# MONTANA DEPARTMENT OF TRANSPORTATION WETLAND MITIGATION MONITORING REPORT: YEAR 2004

Musgrave Lake Zurich, Montana



Prepared for:

MONTANA DEPARTMENT OF TRANSPORTATION 2701 Prospect Ave Helena, MT 59620-1001 Prepared by:

LAND & WATER CONSULTING ~ A DIVISION OF PBS&J
P.O. Box 239
Helena, MT 59624

June 2005

Project No: B4054.00 - 0304





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#### 1.0 INTRODUCTION

The Musgrave Lake wetland mitigation project was constructed in late 2000/early 2001 in Watershed 11 (Milk River). It is anticipated that this site will compensate for wetland impacts resulting from several proposed Montana Department of Transportation (MDT) highway and bridge reconstruction projects along the U.S. Highway 2 corridor between Havre and Harlem. Constructed on private land in the MDT Great Falls District, the mitigation site is located approximately four miles south of Zurich and the U.S. Highway 2 corridor within 0.25 mile of the Milk River in Blaine County (**Figure 1**). The goal of the project is to restore hydrology via construction of ditch plugs in natural drained wetland basins and historic oxbow sections, providing at least 27.2 acres of wetland credit within the confines of a 100-acre conservation easement. The agreement between the landowner and MDT specifies that approximately 27.2 acres of wetland credit will be developed.

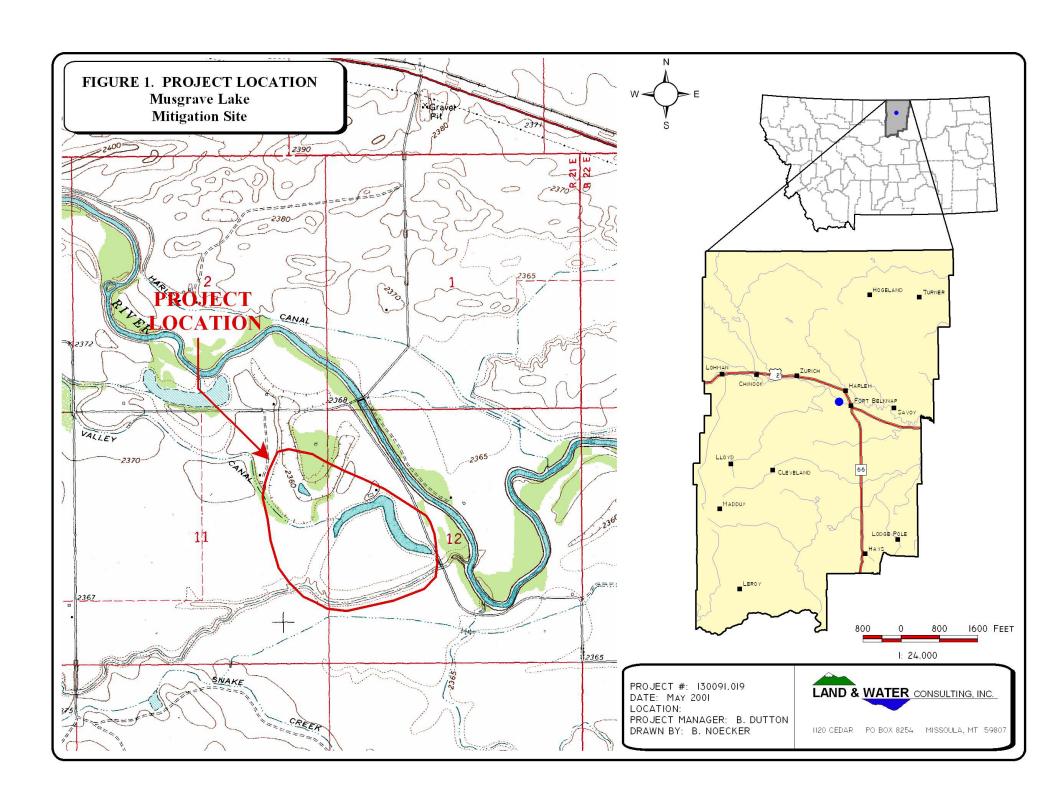
The approximate site boundary is illustrated on **Figure 2** (**Appendix A**), and the original conceptual layout is provided in **Appendix D**. The project is comprised of two "restoration" sites and one "enhancement" site. A second enhancement site was dropped from consideration in 2003. Restoration Site 1 (RS1) occurs in a basin in the northwest corner of the mitigation area. Restoration Site 2 (RS2) occurs within a drained and farmed historic oxbow section of Musgrave Lake located along the south property boundary. Wetland hydrology in these areas is to be supplied by precipitation, surface runoff, and possibly groundwater, and is anticipated to result in maximum depths of 3-3.5 feet and 1-1.5 feet at RS1 and RS2, respectively.

Approximately 4.6 acres of impaired, low-quality wetlands were delineated by MDT at RS1 prior to project implementation. However, given the restoration of hydrology, the Corps of Engineers (COE) has approved allocation of 1:1 credit at the two basins, inclusive of these existing impaired wetlands (1:1 ratio) (Urban pers. comm.). No pre-project wetlands were delineated by MDT at RS2. A target of 24.5 "restoration" credit acres was established in these two basins by the landowner (Musgrave Lake Ranch LLC [MLR] 2001). An additional 0.75 acre of credit was proposed by the landowner and tentatively approved by the COE (2001) for maintenance of at least three acres of 75-foot wide upland buffer around all wetland and riparian areas (4:1 ratio).

The project further intends to enhance approximately four to five acres of Musgrave Lake at an area referenced as Enhancement Site 1 (ES1) (**Figure 2, Appendix A**). Although currently wetland, Enhancement Site 1, the "middle" portion of Musgrave Lake, is separated from the lake's southern arm by an earthen dike and was impacted by a large drainage ditch, a perched culvert causing headcutting & associated sedimentation, and chronic overgrazing. The project attempts to remedy these problems by relocating the water control structure, installing a larger culvert, and revising the grazing system. Grazing will be prohibited for five years, after which grazing prescriptions will follow a Natural Resources Conservation Service grazing management plan. Assuming that an appropriate increase in wetland functional condition is achieved, a ratio of 3:1 was tentatively approved for enhancement by the COE.







The wetland credit breakdown proposed by the landowner (MLR 2001) and tentatively approved by the COE (2001), once performance standards are met, is as follows:

Restoration Site 1: 13.6 acres, 1:1 ratio, 13.6 credits
Restoration Site 2: 10.9 acres, 1:1 ratio, 10.9 credits
Enhancement Sites 1 and 2: 11.2 acres, 3:1 ratio, 3.7 credits
Upland Buffer: 3 acres, 4:1 ratio, 0.75 credits

Total Credits: 28.95 acres (note: the agreement between the landowner and MDT specifies that approximately 27.2 acres of wetland credit will be developed; this is the minimum target for the project. Enhancement Site 2 was dropped from the mitigation site in 2003 per COE / MDT discussions as it was considered to be a well-functioning system).

To achieve a 3:1 ratio for wetland enhancement, the COE has required that significant functional improvement be demonstrated (COE 2001). This will occur if the composite functional assessment score improves to within 10 percent of that achieved at the onsite reference wetland (**Figure 2**). The COE (2001) further stated that "enhancement of an existing wetland must show significant functional increase to qualify for any credit. Simply changing the character or type of an existing good wetland to a different type of equally good wetland may not qualify for credit." Other than these improvements to functional attributes, and a five-year monitoring term, no performance standards or success criteria were required by the COE or other agencies.

The site was previously monitored in 2001, 2002, and 2003. This report documents the results of 2004 monitoring efforts. The monitoring area is illustrated in **Figure 2** (**Appendix A**).

#### 2.0 METHODS

#### 2.1 Monitoring Dates and Activities

The site was visited on May 25 (spring) and July 27 (mid-season) 2004. The primary purpose of the spring visit was to conduct a bird/general wildlife reconnaissance. The mid-May period was selected for the spring visit because monitoring between mid-May and early June is likely to detect migrant as well as early nesting activities for a variety of avian species (Carlson pers. comm.), as well as maximizing the potential for amphibian detection. In Montana, most amphibian larval stages are present by early June (Werner pers. comm.).

The mid-season visit was conducted to document vegetation, soil, and hydrologic conditions used to map jurisdictional wetlands. All information contained on the Wetland Mitigation Site Monitoring Form (**Appendix B**) was collected at this time. Activities and information conducted/collected included: wetland delineation; wetland/open water boundary mapping; vegetation community mapping; vegetation transects; soils data; hydrology data; bird and general wildlife use; photograph points; macro-invertebrate sampling; functional assessment; and (non-engineering) examination of dike structures.





#### 2.2 Hydrology

Hydrologic indicators were evaluated at the site during the mid-season visit. Approximate designed water depths are shown on the conceptual restoration plan in **Appendix D**. Wetland hydrology indicators were recorded using procedures outlined in the COE 1987 Wetland Delineation Manual (Environmental Laboratory 1987). Hydrology data were recorded on COE Routine Wetland Delineation Data Forms (**Appendix B**).

All additional hydrologic data were recorded on the mitigation site monitoring form (**Appendix B**). Where possible, the boundary between wetlands and open water (no rooted vegetation) aquatic habitats was mapped on the aerial photograph and an estimate of the average water depth at this boundary was recorded.

No groundwater monitoring wells were installed at the site. If located within 18 inches of the ground surface (soil pit depth for purposes of delineation), groundwater depths were documented on the routine wetland delineation data form at each data point.

#### 2.3 Vegetation

General dominant species-based vegetation community types (e.g., *Typha latifolia/Scirpus acutus*) were delineated on an aerial photograph during the mid-season visit. Standardized community mapping was not employed as many of these systems are geared towards climax vegetation and may not reflect yearly changes. Estimated percent cover of the dominant species in each community type was listed on the site monitoring form (**Appendix B**).

Three 10-foot wide belt transects were sampled during the mid-season monitoring event to represent the range of current vegetation conditions. Transects were evaluated at RS 1, RS 2, and ES 1. Percent cover was estimated for each vegetative species for each successive vegetation community encountered within the "belt" using the following values: + (<1%); 1 (1-5%); 2 (6-10%); 3 (11-20%); 4 (21-50%); and 5 (>50%).

Approximate transect locations are depicted on **Figure 2** (**Appendix A**). The transects will be used to evaluate changes over time, especially the establishment and increase of hydrophytic vegetation. Transect locations were marked on the air photo and all data recorded on the mitigation site monitoring form. Photos along each transect were taken from both ends during the mid-season visit.

A comprehensive plant species list prepared for the site in 2001 was updated as new species were encountered. Woody species were not planted at this mitigation site. Consequently, no monitoring relative to the survival of such species was conducted.

#### 2.4 Soils

Soils were evaluated during the mid-season visit according to hydric soils determination procedures outlined in the COE 1987 Wetland Delineation Manual. Soil data was recorded for each wetland determination point on the COE Routine Wetland Delineation Data Form





(**Appendix B**). The most current terminology used by NRCS was used to describe hydric soils (USDA 1998).

#### 2.5 Wetland Delineation

Wetland Delineation Was conducted during the mid-season visit according the 1987 COE Wetland Delineation Manual. The indicator status of vegetation was derived from the National List of Plant Species that Occur in Wetlands: Northwest Region 9 (Reed 1988). Wetland and upland areas within the monitoring area were investigated for the presence of wetland hydrology, hydrophytic vegetation and hydric soils. The information was recorded on COE Routine Wetland Delineation Data Forms (**Appendix B**). The wetland/upland boundary was modified on the aerial photo. The wetland/upland boundary in combination with the wetland/open water habitat boundary was used to calculate the wetland area developed at each impoundment.

### 2.6 Mammals, Reptiles, and Amphibians

Mammal, reptile, and amphibian species observations and other positive indicators of use, such as vocalizations, were recorded on the wetland monitoring form during each visit. Indirect use indicators, including tracks; scat; burrows; eggshells; skins; bones; etc., were also recorded. Observations were recorded as the observer traversed the site while conducting other required activities. Direct sampling methods, such as snap traps, live traps, and pitfall traps, were not implemented. A comprehensive list of observed species was compiled. Observations from past years will ultimately be compared with new data.

#### 2.7 Birds

Bird observations were recorded during each visit. No formal census plots, spot mapping, point counts, or strip transects were conducted. During the spring visit, observations were recorded in compliance with the bird survey protocol in **Appendix E**. During the mid-season visit, bird observations were recorded incidental to other monitoring activities. During all visits, observations were categorized by species, activity code, and general habitat association (see field data forms in **Appendix B**). Observations from past years will be compared with new data.

#### 2.8 Macroinvertebrates

A total of three macroinvertebrate samples, one each at RS1, RS2, and ES1, were collected during the mid-season site visit and data recorded on the wetland mitigation monitoring form. Macroinvertebrate sampling procedures are included in **Appendix F**. The approximate locations of these sample points are shown on **Figure 2**, **Appendix A**. Samples were preserved as outlined in the sampling procedure and sent to Rhithron Associates for analysis.

#### 2.9 Functional Assessment

Functional assessment forms were completed at RS1, RS2, and ES1 using the 1999 MDT Montana Wetland Assessment Method. Field data necessary for this assessment were generally collected during each mid-season site visit. An abbreviated field data sheet for the 1999 MDT





Montana Wetland Assessment Method was compiled to facilitate rapid collection of field information. The remainder of the functional assessment was completed in the office.

Pre-project functional assessments of the mitigation site and reference area were included in the 2001 monitoring report and are not provided in this document.

#### 2.10 Photographs

Photographs were taken during the mid-season visit showing the current land use surrounding the site, the upland buffer, the monitored area, and the vegetation transects. The approximate location of photo points is shown on **Figure 2**, **Appendix A**. All photographs were taken using a 50 mm lens. A description and compass direction for each photograph was recorded on the wetland monitoring form.

#### 2.11 GPS Data

During the 2004 monitoring season, no survey points were collected with a GPS unit as most site features were recorded during 2001. These included vegetation transect beginning and ending locations, all photograph locations and wetland boundaries. Wetland boundary changes observed in 2004 were documented by hand on a 2003 aerial photograph.

#### 2.12 Maintenance Needs

Dike structures were examined during site visits for obvious signs of breaching, damage, or other problems. This did not constitute an engineering-level structural inspection, but rather a cursory examination. Current or future potential problems were documented.

#### 3.0 RESULTS

#### 3.1 Hydrology

Substantial inundation was observed at each of the three monitored sites. Water depths ranged between approximately 2 inches and five feet. Open water areas mapped during previous years had largely filled in with aquatic vegetation in 2004. Specific recorded water depths are provided on the attached data forms. According to the Western Regional Climate Center, mean monthly precipitation totals from January through July over the last 55 years total 8.6 inches for the Chinook station. During 2004, 9.8 inches of precipitation were recorded in Chinook between January and July. Thus, this year-four evaluation was apparently conducted during a slightly above-average precipitation period.

RS1 was virtually 100 percent inundated, with an average depth of about two feet and a range of depths from two inches to an estimated four feet. Deepest areas were located in the center of the impoundment. A groundwater component appears to contribute to this site, possibly resulting from upslope irrigation ditch seepage.





RS2 was approximately 85 percent inundated, with an average depth of 6 inches and a depth range of one to five feet in inundated areas. A deep pool occurs where water enters the site through a culvert at the northwest end. The vast majority of this site east of the ditch/dike was inundated during the summer visits, and was in the process of filling during the spring visit.

ES1 was virtually 100 percent inundated during spring and summer visits, with an average depth of 8 to 10 inches and a range of depths from 0 to 30 inches.

#### 3.2 Vegetation

Vegetation species identified on the site are presented in **Table 1** and on the attached data form. As of 2004, nine wetland community types were identified and mapped on the mitigation area (**Figure 3**, **Appendix A**). These included Type 1: *Typha latifolia/Scirpus acutus*, Type 2: *Polygonum amphibium*, Type 3: *Salix exigua/Elaeagnus angustifolia*, Type 4: *Potamogeton/Myriophyllum*, Type 5: *Carex*, Type 7: *Populus deltoids*, Type 8: *Rumex crispus* (Type 8 was added in 2003 due to increased inundation at RS1 and RS2, which eliminated Type 6: *Hordeum jubatum/Rumex crispus*). Two new types, Type 9: *Scirpus maritimus / Beckmannia syzigachne* and Type 10: *Beckmannia syzigachne*, were added in 2004. Dominant species within each of these communities are listed on the attached data form (**Appendix B**).

Type 1 occurs commonly at RS1 and ES1. Type 2 occurs primarily in newly developing wetland areas of RS1 and RS2, and in 2003 was reduced to primarily *Polygonum amphibium* communities, with far less *Alopecurus pratensis* than observed in previous years. Consequently, this community type was revised from *Polygonum amphibium / Alopecurus pratensis* to simply *Polygonum amphibium* in 2003. Type 3 occurs in patches at RS1, ES1, and RS2. Type 4 occurs in the ditch segment of ES1, in the pool at the culvert outlet at RS2, and throughout the main impoundment at RS1. Aquatic vegetation in Type 4 increased dramatically in 2004, both in terms of density and diversity. Type 5 occurs primarily at ES1. Type 7 occurs mainly along the south and east fringe of RS1 in newly-inundated areas formerly mapped as uplands. Type 8 occurs as a fringe around RS1 and in large sections of RS2. Type 9 developed within the main body of RS1, while Type 10 developed within ES1 and along the north perimeter of RS1.

Upland communities generally range from kochia (*Kochia scoparia*) and smooth brome (*Bromus inermis*)-dominated areas, to hayland dominated by alfalfa (*Medicago sativa*) and/or foxtail barley (*Hordeum jubatum*).

Vegetation transect results are detailed in the attached data form (**Appendix B**), and are summarized in **Tables 2**, **3** and **4** and in **Charts 1**, **2**, and **3**.





Table 1: 2001-2004 Musgrave Lake vegetation species list.

Species <sup>1</sup>	Region 9 Wetland Indicator Status	Species <sup>1</sup>	Region 9 Wetland Indicator Status		
Acer negundo	FAC+	Melilotus alba	FACU		
Agropyron intermedium		Myriophyllum spicatum	OBL		
Agropyron repens	FACU	Najas flexilis			
Agropyron smithii	FACU	Najas guadalupensis			
Agrostis alba	FACW	Phalaris arundinacea	FACW		
Alisma gramineum	OBL	Phleum pretense	FAC-		
Alisma plantago-aquatica	OBL	Plantago major	FAC+		
Alopecurus pratensis	FACW	Poa bulbosa			
Apocynum androsaemifolium		Poa pratensis	FAC		
Arctium minus		Polygonum amphibium	OBL		
Asclepias speciosa	FAC+	Polygonum erectum	FACW-		
Asparagus officinalis		Polygonum lapathifolium	FACW		
Beckmannia syzigachne	OBL	Polygonum persicaria	FACW		
Bromus inermis		Populus deltoides	FAC		
Carex lanuginose	OBL	Potamogeton natans	OBL		
Carex praegracilis	FACW	Potamogeton pectinatus	OBL		
Carex stipata	OBL	Potentilla anserina	OBL		
Carex utriculata	OBL	Potentilla gracilis	FAC		
Carex vesicaria	OBL	Prunus virginiana	FACU		
Carex vulpinoidea	OBL	Ranunculus occidentalis	FAC		
Chenopodium album	FAC	Rosa nutkana	FAC-		
Cicuta douglasii	OBL	Rumex crispus	FACW		
Cirsium arvense	FAC-	Sagittaria cuneata	OBL		
Cornus stolonifera	FACW	Salix amygdaloides	OBL		
Elaeagnus angustifolia	FAC	Salix exigua	OBL		
Eleocharis acicularis	OBL	Salix lutea	OBL		
Eleocharis palustris	OBL	Scirpus acutus	OBL		
Elodea canadensis	OBL	Scirpus americanus	OBL		
Festuca sp.	==	Scirpus maritimus	OBL		
Glyceria grandis	OBL	Scirpus validus	OBL		
Glycyrrhiza lepidota	FAC+	Sium suave	OBL		
Helianthus annuus	FACU+	Solidago canadensis	FACU		
Hordeum jubatum	FAC-	Spartina pectinata	OBL		
Iva xanthifolia	FAC	Sparganium emersum	OBL		
Juncus effuses	FACW	Sparganium eurycarpum	OBL		
Kochia scoparia	FAC	Symphoricarpos occidentalis			
Lemna minor	OBL	Taraxacum officinale	FACU		
Lycopus americanus	OBL	Typha latifolia	OBL		
Medicago sativa		Utricularia intermedia	OBL		

Bolded species indicate those documented in the analysis area for the first time in 2004.





