/depth regime (usually slow-deep). |
| SCORE | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| 4. Sediment Deposition | Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. | Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools. | Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent. | Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. |
| SCORE | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| 5. Channel Flow Status | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills > 75% of the available channel; or <25% of channel substrate is exposed. | Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| SCORE | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |

*Adapted from EPA Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition, 1999.*

Parameters to be evaluated broader than sampling reach

| Habitat Parameter | Condition Category | | | |
|---|---|---|---|---|
| | Optimal | Suboptimal | Marginal | Poor |
| 6. Channel Alteration | Channelization or dredging absent or minimal; stream with normal pattern. | Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present. | Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. |
| SCORE | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| 7. Frequency of Riffles (or bends) | Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important. | Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15. | Occasional riffle or bend, bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. | Generally all flat water or shallow riffles; poor habitat, distance between riffles divided by the width of the stream is a ratio of > 25. |
| SCORE | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| 8. Bank Stability (score each bank)<br><br>Note: determine left or right side by facing downstream | Banks stable, evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion, high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. |
| SCORE (LB) | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| SCORE (RB) | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| 9. Vegetative Protection (score each bank) | More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. | 70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. | 50-70% of the streambank surfaces covered by vegetation, disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. | Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. |
| SCORE (LB) | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| SCORE (RB) | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| 10. Riparian Vegetative Zone Width (score each bank riparian zone) | Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. |
| SCORE (LB) | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| SCORE (RB) | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |

**Total Score**

*Adapted from EPA Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition, 1999.*

# Appendix B: LANL Bioassessment Field Data Sheet

**SAMPLE LOCATION**

Date: (dy/mo/yr): _____ Sample Time: _____

Stream Name: _____ Site Name: _____

Site Description: _____

Field Crew: _____ Program: _____

**SITE INFORMATION**

USGS 7.5' Quadrangle: _____ Ownership: _____

Watershed Name: _____ Elev.(ft): _____

HUC – Reach: _____ County: _____ State: _____ Aspect: _____

Site Id Latitude (DMS): _____ Site Id Longitute (DMS): _____ Method: _____

Most Recent Flood Even (Date, Discharge): _____

Designated Uses: _____

**POST SAMPLING RECOMMENDATIONS**

(Notes about flow regime, relocating site, site access, sample types, analysis parameters, etc.)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

## FIELD OBSERVATIONS

Precipitation (Circle one): None Light Moderate Heavy

Previous precipitation (24 hr) (Circle one): None Light Moderate Heavy

Could cover (%): _____

## FIELD MEASUREMENTS

Air T (°C): _____ Turbidity (NTU): _____

Water T (°C): _____ D.O. (mg/l):_____ D.O. % Sat.:_____ Conductivity (µmos/cm):_____ pH: _____

**Samples Collected** **Sample Time:** _____ **QC Sample (Y/N):**_____

| **Water Collection Method:** | **Parameter Sets:** | **Biological Samples:** | |
|---|---|---|---|
| ____ Composite | ____ Inorganics | **Macroinvertibrates:** | **Macroinvertibrates:** |
| ____ Grab | ____ Nutrients | ___ Riffle (field split____) | ___ Edge (field split____) |
| | ____ Total Metals | ___ Pool (field split____) | ___ Other (field split____) |
| | ____ Dissolved Metals | **Algae:** | **Algae:** |
| | ____ Bacteria | ___ Diatoms, Riffle | ___ Filamentous, Riffle |
| | ____ Radiochemicals | ___ Diatoms, Pool | ___ Filamentous, Pool |
| | ____ Parasites/Viruses | ___ Diatoms, Artificial Substrate | ___ Filamentous, composite |
| | ____ Other _____ | | |

## ADDITIONAL SAMPLE NOTES

**DISCHARGE: Marsh-McBirney** **USGS Staff Height: _____**

| | Distance, ft. | Width, ft. | Depth, ft. | Area, ft.$^2$ | Velocity, ft/s | Discharge, cfs |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | | | | | |
| 12 | | | | | | |
| 13 | | | | | | |
| 14 | | | | | | |
| 15 | | | | | | |
| 16 | | | | | | |
| 17 | | | | | | |
| 18 | | | | | | |
| 19 | | | | | | |
| 20 | | | | | | |
| 21 | | | | | | |
| 22 | | | | | | |
| 23 | | | | | | |
| 24 | | | | | | |
| 25 | | | | | | |
| 26 | | | | | | |
| 27 | | | | | | |
| | TOTAL = | | AVG = | TOTAL = | AVG = | TOTAL = |

**FLOAT METHOD**

Float distance should be 2-3 times wetted width of stream

| Float Distance, ft.: | Float Time (seconds) | | | | | | | | | | Average Time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |

Float Distance (ft.): _____ /Avg. Time (s): _____ = _____ Avg. Velocity (ft/s)

Avg. Velocity: _____ x 0. 85 Correction Factor = _____ Connected Velocity (ft/s)

Corrected Velocity (ft/s): _____ x Area (ft.$^2$): _____ = _____ Discharge cfs

## GENERAL SITE CHARACTERISTICS

General Appearance in the Stream Reach (Check all that apply)

____ No refuse visible
____ Small volume refuse (e.g. cans, paper) rare
____ Small volume refuse common
_____ Large Volume refuse (e.g. tires, carts) rare
_____ Large Volume refuse common

General Appearance of the Stream-bank along the Reach (Check all that apply)

____ No refuse visible
____ Small volume refuse (e.g. cans, paper) rare
____ Small volume refuse common
_____ Large Volume refuse (e.g. tires, carts) rare
_____ Large Volume refuse common

Water Appearance (Check all that apply)

____ Clear
____ Milky
____ Turbid
____ Light Brown
____ Dark Brown
____ Oily Sheen
____ Reddish
____ Greenish
____ Other _____

Water Odor (Check all that apply)

____ None
____ Sewage
____ Chlorine
____ Fishy
____ Rotten Eggs
____ Other _____

Appearance at Water's Edge (Check one)

____ No evidence of salt crusts
____ White crusty deposits rare
_____ Numerous white crusty deposits localized
_____ Banks covered with white crusty deposits

Fish (Based on observation)

1. Abundant Comments: _____
2. Rare Comments: _____
3. Absent Comments: _____

Crayfish (Based on observation)

1. Abundant Comments: _____
2. Rare Comments: _____
3. Absent Comments: _____

Recent (past 2 months) flood or long term drought evidence (Check all that apply)

_____ No recent flood evidence
_____ Fresh debris line
_____ Grasses laid over
_____ Recent flood even greater than baseflow:
< bankfull width
> bankfull width – estimated width _____
____ Fresh debris suspended in bushes/trees
____ Other _____
____ Drought Conditions Prevailing

Flow Regime (Check one)

___ Perennial stream channel. Surface water persists all year long.
___ Intermittent stream channel. One which flows only seasonally or sporadically. Surface sources include springs, snow melt and flows that reappear along various locations of a reach, then run subterranean (interrupted).
___ Subterranean stream channel. Flows parallel to and near the surface for various seasons; subsurface flow which follows the stream bed.
___ Ephemeral stream channel. Flows only in response to precipitation.