Table 2: Transect 1 (RS1) data summary.

Monitoring Year	2001	2002	2003	2004
Transect Length (feet)	500	500	500	500
# Vegetation Community Transitions along Transect	4	6	6	7
# Vegetation Communities along Transect	3	4	4	6
# Hydrophytic Vegetation Communities along Transect	2	3	3	5
Total Vegetative Species	19	16	16	21
Total Hydrophytic Species	8	9	9	15
Total Upland Species	11	7	7	6
Estimated % Total Vegetative Cover	100	25	20	70
% Transect Length Comprised of Hydrophytic Vegetation Communities	68	33	17	90
% Transect Length Comprised of Upland Vegetation Communities	32	3	3	<1
% Transect Length Comprised of Unvegetated Open Water	0	64	80	9
% Transect Length Comprised of Bare Substrate	0	0	0	0%

Table 3: Transect 2 (ES1) data summary.

Monitoring Year	2001	2002	2003	2004
Transect Length (feet)	86	86	86	86
# Vegetation Community Transitions along Transect	1	1	2	2
# Vegetation Communities along Transect	2	2	3	3
# Hydrophytic Vegetation Communities along Transect	1	1	2	2
Total Vegetative Species	13	14	9	11
Total Hydrophytic Species	10	10	6	8
Total Upland Species	3	4	3	3
Estimated % Total Vegetative Cover	100	100	70	80
% Transect Length Comprised of Hydrophytic Vegetation Communities	79	79	83	83
% Transect Length Comprised of Upland Vegetation Communities	21	21	17	17
% Transect Length Comprised of Unvegetated Open Water	0	0	0	0
% Transect Length Comprised of Bare Substrate	0	0	0	0

Table 4: Transect 3 (RS2) data summary.

Monitoring Year	2001	2002	2003	2004
Transect Length (feet)	170	170	170	170
# Vegetation Community Transitions along Transect	2	2	3	3
# Vegetation Communities along Transect	2	2	3	3
# Hydrophytic Vegetation Communities along Transect	1	1	2	2
Total Vegetative Species	13	12	9	14
Total Hydrophytic Species	6	6	4	8
Total Upland Species	7	6	5	6
Estimated % Total Vegetative Cover	100	100	80	90
% Transect Length Comprised of Hydrophytic Vegetation Communities	47	47	85	88
% Transect Length Comprised of Upland Vegetation Communities	53	53	15	12
% Transect Length Comprised of Unvegetated Open Water	0	0	0	0
% Transect Length Comprised of Bare Substrate	0	0	0	0





Chart 1: Transect maps showing vegetation types from start (0 feet) to the end (500 feet) of transect 1 (RS1) for each year monitored

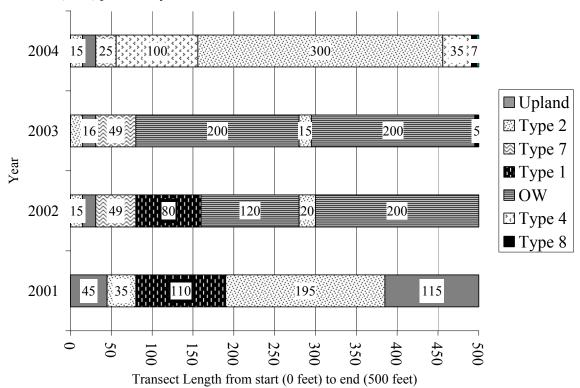


Chart 2: Transect maps showing vegetation types from start (0 feet) to the end (86 feet) of transect 2 (ES1) for each year monitored

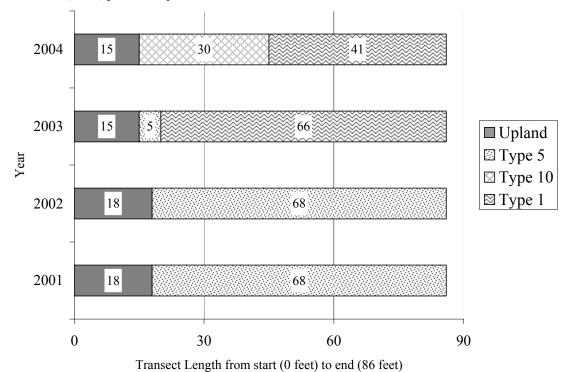






Chart 3: Transect maps showing vegetation types from start (0 feet) to the end (170 feet) of transect 3 (RS2) for each year monitored

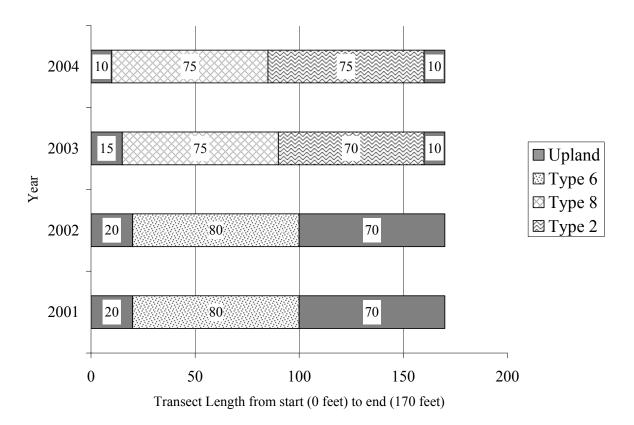
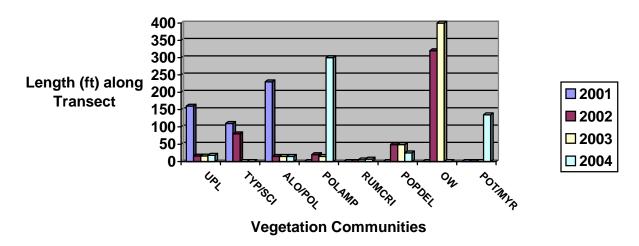


Chart 4: Length of vegetation communities along Transect 1.



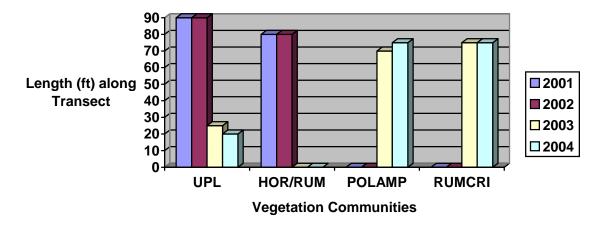




70 60 50 Length (ft) along 40 **2001 Transect 2002** 30 **2003** 20 **2004 UPL** TYP/SCI **BECSYZ** Carex **Vegetation Communities** 

Chart 5: Length of vegetation communities along Transect 2.

Chart 6: Length of vegetation communities along Transect 3.



#### 3.3 Soils

According to the Blaine County soil survey (Soil Conservation Service 1986), soils at RS1 and the proposed enhancement areas are Typic Fluvaquents. These are somewhat poorly drained or poorly drained silty clays and silty clay loams that formed in alluvium in areas with seasonally high water tables, usually during the irrigation season. Typic Fluvaquents are not suited to cultivated crops, windbreaks, or most urban uses due to flooding and general wetness.

These characteristics were generally confirmed during monitoring. Soils sampled in wetland areas along the RS1 transect consistently were comprised of silty clays / clay loams with a matrix color of 2.5Y4/2 with mottles in the range of 2.5 Y 5/6 or 10YR 5/8, indicating a fluctuating water table. Soils along the ES 1 transect were comprised of silty clay loam with a matrix color of 2.5Y 4/1. Wetland soils were saturated or inundated at the time of the survey.

Soils at RS2 consist of Havre silty clay loam, saline. This is a well-drained soil formed in alluvium on flood plains and stream terraces. Permeability is moderately slow, and the available water capacity is moderate because of the effects of salts and sodium. According to the soil survey, this soil type is often subject to rare flooding. Soils were sampled at RS2 along the





transect. Soils were comprised of silty clay loams with a matrix color of 10YR4/1 and distinct mottles of a 10YR4/6 color. Soils were inundated during the survey. Soils in this area have developed stronger hydric characteristics as the hydroperiod has increased.

#### 3.4 Wetland Delineation

Delineated wetland boundaries are illustrated on **Figure 3**. Completed wetland delineation forms are included in **Appendix B**. Soils, vegetation, and hydrology are discussed in preceding sections. In 2004, it was discovered that previous gross aquatic area calculations at RS1 included 1.89 acres of the adjacent reference area. These 1.89 acres were not included in 2004 RS1 totals, which is why 2004 totals for RS-1 are lower than 2003 totals. Delineation results are as follows:

RS1: 4.59 wetland acres impaired pre-existing, but currently "restored".

7.6 acres of additional emergent, aquatic bed, scrub-shrub and forested wetland interspersed with open water patches.

Total of 12.19 acres of aquatic habitats delineated in 2004 (the same as delineated in 2003 minus the reference area as described above).

RS2: 0 wetland acres pre-existing.

6.67 wetland acres "restored".

Total of 6.67 acres of wetlands delineated in 2004; a gain of 0.28 acre over 2003 totals.

ES1: 4.3 wetland acres pre-existing within delineation area (see below).

0.5 estimated (planimeter) additional pre-existing wetland acres within easement area north of ditch.

0.18 acre additional wetlands delineated in 2003 and 2004.

Total of 4.98 wetland acres; increase of 0.18 acre from 2002.

Approximately 19.04 wetland/aquatic habitat acres have been "restored" on the mitigation site to date (RS1: 12.19 acres; RS2: 6.67 acres; ES1: 0.18 acre), while approximately 4.8 acres have been enhanced (ES1).

Wetland borders of ES1 were delineated in 2001, although the north border of ES1 was drawn based on the approximate easement borders and is therefore "artificial". The north border of ES1 was drawn along the path of the ditch flowing into the site from the west, even though the actual wetland is contiguous to the north. Slight wetland expansion occurred along the south border of ES1 (along the dike) in 2003, which remained consistent in 2004.

#### 3.5 Wildlife

Wildlife species, or evidence of wildlife, observed on the site during 2001-2004 monitoring efforts are listed in **Table 5**. Specific evidence observed, as well as activity codes pertaining to birds, is provided on the completed monitoring form in **Appendix B**. Four mammal, two amphibian, and 41 bird species were noted using portions of the mitigation site during 2004





Table 5: Fish and wildlife species observed	on the Musgrave Lake Mitigation Site, 2001-2004.
FISH	
Unidentified Minnow Species (Hybognathus sp.)	
AMPHIBIANS	
Northern Leopard Frog (Rana pipiens)	Western Chorus Frog (Pseudacris triseriata)
REPTILES	
-	
Plains Garter Snake (Thamnophis radix)	
BIRDS	
American Coot (Fulica americana)	Lesser Scaup (Aythya affinis)
American Kestrel (Falco sparverius)	Long-billed Dowitcher (Limnodromus scolopaceus)
American Robin (Turdus migratorius)	Mallard (Anas platyrhynchos)
American White Pelican (Pelecanus erythrorhynchos)	Marbled Godwit (Limosa fedoa)
American Wigeon (Anas Americana)	Marsh Wren (Cistothorus palustris)
Bank Swallow (Riparia riparia)	Mourning Dove (Zenaida macroura)
Barn Swallow (Hirundo rustica)	Northern Flicker (Colaptes auratus)
Belted Kingfisher (Ceryle alcyon)	Northern Harrier (Circus cyaneus)
Black-billed Magpie (Pica pica)	Northern Pintail (Anas acuta)
Black-capped Chickadee (Poecile atricapillus)	Northern Rough-winged Swallow (Stelgidopteryx serripennis)
Blue-winged Teal (Anas discors)	Northern Shoveler (Anas clypeata)
Bobolink (Dolichonyx oryzivorus)	Orange-crowned Warbler (Vermivora celata)
Brewer's Blackbird (Euphagus cyanocephalus)	Red-tailed Hawk (Buteo jamaicensis)
Brown-headed Cowbird (Molothrus ater)	Red-winged Blackbird (Agelaius phoeniceus)
Bufflehead (Bucephala albeola)	Ring-billed Gull (Larus delawarensis)
Bullock's Oriole (Icterus bullockii)	Ring-necked Pheasant (Phasianus colchicus)
Canada Goose (Branta canadensis)	Rock Dove (Columba livia)
Canvasback (Aythya valisineria)	Savannah Sparrow (Passerculus sandwichensis)
Cedar Waxwing (Bombycilla cedrorum)	Sharp-tailed Grouse (Tympanuchus phasianellus)
Chipping Sparrow (Spizella passerina)	Solitary Sandpiper ( <i>Tringa solitaria</i> )
Clay-colored Sparrow (Spizella pallida)	Song Sparrow (Melospiza melodia)
Cliff Swallow (Petrochelidon pyrrhonota)	Sora (Porzana carolina)
Common Grackle (Quiscalus quiscula)	Spotted Sandpiper (Actitis macularia)
Common Nighthawk (Chordeiles minor)	Swainson's Hawk (Buteo swainsoni)
Common Snipe (Gallinago gallinago)	Tree Swallow (Tachycineta bicolor)
Common Tern (Sterna hirundo)	Upland Sandpiper (Bartramia longicauda)
Common Yellowthroat (Geothlypis trichas)	Warbling Vireo (Vireo gilvus)
Double-crested Cormorant (Phalacrocorax auritus)	Western Meadowlark (Sturnella neglecta)
Eastern Kingbird (Tyrannus tyrannus)	Western Sandpiper (Calidris mauri) Western Wood-pewee (Contopus sordidulus)
European Starling (Sturnus vulgaris)	
Franklin's Gull (Larus pipixcan)	Willet (Catoptrophorus semipalmatus) Willow Flycatcher (Empidonax traillii)
Gadwall (Anas strepera)	Wilson's Phalarope (Phalaropus tricolor)
Gray Cathird (Dumetella carolinensis)	Wood Duck (Aix sponsa)
Great Horned Owl (Bubo virginianus)	Yellow-rumped Warbler (Dendroica coronata)
Great Blue Heron (Ardea herodias)	Yellow Warbler (Dendroica petechia)
Green-winged Teal (Anas crecca)	Yellow-headed Blackbird (Xanthocephalus xanthocephalus)
House Wren ( <i>Troglodytes aedon</i> ) <b>Killdeer</b> ( <i>Charadrius vociferous</i> )	1 chow-neaded Diackon a (Adminocephanas Adminocephanas)
Least Flycatcher (Empidonax minimus)	
MAMMALS	
American Badger (Taxidea taxus)	Meadow Vole (Microtus pennsylvanicus)
American Beaver (Castor canadensis)	Raccoon (Procyon lotor)
Coyote (Canis latrans)	Richardson's Ground Squirrel (Spermophilus richardsonii)
Long-tailed Weasel (Mustela frenata)	White-tailed Deer (Odocoileus virginianus)

**Bolded** species were observed during 2004 monitoring. All other species were observed during one or more of the previous monitoring years, but not during 2004.





monitoring efforts. Several Blue-winged Teal (*Anas discors*) broods were observed at RS1 and RS2 during the July visit.

Of special interest were observations of northern leopard frogs (*Rana pipiens*) at each of the sites during 2004. Leopard frogs are considered a "species of special concern" by the Montana Natural Heritage Program (MNHP) due largely to their apparent extirpation from the portion of their historic distribution west of the Continental Divide. This species has been assigned the rank of S1 (critically imperiled) west of the Divide and S3 (rare occurrence and/or restricted range and/or vulnerable to extinction) east of the Divide by the MNHP.

#### 3.6 Macroinvertebrates

Macroinvertebrate sampling results are provided in **Appendix F** and are summarized below by Rhithron Associates (Bollman 2004). Bioassessment results are summarized in **Chart 7**.

RS1. Total bioassessment scores continue to decline at this site; biotic conditions rated poor in 2004. Taxa richness diminished in 2004, and the fauna assumed the snail-and-scud composition that suggests that macrophytes were the dominant habitat. Sediment dwellers and inhabitants of the water column were also represented, however. Scrapers dominated the functional composition of the assemblage, consistent with abundant macrophytes. The biotic index value increased between 2003 and 2004; this may have been related to increased water temperature, or increased nutrient enrichment.

RS2. Sub-optimal conditions persisted at this site in 2004; bioassessment score remained unchanged since 2003. Taxa richness increased, largely owing to the gain of several midge taxa. The large number of tubificid worms encountered by samplers in 2003 were not present in 2004. Hemoglobin-bearers were instead represented by tolerant midges, but these were not particularly abundant. The biotic index value did not, however, indicate improvement in water quality in 2004; still, the value was not far above the median value for sites in this study. Habitats appear to have been diverse, with macrophyte-oriented snails, water-column-inhabiting dytiscid beetles, and benthic burrowers all present.

ES1. Poor taxa richness in 2003 showed dramatic improvement in 2004, when the overall bioassessment score indicated optimal wetland conditions. Several snail and midge taxa appeared in 2004. Snails were so abundant that it seems likely that macrophytes provided the dominant habitat. The presence of dragonflies supports this theory. Ceratopogonid gnats were abundant in both years. As adults, these flies rely on blood meals. Abundance of larvae of bloodfeeding insects may be a signal of poor water quality conditions, though this has not been adequately explored. Water quality indicators remained stable between 2003 and 2004.





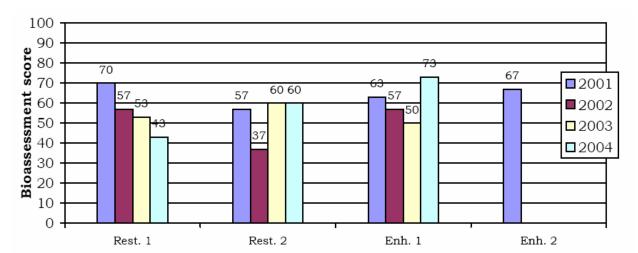


Chart 7: Bioassessment Scores for Musgrave Lake, 2001-2004

#### 3.7 Functional Assessment

Completed functional assessment forms are presented in **Appendix B**. Functional assessment results are summarized in **Table 6**. For comparative purposes, the functional assessment results for the reference wetland site and baseline conditions prepared by MDT and the landowner are also included in **Table 6**. Ratings and scores in 2004 were very similar to those calculated in 2003 (**Table 6**). All three sites remain Category II wetlands in 2004.

Based on the baseline functional assessments conducted by MDT and the landowner, the site has experienced an apparent gain of about 120 functional units (acreage x functional points) at restoration sites RS1 and RS2, and 18.17 functional units at ES1. As stated in the 2001 report, some of this lift at ES1 may be due to differing approaches to completing the assessment form. No pre-project functional assessment was conducted at RS2 due to the absence of pre-project wetlands.

The composite score at ES1 (7.6 points) exceeded the composite score for the reference wetland (6.6 points) in 2004. This is partially due to the fact that some variables evaluated and scored for the enhancement site were not evaluated for the reference wetland, resulting in additional points assigned to the enhancement site. Appreciable functional gain, however, occurred at ES1 in 2003-2004.

#### 3.8 Photographs

Representative photographs taken from photo-points and transect ends are provided in **Appendix C**. **Figures 2** and **3** (**Appendix A**) are based on the 2003 aerial photograph; consequently, a 2004 aerial photograph is also provided in **Appendix C**.

#### 3.9 Maintenance Needs/Recommendations

All dikes were in good condition during the spring and mid-season visits. Lowering the water level slightly at RS1 may be necessary to prevent drowning of existing mature cottonwoods.





#### 3.10 Current Credit Summary

Approximately 19.04 wetland/aquatic habitat acres have been "restored" on the mitigation site to date (RS1: 12.19 acres; RS2: 6.67 acres; ES1: 0.18 acre), while approximately 4.8 acres have been enhanced (ES1). In 2004, it was discovered that previous gross aquatic area calculations at RS1 included 1.89 acres of the adjacent reference area. These 1.89 acres were not included in 2004 RS1 totals, which is why 2004 totals for RS-1 are lower than 2003 totals. Approximately 0.16 wetland acres were gained at RS2 in 2004 due to increased inundation. The slight wetland expansion (0.18 acre) along the south border of ES1 (along the dike) observed in 2003 remained consistent in 2004.

Appreciable functional enhancement has been achieved across about 4.98 acres within the easement area at ES1, currently calculated at an approximate 18.17 functional unit "gain". An applied 1:3 credit ratio at ES1 would result in approximately 1.66 acres of credit. Also, it should be noted that the total wetland acreage within the easement area at the enhancement site appears to be approximately six acres short of the original 11-acre estimate (original acreage for enhancement was estimated at 11.2 acres for both enhancement sites 1 and 2; 2004 acreage at Enhancement Site 1 is approximately 4.98 acres; Enhancement Site 2 was dropped in 2003), reducing the amount of credit available at this site.

Approximately 0.75 acre of credit is associated with the upland buffer surrounding wetlands. Consequently, the maximum assignable credit at this site (RS1, RS2, ES1, and upland buffer) as of 2004 is approximately 19.04 + 1.66 + 0.75 = 21.45 acres.





Table 6: Summary of 2004 Wetland Function/Value Ratings and Functional Points <sup>1</sup> at the Musgrave Lake Mitigation Project

	Wetland Numbers						
Function and Value Parameters From the 1999 MDT Montana Wetland Assessment Method	Reference Wetland (Stutzman 1999)	Pre-Project RS1 <sup>2</sup> (Stutzman 1999)	Pre-Project ES1 (MDT 1999)	2004 RS1	2004 RS2	2004 ES1	
Listed/Proposed T&E Species Habitat	Low (0.3)	Low (0.3)	Low (0.3)	Low (0.3)	Low (0.3)	Low (0.3)	
MNHP Species Habitat	Mod (0.7)	Low (0.1)	Mod (0.7)	High (1.0)	High (1.0)	High (1.0)	
General Wildlife Habitat	High (0.9)	Low (0.1)	Mod (0.7)	Exceptional (1.0)	High (0.9)	High (0.9)	
General Fish/Aquatic Habitat	NA	NA	Low (0.3)	NA	Low (0.3)	Low(0.3)	
Flood Attenuation	Mod (0.5)	Low (0.1)	Mod (0.5)	Mod (0.6)	Mod (0.5)	Mod (0.5)	
Short and Long Term Surface Water Storage	High (1)	Low (0.2)	Low (0.3)	High (0.9)	High (0.9)	Mod (0.6)	
Sediment, Nutrient, Toxicant Removal	Mod (0.7)	Mod (0.4)	Low (0.2)	NA	High (1.0)	High (1.0)	
Sediment/Shoreline Stabilization	NA	NA	Low (0.2)	Low (0.2)	NA	Mod (0.6)	
Production Export/ Food Chain Support	High (0.9)	Mod (0.5) [Low 0.2]	Mod (0.7)	High (0.9)	High (0.8)	High (0.8)	
Groundwater Discharge/Recharge	High (1)	NA	NA	High (1.0)	High (1)	High (1)	
Uniqueness	Low (0.3)	Low (0.2)	Low (0.1)	Mod (0.6)	Low (0.5)	Mod (0.5)	
Recreation/Education Potential	Low (0.3)	Low (0.1)	Low (0.1)	Low (0.1)	Low (0.1)	Low (0.1)	
Actual Points/Possible Points	6.6 / 10	2.0 / 9	4.1 / 11	6.6 / 10	7.3 / 11	7.6 / 12	
% of Possible Score Achieved	66	22	37	66	66	63	
Overall Category	II	III	III	II	II	$II^3$	
Total Acreage of Assessed Wetlands within Easement (ac)	6.5 (estimated)	4.59	4.8	12.19	6.67	4.98	
Functional Units (acreage x actual points) (fu)	42.90	9.18	19.68	80.45	48.69	37.85	
Net Acreage Gain (ac)	NA	NA	NA	7.60	6.67	0.18	
Net Functional Unit Gain (fu)	NA	NA	NA	71.27	48.69	18.17	
Total Functional Unit Gain over baseline	138.13 Total Fun	ctional Units; 119	.96 at restoration	n wetlands; 18.17 at	enhancement	wetlands	





<sup>&</sup>lt;sup>1</sup> See completed MDT functional assessment forms in **Appendix B** for further detail.

<sup>2</sup> Production Export rating was corrected based on size of vegetated component in the AA and shown in bold; this resulted in site rating as Category III.

<sup>3</sup> Did not achieve Category II rating based on functional points, but did achieve Category II rating based on score for MNHP species and/or general wildlife habitat.

#### 4.0 REFERENCES

- Bollman, W. 2004. MDT Wetland Mitigation Monitoring Project Aquatic Invertebrate Monitoring Summary 2001-2004. Rhithron Associates Inc. Missoula, MT.
- Carlson, J. 2001. Program Zoologist, Montana Natural Heritage Program, Helena, Montana. April conversation.
- Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual*. U.S. Army Corps of Engineers, Washington, DC.
- Musgrave Lake Ranch LLC. 2001. June 26<sup>th</sup> letter from Jeff Stutzman to Todd Tillinger (Army Corps of Engineers) regarding Milk River Basin Wetland Mitigation Project. Missoula, Montana.
- Ralph, C.J., Geupel, G.R., Pyle, P., Martin, T.E., and D.F. DeSante. 1993. *Handbook of field methods for monitoring landbirds*. Gen. Tech. Rep. PSW-GTR-144. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Dept. of Agriculture. 41 p.
- Reed, P.B. 1988. *National list of plant species that occur in wetlands: North West (Region 9)*. Biological Report 88(26.9), May 1988. U.S. Fish and Wildlife Service. Washington, D.C.
- Soil Conservation Service (SCS). 1986. Soil survey of Blaine County and part of Phillips County, Montana. Bozeman, Montana.
- Urban, L. 2001. Wetland Mitigation Specialist, Montana Department of Transportation, Helena, Montana. March 2001 meeting.
- Urban, L. 2002. Wetland Mitigation Specialist, Montana Department of Transportation, Helena, Montana. January 2002 meeting and August 2002 telephone conversation.
- U.S. Army Corps of Engineers (COE). 2001. December 6<sup>th</sup> letter from Allan Steinle to Jeff Stutzman (Musgrave Lake Ranch LLC) regarding Milk River Wetland Mitigation Project Corps File # 2000-90-331. Helena, Montana.
- USDA Natural Resources Conservation Service (NRCS). 1998. *Field Indicators of Hydric Soils in the United States*, Version 4. G. Hurt, P. Whited and R. Pringle (eds.). USDA, NRCS Fort Worth, TX.
- Werner, K. 1998. Herpetologist, Salish-Kootenai Community College, Pablo, Montana. May instructional presentation.



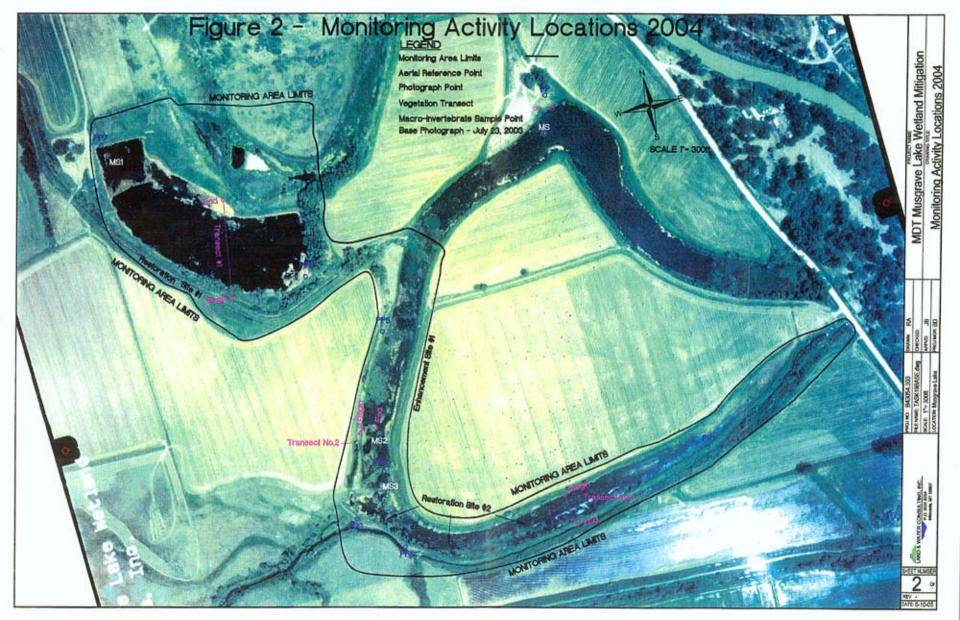


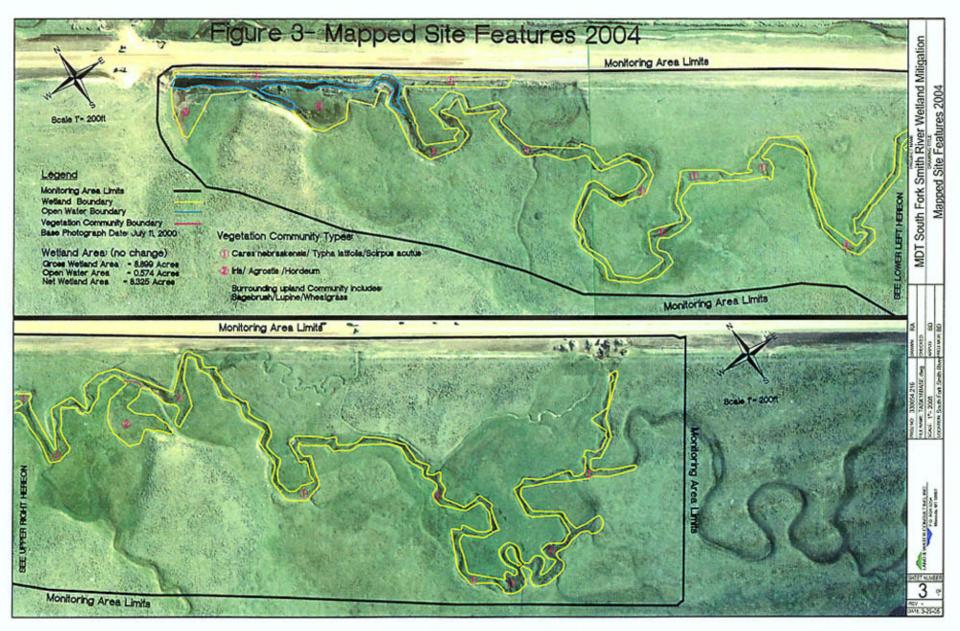
## Appendix A

## FIGURES 2 & 3

MDT Wetland Mitigation Monitoring Musgrave Lake Zurich, Montana







## Appendix B

2004 WETLAND MITIGATION SITE MONITORING FORM 2004 BIRD SURVEY FORMS 2004 WETLAND DELINEATION FORMS 2004 FUNCTIONAL ASSESSMENT FORMS

MDT Wetland Mitigation Monitoring Musgrave Lake Zurich, Montana



## LWC / MDT WETLAND MITIGATION SITE MONITORING FORM

Locat Legal Weatl Initial	ion:S. of Zur description: ner Condition Evaluation	ich T_32N R21E_Sens:dry, sunny Date:5 / 15 / 0 area:_100acres	MDT District MDT District MDT District Person Person T_ Visit #:	et: Great Fa ime of Day:070 on(s) conducting 8 Monitor	alls Milepost:_4 0-1200 the assessmenting Year:_4	: Berglund	27 / 04
			HYI	DROLOGY			
Inund Asses Depth If asse Other	ation: Prese sment area u at emergent essment area	Source: Irrigation vent X Absent nt X Absent nder inundation: vegetation-open wis not inundated are hydrology on site (dated.	Average de 90% rater boundary: e the soils satur	epths:_0-2 <u>ft</u> Ra _3 <u>_ft</u> rated w/in 12" c	nge of depths:_ of surface: Yes_	_XNo	ES1 are all
Mon		Presentvater below ground		Depth	Well#	Depth	
X X elevat NA COM	_Map emerg _Observe ext tions (drift lin _GPS survey	ties Checklist: ent vegetation-operatent of surface water nes, erosion, vegetar y groundwater mon COBLEMS: RS1: ed, ave. depth = 1 f	er during each sation staining et attoring wells lost 100% inundate	site visit and loo (c.) (cations if prese (cd, ave. depth =	$\frac{1}{2}$ feet, range = $\frac{1}{2}$	2" to 4'	



#### **VEGETATION COMMUNITIES**

Community No.:\_1\_\_ Community Title (main species):\_TYP LAT / SCI ACU\_\_\_\_\_

Dominant Species	% Cover	Dominant Species	% Cover
TYP LAT	>50	POL AMP	11-20
SCI ACU	21-50	SAG CUN	1-5
CAR LAN	21-50	ALO PRA	1-5
ELE PAL	6-10	SPA EME	1-5
CAR VES	21-50		

COMMENTS/PROBLEMS: _	_Similar to 2001- 2003, with a few new species

Community No.:\_\_2\_ Community Title (main species):\_ALO PRA / POL AMP\_\_\_\_\_

Dominant Species	% Cover	Dominant Species	% Cover
ALO PRA	1-5	SAG CUN	1-5
POL AMP	>50	POT PEC	6-10
RUM CRI	1-5	UTR INT	6-10
TYP LAT	1-5	NAJ GUA	6-10
SCI ACU	1-5	ALI GRA	6-10

**COMMENTS/PROBLEMS:** \_\_\_POL AMP vastly dominated this community type in 2003 and 2004; ALO PRA was removed from community type title due to current lack of dominance. \_\_\_\_\_

Community No.:\_\_3\_ Community Title (main species):\_SALIX / <del>ELA ANG</del>\_\_\_\_\_

Dominant Species	% Cover	Dominant Species	% Cover
SAL EXI	>50	BRO INE	6-10
SAL LUT	21-50	SAL AMY	>50
ELA ANG	<del>&gt;50</del>	POL AMP	6-10
CAR LAN	21-50		
AGR ALB	11-20		

COMMENTS/PROBLEMS:	Similar to 2002 and 2003.

#### **Additional Activities Checklist:**

\_X\_\_Record and map vegetative communities on air photo



## **VEGETATION COMMUNITIES (continued)**

Community No.:\_4\_\_ Community Title (main species):\_POT / MYR\_\_\_\_\_

Dominant Species	% Cover	Dominant Species	% Cover
POT PEC	>50	POT GRA	1-5
MYR SPI	>50	ALI GRA	1-5
NAJ GUA	>50	ELO CAN	6-10
UTR INT	>50		
SAG CUN	6-10		

COMMENTS/PROBLEMS:Subst	antial increase in	aquatic species coverage in 2004	
Community No.:_5 Community Title	(main species):	_CAREX	
Dominant Species	% Cover	Dominant Species	% Cover
CAL VUL	21-50	ALO PRA	6-10
CAR UTR	21-50	AGR ALB	11-20
CAR VES	21-50	POL AMP	1-5
TYP LAT	6-10		
CAR LAN	21-50		
Community No.:10 Community Title	(main species):	_BEC SYZ	
Dominant Species	% Cover	Dominant Species	% Cover
BEC SYZ	>50	-	
POL LAP	21-50		
AGR ALB	21-50		
SCI ACU	1-5		
POL AMP	6-10		
COMMENTS/PROBLEMS:This of	community was	new in 2004.	



## **VEGETATION COMMUNITIES (continued)**

Community No.:\_7\_\_ Community Title (main species):\_POP DEL\_\_\_\_\_

Dominant Species	% Cover	Dominant Species	% Cover
POP DEL	21-50	TYP LAT	11-20
ELA ANG	11-20		
SAL LUT	11-20		
SAL EXI	11-20		
IVA XAN	11-20		
Community No.:_8 Community Title	le (main species):	RUM CRI	
· ·	· · · · · · · · · · · · · · · · · · ·		% Cover
Community No.:_8 Community Title  Dominant Species  RUM CRI	le (main species):    % Cover   >50	RUM CRI	% Cover <1
Dominant Species	% Cover	Dominant Species	
Dominant Species RUM CRI	% Cover >50	Dominant Species TYP LAT	<1
Dominant Species RUM CRI AGR REP	% Cover >50 21-50	Dominant Species TYP LAT	<1

<b>COMMENTS/PROBLEMS:</b> New community type in 2003.	Replaced Type 6. Occurs around perimeter of
RS1 and in portions of RS2. Same in 2004.	
•	

Community No.:\_9\_\_ Community Title (main species):\_\_SCI MAR / BEC SYZ

Dominant Species	% Cover	Dominant Species	% Cover
SCI MAR	>50	TYP LAT	1-5
BEC SYZ	21-50	ALO PRA	11-20
SCI ACU	6-10		
RUM CRI	11-20		
HOR JUB	1-5		

COMMENTS/PROBLEMS:	New community type in 2004; replaced some Type 8



## **COMPREHENSIVE VEGETATION LIST**

Species	Vegetation	Species	Vegetation
1	Community	1	Community
	Number(s)		Number(s)
		D 1 11	
Acer negundo	3	Poa bulbosa	7, upland
Agropyron intermedium	upland	Poa pratensis	2, upland
Agropyron repens	2,6, 8, 10	Polygonum amphibium	1, 2, 5, 8
Agropyron smithii	Upland	Polygonum lapathifolium	1,2
Agrostis alba	1,2,3,7	Polygonum persicaria	1,2
Alisma plantago-aquatica	1,4	Populus deltoides	7
Alopecurus pratensis	2,5, 10, 9	Potamogeton natans	4
Apocynum androsaemifolium	7, upland	Potentilla anserina	1,6
Arctium minus	3,7	Prunus virginiana	3, upland
Asclepias speciosa	5,7	Ranunculus occidentalis	1,4
Asparagus officinalis	Upland	Rosa nutkana	3, upland
Beckmannia syzigachne	1,5, 8, 10, 9	Rumex crispus	1,5, 6, 8, 10, 9
Bromus inermis	3,7, upland	Sagittaria cuneata	1,4
Carex lanuginose	1,3,5	Salix amygdaloides	3
Carex praegracilis	5, upland	Salix exigua	3
Carex stipata	5	Salix lutea	3
Carex utriculata	1,5	Scirpus acutus	1, 9
Carex vesicaria	1,5, 8	Scirpus americanus	1,6
Carex vulpinoides	5	Scirpus maritimus	1, 8, 10, 9
Chenopodium album	6, upland	Scirpus validus	1
Cicuta douglasii	1,3	Sium suave	1,4
Cirsium arvense	1,3	Solidago canadensis	1,3,7, upland
Convolvulus arvensis	Upland	Spartina pectinata	5
Cornus stolonifera	3,7	Sparganium eurycarpum	1
Elaeagnus angustifolia	3,7	Symphoricarpos occidentalis	Upland
Eleocharis acicularis	1,4	Taraxacum officinale	Upland
Eleocharis palustris	1,2,4	Typha latifolia	1,4,7, 8, 9
Festuca arundinacea	6	Potentilla gracilis	4
Glyceria grandis	1,2, 10	Utricularia intermedia	4
Glycyrrhiza lepidota	2,7	Sparganium emersum	4
Helianthus annuus	Upland	Alisma gramineum	4
Hordeum jubatum	6, upland, 10, 9	Phalaris arundinacea	1
Iva xanthifolia	7, upland	Phleum pratense	2, upland
Juncus effuses	1	<b>*</b> ****	3 04 00
Kochia scoparia	upland		
Lemna minor	4		
Lycopus americanus	1,2,4		
Medicago sativa	upland		
Melilotus alba	upland		
Myriophyllum spicatum	4		
Najas guadalupensis	4		
Najas flexilis	4		

ditch spoil pile south of RS 2.	Dense growth of Kochia on dikes at RS 1. Also dense Canada thistle on old



## PLANTED WOODY VEGETATION SURVIVAL

Species	Number Originally Planted	Number Observed	Mortality Causes					
NO WOODY SPECIES PLANTED								
COMMENTS/PROBLEMS:								
- <del></del>								
			prince .					



## WILDLIFE

## **BIRDS**

(Attach Bird Survey Field Forms)

Were man made nesting structures installed? Yes	No_X_T	ype: H	ow many?_	Are	the nesting
structures being utilized? Yes No Do					
·			-		
MAMMA	LS AND HER	PTILES			
Species	Number	Indirect indication of use			
•	Observed	Tracks	Scat	Burrows	Other
White-tailed deer	2	yes	yes		
Badger	0			yes	
Raccoon	0	yes			
Beaver	0				slide,
					dams
Northern leopard frog (RS1,ES1, RS2)	50+				
Western chorus frog (RS1, RS2, ES1)	100+				
Meadow vole	1				
	•	•	•	•	
_XMacroinvertebrate sampling (if required)  COMMENTS/PROBLEMS:Substantial from	og activity obse	erved in 2004	at all sites.		