Flow Variability (Check one)

_____ Seasonal variation in stream flow dominated primarily by **snowmelt** runoff.
_____ Seasonal variation in stream flow dominated primarily by **stormflow** runoff.
_____ Uniform stage and associated stream flow due to **spring fed condition.**
_____ **Regulated stream flow** due to diversions, dam release, dewatering, etc.
_____ **Altered flows** due to development such as urban streams, cut-over watersheds, vegetation conversions (e.g. forested to grassland) that changes flow response to precipitation events.

**AQUATIC PLANTS**

Filamentous Algae

Estimated percent of filamentous algae bed throughout study reach: _____ % cover

Floating Algae

Are any detached clumps or mats of algae floating downstream?

1. Abundant Comments: _____
2. Rare Comments: _____
3. Absent Comments: _____

Algal Slime (not filamentous)

Are the submerged rocks, bedrock, woody material in the stream coated with a layer of algal slime? May be slippery to the touch, but no readily visible.

1. Abundant – thick -coating Comments: _____
2. Rare- thin-coating Comments: _____
3. Absent Comments: _____

Percent macrophytes covering stream-bed throughout the reach:_____ % cover

Description of algae/macrophytes in reach (emergent and submergent):

**CHANNEL/HABITAT COMPLEXITY**

(Reach length equals 2 meander lengths or 20-30 times beankfull wieth of the stream) Use a minimum of 100 m reach to identify habitat types for large streams.

| Habitat | Number of Paces | % | |
|---|---|---|---|
| Pool | | | |
| Riffle | | | |
| Run | | | Riffle/Pool Ratio |
| Total | | | |

**EMBEDDEDNESS**

(Estimate the percent Embeddedness of 10 cobbles along each of the three riffle transects. Select three different riffles within the reach wherever possible. Begin and end transect at edges of riffle, don't include edge particles of the wetted width. Count sand and fines as 100% embedded and bedrock and hardpan as 0% embedded. Gravel is selected from a patch of gravel is considered 100% embedded.)

| | | | | | | | | | | | Average % Embeddedness |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Transect #1 | | | | | | | | | | | |
| Transect #2 | | | | | | | | | | | |
| Transect #3 | | | | | | | | | | | |

**ORGANIC DEBRIS/CHANNEL BLOCKAGES (IN ACTIVE CHANNEL)**

Mark single most appropriate description

___ No organic debris or channel blockages

___ Infrequent debris, what's present consists of small, floatable

___ Moderate frequency, mixture of small to medium size debris affects less than 10% of active channel area.

___ Numerous debris mixture of medium to large sizes – affecting up to 30% of the area of the active channel.

___ Debris dams of predominantly large material affecting over 30% to 50% the channel area and often occupying the total width of the active channel.

___ Extensive, large debris dams either continuous, or influencing over 50% or channel area. Forces water onto flood plain even with moderate flows. Generally presents a fish migration blockage.

___ Beaver dams. Few and/or infrequent. Spacing allows for normal stream/flow conditions between dams.

___ Beaver dams – Frequent. Back water occurs between dams – stream flow velocities reduced between dams.

___ Beaver dams- abandoned where numerous dams have filled in with sediment and are causing channel adjustments of lateral migration, avulsion, and degradation, etc.

___ Man-made structures – diversion dams, low dams, controlled by-pass channels, baffled bed configuration with gabions, etc.

**SITE MAP SKETCH:** (Include location of riffles , pools, runs, snags, submerged logs, undercut banks, areas of stable cobble habitat, point bars, mid-channel or side bars, areas with cut or eroding banks, location and types of riparian vegetation, etc.)

RIPARIAN VEGETATION COVER: (Record the % cover of each vegetation type. Consider each vegetative layer separately with a score of 0-100% for each)

| Riparian Vegetation Cover | Percent Cover |
|---|---|
| Canopy of riparian trees ( >5m hight) | |
| Understory of woody shrubs, samplings, herbs, grasses & forbs (0.5 to 5 m high) | |
| Ground cover of woody shrubs seedlings, herbs, grasses & forbs ( <0.5 m high) | |
| Barren, bare dirt | |