#### **PHOTOGRAPHS**

Using a camera with a 50 mm lenses and color film take photographs of the following permanent reference points listed in the checklist below. Record the direction of the photograph using a compass. (The first time at each site establish a permanent reference point by setting a ½ inch rebar or fencepost extending 2-3' above ground, survey the location with a resource grade GPS and mark the location on the air photo.) Checklist:

		ach of the 4 cardinal directions surro		
		oto showing upland use surrounding ts, take additional photos	wetland – If more than one	
		oto showing buffer surrounding wetla	and	
		n each end of vegetation transect show		
<b>T</b> 1	DI +	I N		
Location	Photo Frame #	Photograph Description		Compass
A	riaine #	SEE FIGURES AND PHOTO SHE	FTS	Reading
В		SEET IGURES AND THOTO SHE	L13	
C				
D				
Е				
F				
G				
Н				
COMME	NTS/PROB	LEMS:		
		GPS SURVE	VING	
Using a re	source grade	GPS survey the items on the checklish		ation points with the
		d recording rate. Record file number		
Checklist:				
Inri	adjetional xx	etland boundary		
		recognizable on the air photo		
		ints of vegetation transect(s)		
	to reference			
Gro	oundwater mo	onitoring well locations		
~~-				
		LEMS:No GPS data collected in	2004; modifications made us	ing high-quality 2002
aeriai piioi	ograph durir	ng field visits.		



### WETLAND DELINEATION

(Attach Corps of Engineers delineation forms)

At each site conduct the items on the checklist below:  X Delineate wetlands according to the 1987 Army Corps manual.  X Delineate wetland-upland boundary on the air photo  NA Survey wetland-upland boundary with a resource grade GPS survey
COMMENTS/PROBLEMS:
FUNCTIONAL ASSESSMENT (Complete and attach full MDT Montana Wetland Assessment Method field forms; also attach abbreviated field forms, if used)
COMMENTS/PROBLEMS: ES2 NOT SAMPLED (PER MDT INSTRUCTION).
MAINTENANCE  Were man-made nesting structures installed at this site? YES NO_X  If yes, do they need to be repaired? YES NO  If yes, describe problems below and indicate if any actions were taken to remedy the problems.  Were man-made structures build or installed to impound water or control water flow into or out of the wetland? YES_X_ NO  If yes, are the structures working properly and in good working order? YES NO_X_  If no, describe the problems below.
COMMENTS/PROBLEMS: _Flow was overtopping road/dike between ES1 and RS2 during May visit.



MDT WETLA	ND MONIT	ORING – VEGETATION TRANSECT	
Site: Musgrave Lake Date:	7/27/04	Examiner: Berglund Transect # RS1	
Approx. transect length: 500 feet	Compass Di	rection from Start (Upland):	
Vegetation type A: ALO PRA (Wetland comm. #		Vegetation type B: UPLAND	
Length of transect in this type: 15	Feet	Length of transect in this type: 16	feet
Species:	Cover:	Species:	Cover:
ALO PRA	>50	BRO INE	6-10
APO AND	6-10	PHL PRA	21-50
CAR LAN	1-5	AGR REP	21-50
PHL PRA	1-5	POA PRA	1-5
SCI ACU	<1		
		SYM OCC	<1
		APO AND	1-5
Upland in 2001		POL AMP	<1
			<u> </u>
Total Vegetative Cover:	100	Total Vegetative Cover:	100
<b>Vegetation type C:</b> POP DEL (Wetland comm. #		<b>Vegetation type D:</b> POT / MYR (Wetland comm. #4)	
Length of transect in this type: 25	feet	Length of transect in this type: approx. 100	feet
Species:	Cover:	Species:	Cover:
POP DEL (not rooted in transect)	21-50	SAG CUN	6-10
POL AMP	11-20	SCI ACU	1-5
TYPLAT	<1	POL AMP	1-5
SAG CUN	1-5	NAJ GUA	>50
SCI ACU	1-5	POT PEC	>50
NAJ GUA	1-5	MYR SPI	>50
UTR VUL	1-5	UTR VUL	>50
POT PEC	1-5		<u> </u>
			<u> </u>
		Estimated from photo – inaccessible due to flooding	<del></del>
Total Vegetative Cover:	90	Total Vegetative Cover:	20%

MDT WETL	AND MONITORING	G – VEGETATION TRANSECT (continued)	
Site: Musgrave Lake	Date: 7/27/04	Examiner: Berglund Transect # RS1 -	- cont.
Approx. transect length: 500	Compass Dir	rection from Start (Upland):	
<b>Vegetation type E:</b> POL AMP (COMM. flooded out)	#2, w/ALO PRA	<b>Vegetation type F:</b> POT / MYR (Wetland comm. #4)	
Length of transect in this type: Approx. 3	00 feet	Length of transect in this type: approx. 35	feet
Species:	Cover:	Species:	Cover:
POL AMP	>50	MYR PEC	>50
SAG CUN	6-10	NAJ GUA	>50
Estimated from aerial photo.		POT PEC	>50
•		UTR INT	>50
		ALI GRA	1-5
Total Vegetative		Total Vegetative Cover	: 80%
Vegetation type G: RUM CRI (Wetland		Vegetation type H: UPLAND	
Length of transect in this type: 7	feet	Length of transect in this type: 2	feet
Species:	Cover:	Species:	Cover:
RUM CRI	6-10	BRO INE	>50
BEC SYZ	6-10		
SCI MAR AGR REP	<1 6-10		
SCI ACU	1-5		
SCI ACU	1-3		
Total Vegetative	Cover: 40%	Total Vegetative Cover	: 100%
Total vegetative	COVCI. 70/0	Total vegetative cover	. 100/0



MDT WETLA	ND MONITO	RING – VEGETATION TRANSECT	
Site: Musgrave Lake Date:	7/27/04	Examiner: Berglund Transect # RS2	
Approx. transect length: 170 ft			
Vegetation type A: UPLAND		<b>Vegetation type B:</b> RUM CRI (Wetland Comm. #8)	
Length of transect in this type: 10	feet	Length of transect in this type: 75	feet
Species:	Cover:	Species:	Cover:
AGR REP	21-50		
BRO INE	21-50	RUM CRI	>50
SYM OCC	11-20	AGR REP	>50
ROS NUT	1-5	POL AMP	1-5
CIR ARV	6-10	TYP LAT	<1-5
GLY LEP	1-5	HOR JUB	6-10
		POL LAP	1-5
Similar to 2002.		SCI ACU	<1
		Inundated 6-8"	
T + 1W + ri C	100	T + 1V + + C	0.5
Total Vegetative Cover:	100	Total Vegetative Cover:	95
<b>Vegetation type C:</b> POL AMP (Wetland Comm.	#2)	<b>Vegetation type D:</b> Upland	
Length of transect in this type: 75	feet	Length of transect in this type: 10	feet
Species:	Cover:	Species:	Cover:
POL AMP	21-50	SYM OCC	21-50
RUM CRI	1-5	BRO INE	11-20
TYP LAT	1-5	CIR ARV	11-20
POL LAP	1-5		
AGR REP	1-5		
HOR JUB	11-20		
NAJ FLE	11-20		
Inundated 6-12". Was upland in 2002.			
Total Vegetative Cover:	80	Total Vegetative Cover:	100



MDT WETLA	ND MONITO	RING – VEGETATION TRANSECT	
Site: Musgrave Lake Date:	7/27/04	Examiner: Berglund Transect # ES1	
		ction from Start (Upland): 106 degrees	
<b>Vegetation type A:</b> UPLAND		<b>Vegetation type B:</b> BEC SYZ (Wetland Comm. # 10)	
Length of transect in this type: 15	Feet	Length of transect in this type: 30	feet
Species:	Cover:	Species:	Cover:
PRU VIR	1-5	BEC SYZ	>50
ROS WOO	<1	POL LAP	21-50
BRO INE	21-50	AGR ALB	21-50
POL AMP	11-20	SCI ACU	1-5
IVA XAN	1-5	POL AMP	6-10
		Fringe of flooded area (was 68'wide in 2002).	
Total Vegetative Cover:	100	Total Vegetative Cover:	100
<b>Vegetation type C:</b> TYP LAT/SCI ACU (Wet. Co	omm. #1)	Vegetation type D:	
Length of transect in this type: 41	feet	Length of transect in this type:	feet
Species:	Cover:	Species:	Cover:
TYP LAT	<1		
SCI ACU	21-50		
POL LAP	11-20		
BEC SYZ	21-50		
POL AMP	11-20		
AGR ALB	6-10		
PHL ARU	1-5		
Flooded to 2-foot depth. Total Vegetative Cover:	50	Total Vegetative Cover:	



#### MDT WETLAND MONITORING – VEGETATION TRANSECT (back of form)

<b>Cover Estima</b>	ate	<b>Indicator Class:</b>	Source:
+ = <1%	3 = 11-20%	+ = Obligate	P = Planted
1 = 1-5%	4 = 21-50%	<ul><li>- = Facultative/Wet</li></ul>	V = Volunteer
2 = 6-10%	5 = >50%	0 = Facultative	

Percent of perimeter see below % developing wetland vegetation – excluding dam/berm structures.

Establish transects perpendicular to the shoreline (or saturated perimeter). The transect should begin in the upland area. Permanently mark this location with a standard metal fencepost. Extend the imaginary transect line towards the center of the wetland, ending at the 3 food depth (in open water), or at a point where water depths or saturation are maximized. Mark this location with another metal fencepost.

Estimate cover within a 10 ft wide "belt" along the transect length. At a minimum, establish a transect at the windward and leeward sides of the wetland. Remember that the purpose of this sampling is to monitor, not inventory, representative portions of the wetland site.

#### Notes:

All sites inundated and transitioning to wetland areas.

% perimeter developing wetland vegetation: RS1 – 100; ES1 – 100; RS2 – 90.



#### **BIRD SURVEY - FIELD DATA SHEET**

Page\_\_1\_of\_\_1\_ Date: 5/25/04

SITE: Musgrave Lake Survey Time: 0945-1200

Bird Species	#	Behavior	Habitat	Bird Species	#	Behavior	Habitat
Ring-Necked Pheasant	4	F	UP	Bank Swallow	2	F	OW
Canada Goose	10	F, BP	OW, MA	American Wigeon	1	FO	OW
American Robin	10	F	FO	Double-Crested	1	F	OW
				Cormorant			
Red-Winged Blackbird	20+	F, N	MA				
Common Snipe	3	F	MA				
Yellow-Headed	10+	N, F	MA				
Blackbird							
Brewer's Blackbird	10	F	UP				
Gadwall	1	F	OW				
Northern Rough-	2	F	OW				
Winged Swallow							
Willow Flycatcher	2	F	MA, FO				
Mallard	6	F	MA, OW				
Swainson's Hawk	2	FO	MA				
Tree Swallow	2	F	OW, MA				
Black-Capped	1	F	MA				
Chickadee							
Common Yellowthroat	3	F	MA				
Song Sparrow	10	F	MA, UP				
Sora	2	F	MA				
Mourning Dove	6	F	UP, FO				
Franklin's Gull	6	FO	OW, UP				
Willett	1	F	MA				
Western Meadowlark	6	F	UP				
Ring-Billed Gull	10	FO	OW, UP				
American White	6	FO	OW, MA				
Pelican							
Blue-Wing Teal	4	F	MA				
Wilson's Phalarope	1	F	MA				
Brown-Headed	6	F	UP				
Cowbird							
Northern Pintail	6	FO	MA				
Bobolink	1	F	UP				
Yellow Warbler	1	F	MA				
Spotted Sandpiper	4	F	MA				

#### Notes:

RS1 - 100% full & spilling; RS2 - 80-85% full – need another board or two in standpipe to fill; ES1 - 20-25% full – more boards at standpipe needed to fill. Water level about 2.5 feet below road surface.

Numerous chorus frogs at all three sites (vocalizing), 1 leopard frog observed at RS-1, numerous ground squirrels in field north of RS-1, deer tracks & scat, many beaver slides between RS-2 and canal to south, with dams in canal.

50/50 sun/clouds, calm, dry conditions – recent rain

**Behavior**: BP – one of a breeding pair; BD – breeding display; F – foraging; FO – flyover; L – loafing; N – nesting

**Habitat**: AB – aquatic bed; FO – forested; I – island; MA – marsh; MF – mud flat; OW – open water; SS – scrub/shrub; UP – upland buffer; WM – wet meadow, US – unconsolidated shoreline



#### **BIRD SURVEY - FIELD DATA SHEET**

Page\_\_1\_of\_\_1\_ Date: 7/27/04

**SITE:** Musgrave Lake

Survey Time: 0700-1130

Bird Species	#	Behavior Habita		Bird Species	#	Behavior	Habitat
				Eastern Kingbird	10	F	UP
				Blue-Winged Teal	25	Broods	MA
				Red-Tailed Hawk	1	F	MA
				Northern Rough-	200	F	MA
				winged Swallow			
				Barn Swallow	30	F	OW
				Ring-Necked	2	F	UP
				Pheasant			
				Killdeer	20	F	MA
				Red-Winged	200	F,N	MA
				Blackbird			
				Yellow-Headed	10	N	MA
				Blackbird			
				Great Horned Owl	1	F	UP
				Great Blue Heron	6	F	MA
				Double-Crested	1	F	MA
				Cormorant			
				Mourning Dove	12	F	UP
				Gadwall	2	F	MA
				Mallard	6	F	MA
				Willet	2	F	MA
				Wilson's Phalarope	6	F	MA
				Western Wood	1	F	FO
				Pewee			
				American Robin	10	F	ALL
				Yellow Warbler	6	F	FO
				Common Tern	2	F	MA
				Ring-billed Gull	6	FO	MA
				Common	2	F	FO
				Yellowthroat			

#### Notes:

Beaver sign at RS-2, white-tailed deer observed @RS1 and ES1, numerous northern leopard frogs observed at ES1, RS1, RS2. Dry, sunny.

Raccoon tracks, beaver slides & dams, meadow vole, white-tailed doe & fawn

**Behavior**: BP – one of a breeding pair; BD – breeding display; F – foraging; FO – flyover; L – loafing; N – nesting

**Habitat**: AB – aquatic bed; FO – forested; I – island; MA – marsh; MF – mud flat; OW – open water; SS – scrub/shrub; UP – upland buffer; WM – wet meadow, US – unconsolidated shoreline



### DATA FORM ROUTINE WETLAND DETERMINATION (1987 COE Wetlands Delineation Manual)

Project/Site: Musgrave Lake Mitigation Site Project No: #4421 Applicant/Owner: Montana Department of Transportation Investigators: Berglund Plot ID: 1								
Do Normal Circumstances exist on the site is the site significantly disturbed (Atypical is the area a potential Problem Area? (If needed, explain on the reverse side)	Situation	:)? Ÿ	es No es No es No	Community ID: Transect ID: Field Location: RS-1, beginning of	1			
VEGETATION  Dominant Plant Species(Latin/Common)	Stratum		egion No. 9	ecies(Latin/Comm		Tex	Indicator	
Alopecurus pratensis	Herb	FACW	Carex land		ionj	Herb	OBL	
Foxtail.Meadow	1000	1.70**	Sedge, Wo				OBL	
Apocynum androsaemifolium	Herb	NI	Scirpus ac			Herb	OBL	
dogbane	1	l'''	Bulrush,H			H		
Phieum pratense	Herb	FACU				+		
Timothy	1					┨		
11110017	<del>                                     </del>		<del>                                     </del>			+		
	1	l				┥		
	-					+		
	1	l	<del></del>			-		
		-				+		
	-	l	<u> </u>			-		
	-					+		
	4	l	<b></b>					
	1	1				_		
		L						
Percent of Dominant Species that are OBL, (excluding FAC-) 3/4 = 75.00%	, FACW o	r FAC:	FAC No		= 75.00% = 2.00			
Remarks: ALO PRA vastly dominant.			11					
HYDROLOGY								
NO Recorded Data(Describe in Remark	s):	Wet	land Hydro	logy Indicators				
N/A Stream, Lake or Tide Gauge			Primary In	dicators				
N/A Aerial Photographs				undated				
N/A Other				aturated in Uppe	r 12 Inches			
YES No Recorded Data			NO Water Marks NO Drift Lines					
Field Observations				ediment Deposits				
rield Observations				rainage Patterns	in Wetlands			
				y Indicators				
Depth of Surface Water:	= 3 (in.)			xidized Root Cha		12 Inches		
Depth to Free Water in Pit:	N/A (in.)			ater-Stained Lea				
2-parto rico mator arrit.	(111.)			ocal Soil Survey	Data			
Depth to Saturated Soil:	N/A (in.)			AC-Neutral Test ther(Explain in R	emarks)			
Remarks: Much of site is inundated. Free water at top of pit.								

Page 1 of 2

WetForm<sup>bm</sup>

#### DATA FORM ROUTINE WETLAND DETERMINATION (1987 COE Wetlands Delineation Manual)

SOILS							Plot ID: 1	
Map Sym	bol: 129 ly (Subgroup	bs and Phase): Drainage Class: p): Typic Fluvaque		, 0-2%		ped Hydric Inclu ervations Confi	usion? irm Mapped Typ	oe? (Yes) No
Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mot Abundance		Texture, Conc	retions, Structu	ire, etc
10	В	2.5Y4/2	2.5Y5/6	Common	Distinct	Clay loam		
10	В	2.5Y4/2	10YR5/8	Common	Distinct	Silty clay		
	NO Sulfid NO Aquic NO Reduc YES Gleyer s:	Moisture Regime cing Conditions d or Low Chroma g of transect.		NO Orga NO Lista NO Lista	anic Streak ed on Loca ed on Natio	ing in Sandy Sc I Hydric Soils L onal Hydric Soil in Remarks)	ist	, 30113
	D DETERMIN		) No	Tie the Co	dina Daire	dhia the Materia	ado Mas	-
Wetland I Hydric So	tic Vegetatior Hydrology Pre ils Present?		No	is the Sami	pling Point v	vithin the Wetlar	nd? (Yes) N	No
Remarks: Restoration		developing marsh are	a. This plot taken at l	beginning of tra	ansect. Cent	er of transect not a	accessible due to in	nundation.

Page 2 of 2

WetForm<sup>bm</sup>



# DATA FORM ROUTINE WETLAND DETERMINATION (1987 COE Wetlands Delineation Manual)

Project/Site: Musgrave Lake Mitigation Applicant/Owner: Montana Department of Tr Investigators: Berglund	oject No: #4421	County: B	7-Jul-2004 laine ontana				
Do Normal Circumstances exist on the site Is the site significantly disturbed (Atypical Is the area a potential Problem Area? (If needed, explain on the reverse side)	Situation:		Yes No Yes No Yes No	Community ID: Transect ID: Field Location: Center of Transe	2		
VEGETATION			Region No. 9				
Dominant Plant Species(Latin/Common)	Stratum			cies(Latin/Comr	non)	Stratum	Indicator
Scirpus acutus	Herb	OBL	Agrostis a	lba		Herb	FACW
Bulrush, Hard-Stem	Herb	OBL	Redtop	m lapathifolium		Herb	FACW+
Polygonum amphibium Smartweed,Water	Leip	OBL	Willow-We			1000	FACW
Beckmannia syzigachne	Herb	OBL	AAIIIOM-AAI	960		+	<del> </del>
Sloughgrass, American	1,1012	1000	-			┨	l
Sloughighass, American							
						1	-
	ł					┨	1
		-				┼	
	ł		$\vdash$			┨	l
Percent of Dominant Species that are OBL, (excluding FAC-) 5/5 = 100.00%  Remarks:	FACW o	r FAC:			= 100.00% 5 = 1.40		•
HYDROLOGY							
YES Recorded Data(Describe in Remark NO Stream, Lake or Tide Gauge YES Aerial Photographs NO Other NO No Recorded Data Field Observations	s):	V	Primary In YES In YES S NO W NO D	ology Indicators dicators nundated aturated in Uppe Vater Marks wrift Lines dediment Deposit trainage Patterns	ts		
Depth of Surface Water:	= 4 (in.)		Secondar	y Indicators	annels in Upper	12 Inches	
Depth to Free Water in Pit:	N/A (in.)		NO V	Vater-Stained Le	aves		
Depth to Saturated Soil:	N/A (in.)		YEŞ F	ocal Soil Survey AC-Neutral Test hther(Explain in I			
Remarks: Site inundated to about 4" deep.				and the property of the proper	······································		

Page 1 of 2 WetForm<sup>bm</sup>

# DATA FORM ROUTINE WETLAND DETERMINATION (1987 COE Wetlands Delineation Manual)

Project/S Applican Investiga	t/Owner: Mo	sgrave Lake Mitiga Intana Department Inglund		Project No: #4421 Date: 27-Jul-2004 County: Blaine State: Montana Plot ID: 2							
SOILS											
Map Sym	bol: 129 ly (Subgroup	es and Phase): Drainage Class: p): Typic Fluvaquer		, 0-2%		ed Hydric Inclu ervations Confi		ed Type? (Yes	) No		
Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mo Abundance		Texture, Conc	retions, S	Structure, etc			
6	В	2.5Y4/1	N/A	N/A	N/A	Silty clay loam					
Hydric Soil Indicators:  NO Histosol NO Histosol NO Histo Epipedon NO Sulfidic Odor NO Sulfidic Odor NO Quality Companie Streaking in Sandy Soils NO Reducing Conditions YES Gleyed or Low Chroma Colors  Remarks:  NO Concretions NO Hydro Content in Surface Layer in Sandy Soils NO Organie Streaking in Sandy Soils NO Listed on Local Hydric Soils List NO Listed on National Hydric Soils List NO Other (Explain in Remarks)											
WETLAN	DETERMIN	VATION									
Hydrophy Wetland	tic Vegetation Hydrology Probils Present?	n Present? (Yes	No No	Is the Sam	pling Point v	vithin the Wetlar	nd? (	es No			
Remarks Enhancem		t in center of transect	. Site inundated durin	ng survey.							

Page 2 of 2 WetForm\*\*



#### DATA FORM ROUTINE WETLAND DETERMINATION (1987 COE Wetlands Delineation Manual)

Project/Site: Musgrave Lake Mitigation Site Project No: #4421 Date: 27-Jul-2004 Applicant/Owner: Montana Department of Transportation County: Blaine State: Montana Project ID: 3												
Do Normal Circumstances exist on the site is the site significantly disturbed (Atypical is the area a potential Problem Area? (If needed, explain on the reverse side)	-	)? Y	es No es No es No	Community ID: Transect ID: Field Location: RS2 along transe	3							
VEGETATION	(1	JSFWS Re	gion No.	9)								
Dominant Plant Species(Latin/Common)	Stratum		tor Plant Species(Latin/Common) Stratum									
Rumex crispus	Herb	FACW	Hordeum			Herb	FAC+					
Dock,Curly			Barley,Fo									
Agropyron repens	Herb	FACU	Polygonu	m lapathifolium		Herb	FACW+					
Quackgrass	L	L	Willow-W	eed								
Polygonum amphibium	Herb	OBL	Scirpus a	cutus		Herb	OBL					
Smartweed, Water			Bulrush,H	ard-Stem		1						
Typha latifolia	Herb	OBL										
Cattail, Broad-Leaf												
Percent of Dominant Species that are OBL, (excluding FAC-) 6/7 = 85.71%	FACW or	FAC:			= 83.33% 7 = 2.00	<u> </u>						
Remarks:												
COLUMN TWO IS NOT THE OWNER, NAME AND ADDRESS OF THE OWNER, THE OW		1										
NO Recorded Data(Describe in Remarks	s):			ology Indicators								
N/A Stream, Lake or Tide Gauge			Primary Ir									
N/A Aerial Photographs N/A Other				nundated aturated in Uppe	a 12 laches							
				aturated in Oppe Vater Marks	or 12 inches							
YES No Recorded Data			NO D	rift Lines								
Field Observations			YES D	ediment Deposit rainage Patterns y Indicators								
Depth of Surface Water:	= 6 (in.)		<u>NO</u> C	xidized Root Ch	annels in Upper	12 Inches						
Depth to Free Water in Pit:	N/A (in.)		NO Water-Stained Leaves NO Local Soil Survey Data									
Depth to Saturated Soil:	N/A (in.)			AC-Neutral Test ther(Explain in F								
Remarks: Site inundated to 6°.												

Page 1 of 2

#### DATA FORM ROUTINE WETLAND DETERMINATION (1987 COE Wetlands Delineation Manual)

Investigators:	Berglund			s		Montana						
SOILS  Map Unit Name (Series and Phase): Havre silty clay loam, saline Map Symbol: 58 Drainage Class: WD Mapped Hydric Inclusion?  Taxonomy (Subgroup): Ustic Torrifluvents Field Observations Confirm Mapped Type? Yes No  Profile Description												
Depth (inches) Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)		Texture, Concre	etions, S	Structure, etc						

10	В	10YR4/1	10YR4/6	Common	Distinct	Silty clay loam
Hydric S	NO Sulfid NO Aquid NO Redu	sol Epipedon		NO High NO Org NO List NO List	anic Streak ed on Loca ed on Natio	content in Surface Layer in Sandy Soils ing in Sandy Soils I Hydric Soils List inal Hydric Soils List in Remarks)
Remark	s:					

WETLAND DETERMINATION

lydrophytic Vegetation Present? Wetland Hydrology Present? Hydric Soils Present?	Yes Yes Yes	No No No	Is the Sampling Point within the Wetland?	(es)	No
Remarks:					

Restoration site 2, along transect. Site much wetter than observed in 2001 or 2002. Consistent with 2003. Developing strong wetland characteristics



#### MDT MONTANA WETLAND ASSESSMENT FORM (revised May 25, 1999)

MIDI	MONTAL	NA WEILANL	ASSES	SMENT FORM	i (revised May 25	, 1999	)	
1. Project Name: Musgrave Lake Mit	igation Projec	<u>t</u> 2.	Project #:	130091-019				
<b>3. Evaluation Date:</b> <u>7/27/04</u>	4. Eva	luator(s): Berglun	<u>d</u>	5. W	etland / Site #(s): ES-	1		
6. Wetland Location(s) i. T: 32 N ii. Approx. Stationing / Mileposts	<b>R</b> : <u>21</u> <u>E</u>	S: 11, 12	AT (16		: <u>E</u> S:			
iii. Watershed: <u>10050004</u>		GPS Reference 1						
Other Location Information: <b>E</b>	Enhancement S	Site 1, center of ease	ment, soutl	n of Zurich, south of	Milk River, Blaine Co	unty.		
<ul><li>7. A. Evaluating Agency MDT</li><li>B. Purpose of Evaluation:</li></ul>	ed by MDT p		ì		_ (visually estimated) (measured, e.g. GPS)	estimate	rd)	
☐ Mitigation wetlands; pre-c ☐ Mitigation wetlands; post- ☐ Other		Comme	nts: <u>Enhan</u> o	cement Site 1	4.98 (measured	, e.g. GP	PS)	
10. CLASSIFICATION OF WETLA	AND AND AC	QUATIC HABITA'	TS IN AA		1		1	1
HGM CLASS <sup>1</sup>	SYSTEM <sup>2</sup>	SUBSYSTEM	2	CLASS <sup>2</sup>	WATER REGIN	<b>1E</b> <sup>2</sup>	MODIFIER <sup>2</sup>	% OF AA
Riverine	Palustrine	None	Em	ergent Wetland	Seasonally Floor	ded	Impounded	8:
Riverine	Palustrine	None	Scru	b-Shrub Wetland	Seasonally Floor	ded	Impounded	10
Riverine	Palustrine	None		Aquatic Bed	Semipermanently F	looded	Impounded	
$^{1}$ = Smith et al. 1995. $^{2}$ = Cowardin et	al. 1979.							
11. ESTIMATED RELATIVE ABU Common Comments:  12. GENERAL CONDITION OF A. i. Regarding Disturbance: (Us	` A	·	ite response	ı.)		,		
	Land manag	ged in predominantly r			but moderately grazed		ultivated or heavily grazed	or logged.
Conditions Within AA	state; is not	grazed, hayed, logged onverted; does not con	, or	or hayed or selective	ly logged or has been ring; contains few roads	subject clearing	to substantial fill placeme g, or hydrological alteration building density.	nt, grading
AA occurs and is managed in predominantly a natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings.				,			moderate disturbanc	e
AA not cultivated, but moderately grazed or hayed or selectively logged or has been subject to relatively minor clearing, or fill placement, or hydrological alteration; contains few roads or buildings.								
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrologica alteration; high road or building density.	l							
Comments: (types of disturba	nce, intensity,	season, etc.) Grazii	ng and hayl	and occur adjacent to	o site.			
ii. Prominent weedy, alien, & i	ntroduced spe	ecies: <u>CIR ARV, P</u>	HL PRA, K	COC SCO				
iii. Briefly describe AA and surpartial SS component. Surrounding lar			hancement	Site #1 in approxima	ate center of site. Larg	e, impou	unded marsh / oxbow a	rea with
13. STRUCTURAL DIVERSITY (B	ased on 'Class	s' column of #10 ab	ove.)					
Number of 'Cowardin' Vegetated Classes Present in AA	≥3 Vegeta	ited Classes or class is forested		ted Classes or ted	≤ 1 Vegetated Class			
Select Rating		High						



Comments: \_\_\_

<b>14A.</b> H	AA is Documented								NED (	OR E	NDAN	GER	ED P	LAN	ΓS AN	ND AN	NIMA	LS				
	Primary or Critical h Secondary habitat (li Incidental habitat (li No usable habitat	st species)	ŕ	□ D □ D □ D □ D	□ s ⊠ s	Ba	ld Eag	<u>de</u>														
ii.	8 \	e strongest hat	oitat cl	nosen	in 14 <i>A</i>	_									_			r Lov	v (L) f	or this	func	tion.
Highe	est Habitat Level	doc/primary	su	ıs/prin	nary	doc	c/seco	ndary	sus	s/seco	ndary	doo	c/incid	lental	sus	s/incid	ental		none	;		
Funct	ional Point and Rating															.3 (L	)					
	If documented, list the source (e.g., observations, records, etc.):																					
<b>14B.</b> H		cies listed in 14 (D) or Suspecto	<b>4A(i).</b> ed (S)	to cor	ntain (c	heck	box):				ONT	ANA	NAT	URAI	L HEI	RITA	GE PI	ROG	RAM.			
	Primary or Critical h Secondary habitat (li Incidental habitat (li No usable habitat	ist species)		□ D □ D □ D	□ S □ S □ S	_	orthern	*														
iii	i. Rating (Based on the est Habitat Level:	doc/primary				_			_			_	of Hig c/incid		_	erate (		r Lov			func	ion.
_		1 ,	Su	ıs/prin	iai y	doc	c/seco	nuary	Sus	s/seco	iuary	doc	Z/IIICIC	entai	Sus	s/IIICIU	entai		none	; 		
Funct	ional Point and Rating	1 (H)																				
	onditions continue to imp General Wildlife Habita Evidence of overall	t Rating											ern le	<u>opard</u>	frogs	obser	ved at	ES2	<u>in 200</u>	4 and	habita	<u>at</u>
$\triangleright$	stantial (based on any of observations of abundant wildlife sign presence of extremely interviews with local	lant wildlife #s n such as scat, t limiting habita	or hig racks, at feat	nest s ures n	tructu ot avai	res, g lable	ame tr	ails, e	etc.			□ Lo		few of little spars	or no v to no se adja	wildlif wildli icent u	fe sigi	ervati n food	sourc	es		se periods
	derate (based on any of observations of scatte common occurrence of adequate adjacent upl interviews with local	red wildlife gro of wildlife sign and food sourc	such a	as scat	, track	s, nes						eak pe	eriods									
ii.	. Wildlife Habitat Feat	ures (Working	from	top to	botto	n, sel	lect ap	propr	iate A	A attr	ibutes	to de	termin	e the	excep	tional	(E), h	igh (I	H), mo	derate	(M),	or low (L
	rating. Structural diver	rsity is from #1	3. Fo:	r class	cover	to be	e consi	dered	evenl	y dist	ributec	l, veg	etated	class	es mu	st be v	vithin	20%	of eac	h othe	r in te	rms of
	their percent compositi	on in the AA (	see #1	0). D	uratior	of S	urface	Wate	er: P/I	P = pe	rmane	nt/pei	ennia	l; S/I =	= seas	onal/i	ntermi	ttent;				
	T/E = temporary/epher											•										
[	Structural Diversity (fr	om #13)				ØΙ	High							ПМо	derate	;				П	Low	
	Class Cover Distribution (all vegetated classes)			□F	Even			⊠Uı	neven			ПЕ	Even			Ur	neven				ven	
	Duration of Surface W 10% of AA	ater in ≥	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
	Low disturbance at AA Moderate disturbance (see #12)																					
	High disturbance at A	A (see #12)																				
iii	i. <b>Rating</b> (Using 14C(i) a		ve and	d the r	natrix	belov	w to ar	rive a	t the f	unctio	nal po	int an	ıd ratii	ng of	except	tional	(E), hi	igh (F	I), mo	derate	(M),	or low (L
ı	for this function.) Evidence of Wildlif	e I Ise				Wile	illife H	ahita	t Fact	nrec	Ratine	r fron	1.14C	ii)				7				
	from 14C(i)	- 030	П Ех	ceptio	onal	77110		Hig		ai CS		Mode		11)	Г	Lov	v	$\exists$				
	Substantial	<u> </u>	_					0 (LL)		+				+				7				

Comments: Numerous waterfowl, shorebirds, northern leopard frogs observed.

Moderate Low



If the AA is not or was not histor Assess if the AA is used by fish barrier, etc.]. If fish use occurs i	or the existing situation	is "correctable	" such th	at the AA	could be a	ised by fis	h [e.g. fish u	se is preclud			
[14D(i)] below should be marked								an irrigation	canarj, me	тавна Qua	шц
i. <b>Habitat Quality</b> (Pick the app Duration of Surface Water in AA		n matrix to pic		eptional (			te (M), or lo asonal / Inte			porary / Eph	amaral
Cover - % of waterbody in AA c		(e a	reili	ianent/Fei	Tilliai	<u> </u>	asonai / mic	Hillittent		iporary / Epii	emerar
submerged logs, large rocks & b			25%	10-25%	<10%	>25%	10-25%	<10%	>25%	10-25%	<10%
floating-leaved vegetation) Shading - >75% of streambank of	er sharaling of A A gonts	vino						M			
riparian or wetland scrub-shrub of	or forested communities	illis						IVI			
Shading – 50 to 75% of streambariparian or wetland scrub-shrub of	ank or shoreline of AA	contains									
Shading - < 50% of streambank riparian or wetland scrub-shrub of	or shoreline of AA cont	ains						1			
ii. Modified Habitat Quality:	Is fish use of the AA pr	ecluded or sign									
	duce the rating from 141	O(i) by one leve	el and ch	eck the me	odified hal	oitat qualit	y rating:	□ E □	Н ∐М	L	
iii. Rating (Use the conclusions from	om 14D(i) and 14D(ii) abov	e and the matrix						l (E), high (H)	), moderate (	M), or low (L).	)
Types of Fish Known or Suspected Within AA	☐ Exception:	al		High	павнан	Quality fro	Moder	ate		⊠ Low	
Native game fish		**									
Introduced game fish											
Non-game fish										.3 (L)	
No fish  Comments: Fish use is incide		s enter from N	Ausarav		nd associ	ated irriga					
14E. FLOOD ATTENUATION Applies only to wetlands so If wetlands in AA do not find it. Rating (Working from top to function.)	ubject to flooding via in looded from in-channel bottom, mark the appro	or overbank flo	w, check	NA above at the fur	nctional po	oint and ra			te (M), or le		
Estimated wetland area in AA su				□ ≥ 10 :			<10, >2			≤2 acres	
% of flooded wetland classified		or both	75%	25-75			_	_		25-75%	<25%
AA contains <b>no outlet or restric</b> AA contains <b>unrestricted outlet</b>								.5 (M)			
ii. Are residences, businesses,  Y N Comm be used to carry flood flows from  14F. SHORT AND LONG TE Applies to wetlands that fle If no wetlands in the AA a:  i. Rating (Working from top to	nents: This function the Milk River.  RM SURFACE WAT bood or pond from overbre subject to flooding or	ER STORAGE ank or in-change ponding, check	E E Enel flow, k NA abo	al", in that  NA (proprecipitations)	ceed to 14	ultimately 4G) I surface fl	occurs via a	n irrigation o	ditch. How	ever, the ditc	h could
Abbreviations: P/P = perman Estimated maximum acre feet of	ent/perennial; S/I = sea:	sonal/intermitte	nt; T/E =		y/epheme	ral.	⊠ <5, >1 a			_	<i></i>
the AA that are subject to period  Duration of surface water at wet					C ICCI					i ≤i acre io	ot
				S/I						≤1 acre fo	
*	ands within the AA 5 out of 10 years		P/P	S/I	T/I	E P/P	S/I .6 (M	T/E	P/P	S/I 	T/E
Wetlands in AA flood or pond <	ands within the AA 5 out of 10 years		P/P	-	T/I	E P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond < Comments:  14G. SEDIMENT/NUTRIENT Applies to wetlands with p If no wetlands in the AA a	ands within the AA  5 out of 10 years  5 out of 10 years  T/TOXICANT RETEN  otential to receive exceive subject to such input,	ss sediments, no check NA abo	P/P REMOVAutrients, ove.	AL or toxican	T/I	P/P	S/I .6 (M 4H) urface or gro	T/E ) ound water o	P/P or direct inp	S/I	T/E
Wetlands in AA flood or pond < Comments:  14G. SEDIMENT/NUTRIENT Applies to wetlands with p	5 out of 10 years 5 out of 10 years 5 out of 10 years  T/TOXICANT RETEN otential to receive excere subject to such input, bottom, use the matrix	ss sediments, no check NA abo	P/P REMOVA utrients, ove. at the fur	AL or toxican	T/I	P/P roceed to 1 influx of s ting of hig	S/I  .6 (M   4H)  urface or growth (H), mode	T/E ) ound water o	P/P or direct inp	S/I	T/E
Wetlands in AA flood or pond < Comments:  14G. SEDIMENT/NUTRIENT Applies to wetlands with p If no wetlands in the AA a	5 out of 10 years 5 out of 10 years 5 out of 10 years  T/TOXICANT RETEN otential to receive excere subject to such input, bottom, use the matrix  AA receives of to moderate le other function	ss sediments, nu check NA abo pelow to arrive r surrounding lan evels of sediments s are not substant , sources of nutri	P/P    REMOVA  utrients, ove.  at the full duse has s, nutrients ially impa	AL or toxicant netional potential to s, or composired. Mino	T/I   NA (p. ts through oint and ra deliver low unds such the	roceed to 1 influx of s  ting of hig Wate devel toxica delive other	S/I  .6 (M   4H) urface or gro  h (H), mode rbody on MD opment for "p ints or AA rece rb nigh levels functions are es of nutrients	ound water crate (M), or EQ list of water obable cause reviews or surro of sediments, substantially it or toxicants,	P/P or direct inp low (L) for erbodies in n s' related to ounding land nutrients, or impaired. Mi	S/I	T/E
Wetlands in AA flood or pond < Comments:  14G. SEDIMENT/NUTRIENT Applies to wetlands with p If no wetlands in the AA as i. Rating (Working from top to  Sediment, Nutrient, and Toxicant Inp	ands within the AA 5 out of 10 years 5 out of 10 years  T/TOXICANT RETEN otential to receive excere subject to such input, bottom, use the matrix  AA receives of to moderate le other function sedimentation eutrophication	ss sediments, nu check NA abo pelow to arrive r surrounding lan evels of sediments s are not substant , sources of nutri	P/P    REMOVA  utrients, ove.  at the full duse has s, nutrients ially impa	AL or toxicant nctional population of the potential to so or composired. Mino kicants, or s	T/I   NA (pts through oint and radeliver low unds such through rights of	roceed to 1 influx of s  ting of hig Wate devel toxica delive other	S/I  .6 (M   4H) urface or gro  h (H), mode rbody on MD opment for "p ints or AA rece rb nigh levels functions are es of nutrients	ound water corate (M), or EQ list of water obable cause believes or surroof sediments, is substantially it	P/P   or direct inp  low (L) for erbodies in n s' related to punding land nutrients, or impaired. Misor signs of et	ut.  this function eed of TMDL sediment, nutri use has potenti compounds sucajor sedimentat	T/E

NA (proceed to 14E)

14D. GENERAL FISH/AQUATIC HABITAT RATING

AA contains no or restricted outlet

Comments: Treats adjacent agricultural runoff.