METHODS OF MEASURING AREAL EXTENT 143

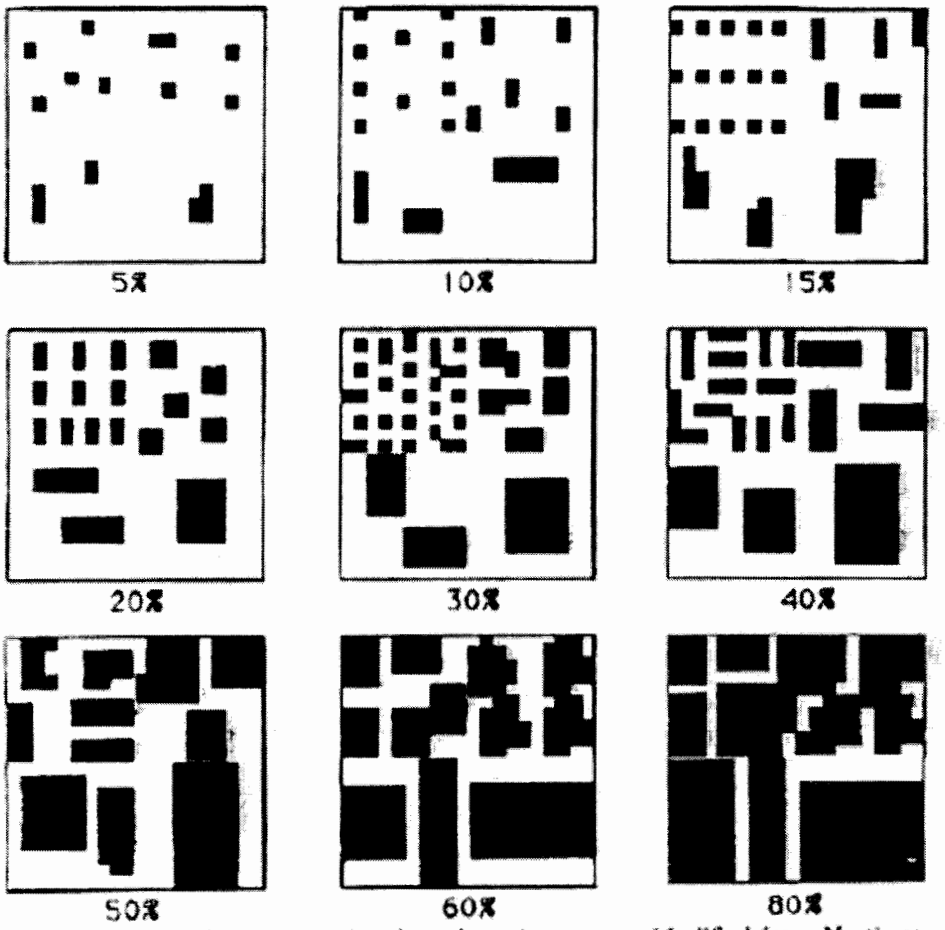


Figure 5.9. Chart for visual estimation of areal coverage. Modified from Northcote (1979) by permission of Rellim Technical Publications

**REGENERATION POTENTIAL OF RIPARIAN TREES**

(List the common riparian species in order of most abundant to least, then check the boxes for each age class that is present)

| Species | Mature Trees | Young Trees | Saplings | Seedlings* |
|---|---|---|---|---|
| 1) | | | | |
| 2) | | | | |
| 3) | | | | |
| 4) | | | | |
| 5) | | | | |

Mature trees = diameter > 40 cm (16") @ 1 m height
Young trees = diameter 3-40 cm @ 1 m height
Saplings = diameter < 3 cm (<1.2")
Seedlings = New growth this year; *note if present but don't cound as an age class*

**AGE CLASSES OF THE DOMINANT RIPARIAN TREE SPECIEIS** (Check the one that applies)

_____ Species abundant in 3 age classes
_____ Abundant in 2 age classes
_____ Only one age class present
_____ No regeneration evident, few mature trees found, no saplings or seedlings or if present they are heavily grazed/damaged.

**ADDITIONAL FIELD NOTES**: (Note: How stream is confined, geomorphic features, streambed structure, habitat variety, dimentation, flood/drought evidence, fish, frogs, other wildlife, channel modifications etc.)

Appendix C:
Aquatic Invertebrate Report for samples collected by the Los Alamos National Laboratory

Report prepared for:
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Los Alamos, New Mexico 87545

Report prepared by:
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National Aquatic Monitoring Center
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435.797.2038

5 December 2005

**Sampling Locations**
Table 1. Sampling site locations.

| Station ID | Location | County | State | Latitude degrees north | Longitude degrees west | Elevation (meters) |
|---|---|---|---|---|---|---|
| EFFLUE1W | Effluent Canyon | Los Alamos | New Mexico | 34.962 | 106.287 | 2210 |
| MORTAN1W | Mortandad Canyon | Los Alamos | New Mexico | 35.867 | 106.313 | 2195 |
| MORTAN2W | Mortandad Canyon | Los Alamos | New Mexico | 35.863 | 106.288 | 2134 |

**Methods**

*Field sampling*

Samples were collected on 21 June and 26 September 2005. Aquatic invertebrates were collected from pools and slow shallow habitats with a dip net with a 500 micron mesh net. Samples were collected qualitatively, so the sampling area for each sample is not known.

*Laboratory methods*

The general procedures followed for processing invertebrate samples were similar to those recommended by the United States Geological Survey (Cuffney et al. 1993) and are described in greater detail and rationalized in Vinson and Hawkins (1996). Methods for individual samples are presented in Table 2. Samples were sub-sampled if the sample appeared to contain more than 600 organisms. Sub-samples were obtained by pouring the sample into an appropriate diameter 250 micron sieve, floating this material by placing the sieve within an enamel pan partially filled with water and leveling the material within the sieve. The sieve was then removed from the water pan and the material within the sieve was divided into equal parts. One side of the sieve was then randomly chosen to be processed and the other side was set aside. The sieve was then placed back in the enamel pan and the material in the sieve again leveled and split in half. This process was repeated until approximately 600 organisms remained in one-half of the sieve. This material was then placed into a petri dish and all organisms were removed under a dissecting microscope at 10-30 power. Additional sub-samples were taken until at least 600 organisms were removed. All organisms within a sub-sample were removed. During the sorting process the organisms were separated into Orders. When the sorting of the sub-samples was completed, the entire sample was spread throughout a large white enamel pan and searched for 10 minutes to remove any taxa that might not have been picked up during the initial sample sorting process. The objective of this "big/rare" search was to provide a more complete taxa list by finding rarer taxa that may have been excluded during the sub-sampling process. These rarer bugs were placed into a separate vial and tracked separately from the bugs removed during the sub-sampling process. The numbers of invertebrates collected and identified in each sample are presented in Table 2. All identified invertebrates removed from each sample were composited into a single museum-grade glass screw-top vial with a polypropylene lid and polypropylene liner. Internal sample labels were written in pencil on waterproof paper.