AA contains unrestricted outlet

B-22

1 (H)



A	pplies	IENT/SHO only if AA to wave act	occurs or	or with	in the ban	ks or a ri	iver, strean	NA (proc n, or othe			made drai	nage, o	r on the sh	oreline of	`a stand	ing water	body th	at is
		rking from to	_										moderate (N	A), or low (	L) for thi	s function.		
		er of wetlar ne by speci				uration o	of Surface	Water A	,									
	ootma	- 1	es with de	ep, oma		Perman	ent / Peren	mial	⊠Sea	asonal / Ir	termittent		Tempora	ry / Ephe	meral			
		≥	65 %															
			-64 %							.6 (M	)							
Comme	mta		35 % rubs along	r notual v	untar agus	*00												
Comme	ents:	rew sn	rubs along	g actual v	vater cour	se.												
i. Ratir	ıg (W	JCTION E	top to bo	ottom, us	e the mat	rix below	to arrive a	at the fun	nctional	point and	rating of	high (H	), moderat	e (M), or	low (L)	for this fu	ınction.	
		e of vegeta outlet; <b>P/I</b>												ether or n	ot the A	A contain	s a surfa	ice or
A	litace		getated co				nai/micrim				1-5 acres			☐ Veg	etated c	omponent	<1 acre	;
В		High		oderate		Low		ligh		Moderate		Low		High	_=	loderate		Low
C			□Y	□N	ΠY	□N	⊠Y	□N	□Y		□Y	□N	Y	□N	□Y	□N	□Y	□N
P/P S/I							.8H											
T/E/A								1							1			
Comme	ents:																	
i. 🗌	Disch	NDWATEI narge Indic Springs a Vegetatio Wetland c Seeps are A perm Wetland c Other	re known on growing occurs at t present a anently fle contains a	or observed during the toe of the wet boded during noutlet,	ved. dormant s a natural land edge ring drou but no in	season/dr slope. ght perio	rought.	ii.	. 🔲 Re	charge In Perma Vetla Other	adicators eable substant contain	trate pre	esents with but not out	tlet.			-	
iii. <b>R</b>	ating	: Use the ii	nformation		4J(i) and Criteria	14j(ii) ab	ove and th	e table b	elow to	arrive at			nt and rational Point an		(H) or	low (L) fo	or this fu	inction.
AA	has k	nown Disc	harge/Rec			or more	indicators	of D/R p	resent		11	unction	1 (H)	u Katilig				
		narge/Recha																
		e Discharge	/Recharge	informa	tion inad	equate to	rate AA E	O/R poter	ntial									
	NIQU	UENESS	1		4			441 C	<i>i</i> • 1		1	u: La	D 1		1 (1)	e di e		
1. Kau		Orking from	•	<i>A</i>	AA contain >80 yr-old	s fen, bog. ) forested	w to arrive , warm sprin wetland or p S1" by the M	igs or mat		AA does t types and	not contain p structural d s plant asso	previous iversity (	ly cited rare (#13) is high isted as "S2"	AA d types	oes not c	ontain prevations and	iously ci	
		tive Abundan		1	□rare	)	Common		ındant	□rare	⊠com		□abundar			Commo	1 🗆	abundant
		nce at AA ( sturbance at		i)							.5N							
		ince at AA		.,														
Comme	ents:																	
i. ii. iii	Is the Chec	EATION / e AA a knock categori ed on the lo	own recre es that ap ocation, d eed to 14I	ational oply to the iversity, (ii) and	or educate AA: size, and then 14L	ional site Education Other site (iv).]	ational / sc ite attribu   N	ientific s tes, is th No [Rate	ere a st	Con trong pot in 14L(iv)	sumptive in the sumption of the sumption of the sum of	rec. <b>recreat</b>	ional or e	consumpt	ive rec. al use?	ed to 14L	· /1	
iv.	. Kat	t <b>ing</b> (Use th	ie matrix t	below to	arrive at	ne functi	ional point Disturba				oderate (N	1), or lo	w (L) for t	inis functi	on.			
	Ov	wnership			Lov	V	Distuiba	Mod		π1Δ(1)	П	High						
	Pu	ıblic owner	ship								-	-						
	Pr	rivate owne	rship								.1(	L)						

Private ownership -Comments: Private land with no access.



### FUNCTION, VALUE SUMMARY, AND OVERALL RATING

Function and Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	Low	0.30	1	
B. MT Natural Heritage Program Species Habitat	High	1.00	1	
C. General Wildlife Habitat	High	0.90	1	
D. General Fish/Aquatic Habitat	Low	0.30	1	
E. Flood Attenuation	Moderate	0.50	1	
F. Short and Long Term Surface Water Storage	Moderate	0.60	1	
G. Sediment/Nutrient/Toxicant Removal	High	1.00	1	
H. Sediment/Shoreline Stabilization	Moderate	0.60	1	
I. Production Export/Food Chain Support	High	0.80	1	
J. Groundwater Discharge/Recharge	High	1.00	1	
K. Uniqueness	Moderate	0.50	1	
L. Recreation/Education Potential	Low	0.10	1	
	Totals:	<u>7.60</u>	<u>12.00</u>	
	Percent of	Total Possible Points:	63% (Actual / Possible)	x 100 [rd to nearest whole #]

Category I Wetland: (Must satisfy one of the following criteria. If not proceed to Category II.)  ☐ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; or  ☐ Score of 1 functional point for Uniqueness; or  ☐ Score of 1 functional point for Flood Attenuation and answer to Question 14E(ii) is "yes"; or  ☐ Percent of total Possible Points is > 80%.
Category II Wetland: (Criteria for Category I not satisfied and meets any one of the following Category II criteria. If not satisfied, proceed to Category IV.)  Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; or  Score of .9 or 1 functional point for General Wildlife Habitat; or  Score of .9 or 1 functional point for General Fish/Aquatic Habitat; or  "High" to "Exceptional" ratings for both General Wildlife Habitat and General Fish / Aquatic Habitat; or  Score of .9 functional point for Uniqueness; or  Percent of total possible points is > 65%.
☐ Category III Wetland: (Criteria for Categories I, II, or IV not satisfied.)
Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; If not satisfied, proceed to Category III.)  "Low" rating for Uniqueness; and  "Low" rating for Production Export / Food Chain Support; and  Percent of total possible points is < 30%.
OVERALL ANALYSIS AREA (AA) RATING: (Check appropriate category based on the criteria outlined above.)



MIL	T MONTA	NA WETLANL	) ASSES	SMENT FORM	l (revised May 25	, 1999	)	
1. Project Name: Musgrave Lake N	Mitigation Projec	<u>t</u> 2.	Project #:	130091-019	Control #: <u>NA</u>			
3. Evaluation Date: <u>7/27/2004</u>	4. Eva	luator(s): Berglun	<u>d</u>	5. We	etland / Site #(s): RS-	1		
6. Wetland Location(s) i. T: 32	N R: 21 E	<b>S:</b> <u>11</u>		T: <u>N</u> R:	E S:			
ii. Approx. Stationing / Milepos	ts: NA							
iii. Watershed: <u>10050004</u>		GPS Reference l	No. (if appl	ies): NA				
Other Location Information:	Restoration Site	e 1, NW corner of e	asement, so	outh of Zurich, south	of Milk River, Blaine	County.		
7. A. Evaluating Agency MDT  B. Purpose of Evaluation:  Wetlands potentially afficiation wetlands; promotion of the property o	e-construction	roject 9. Asses		12.19 a (total acres):	_ (visually estimated) (measured, e.g. GPS) (visually (measured)			
<ul><li>✓ Mitigation wetlands; po</li><li>✓ Other</li></ul>	st-construction	Comme	nts: Restora	ation Site I				
10. CLASSIFICATION OF WET	LAND AND AC	QUATIC HABITA'	TS IN AA					
HGM CLASS <sup>1</sup>	SYSTEM <sup>2</sup>	SUBSYSTEM	2	CLASS <sup>2</sup>	WATER REGIN	1E <sup>2</sup>	MODIFIER <sup>2</sup>	% OF AA
Depression	Palustrine	None	Em	ergent Wetland	Seasonally Floor	ded	Impounded	15
Depression	Palustrine	None	Scru	b-Shrub Wetland	Seasonally Floor	led	Impounded	5
Depression	Palustrine	None	Fo	rested Wetland	Seasonally Floor	led	Impounded	5
Depression	Palustrine	None		Aquatic Bed	Semipermanently Fl	ooded	Impounded	75
$^{1}$ = Smith et al. 1995. $^{2}$ = Cowardin	et al. 1979.	•						
11. ESTIMATED RELATIVE AB Common Comment  12. GENERAL CONDITION OF i. Regarding Disturbance: (1)	AA					,		
			Predo	minant Conditions Ad	jacent (within 500 Feet)			
Conditions Within AA	state; is not	ged in predominantly r grazed, hayed, logged onverted; does not con s.	, or	Land not cultivated, be or hayed or selectivel subject to minor clear or buildings.		subject clearing	Iltivated or heavily grazed to substantial fill placements, or hydrological alteration building density.	ent, grading,
AA occurs and is managed in predominan a natural state; is not grazed, hayed, logge or otherwise converted; does not contain roads or occupied buildings.				low dis	sturbance			
AA not cultivated, but moderately grazed hayed or selectively logged or has been subject to relatively minor clearing, or fill placement, or hydrological alteration; contains few roads or buildings.								
AA cultivated or heavily grazed or logged subject to relatively substantial fill placement, grading, clearing, or hydrologi alteration; high road or building density.								
Comments: (types of distur	bance, intensity,	season, etc.) Grazii	ng and hayl	and occur adjacent to	site.			
ii. Prominent weedy, alien, &	introduced spe	ecies: <u>CIR ARV, P</u>	HA ARU, I	PHL PRA, KOC SCC	<u>)</u>			
iii. Briefly describe AA and s with partial SS and FO fringe. Surro			storation Si	te #1 in NW corner of	of site. Large, impound	ded mars	h / transitional open v	vater area
13. STRUCTURAL DIVERSITY	(Based on 'Class	s' column of #10 ab	ove.)					
Number of 'Cowardin' Vegetated Classes Present in AA	≥3 Vegeta	ted Classes or class is forested		ted Classes or ted	≤ 1 Vegetated Class			
Select Rating		High						



Comments: \_\_

	TAT FOR FEDER AA is Documented								ATEN	IED (	OR E	NDAN	GERI	ED P	LAN	ΓS AN	ID Al	NIMAI	LS				
P S Ir	rimary or Critical h econdary habitat ( <b>li</b> ncidental habitat ( <b>li</b> lo usable habitat	abitat (list st species)	specie )	es) [		∃s ∃s ∃s	Bal	ld Eag	<u>le</u>														
	Rating (Based on th									_	_	_		_				` ' '	Low			funct	ion.
Highest Ha	ibitat Level	doc/prim	nary	sus/	prima	ary	doc	/secor	ndary	sus	/seco	ndary	doc/	/incid	lental	sus	/incid	lental		none	:		
Functional	Point and Rating																.3 (L	.)					
	If docum	ented, list	the so	urce	(e.g.,	obser	vatio	ns, re	cords,	etc.):												₫	
ii. A P S	TAT FOR PLANT Do not include spec AA is Documented or trimary or Critical he econdary habitat (listicidental habit	cies listed i (D) or Susp abitat (list st species)	in 14A pected specie	(i). (S) to es) \[ \bigsize \bigzize \bigzize \bigzize \bigzize \bigzize \bigzize \bizeta \bigzize \bizeta \biz	cont	ain (ch	neck					IONT	ANA N	NATI	URAI	L HEI	RITA	GE PR	OGR	RAM.			
N	lo usable habitat	_			] D [	S																	
vi. <b>F</b>	Rating (Based on th	e strongest	t habita	at cho	sen ir	n 14B(	(i) ab	ove, f	ind th	e corr	espon	ding r	ating o	of Hig	sh (H)	, Mod	erate	(M), or	Low	(L) fo	or this	funct	ion.
Highest Ha	abitat Level:	doc/prim	nary	sus/	prima	ary	doc	/secor	ndary	sus	/seco	ndary	doc/	/incid	lental	sus	/incid	lental		none			
Functional	Point and Rating	1 (H)	)																				
		ented, list												frog	s obse	erved a	at RS1	in 200	1 and	1 2002	; hab	itat co	nditions
continu	ie to improve. Not	observed i	n 2003	, but	nume	rous le	eopa	rd frog	gs obs	erved	again	in 200	)4 <u>.</u>										
	al Wildlife Habita Evidence of overall		ico in ti	ho A	<b>.</b> (C	'hoole	aitha	r guba	tantia	l mod	larata	or lov	)										
⊠ obs ⊠ abs	tial (based on any o servations of abund undant wildlife sign esence of extremely erviews with local	ant wildlif such as so limiting h	fe #s or cat, trac abitat f	cks, n featur	est str	ructure t avail	es, ga able	ame tr	ails, e	etc.			Lov		few of little spars	or no v to no se adja	wildlit wildli cent u	fe sign	rvatio food s	source	es		se periods
obs	te (based on any of servations of scatter mmon occurrence of equate adjacent uplaterviews with local	red wildlife of wildlife s and food so	e group sign su ources	ch as	scat,	tracks	, nes						ak per	riods									
ii. <b>Wi</b> l	ldlife Habitat Feat	ures (Wor	king fr	om to	p to b	ootton	ı, sel	ect ap	propri	iate A	A attr	ibutes	to dete	ermin	e the	excep	tional	(E), hig	gh (H	), mo	derate	(M),	or low (I
ratir	ng. Structural diver	sity is fron	n#13.	For o	class o	cover t	to be	consi	dered	evenl	y dist	ributec	l, vege	tated	class	es mu:	st be v	vithin 2	20% o	of each	othe	r in te	rms of
thei	r percent compositi	on in the A	AA (see	e #10)	. Du	ration	of S	urface	Wate	er: P/I	P = pe	rmane	nt/pere	ennial	l; S/I =	= seas	onal/i	ntermit	tent;				
	= temporary/ephen		,	ĺ							•		1										
	actural Diversity (fr						MH	Iigh							Mo	derate	;					ow	
	ss Cover Distribution (1) (1) (1) (1) (2) (2) (2) (2) (2) (2) (2) (2) (2) (2	on			⊠Ev	/en			Uur	neven			□Ev	ven			Uı	neven			ШΕ	ven	
Dur 10%	ration of Surface W 6 of AA			P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A	P/P	S/I	T/E	A
Mo	w disturbance at AA derate disturbance				E		1		1	1				1 1	1	1					1 1		
	e #12) <b>th</b> disturbance at A	A (see #12)	) .																				
iii. Rat	<b>ing</b> (Using 14C(i) at this function.)				the m			to ar				nal po	I.										
F	Evidence of Wildlife	e Use		<b>7</b>			Wild	life H			ures		g from		(ii)				]				
<u> </u>	from 14C(i)		×	Exc		nal	1	L	Hig	h	-	<u> </u>	Modera	ate	_	[	Lov	V	4				
	Substantial         1 (E)              Moderate																						

Comments: Numerous waterfowl broods, shorebirds, western chorus and leopard frogs observed, as well as numerous additional bird species.

Low



14D. GENERAL FISH/AQUA	TIC HABITAT RATING rically used by fish due to lack of h		oceed to 14I	/	eck the N	A hox above	p.			
	or the existing situation is "correct							ded by perc	hed culvert	or other
	n the AA but is not desired from a d as "Low", applied accordingly in					use within a	an irrigation	canal], the	n Habitat Qı	ality
	propriate AA attributes in matrix to	pick the ex	xceptional (1	E), high (H	), moderat	te (M), or lo	w (L) qualit	y rating.		
Duration of Surface Water in AA		□Pe	rmanent/Per	ennial	□Sea	asonal / Inte	rmittent	□Ten	nporary / Ep	hemeral
Cover - % of waterbody in AA c										
submerged logs, large rocks & b	oulders, overhanging banks,	>25%	10-25%	<10%	>25%	10-25%	<10%	>25%	10-25%	<10%
floating-leaved vegetation) Shading - >75% of streambank of	or shareling of AA contains									
riparian or wetland scrub-shrub										
Shading – 50 to 75% of streamba										
riparian or wetland scrub-shrub		1								
Shading - < 50% of streambank							-			
riparian or wetland scrub-shrub or forested communities.										
included on the 'MDEQ list of w  Y  N  If yes, re-	Is fish use of the AA precluded or vaterbodies in need of TMDL deveduce the rating from 14D(i) by one om 14D(i) and 14D(ii) above and the m	elopment' we level and o	ith 'Probable check the mo	e Impaired odified hab	Uses' list itat quality	ed as cold o y rating:	r warm wat	er fishery o H	r aquatic life	e support?
Types of Fish Known or			Modified	Habitat Q	<b>uality</b> fro	m 14D(ii)				
Suspected Within AA	☐ Exceptional		High			☐ Modera	ate		Low	
Native game fish										
Introduced game fish										
Non-game fish										
No fish Comments: NA										
If wetlands in AA do not f	N ☐ NA (proceed to 14 ubject to flooding via in-channel o looded from in-channel or overban bottom, mark the appropriate attrib	r overbank ik flow, che	ck NA abov		int and rat	ing of high	(H), modera	te (M), or l	ow (L) for the	nis
Estimated wetland area in AA su	bject to periodic flooding		$\boxtimes \ge 10$ a	acres		$\square$ <10, >2	acres		≤2 acre	es
% of flooded wetland classified	as forested, scrub/shrub, or both	75%	6 25-75	% <25%	6 75%	25-759	% <25%	75%	25-75%	<25%
AA contains no outlet or restric	cted outlet			.6 (M	(I)					
AA contains unrestricted outlet	i .									
carry flood flows from the Milk  14F. SHORT AND LONG TE Applies to wetlands that fle If no wetlands in the AA a  i. Rating (Working from top to		what "artificate AGE whannel flow check NA a	NA (prov. precipitation in the control of the cont	ceed to 14 on, upland	G) surface fletting of high	an irrigation	ditch. How	vever, the d	litch could b	e used to
	water contained in wetlands within					□ <5, >1 ac	ere feet		≤1 acre f	oot
Duration of surface water at wet		P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond ≥			.9 (H							
Wetlands in AA flood or pond <										
Comments:	•	•			<u>,                                      </u>	•	•	•		
Applies to wetlands with p	T/TOXICANT RETENTION AN otential to receive excess sedimen- re subject to such input, check NA	ts, nutrients		NA (pross through i			ound water	or direct inp	out.	

i. Rating (Working from top to bottom, use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.)