Table 2. Laboratory sample processing information. The percentage of each sample processed and the total number of invertebrates identified for each sample are reported.

| Sample ID | Station ID | Sampling date | % of sample processed | Number of individuals identified |
|---|---|---|---|---|
| 125291 | MORTAN1W | 6/21/2005 | 6 | 720 |
| 125292 | MORTAN2W | 6/21/2005 | 100 | 48 |
| 125293 | EFFLUE1W | 6/21/2005 | 63 | 647 |
| 125294 | MORTAN1W | 9/26/2005 | 100 | 687 |
| 125295 | EFFLUE1W | 9/26/2005 | 100 | 76 |

**Data summarization**

A number of metrics or ecological summaries were provided for each sampling station. These metrics were calculated as follows:

**Taxa richness** - Richness is a component and estimate of community structure and stream health based on the number of distinct taxa. Taxa richness normally decreases with decreasing water quality. In some situations organic enrichment can cause an increase in the number of pollution tolerant taxa. Taxa richness was calculated for operational taxonomic units (OTUs) and the number of unique genera or families. The values for operational taxonomic units may be overestimates of the true taxa richness at a site if individuals were the same taxon as those identified to lower taxonomic levels or they may be underestimates of the true taxa richness if multiple taxa were present within a larger taxonomic grouping but were not identified. All individuals within all samples were generally identified similarly, so that comparisons in operational taxonomic richness among samples within this dataset are appropriate, but comparisons to other data sets may not. Comparisons to other datasets should be made at the genera or family level.

**Abundance** - The abundance, density, or number of aquatic macroinvertebrates per unit area is an indicator of habitat availability and fish food abundance. Abundance may be reduced or increased depending on the type of impact or pollutant. Increased organic enrichment typically causes large increases in abundance of pollution tolerant taxa. High flows, increases in fine sediment, or the presence of toxic substances normally cause a decrease in invertebrate abundance. Invertebrate abundance is

presented as the number of individuals per square meter for quantitative samples and the number of individuals collected for qualitative samples.

**EPT** - A summary of the taxa richness and abundance among the insect Orders Ephemeroptera, Plecoptera, and Trichoptera (EPT). These orders are commonly considered sensitive to pollution.

**Number of families** - All families are separated and counted. The number of families normally decreases with decreasing water quality.

**Percent taxon or family dominance** – An assemblage dominated by a single taxon or several taxa from the same family suggests environmental stress.

**Shannon Diversity Index** - Ecological diversity is a measure of community structure defined by the relationship between the number of distinct taxa and their relative abundances. The Shannon diversity index was calculated for each sampling location for which there were a sufficient number of individuals and taxa collected to perform the calculations. The calculations were made following Ludwig and Reynolds (1988, equation 8.9, page 92).

**Evenness** - Evenness is a measure of the distribution of taxa within a community. The evenness index used in this report was calculated following Ludwig and Reynolds (1988, equation 8.15, page 94). Value ranges from 0-1 and approach zero as a single taxa becomes more dominant.

**Biotic indices -** Biotic indices use the indicator taxa concept. Taxa are assigned water quality tolerance values based on their specific tolerances to pollution. Scores are typically weighted by taxa relative abundance. In the United States the most commonly used biotic index is the Hilsenhoff Biotic Index (Hilsenhoff 1987, Hilsenhoff 1988). The Hilsenhoff Biotic Index (HBI) summarizes the overall pollution tolerances of the taxa collected. This index has been used to detect nutrient enrichment, high sediment loads, low dissolved oxygen, and thermal impacts. It is best at detecting organic pollution. Families were assigned an index value from 0- taxa normally found only in high quality unpolluted water, to 10- taxa found only in severely polluted waters. Family level values were taken from Hilsenhoff (1987, 1988) and a family level HBI was calculated for each sampling location for which there were a sufficient number of individuals and taxa collected to perform the calculations. Sampling locations with HBI

values of 0-2 are considered clean, 2-4 slightly enriched, 4-7 enriched, and 7-10 polluted. Rather than using mean HBI values for a sample, taxon HBI values can also be used to determine the number of pollution intolerant and tolerant taxa occurring at a site. In this report taxa with HBI values of 0-2 were considered intolerant clean water taxa and taxa with HBI values of 9-10 were considered pollution tolerant taxa. The number of tolerant and intolerant taxa and the abundances of tolerant and intolerant taxa were calculated for each sampling location.

**USFS Community tolerant quotient** - This index has been widely used by the USFS and BLM throughout the western United States. Taxa are assigned a tolerant quotient (TQ) from 2-taxa found only in high quality unpolluted water, to 108 - taxa found in severely polluted waters. TQ values were developed by Winget and Mangum (1979). The dominance weighted community tolerance quotient (CTQd) was calculated. Values can vary from about 20 to 100, in general the lower the value the better the water quality.

**Functional feeding group measures** – A common classification scheme for aquatic macroinvertebrates is to categorize them by feeding acquisition mechanisms. Categories are based on food particle size and food location, e.g., suspended in the water column, deposited in sediments, leaf litter, or live prey. This classification system reflects the major source of the resource, either within the stream itself or from riparian or upland areas and the primary location, either erosional or depositional habitats. The number of taxa and individuals of the following feeding groups were calculated for each sampling location.

**Shredders** - Shredders use both living vascular hydrophytes and decomposing vascular plant tissue - coarse particulate organic matter (CPOM). Shredders are sensitive to changes in riparian vegetation. Shredders can be good indicators of toxicants that adhere to organic matter.

**Scrapers** - Scrapers feed on periphyton - attached algae and associated material. Scraper populations increase with increasing abundance of diatoms and can decrease as filamentous algae, mosses, and vascular plants increase. Scrapers decrease in relative abundance in response to sedimentation and organic pollution.

**Collector-filterers** - Collector-filterers feed on suspended fine particulate organic matter (FPOM). Collector-gatherers are sensitive to toxicants in the water column and deposited in sediments.

**Collector-gatherers** - Collector-gatherers feed on deposited fine particulate organic matter. Collector-gatherers are sensitive to deposited toxicants.

**Predators** - Predators feed on living animal tissue.

**Unknown feeding group** - This category includes taxa that are highly variable, parasites, and those that for which the primary feeding mode is currently unknown.

**Clinger taxa -** The number of clinger taxa have been found by Karr and Chu (1998) to respond negatively to human disturbance. Clinger taxa were determined using information in Merritt and Cummins (1996). These taxa typically cling to the tops of rocks and are thought to be reduced by sedimentation or abundant algal growths

**Long-live taxa** – The number of long-lived taxa was calculated the number of taxa collected that typically have 2-3 year life cycles. Disturbances and water quality and habitat impairment typically reduces the number of long-lived taxa Karr and Chu (1998). Life-cycle length determinations were based on information in Merritt and Cummins (1996) and Dr. Mark Vinson's knowledge of the invertebrate fauna of Utah.