AA receives or surrounding land use has potential to deliver low

Waterbody on MDEQ list of waterbodies in need of TMDL

AA receives or surrounding land use has potential to deliver low development for "probable causes" related to sediment, nutrients, or to moderate levels of sediments, nutrients, or compounds such that Sediment, Nutrient, and Toxicant Input toxicants or AA receives or surrounding land use has potential to other functions are not substantially impaired. Minor Levels Within AA deliver high levels of sediments, nutrients, or compounds such that sedimentation, sources of nutrients or toxicants, or signs of other functions are substantially impaired. Major sedimentation, eutrophication present. sources of nutrients or toxicants, or signs of eutrophication present. % cover of wetland vegetation in AA □ ≥ 70% ☐ < 70%
</p> □ ≥ 70% ☐ < 70%
</p> Evidence of flooding or ponding in AA ☐ Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No AA contains no or restricted outlet AA contains unrestricted outlet

Comments:



Ap	EDIMENT/SHORE plies only if AA occupiect to wave action.	urs on or wi	ithin the banks or	a river, strean	NA (proceed n, or other n	d to 14I) natural or	man-n	nade draii	nage, or	on the sho	oreline of	a standi	ng water	body tha	ıt is
i. Rating	(Working from top to b	oottom, use th	he matrix below to a	rrive at the func	ctional point a	and rating e	xceptio	onal (E), hi	gh (H), n	noderate (M	f), or low (	L) for thi	s function.		
	Cover of wetland str		200000	on of Surface	Water Adja	acent to R	ooted	Vegetatio	on						
	oreline by species was otmasses.	ith deep, bi	nding Perr	nanent / Peren	nnial [	⊠Seasona	ıl / Inte	ermittent		Tempora	ry / Epher	neral			
	≥ 65 %														
	35-64 %														
Comme	< 35 %		on is developing a	along dikes			2 (L)								
i. <b>Ratin A</b> = a	g (Working from top creage of vegetated c	to bottom, component i permanent/p	use the matrix be in the AA. $\mathbf{B} = st$	low to arrive a	sity rating fi	rom #13. <b>A</b> = tempo	C = Y rary/e <sub>j</sub>	es (Y) or phemeral	: No (N)	, moderate as to whe	ther or no	ot the A	for this fu	s a surfa	
В		☐ Moderat		□I	High	Mode			Low		High		oderate		Low
С		Y	N Y	N Y		Y [	N	□Y	□N	$\square \overline{Y}$	□N	Y	□N	□Y	□N
P/P		-													
S/I	.9Н					-									
T/E/A Comme	-4	-													
	□ Vegetation gro     □ Wetland occur     □ Seeps are pres     □ AA permanen     □ Wetland conta     □ Other	rs at the toe sent at the w tly flooded	of a natural slope vetland edge. during drought p	e.						ut not out	•				
iii. <b>R</b> a	ating: Use the inform	nation from		) above and th	e table belo	w to arriv	e at th					(H) or l	ow (L) fo	r this fu	nction.
A A	has known Discharge	a/P agharga	Criteria	ra indiantara	of D/P pros	ant		Fu	inctiona	Point and	1 Rating				
	Discharge/Recharge i			ne mulcators	of D/K pics	SCIIL									
	ilable Discharge/Rec			e to rate AA D	D/R potentia	al									
Commercial		-			·	·	nt and	rating of	hịah (U	) modorat	ra (M) ar	low (L)	for this f	imation	
	Replacement Potential		AA contains fen, (>80 yr-old) fores association listed	bog, warm sprin ted wetland or p as "S1" by the N	ngs or mature blant	types or co	does no s and st	ot contain p tructural di plant assoc	oreviously versity (#	cited rare \$\frac{1}{2}\$13) is high sted as "\$2"	AA de types	oes not co	ontain prev ations and is low-moo	iously cite structural	
	Relative Abundance from		□rare	common	abunda		rare	Com		□abundan			commor	1 <u>a</u>	abundant
	turbance at AA (#12i te disturbance at AA	/					<u>-</u>	.6M							
	turbance at AA (#12	. /					-								
Comme	nts:														
i. ii. iii.	ECREATION / EDU Is the AA a known to Check categories the Based on the location  Yes [Proceed to Parting (Use the process)]	recreationa nat apply to ion, diversi to 14L (ii) a	al or educational the AA:	ducational / sc er site attribu	tes, is there No [Rate as	dy e a strong low in 14	Const g poter L(iv)]	umptive r	ec. recreati	☐ Non-onal or eo	consumpt lucationa	ive rec.  al use?	ed to 14L(	· /-	
IV.	Rating (Use the ma	airix below	to arrive at the fu					uerate (M	ı), or lov	v (L) for t	nis runcti	on.			
	Ownership		Low	Disturba	nce at AA f  Modera		) <u> </u>	Пн	High						
	Public ownership								•						
	Private ownership	)						.1(1	L)						

Private ownership -Comments: Private land with no access.



### FUNCTION, VALUE SUMMARY, AND OVERALL RATING

Function and Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	Low	0.30	1	
B. MT Natural Heritage Program Species Habitat	High	1.00	1	
C. General Wildlife Habitat	Except.	1.00	1	
D. General Fish/Aquatic Habitat	NA	0.00		
E. Flood Attenuation	Moderate	0.60	1	
F. Short and Long Term Surface Water Storage	High	0.90	1	
G. Sediment/Nutrient/Toxicant Removal	NA	0.00		
H. Sediment/Shoreline Stabilization	Low	0.20	1	
I. Production Export/Food Chain Support	High	0.90	1	
J. Groundwater Discharge/Recharge	High	1.00	1	
K. Uniqueness	Moderate	0.60	1	
L. Recreation/Education Potential	Low	0.10	1	
	Totals:	<u>6.60</u>	<u>10.00</u>	
	Percent of	66% (Actual / Possible	) x 100 [rd to nearest whole #]	

☐ Score of 1 functional p☐ Score of 1 functional p☐	fust satisfy <b>one</b> of the following criteria. If not proceed to Category II.) point for Listed/Proposed Threatened or Endangered Species; <b>or</b> point for Uniqueness; <b>or</b> point for Flood Attenuation <b>and</b> answer to Question 14E(ii) is "yes"; <b>or</b> ble Points is > 80%.	
Score of 1 functional p Score of .9 or 1 function Score of .9 or 1 function "High" to "Exceptional	riteria for Category I not satisfied <b>and</b> meets any <b>one</b> of the following Category II criteria. If not satisfied, proceed to Category IV point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; <b>or</b> ional point for General Wildlife Habitat; <b>or</b> ional point for General Fish/Aquatic Habitat; <b>or</b> al' ratings for <b>both</b> General Wildlife Habitat <b>and</b> General Fish / Aquatic Habitat; <b>or</b> point for Uniqueness; <b>or</b> ble points is > 65%.	7.)
☐ Category III Wetland:	d: (Criteria for Categories I, II, or IV not satisfied.)	
Category IV Wetland: (Cr	Criteria for Categories I or II are not satisfied and <u>all</u> of the following criteria are met; If not satisfied, proceed to Category III.) queness; and duction Export / Food Chain Support; and	
Category IV Wetland: (Cr     "Low" rating for Uniqu     "Low" rating for Produ     Percent of total possibl	Criteria for Categories I or II are not satisfied and <u>all</u> of the following criteria are met; If not satisfied, proceed to Category III.) queness; and duction Export / Food Chain Support; and	



#### MDT MONTANA WETLAND ASSESSMENT FORM (revised May 25, 1999)

14110 1		WI WEILMIL	, INDOES	DIVILLITI I ORIV	i (i evised iviay 25	, 1)))	,			
1. Project Name: Musgrave Lake Mit	igation Project	<u>t</u> 2.	Project #:	130091-019	Control #: NA					
<b>3. Evaluation Date:</b> <u>7/27/2004</u>	4. Eva	luator(s): Berglun	<u>d</u>	5. W	etland / Site #(s): RS-	<u>2</u>				
6. Wetland Location(s) i. T: $\underline{32}$ $\underline{N}$ ii. Approx. Stationing / Mileposts	<b>R</b> : <u>21</u> <u>E</u> : <u>NA</u>	<b>S</b> : <u>11, 12</u>		T: <u>N</u> R:	<u>E</u> <b>S</b> :					
iii. Watershed: <u>10050004</u>		GPS Reference 1	No. (if appl	ies): NA						
Other Location Information: I	Restoration Site	e 2, SE corner of ea	sement, sou	nth of Zurich, south o	of Milk River, Blaine C	ounty.				
7. A. Evaluating Agency MDT		8. Wetla	and Size (to		_ (visually estimated) (measured, e.g. GPS)					
B. Purpose of Evaluation:  Wetlands potentially affec Mitigation wetlands; pre- Mitigation wetlands; post Other	construction			a (total acres):	${6.67}$ (visually ${}$					
10. CLASSIFICATION OF WETLA	AND AND AÇ	UATIC HABITA'	TS IN AA							
HGM CLASS <sup>1</sup>	SYSTEM <sup>2</sup>	SUBSYSTEM	2	CLASS <sup>2</sup>	WATER REGIN	1E <sup>2</sup>	MODIFIER <sup>2</sup>	% OF AA		
Depression	Palustrine	None	Em	ergent Wetland	Seasonally Floor	led	Impounded	80		
Depression	Palustrine	None	Scru	b-Shrub Wetland	Seasonally Floor	led	Impounded	10		
Depression	Palustrine	None		Aquatic Bed	Seasonally Floor	led	Impounded	10		
<sup>1</sup> = Smith et al. 1995. <sup>2</sup> = Cowardin et	al. 1979.									
Common Comments:  12. GENERAL CONDITION OF A	A	v to select appropria		/		Ź				
	Land manage	ged in predominantly r	Predo		jacent (within 500 Feet) out moderately grazed		ultivated or heavily grazed	l or loggad:		
Conditions Within AA	state; is not	grazed, hayed, logged onverted; does not con	, or	or hayed or selectivel		subject clearing	to substantial fill placements, or hydrological alterations building density.	ent, grading		
AA occurs and is managed in predominantly a natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings.							moderate disturband	ce		
AA not cultivated, but moderately grazed or hayed or selectively logged or has been subject to relatively minor clearing, or fill placement, or hydrological alteration; contains few roads or buildings.										
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrologica alteration; high road or building density.	1									
Comments: (types of disturba	ince, intensity,	season, etc.) Grazii	ng and hayl	and occur adjacent to	site.					
ii. Prominent weedy, alien, & i	ntroduced spe	ecies: <u>CIR ARV, P</u>	HL PRA, K	COC SCO						
iii. Briefly describe AA and su component. Surrounding land use is a		d use / habitat: Re	storation Si	te #2 in SE corner of	f site. Large, impound	ed marsh	n / oxbow area with pa	rtial SS		
13. STRUCTURAL DIVERSITY (E	ased on 'Class	s' column of #10 ab	ove.)							
Number of 'Cowardin' Vegetated Classes Present in AA	≥3 Vegeta	ted Classes or class is forested		ted Classes or ted	≤ 1 Vegetated Class					
Select Rating		High								



Comments: \_\_\_

Primary or Critical habitat (list species)								
Highest Habitat Level doc/primary sus/primary doc/secondary sus/secondary doc/incidental sus/incidental none Functional Point and Rating 3.3 (L)								
Highest Habitat Level doc/primary sus/primary doc/secondary sus/secondary doc/incidental sus/incidental none Functional Point and Rating 3.3 (L)	etion							
Functional Point and Rating3 (L)	etion.							
If documented, list the source (e.g., observations, records, etc.):								
14B. HABITAT FOR PLANTS AND ANIMALS RATED AS S1, S2, OR S3 BY THE MONTANA NATURAL HERITAGE PROGRAM.  Do not include species listed in 14A(i).  iii. AA is Documented (D) or Suspected (S) to contain (check box):								
Primary or Critical habitat (list species)								
ix. Rating (Based on the strongest habitat chosen in 14B(i) above, find the corresponding rating of High (H), Moderate (M), or Low (L) for this fun	ction.							
Highest Habitat Level: doc/primary sus/primary doc/secondary sus/secondary doc/incidental sus/incidental none								
Functional Point and Rating 1 (H)								
14C. General Wildlife Habitat Rating iii. Evidence of overall wildlife use in the AA: (Check either substantial, moderate, or low)  Substantial (based on any of the following)  □ boservations of abundant wildlife #s or high species diversity (during any period) □ dew or no wildlife observations during peak □ presence of extremely limiting habitat features not available in the surrounding area □ interviews with local biologists with knowledge of the AA □ moderate (based on any of the following) □ doservations of scattered wildlife groups or individuals or relatively few species during peak periods □ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc. □ adequate adjacent upland food sources □ interviews with local biologists with knowledge of the AA □ wildlife Habitat Features (Working from top to bottom, select appropriate AA attributes to determine the exceptional (E), high (H), moderate (M rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in their percent composition in the AA (see #10). Duration of Surface Water: P/P = permanent/perennial; S/I = seasonal/intermittent;	edge of AA							
T/E = temporary/ephemeral; A= absent.								
Structural Diversity (from #13)								
Class Cover Distribution (all vegetated classes)								
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	E <b>A</b>							
Low disturbance at AA (see #12)								
Moderate disturbance at AA								
High disturbance at AA (see #12)								
iii. <b>Rating</b> (Using 14C(i) and 14C(ii) above and the matrix below to arrive at the functional point and rating of exceptional (E), high (H), moderate (M), or low for this function.)								
Wildlife Hebitet Feetunes Deti from 140(2)								
Evidence of Wildlife Use from 14C(i)								

Comments: <u>Numerous waterfowl, shorebirds, western chorus frogs, northern leopard frogs observed.</u>



If the AA is not or was not histor Assess if the AA is used by fish of barrier, etc.]. If fish use occurs in [14D(i)] below should be marked	or the exis	sting situation is "correct but is not desired from a	able" such resource r	that the nanagem	AA co	uld be us spective	ed by fish (e.g. fish	ι [ <i>e.g.</i> fish ι	ise is precli				
i. <b>Habitat Quality</b> (Pick the app	propriate A	AA attributes in matrix to	pick the e	exception	al (E),	high (H)	, moderat	e (M), or lo	ow (L) qual	ity rating.			
Duration of Surface Water in AA				ermanent				asonal / Inte			Temporary /	Ephe	meral
Cover - % of waterbody in AA co submerged logs, large rocks & bo floating-leaved vegetation)			>25%	10-25	5%	<10%	>25%	10-25%	<10%	>25%			<10%
Shading - >75% of streambank o									M				
riparian or wetland scrub-shrub of Shading – 50 to 75% of streamba													
riparian or wetland scrub-shrub of Shading - < 50% of streambank of													
riparian or wetland scrub-shrub o													
ii. Modified Habitat Quality: included on the 'MDEQ list of w  Y	raterbodies duce the ra	s in need of TMDL deve ating from 14D(i) by one	lopment' v level and	vith 'Prol	bable I e modi	mpaired fied habi	Uses' list tat quality	ed as cold or rating:	or warm wa	ter fisher	y or aquatic	life s	oody upport?
Types of Fish Known or				Modi	fied H	abitat O	<b>uality</b> fro	m 14D(ii)					
Suspected Within AA		Exceptional		☐ Hi			,	Moder	ate		⊠ Lo	w	
Native game fish													
Introduced game fish													
Non-game fish									.3 (L	)			
No fish													
14E. FLOOD ATTENUATION Applies only to wetlands su If wetlands in AA do not fl  i. Rating (Working from top to function.)	ubject to f looded fro	m in-channel or overban	r overbank k flow, ch	eck NA a		ional poi	nt and rat	ing of high	(H), moder	ate (M), o	or low (L) fo	or this	3
Estimated wetland area in AA su					10 acre	es		<b>⊠</b> <10, >2			<u></u> ≤2 :		
% of flooded wetland classified a	as forested	l, scrub/shrub, or both	759	% 25	-75%	<25%	75%	25-75	% <25%	6 759	% 25-7	5%	<25%
AA contains <b>no outlet or restric</b> AA contains <b>unrestricted outlet</b>		t			<u></u>				.5 (M				
ii. Are residences, businesses, c \[ \begin{array}{ c c c c c c c c c c c c c c c c c c c	nents:  1 the Milk  RM SUR  1 the subject  1 bottom, uent/perent	This function is some River.  FACE WATER STOR and from overbank or in-cepto flooding or ponding, of the set the matrix below to a mial; S/I = seasonal/intermatrix	AGE hannel flocheck NA rrive at the mittent; T/I	☐ NA w, precipabove.	(proce itation	ed to 140, upland a	timately of high	occurs via a	n irrigation	ditch. H	lowever, the	ditch	
Estimated maximum acre feet of the AA that are subject to period:			n	<b>⊠</b> >5	acre fo	eet		□ <5, >1 a	cre feet		≤1 ac	re foo	ot
Duration of surface water at wetl			P/1	Р	S/I	T/E	P/P	S/I	T/E	P/1	P S/	Ι	T/E
Wetlands in AA flood or pond ≥				.9	(H)								
Wetlands in AA flood or pond <	5 out of 1	10 years											
Comments:  14G. SEDIMENT/NUTRIENT Applies to wetlands with pour If no wetlands in the AA and i. Rating (Working from top to lead to be a sediment Nutrient and Toxicant Incompared to the sediment Nutrient Incompared to the sediment Incompared to the sediment Incompared to the sediment Nutrient Incompared to the sediment Nutrient Incompared to the sediment Incom	otential to re subject bottom, us	receive excess sediment to such input, check NA se the matrix below to ar AA receives or surroundin to moderate levels of sedir	ts, nutrient above. rrive at the ag land use h ments, nutrie	functional functional as potential ents, or con	cants that the cants the cants the cants the cants all to delumpound	hrough in  t and rati  liver low	ng of high	h (H), mode body on MD opment for "p	erate (M), o EQ list of was	r low (L)	for this fun in need of TM I to sediment,	IDL nutrie	nts, or
Sediment, Nutrient, and Toxicant Input Levels Within AA  to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.  to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.  to moderate levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.									n that on, esent.				
		<b>⋈</b> ≥ 70%			~ /U/0			11/	/ W / 0		1 1	~ /W/(	U

NA (proceed to 14E)

14D. GENERAL FISH/AQUATIC HABITAT RATING

LAND & WATER

☐ No

Yes

☐ No

Yes

☐ No

☐ Yes

X Yes

1 (H)

☐ No

Evidence of flooding or ponding in AA

Comments: <u>Treats adjacent agricultural runoff.</u>

AA contains no or restricted outlet

AA contains unrestricted outlet

A	pplies of	ENT/SHO nly if AA wave acti	occurs on	or within	n the ban	ks or a riv	er, strean	NA (proc n, or other			nan-m	nade drai	nage, o	r on the sh	oreline o	f a standi	ng water	body tł	nat is	
i. Ratin	<b>g</b> (Worki	ing from top	to bottom	, use the n	natrix belo	w to arrive	at the func	tional poi	int and r	ating ex	ceptio	nal (E), h	igh (H),	moderate (N	M), or low	(L) for thi	s function.			
		of wetlan				uration oj	f Surface	Water A	djacen	t to Ro	oted	Vegetati	on							
	horeline ootmass	by specieses.	es with de	ep, bindi	ng [	Permane	ent / Peren	mial	□Se	easonal	/ Inte	ermittent		Tempora	ry / Ephe	meral				
			65 %																	
		35-	64 %																	
			35 %																	
Comme	ents:	Nomina	l flow cor	nponent	no wav	e action.														
i. <b>Ratin A</b> = a	<b>1g</b> (Wor	ction Existing from of vegetat utlet; P/P	top to bo	ttom, use nent in tl	the mati	rix below  B = structi	to arrive a	sity ratin	g from	#13. <b>(</b>	C = Y	es (Y) o	r No (N	as to wh						
A			getated co									-5 acres			☐ Ve	getated co	omponent	<1 acr	e	
В		High	-,	oderate		Low	□I	High		Modera	ite		Low		High	□M	oderate			
С	$\Box$ Y	□N	⊠Y	□N	□Y	□N	$\square Y$	□N	$\square$ Y		N	$\square$ Y	□N	$\square$ Y	□N	$\square$ Y	□N	□Y	ľ□N	
P/P																				
S/I			.8H																	
T/E/A								-												
jii <b>D</b>		Wetland o Seeps are AA perma Wetland c Other Use the in	present at anently flo contains ar	the wetle oded dur outlet, b	and edge ring drou out no inl	ght period et.		e table b	elow to			e functio	nnal noi:	nt and rati	ng of hig	h (H) or <sup>1</sup>	ow (L) fo	or this f	inction	
111. IN	ating.	OSC the III	Hormation		Criteria	17)(11) 400	ove and th	c table b	ciow ic	J allive	at tii			al Point an		11 (11) 01 1		n uns 1	unction.	
AA	has kno	own Disch	narge/Recl	harge are	a or one	or more ii	ndicators of	of D/R p	resent					1 (H)						
No	Dischar	rge/Rechai	rge indica	tors pres	ent															
Av	ailable I	Discharge/	Recharge	informat	tion inade	equate to	rate AA D	O/R poter	ntial											
Comme	NIQUE	ENESS rking fron	n top to bo	ottom, us	e the mat	trix below	to arrive	at the fu	nctiona	al point	and 1	rating of	high (H	I), modera	te (M), o	r low (L)	for this f	unction	1.	
	•	ement Pote		(> as	80 yr-old	s fen, bog, ) forested w listed as "S	vetland or p	olant	ure	types	and stains	ructural d plant asso	iversity (	y cited rare #13) is high sted as "S2	types diver	or associ	ontain prevations and is low-mo	structura		
		e Abundana		l l	□rare		common		ındant	□ra		⊠com	mon	abunda			Commo	1 [	abundant	
		e at AA (#							-						-	-				
		irbance at		)				-	-			.5N	1		-	-				
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i. ii. iii	Is the A Check Based S Ratin Owr	ATION / I AA a kno categorie I on the lo Yes [Proce ag (Use the nership	wn recreates that appointed to 14L	ational o ply to th iversity, (ii) and	r educat e AA: size, and then 14L	ional site Educa other sit (iv).]	tional / sc te attribu	ientific s tes, is the No [Rate and ratio	study nere a s as low ng of h A from	strong j in 14L	Consu poten (iv)]	umptive intial for	rec. recreat  1), or lo	ional or e	consump ducation	tive rec. al use?	ed to 14Ll	· / -		
	Priv	ate owner	rship									.1(	L)							

Private ownership -Comments: Private land with no access.