## Results

Abundance data and taxa richness are reported as the estimated number of individuals per sample. NC = Not calculated. * = unable to calculate. EPT = totals for the insect orders, Ephemeroptera, Plecoptera, Trichoptera.

| Station ID | Sampling date | Sample ID | Total abundance | EPT abundance | Number of families | Dominant family | Dominant family abundance | % contribution dominant family |
|---|---|---|---|---|---|---|---|---|
| MORTAN1W | 6/21/2005 | 125291 | 10545 | 52 | 10 | Chironomidae | 9691 | 91.9 |
| MORTAN2W | 6/21/2005 | 125292 | 48 | 3 | 6 | Chironomidae | 33 | 68.75 |
| EFFLUE1W | 6/21/2005 | 125293 | 1023 | 2 | 10 | Chironomidae | 884 | 86.41 |
| MORTAN1W | 9/26/2005 | 125294 | 687 | 117 | 14 | Chironomidae | 490 | 71.32 |
| EFFLUE1W | 9/26/2005 | 125295 | 76 | 3 | 5 | More then one | 54 | 71.05 |
| Mean | | | 2476 | 35 | 9 | | 2230 | 90.09 |

**Diversity indices**

| Station ID | Sampling date | Sample ID | Total taxa richness | EPT richness | Shannon diversity | Simpson diversity | Evenness |
|---|---|---|---|---|---|---|---|
| MORTAN1W | 6/21/2005 | 125291 | 16 | 2 | 1.097 | 0.515 | 0.473 |
| MORTAN2W | 6/21/2005 | 125292 | 12 | 1 | 1.908 | 0.229 | 0.588 |
| EFFLUE1W | 6/21/2005 | 125293 | 16 | 1 | 1.232 | 0.468 | 0.469 |
| MORTAN1W | 9/26/2005 | 125294 | 25 | 3 | 2.088 | 0.176 | 0.661 |
| EFFLUE1W | 9/26/2005 | 125295 | 12 | 2 | 1.344 | 0.446 | 0.438 |
| Mean | | | 16.2 | 1.8 | 1.534 | 0.367 | 0.526 |

## Biotic Indices

| Station ID | Sampling date | Sample ID | Hilsenhoff Biotic Index | Indication | USFS Biotic Condition Index |
|---|---|---|---|---|---|
| MORTAN1W | 6/21/2005 | 125291 | 5.58 | Moderate organic enrichment | 98 |
| MORTAN2W | 6/21/2005 | 125292 | 5.08 | Moderate organic enrichment | 101 |
| EFFLUE1W | 6/21/2005 | 125293 | 5.24 | Moderate organic enrichment | 99 |
| MORTAN1W | 9/26/2005 | 125294 | 5.12 | Moderate organic enrichment | 96 |
| EFFLUE1W | 9/26/2005 | 125295 | 1.37 | Little organic enrichment | 62 |
| Mean | | | 4.48 | | 91 |

Taxa richness and relative abundance values with respect to tolerance or intolerance to pollution were based on the Hilsenhoff Biotic Index (HBI). Intolerant taxa are those taxa given a HBI score of 0, 1, or 2. Tolerant taxa are those taxa given a HBI score of 8, 9, or 10. Data are presented as the estimated number per sample.

| | | | Intolerant taxa | | Tolerant taxa | | | |
|---|---|---|---|---|---|---|---|---|
| Station ID | Sampling date | Sample ID | Taxa richness | Abundance | Taxa richness | | Abundance | |
| MORTAN1W | 6/21/2005 | 125291 | 0 | 0 | 2 | (13.0) | 20 | 0 |
| MORTAN2W | 6/21/2005 | 125292 | 0 | 0 | 1 | (8.0) | 1 | (2.0) |
| EFFLUE1W | 6/21/2005 | 125293 | 0 | 0 | 2 | (13.0) | 3 | 0 |
| MORTAN1W | 9/26/2005 | 125294 | 0 | 0 | 3 | (12.0) | 8 | (1.0) |
| EFFLUE1W | 9/26/2005 | 125295 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | | 0 | 0 | 2 | (9.2) | 6 | (0.6) |

## Functional feeding groups

Taxa richness for each feeding group. The percent of the total is shown in parenthesis.

| Station ID | Sampling date | Sample ID | Shredders | | Scrapers | | Collector-filterers | | Collector-gatherers | | Predators | | Unknown | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MORTAN1W | 6/21/2005 | 125291 | 1 | (6.0) | 0 | 0 | 1 | (6.0) | 6 | (38.0) | 7 | (44.0) | 0 | 0.0 |
| MORTAN2W | 6/21/2005 | 125292 | 1 | (8.0) | 0 | 0 | 0 | 0.0 | 4 | (33.0) | 5 | (42.0) | 2 | (17.0) |
| EFFLUE1W | 6/21/2005 | 125293 | 2 | (13.0) | 0 | 0 | 1 | (6.0) | 6 | (38.0) | 6 | (38.0) | 1 | (6.0) |
| MORTAN1W | 9/26/2005 | 125294 | 2 | (8.0) | 0 | 0 | 2 | (8.0) | 10 | (40.0) | 9 | (36.0) | 2 | (8.0) |
| EFFLUE1W | 9/26/2005 | 125295 | 0 | 0.0 | 0 | 0 | 0 | 0.0 | 7 | (58.0) | 2 | (17.0) | 3 | (25.0) |
| Mean | | | 1 | (7.0) | 0 | 0 | 1 | (5.0) | 7 | (41.0) | 6 | (36.0) | 2 | (10.0) |

Invertebrate abundance for each feeding group. The percent of the total is shown in parenthesis.

| Station ID | Sampling date | Sample ID | Shredders | | Scrapers | | Collector-filterers | | Collector-gatherers | | Predators | | Unknown | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MORTAN1W | 6/21/2005 | 125291 | 16 | 0.0 | 0 | 0.0 | 544 | (5.0) | 9112 | (86.0) | 872 | (8.0) | 0 | 0.0 |
| MORTAN2W | 6/21/2005 | 125292 | 2 | (4.0) | 0 | 0.0 | 0 | 0.0 | 31 | (65.0) | 11 | (23.0) | 4 | (8.0) |
| EFFLUE1W | 6/21/2005 | 125293 | 3 | 0.0 | 0 | 0.0 | 55 | (5.0) | 773 | (76.0) | 184 | (18.0) | 8 | (1.0) |
| MORTAN1W | 9/26/2005 | 125294 | 16 | (2.0) | 0 | 0.0 | 17 | (2.0) | 487 | (71.0) | 164 | (24.0) | 3 | 0.0 |
| EFFLUE1W | 9/26/2005 | 125295 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 19 | (25.0) | 5 | (7.0) | 52 | (68.0) |
| Mean | | | 7 | 0.0 | 0 | 0.0 | 123 | (5.0) | 2084 | (84.0) | 247 | (10.0) | 13 | (1.0) |

The 10 metrics thought to be most responsive to human (induced disturbance (Karr and Chu 1998).

| Station ID | Sampling date | Sample ID | Total taxa | Ephemeroptera taxa | Plecoptera taxa | Trichoptera taxa | Long-lived taxa | Intolerant taxa | % Tolerant individuals | Clingeer taxa | % Contribution dominant taxon | % Predators |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MORTAN1W | 6/21/2005 | 125291 | 16 | 1 | 0 | 1 | 6 | 0 | 0.2 | 0 | 70.1 | 8.3 |
| MORTAN2W | 6/21/2005 | 125292 | 12 | 0 | 0 | 1 | 1 | 0 | 2.1 | 0 | 45.8 | 22.9 |
| EFFLUE1W | 6/21/2005 | 125293 | 16 | 1 | 0 | 0 | 3 | 0 | 0.3 | 0 | 66.6 | 18 |
| MORTAN1W | 9/26/2005 | 125294 | 25 | 2 | 0 | 1 | 4 | 0 | 1.2 | 2 | 26.3 | 23.9 |
| EFFLUE1W | 9/26/2005 | 125295 | 12 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 65.8 | 6.6 |
| Mean | | | 16 | 1 | 0 | 1 | 3 | 0 | 0.3 | 0 | 67.2 | 10 |

**Literature Cited**

Cuffney, T.F., Gurtz, M.E. and Meador, M.R. 1993. Methods for collecting benthic invertebrate samples as part of the National Water Quality Assessment Program: United States Geological Survey Open File Report 93-406.

Hilsenhoff, W. L. 1988. Rapid field assessment of organic pollution with a family level biotic index. The Journal of the North American Benthological Society. 7:65(68.

Hilsenhoff, W.L. 1987. An improved index of organic stream pollution. The Great Lakes Entomologist. 20:31(39.

Karr, J.R. and E.W. Chu. 1998. Restoring life in running waters: better biological monitoring. Island Press, Washington, D.C.

Ludwig, J.A. and J.F. Reynolds. 1988. Statistical ecology: a primer on methods and computing. John Wiley and Sons. New York.

Merritt, R.W. and K.W. Cummins, editors, 1996. An introduction to the aquatic insects of North America. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Vinson, M.R. and C.P. Hawkins. 1996. Effects of sampling area and subsampling procedures on comparisons of taxa richness among streams. Journal of the North American Benthological Society 15:393-400.

Wingett, R.N. and F. A. Mangum. 1979. Biotic condition index: integrated biological, physical, and chemical parameters for management. U.S. Forest Service Intermountain Region, U.S. Department of Agriculture, Ogden, Utah.

**Major taxonomic identification resources used**

Baumann, R.W., A.R. Gaufin, and R.F. Surdick. The stoneflies (Plecoptera) of the Rocky Mountains. Memoirs of the American Entomological Society Number 31. Academy of Natural Sciences, Philadelphia, Pennsylvania.

Brown, H. P. 1976. Aquatic Dryopoid Beetles (Coleoptera) of the United States. U. S. EPA. Cincinnati, Ohio.

Burch, J. B. 1973. Biota of Freshwater Ecosystems Identification Manual No. 11, Freshwater Unionacean Clams (Mollusca: Pelecypoda) of North America. U. S. Environmental Protection Agency, Project # 18050, Contract # 14(12(894.

Burch, J. B. 1973. Freshwater Unionacean Clams (Mollusca:gastropoda) of North America. U. S. Environmental Protection Agency, EPA(600\3(82(023. Contract # 68(03(1290.

Burch, J.B. 1980, 1982, 1988. North American freshwater snails. Walkerana, Volume 1, No. 3 and No. 4 and Volume 2, No. 6. Ann Arbor, Michigan.

Clarke, A.H. 1981. The freshwater molluscs of Canada. National Museum of Canada. Ottawa.

Edmunds, G. F., Jr., S. L. Jensen and L. Berner. 1976. The Mayflies of North and Central America. North Central Publishing Co., St. Paul, Minnesota.

Johannsen, O. A. 1977. Aquatic Diptera: Eggs, Larvae, and Pupae of Aquatic Flies. Published by the University, Ithaca, New York. 210 Pages.

Klemm, D. J. 1985. A Guide to the Freshwater Annelida (Polychaeta, Naidid and Tubificid Oligochaeta and Hirudinea) of North America. Kendall/Hunt Publishing Co., Dubuque, Iowa.

Larson, D.J., Y. Alarie, and R.E. Roughley. 2000. Predaceous diving beetles

(Coleoptera: Dytiscidae) of the Nearctic Region, with emphasis on the fauna of Canada and Alaska. NRC Research Press, Ottawa, Ontario, Canada.
McCafferty, W. P. 1981. Aquatic Entomology. Jones and Bartlett Publishers, Inc., Boston.
Merritt, R. W. and K. W. Cummins (Editors). 1996. An Introduction to the Aquatic Insects of North America, Third Edition. Kendall/Hunt Publishing Co., Dubuque, Iowa.
Needham, J.G., M.J. Westfall, Jr., M.L. May. 2000. Dragonflies of North America. Scientific Publishers, Gainesville, Florida.
Pennak, R. W. 1989. Freshwater Invertebrates of the United States, Third Edition, John Wiley and Sons, Inc, New York.
Stewart, K. W. and B. P. Stark. 2002. Nymphs of North American Stonefly Genera (Plecoptera). Second Edition. University of North Texas Press, Denton Texas.
Thorp J. H. and A. P. Covich (Editors). 1991. Ecology and Classification of Freshwater Inverebrates. Academic Press, Inc., San Diego, California.
Westfall, M.J. Jr., and M.L. 1996. Damselflies of North America. Scientific Publishers, Gainesville, Florida.
Wiederholm, T. (Editor) 1983. Chironomidae of the Holarctic Region. Entomologica Scandinavica.
Wiggins, G. B. 1996. Larvae of North American Caddisfly Genera (Tricoptera). Second Edition, University of Toronto Press. Toronto.

List of taxa collected in 5 samples. Samples were collected between 21 June 2005 and 26 September 2005. Count is the total number of individuals identified and retained.

| Taxon | Count |
|---|---|
| Annelida | |
| Clitellata subclass oligochaeta | 4 |
| Arthropoda | |
| Arachnida | |
| Trombidiformes | 44 |
| Entognatha | |
| Collembola | 4 |
| Insecta | |
| Coleoptera | |
| Curculionidae | 1 |
| Dytiscidae | 17 |
| Agabus | 3 |
| Hydrophilidae | 8 |
| Laccobius | 1 |
| Diptera | 6 |
| Ceratopogonidae | 4 |
| Atrichopogon/forcipomyia | 1 |
| Chironomidae | 52 |
| Chironominae | 1118 |
| Orthocladiinae | 324 |
| Tanypodinae | 249 |
| Culicidae | 85 |
| Culiseta | 6 |
| Empididae | |
| Chelifera | 1 |
| Muscidae | 4 |
| Psychodidae | |
| Pericoma | 2 |
| Psychoda | 1 |
| Simuliidae | |
| Simulium | 1 |
| Stratiomyidae | 2 |
| Caloparyphus | 2 |
| Nemotelus | 1 |
| Tipulidae | 5 |
| Ephemeroptera | |
| Baetidae | 84 |
| Baetis | 2 |
| Callibaetis | 27 |

List of taxa collected from all samples, continued.

| Taxon | Count |
|---|---|
| Heteroptera | |
| Veliidae | 15 |
| Microvelia | 8 |
| Odonata | |
| Aeshnidae | 11 |
| Aeshna dugesi | 1 |
| Coenagrionidae | 6 |
| Argia | 1 |
| Lestidae | 4 |
| Libellulidae | 1 |
| Trichoptera | 4 |
| Limnephilidae | 15 |
| Malacostraca | |
| Isopoda | |
| Asellidae | |
| Caecidotea | 1 |
| Ostracoda | 50 |
| Nemata | 2 |
| 42 Taxa | 2178 Individuals |

# Taxa Lists for Individual Samples

Taxonomic list and abundances of aquatic invertebrates collected 21 June 2005 at station MORTAN1W, Mortandad Canyon, Los Alamos County, New Mexico. The sample was collected from pool habitat using a dip net. The total area sampled was unspecified. The sample identification number is 125291. The percentage of the sample that was identified and retained was 6% of the collected sample. A total of 720 individuals were removed, identified and retained. Abundance data are presented as the estimated number of individuals collected in the entire sample. Notes - identification to genus or species was not supported because: I - immature organisms, D - damaged organisms, M - poor slide mount, G - gender, U - indistinct characters or distribution, R - retained in our reference collection.

| Order | Family | Subfamily/Genus/species | Life Stage | Abundance | Notes |
|---|---|---|---|---|---|
| Phylum: Arthropoda | | | | | |
| Class: Insecta | | | | | |
| Coleoptera | Dytiscidae | | larvae | 1 | I |
| Coleoptera | Dytiscidae | Agabus | larvae | 18 | |
| Coleoptera | Hydrophilidae | | larvae | 35 | I,U |
| Diptera | Chironomidae | | pupae | 290 | |
| Diptera | Chironomidae | Chironominae | larvae | 7387 | |
| Diptera | Chironomidae | Orthocladiinae | larvae | 1348 | |
| Diptera | Chironomidae | Tanypodinae | larvae | 666 | |
| Diptera | Culicidae | | larvae | 544 | I |
| Diptera | Culicidae | Culiseta | larvae | 50 | |
| Ephemeroptera | Baetidae | | larvae | 36 | D |
| Heteroptera | Veliidae | | larvae | 17 | I |
| Odonata | Aeshnidae | | larvae | 116 | I |
| Odonata | Aeshnidae | Aeshna dugesi | larvae | 1 | R1 |
| Odonata | Lestidae | | larvae | 19 | I |
| Trichoptera | Limnephilidae | | larvae | 16 | I |
| Class: Malacostraca | | | | | |
| Isopoda | Asellidae | Caecidotea | adult | 1 | |
| | | | | --- | |
| Total: 16 taxa | | | | 10545 individuals | |

Taxonomic list and abundances of aquatic invertebrates collected 21 June 2005 at station MORTAN2W, Mortandad Canyon, Los Alamos County, New Mexico. The sample was collected from pool habitat using a dip net. The total area sampled was unspecified. The sample identification number is 125292. The percentage of the sample that was identified and retained was 100% of the collected sample. A total of 48 individuals were removed, identified and retained. Abundance data are presented as the estimated number of individuals collected in the entire sample. Notes - identification to genus or species was not supported because: I - immature organisms, D - damaged organisms, M - poor slide mount, G - gender, U - indistinct characters or distribution, R - retained in our reference collection.

| Order | Family | Subfamily/Genus/species | Life Stage | Abundance | Notes |
|---|---|---|---|---|---|
| Phylum: Arthropoda | | | | | |
| Class: Arachnida | | | | | |
| Trombidiformes | | | adult | 2 | |
| Class: Insecta | | | | | |
| Coleoptera | Hydrophilidae | | larvae | 1 | I |
| Diptera | | | larvae | 1 | I,D |
| Diptera | Ceratopogonidae | | larvae | 1 | I |
| Diptera | Chironomidae | | pupae | 3 | |
| Diptera | Chironomidae | Chironominae | larvae | 22 | |
| Diptera | Chironomidae | Orthocladiinae | larvae | 5 | |
| Diptera | Chironomidae | Tanypodinae | larvae | 3 | |
| Diptera | Muscidae | | larvae | 4 | |
| Diptera | Psychodidae | Pericoma | larvae | 1 | |
| Diptera | Tipulidae | | larvae | 2 | I |
| Trichoptera | | | larvae | 3 | D |
| | | | | --- | |
| Total: 12 taxa | | | | 48 individuals | |

Taxonomic list and abundances of aquatic invertebrates collected 21 June 2005 at station EFFLUE1W, Effluent Canyon, Los Alamos County, New Mexico. The sample was collected from pool habitat using a dip net. The total area sampled was unspecified. The sample identification number is 125293. The percentage of the sample that was identified and retained was 63% of the collected sample. A total of 647 individuals were removed, identified and retained. Abundance data are presented as the estimated number of individuals collected in the entire sample. Notes - identification to genus or species was not supported because: I - immature organisms, D - damaged organisms, M - poor slide mount, G - gender, U - indistinct characters or distribution, R - retained in our reference collection.

| Order | Family | Subfamily/Genus/species | Life Stage | Abundance | Notes |
|---|---|---|---|---|---|
| Phylum: Annelida | | | | | |
| Class: Clitellata subclass oligochaeta | | | adult | 3 | |
| Phylum: Arthropoda | | | | | |
| Class: Arachnida | | | | | |
| Trombidiformes | | | adult | 55 | |
| Class: Insecta | | | | | |
| Coleoptera | Curculionidae | | adult | 1 | |
| Coleoptera | Dytiscidae | | larvae | 6 | I,D |
| Coleoptera | Hydrophilidae | | larvae | 2 | I |
| Diptera | | | larvae | 8 | I |
| Diptera | Ceratopogonidae | Atrichopogon/Forcipomyia | larvae | 2 | I |
| Diptera | Chironomidae | | larvae | 13 | |
| Diptera | Chironomidae | Chironominae | larvae | 681 | |
| Diptera | Chironomidae | Orthocladiinae | larvae | 72 | |
| Diptera | Chironomidae | Tanypodinae | larvae | 118 | |
| Diptera | Culicidae | | larvae | 55 | I |
| Diptera | Psychodidae | Pericoma | larvae | 2 | |
| Diptera | Tipulidae | | larvae | 2 | I |
| Ephemeroptera | Baetidae | Baetis | larvae | 2 | |
| Odonata | Libellulidae | | larvae | 2 | I |
| | | | | --- | |
| Total: 16 taxa | | | | 1023 individuals | |

Taxonomic list and abundances of aquatic invertebrates collected 26 September 2005 at station MORTAN1W, Mortandad Canyon, Los Alamos County, New Mexico. The sample was collected from pool habitat using a dip net. The total area sampled was unspecified. The sample identification number is 125294. The percentage of the sample that was identified and retained was 100% of the collected sample. A total of 687 individuals were removed, identified and retained. Abundance data are presented as the estimated number of individuals collected in the entire sample. Notes - identification to genus or species was not supported because: I - immature organisms, D - damaged organisms, M - poor slide mount, G - gender, U - indistinct characters or distribution, R - retained in our reference collection.

| Order | Family | Subfamily/Genus/species | Life Stage | Abundance | Notes |
|---|---|---|---|---|---|
| Phylum: Annelida | | | | | |
| Class: Clitellata subclass oligochaeta | | | adult | 1 | |
| Phylum: Arthropoda | | | | | |
| Class: Arachnida | | | | | |
| Trombidiformes | | | adult | 5 | |
| Class: Entognatha | | | | | |
| Collembola | | | adult | 4 | |
| Class: Insecta | | | | | |
| Coleoptera | Dytiscidae | | larvae | 12 | I |
| Coleoptera | Hydrophilidae | | larvae | 1 | |
| Diptera | Ceratopogonidae | | larvae | 3 | I |
| Diptera | Chironomidae | | pupae | 21 | |
| Diptera | Chironomidae | Chironominae | larvae | 173 | |
| Diptera | Chironomidae | Orthocladiinae | larvae | 181 | |
| Diptera | Chironomidae | Tanypodinae | larvae | 115 | |
| Diptera | Culicidae | | larvae | 16 | I,D |
| Diptera | Empididae | Chelifera | larvae | 1 | |
| Diptera | Psychodidae | Psychoda | larvae | 1 | |
| Diptera | Simuliidae | Simulium | larvae | 1 | |
| Diptera | Stratiomyidae | | larvae | 2 | I |
| Diptera | Stratiomyidae | Caloparyphus | larvae | 1 | |
| Diptera | Tipulidae | | larvae | 2 | I |
| Ephemeroptera | Baetidae | | larvae | 76 | I,D |
| Ephemeroptera | Baetidae | Callibaetis | larvae | 27 | |
| Heteroptera | Veliidae | | larvae | 13 | I |
| Heteroptera | Veliidae | Microvelia | adult | 8 | |
| Odonata | Coenagrionidae | | larvae | 6 | I |
| Odonata | Coenagrionidae | Argia | larvae | 1 | I |
| Trichoptera | Limnephilidae | | larvae | 14 | I |
| Phylum: Nemata | | | adult | 2 | |
| | | | | --- | |
| Total: 25 taxa | | | | 687 individuals | |

Taxonomic list and abundances of aquatic invertebrates collected 26 September 2005 at station EFFLUE1W, Effluent Canyon, Los Alamos County, New Mexico. The sample was collected from pool habitat using a dip net. The total area sampled was unspecified. The sample identification number is 125295. The percentage of the sample that was identified and retained was 100% of the collected sample. A total of 76 individuals were removed, identified and retained. Abundance data are presented as the estimated number of individuals collected in the entire sample. Notes - identification to genus or species was not supported because: I - immature organisms, D - damaged organisms, M - poor slide mount, G - gender, U - indistinct characters or distribution, R - retained in our reference collection.

| Order | Family | Subfamily/Genus/species | Life Stage | Abundance | Notes |
|---|---|---|---|---|---|
| Phylum: Annelida | | | | | |
| Class: Clitellata subclass oligochaeta | | | adult | 1 | |
| Phylum: Arthropoda | | | | | |
| Class: Arachnida | | | | | |
| Trombidiformes | | | adult | 2 | |
| Class: Insecta | | | | | |
| Coleoptera | Hydrophilidae | Laccobius | adult | 1 | |
| Diptera | Chironomidae | Chironominae | larvae | 9 | |
| Diptera | Chironomidae | Orthocladiinae | larvae | 4 | |
| Diptera | Chironomidae | Tanypodinae | larvae | 3 | |
| Diptera | Culicidae | Culiseta | larvae | 1 | |
| Diptera | Stratiomyidae | Caloparyphus | larvae | 1 | |
| Diptera | Stratiomyidae | Nemotelus | larvae | 1 | |
| Ephemeroptera | Baetidae | | larvae | 2 | D |
| Trichoptera | | | larvae | 1 | I |
| Class: Ostracoda | | | adult | 50 | |
| | | | | --- | |
| Total: 12 taxa | | | | 76 individuals | |