### FUNCTION, VALUE SUMMARY, AND OVERALL RATING

Function and Value Variables	Rating	Actual Functional Points	Possible Functional Points	Functional Units (Actual Points x Estimated AA Acreage)
A. Listed/Proposed T&E Species Habitat	Low	0.30	1	
B. MT Natural Heritage Program Species Habitat	High	1.00	1	
C. General Wildlife Habitat	High	0.90	1	
D. General Fish/Aquatic Habitat	Low	0.30	1	
E. Flood Attenuation	Moderate	0.50	1	
F. Short and Long Term Surface Water Storage	High	0.90	1	
G. Sediment/Nutrient/Toxicant Removal	High	1.00	1	
H. Sediment/Shoreline Stabilization	NA	0.00		
I. Production Export/Food Chain Support	High	0.80	1	
J. Groundwater Discharge/Recharge	High	1.00	1	
K. Uniqueness	Moderate	0.50	1	
L. Recreation/Education Potential	Low	0.10	1	
	Totals:	<u>7.30</u>	<u>11.00</u>	
	Percent of	Total Possible Points:	66% (Actual / Possible	) x 100 [rd to nearest whole #]

Score of 1 funct  Score of 1 funct  Score of 1 funct	: (Must satisfy <b>one</b> of the following criteria. If not proceed to Category II.) ional point for Listed/Proposed Threatened or Endangered Species; <b>or</b> ional point for Uniqueness; <b>or</b> ional point for Flood Attenuation <b>and</b> answer to Question 14E(ii) is "yes"; <b>or</b> Possible Points is > 80%.
Score of 1 funct Score of .9 or 1 Score of .9 or 1 "High" to "Exce Score of .9 funct	d: (Criteria for Category I not satisfied and meets any one of the following Category II criteria. If not satisfied, proceed to Category IV.) ional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; or functional point for General Wildlife Habitat; or functional point for General Fish/Aquatic Habitat; or ptional" ratings for both General Wildlife Habitat and General Fish / Aquatic Habitat; or tional point for Uniqueness; or possible points is > 65%.
☐ Category III We	etland: (Criteria for Categories I, II, or IV not satisfied.)
Category IV Wetlar  "Low" rating for "Low" rating for	etland: (Criteria for Categories I, II, or IV not satisfied.)  nd: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; If not satisfied, proceed to Category III.)  Uniqueness; and Production Export / Food Chain Support; and possible points is < 30%.
Category IV Wetlar  "Low" rating for  "Low" rating for	ad: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; If not satisfied, proceed to Category III.) Uniqueness; and Production Export / Food Chain Support; and



## Appendix C

# REPRESENTATIVE PHOTOGRAPHS 2004 AERIAL PHOTOGRAPH

MDT Wetland Mitigation Monitoring Musgrave Lake Zurich, Montana



### 2004 MUSGRAVE LAKE - SHEET 1



RS1, Transect 1 from Start, 10 degrees N/NE



RS1, Transect 1 from End, 192 degrees S/SW



ES1, Transect 2 from Start, 106 degrees E/SE



ES1, Transect 2 from End, 299 degrees W/NW



RS2, Transect 3 from Start, 167 degrees S/SE



RS2, Transect 3 from End, 354 degrees N/NW



### 2004 MUSGRAVE LAKE - SHEET 2

### **Intentionally Left Blank**

#### **Intentionally Left Blank**





RS2, Photo Point 2, 100 degrees E



RS2, Photo Point 3, 54 degrees NE



RS2, Photo Point 4, 19 degrees S



### 2004 MUSGRAVE LAKE - SHEET 3



ES1, Photo Point 4, 15 degrees N



ES1, Photo Point 5, 123 degrees SE



ES1, Photo Point 5, 290 degrees W/NW (adjacent upland)



RS1, Photo Point 6, 310 degrees NW



RS1, Photo Point 7, 143 degrees SE

**Intentionally Left Blank** 



### 2004 MUSGRAVE LAKES AERIAL PHOTOGRAPH





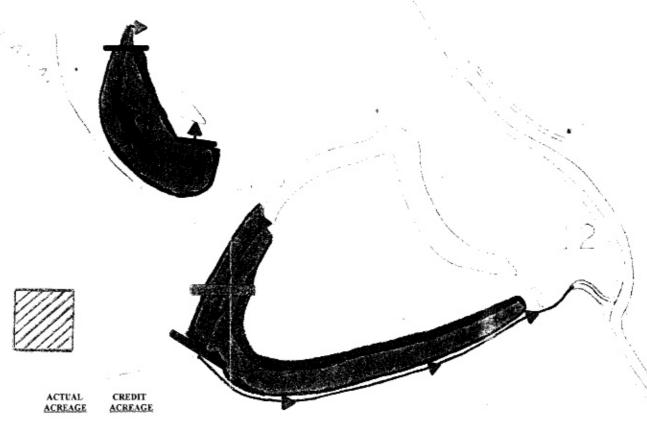
## Appendix D

### **CONCEPTUAL SITE LAYOUT**

MDT Wetland Mitigation Monitoring Musgrave Lake Zurich, Montana



# MUSGRAVE LAKE RANCH WETLAND RESTORATION CONCEPTUAL PLAN



SYMBOL	DESCRIPTION	ACREAGE	ACREAGI
	Standing Water Depth from 0" to 24"	16.6 acres	15.2 acres
	Standing Water Depth from 24" to 42"	3.6 acres	3.6 acre
	Riparian and Upland Buffer	8.4 acres	8.4 acres 27.2 acres
100	Ditch Plug/Dike		
	Borrow Area and Road Fill (existing)		

**Existing Ditches** 

### Appendix E

# BIRD SURVEY PROTOCOL GPS PROTOCOL

MDT Wetland Mitigation Monitoring Musgrave Lake Zurich, Montana



#### **BIRD SURVEY PROTOCOL**

The following is an outline of the MDT Wetland Mitigation Site Monitoring Bird Survey Protocol. Though each site is vastly different, the bird survey data collection methods must be standardized to a certain degree to increase repeatability. An Area Search within a restricted time frame will be used to collect the following data: a bird species list, density, behavior, and habitat-type use. There will be some decisions that team members must make to fit the protocol to their particular site. Each of the following sections and the desired result describes the protocol established to reflect bird species use over time.

#### Species Use within the Mitigation Wetland: Survey Method

Result: To conduct a bird survey of the wetland mitigation site within a restricted period of time and the budget allotment.

#### Sites that can be circumambulated or walked throughout.

These types of sites will include ponds, enhanced historic river channels, wet meadows, and any area that can be surveyed from the entirety of its perimeter or walked throughout. If the wetland is not uncomfortably inundated, conduct several "meandering" transects through the site in an orderly fashion (record the number and approximate location/direction of the transects in the field notebook; they do not have to be formalized or staked). If a very small portion of the site cannot be crossed due to inundation, this method will also apply. Though the sizes of the site vary, each site will require surveying to the fullest extent possible within a set time limit. The optimum times to conduct the survey are in the morning hours. Conduct the survey from sunrise to no later than 11:00 AM. (Note: some sites may have to be surveyed in the late afternoon or evening due to time constraints or weather; if this is the case, record the time of day and include this information in your report discussion.) If the survey is completed before 11:00 AM and no additions are being made to the list, then the task is complete. The overall limiting factor regarding the number of hours that are spent conducting this survey is the number of budgeted hours; this determination must be made by site by each individual.

In many cases, binoculars will be the only instrument that is needed to identify and count the birds using the wetland. If the wetland includes deep water habitat that can not be assessed with binoculars, then a scope and tripod are necessary. If this is the case, establish as many lookout posts as necessary from key vantage points to collect the data. Depending on the size of the open water, more time may be spent viewing the mitigation area from these vantage points than is spent walking the peripheries of more shallow-water wetlands.

#### Sites that cannot be circumambulated.

These types of sites will include large-bodied waters, such as reservoirs, particularly those with deep water habitat (>6 ft) close to the shore and no wetland development in that area of the shoreline. If one area of the reservoir was graded in such a way to create or enhance the development of a wetland, then that will be the area in which the ambulatory bird survey is conducted. The team member must then determine the length of the shoreline that will be surveyed during each visit.



As stated above in the ambulatory site section, these large sites most likely will have to be surveyed from established vantage points.

#### Species Use within the Mitigation Wetland: Data Recording

Result: A complete list of bird species using the site, an estimate of bird densities and associated behaviors, and identification of habitat use.

#### 1. Bird Species List

Record the bird species on the Bird Survey - Field Data Sheet using the appropriate 4-letter code of the common name. The coding uses the first two letters of the first two words of the birds' common name or if one name, the first four (4) letters. For example, mourning dove is coded MODO and mallard is MALL. If an unknown individual is observed, use the following protocol and define your abbreviation at the bottom of the field data sheet: unknown shorebird: UNSB; unknown brown bird (UNBR); unknown warbler (UNWA); unknown waterfowl (UNWF). For a flyover of a flock of unknown species, use a term that describes the birds' general characteristics and include the approximate flock size in parentheses; do not fill in the habitat column. For example, a flock of black, medium-sized birds could be coded: UNBB / FO (25). You may also note on the data sheet if that particular individual is using a constructed nest box.

#### 2. Bird Density

In the office, sum the Bird Survey – Field Data Sheet data by species and by behavior. Record this data in the Bird Summary Table.

#### 3. Bird Behavior

Bird behavior must be identified by what is known. When a species is simply observed, the behavior that it is immediately exhibiting is what is recorded. Only behaviors that have discreet descriptive terms should be used. The following terms are recommended: breeding pair individual (BP); foraging (F); flyover (FO); loafing (L; e.g. sleeping, roosting, floating with head tucked under wing are loafing behaviors); and, nesting (N). If more behaviors are observed that do have a specific descriptive word, use them and we will add it to the protocol; descriptive words or phrases such as "migrating" or "living on site" are unknown behaviors.

#### 4. Bird Species Habitat Use

We are interested in what bird species are using which particular habitat within the mitigation wetlands. This data is easily collected by simply recording what habitat the species was initially observed. Use the following broad category habitat classifications: aquatic bed (AB - rooted floating, floating-leaved, or submergent vegetation); forested (FO); marsh (MA – cattail, bulrush, emergent vegetation, etc. with surface water); open water (OW – primarily unvegetated); scrubshrub (SS); and upland buffer (UP); wet meadow (WM – sedges, rushes, grasses with little to no surface water). If other categories are observed onsite that are not suggested here, we will make a new category next year.



# **GPS Mapping and Aerial Photo Referencing Procedure**

The wetland boundaries, photograph location points and sampling locations were field located with mapping grade Trimble Geo III GPS units. The data was collected with a minimum of three positions per feature using Course/Acquisition code. The collected data was then transferred to a PC and differentially corrected to the nearest operating Community Base Station. The corrected data was then exported to ACAD drawings in Montana State Plain Coordinates NAD 83 international feet.

The GPS positions collected and processed had a 68% accuracy of 7 feet except in isolated areas of Tasks .008 and .011, where it went to 12 feet. This is within the 1 to 5 meter range listed as the expected accuracy of the mapping grade Trimble GPS.

Aerial reference points were used to position the aerial photographs. This positioning did not remove the distortion inherent in all photos; this imagery is to be used as a visual aide only. The located wetland boundaries were given a final review by the wetland biologist and adjustments were made if necessary.

Any relationship of features located to easement or property lines are not to be construed from these figures. These relationships can only be determined with a survey by a licensed surveyor.



# **Appendix F**

# 2004 MACROINVERTEBRATE SAMPLING PROTOCOL AND DATA

MDT Wetland Mitigation Monitoring Musgrave Lake Zurich, Montana



# AQUATIC INVERTEBRATE SAMPLING PROTOCOL

#### **Equipment List**

- D-frame sampling net with 1 mm mesh. Wildco is a good source of these.
- Spare net.
- 1-liter plastic sample jars, wide-mouth. VWR has these: catalog #36319-707.
- 95% ethanol: Northwest Scientific in Billings carries this.

All these other things are generally available at hardware or sporting goods stores. Make the labels on an ink jet printer preferably.

- hip waders.
- pre-printed sample labels (printed on Rite-in-the-Rain or other coated paper, two labels per sample).
- pencil.
- plastic pail (3 or 5 gallon).
- large tea strainer or framed screen.
- towel.
- tape for affixing label to jar.
- cooler with ice for sample storage.

#### Site Selection

Select the sampling site with these considerations in mind:

- Select a site accessible with hip waders. If substrates are too soft, lay a wide board down to walk on.
- Determine a location that is representative of the overall condition of the wetland.

### **Sampling**

Wetland invertebrates inhabit the substrate, the water column, the stems and leaves of aquatic vegetation, and the water surface. Your goal is to sweep the collecting net through each of these habitat types, and then to combine the resulting samples into the 1-liter sample jar.

Dip out about a gallon of water into the pail. Pour about a cup of ethanol into the sample jar. Fill out the top half of the sample labels, using pencil, since ink will dissolve in the ethanol.

Ideally, you can sample a swath of water column from near-shore outward to a depth of approximately 3 feet with a long sweep of the net, keeping the net at about half the depth of the water throughout the sweep. Sweep the water surface as well. Pull the net through a vegetated area, beneath the water surface, for at least a meter of distance.

Sample the substrate by pulling the net along the bottom, bumping it against the substrate several times as you pull.

This step is optional, but it gives you a chance to <u>see</u> that you've collected some invertebrates. Rinse the net out into the bucket, and look for insects, crustaceans, etc. If necessary, repeat the sampling process in a nearby location, and add the net contents to the bucket. Remember to sample all four environments.

Sieve the contents of the bucket through the straining device and pour or carefully scrape the contents of the strainer into the sample jar.

If you skip the bucket-and-sieve steps, simply lift handfuls of material out of the sampling net into the jars. In either case, please include some muck or mud and some vegetation in the jar. Often, you will have collected a large amount of vegetable material. If this is the case, lift out handfuls of material from the sieve into the jar, until the jar is about half full. Please limit material you include in the sample, so that there is only a single jar for each sample.

Top off the sample jar with enough ethanol to cover all the material in the jar. Leave as little headroom as possible.

It is not necessary to sample habitats in any specified order. Keep in mind that disturbing the habitats prior to sampling will chase off the animals you are trying to capture.

Complete the sample labels. Place one label inside the sample jar and tape the other label securely to the outside of the jar. Dry the jar before attaching the outer label if necessary. In some situations, it may be necessary to collect more than one sample at a site. If you take multiple samples from the same site, clearly indicate this by using individual sample numbers, along with the total number of samples collected at the site (e.g. Sample #3 of 5 total samples).

Photograph the sampled site.

# Sample Handling/Shipping

- In the field, keep collected samples cool by storing them in a cooler. Only a small amount of ice is necessary.
- Inventory all samples, preparing a list of all sites and enumerating all samples, before shipping or delivering to the laboratory.
- Deliver samples to Rhithron.

# MDT Wetland Mitigation Monitoring Project Aquatic Invertebrate Monitoring Summary 2001 - 2004

#### **METHODS**

Among other monitoring activities, aquatic invertebrate assemblages were collected at a number of mitigation wetlands throughout Montana. This report summarizes data generated from four years of collection.

The method employed to assess these wetlands is based on constructing an index using a battery of 12 bioassessment metrics or attributes (Table1) tested and recommended by Stribling et al. (1995) in a report to the Montana Department of Health and Environmental Science. In that study, it was determined that some of the metrics were of limited use in some geographic regions, and for some wetland types. Despite that finding, all 12 metrics are used in this evaluation of mitigated wetlands, since detailed geographic information and wetland classifications were unavailable.

Scoring criteria for metrics were developed by generally following the tactic used by Stribling et al. Boxplots were generated using a statistical software package, and distributions, median values, ranges, and quartiles for each metric were examined. All sites in all years of sampling were used. Camp Creek, which was sampled in 2002, 2003, and 2004, was assessed using the tested metric battery developed for montane streams of Western Montana (Bollman 1998). The fauna at the Camp Creek site was different from that of the other sites, and suggested montane stream conditions rather than wetland conditions. For the wetlands, "optimal" scores were generally those that fell above the 75th percentile (for those metrics that decrease in value in response to stress) or below the 25th percentile (for metrics that respond to stress by an increase in value) of all scores. Additional scoring ranges were established by bisecting the range below the 75th percentile for decreasing scores (or above the 25th percentile for increasing scores) into "sub-optimal" and "poor" assessment categories. A score of 5, 3, or 1 was assigned to optimal, sub-optimal, and poor metric performance, respectively. In this way, metric values were translated into normalized metric scores, and scores for all metrics were summed to produce a total bioassessment score. Total bioassessment scores were classified according to a similar process, using the ranges and distributions of total scores for all sites studied in all years.

The purpose of constructing an index from biological attributes or metrics is to provide a means of integrating information to facilitate the determination of whether management action is needed. The nature of the action needed is not determined solely by the index score, however, but by consideration of an analysis of the component metrics, the taxonomic composition of the assemblages, and other issues. The diagnostic functions of the metrics and taxonomic data need more study; our understanding of the interrelationships of natural environmental factors and anthropogenic disturbances are tentative. Thus, the further interpretive remarks accompanying the raw taxonomic and metric data are offered cautiously.

#### Sample processing

Aquatic invertebrate samples were collected at mitigation wetland sites in the summer months of 2001, 2002, 2003, and 2004 by personnel of Land and Water Consulting, Inc. Sampling procedures utilized were based on the protocols developed by the Montana Department of Environmental Quality (MT DEQ). Sampling consisted of D-frame net sweeps through emergent vegetation (when present), the water column, over the water surface, and included disturbing and scraping substrates at each sampled sites. Samples were preserved in ethanol at each wetland site and subsequently delivered to Rhithron Associates, Inc. for processing, taxonomic determinations, and data analysis.

At Rhithron's laboratory, Caton subsamplers and stereomicroscopes with 10X magnification were used to randomly select a minimum of 100 organisms, when possible, from each sample. In some cases, the entire sample contained fewer than 100 organisms; in these cases, all organisms from the sample were taken. Taxa were identified in general accordance with the taxonomic resolution standards set out in the MT DEQ Standard Operating Procedures for Sampling and Sample Analysis (Bukantis 1998). All samples were re-identified by a second taxonomist for quality assurance purposes. The identified samples have been archived at Rhithron's laboratory. Taxonomic data and organism counts were entered into an Excel 2000 spreadsheet, and metrics were calculated and scored using spreadsheet formulae.

#### **Bioassessment metrics**

An index based on the performance of 12 metrics was constructed, as described above. Table 1 lists those metrics, describes their calculation and the expected response of each to increased degradation or impairment of the wetland.

In addition to the summed scores of each metric and the associated impairment classification described above, each individual metric informs the bioassessment to some degree. The four richness metrics (Total taxa, POET, Chironomidae taxa, and Crustacea taxa + Mollusca taxa) can be interpreted to express habitat complexity as well as water quality. Complex, diverse habitats consist of variable substrates, emergent vegetation, variable water depths and other factors, and are potential features of long-established stable wetlands with minimal human disturbance. In the study conducted by Stribling et al. (1995), all four richness metrics were found to be significantly associated with water quality parameters including conductance, salinity, and total dissolved solids.

Four composition metrics (%Chironomidae, %Orthocladiinae of Chironomidae, %Crustacea + %Mollusca, and %Amphipoda) measure the relative contributions of certain taxonomic groups that may have significant responses to habitat and/or water quality impacts. For example, amphipods have been demonstrated to increase in abundance in alkaline conditions. Short-lived, relatively mobile taxa such as chironomids dominate ephemeral environments; many are hemoglobin-bearers capable of tolerating de-oxygenated conditions.

Two tolerance metrics (the Hilsenhoff Biotic Index and %Dominant taxon) were included in the bioassessment battery. The HBI indicates the overall invertebrate assemblage tolerance to nutrient enrichment, warm water, and/or low dissolved oxygen conditions. The percent

abundance of the dominant taxon has been demonstrated to be strongly associated with pH, conductance, salinity, total organic carbon, and total dissolved solids.

Two trophic measures (%Collector-gatherers and %Filterers) may be helpful in expressing functional integrity of the invertebrate assemblage, which can be impacted by poor water quality or habitat degradation. High proportions of filtering organisms suggest nutrient and/or organic enrichment, while abundant collectors suggest more positive functional conditions and well-developed wetland morphology. These organisms graze periphyton growing on stable surfaces such as macrophytes.

#### RESULTS

In 2001, 29 sites were sampled statewide. Nineteen of these sites were revisited in 2002, and 13 new sites were sampled. In 2003, 17 sites that had been visited in both 2001 and 2002 were resampled, and 11 sites sampled for the first time in 2001 were re-visited. In addition, 2 new sites were sampled. In 2004, 25 sites were re-visited, and 6 new sites were sampled. Thus, the 2004 database contains data for 122 sampling events at 50 unique sites. Table 2 summarizes sites and sampling years.

Metric scoring criteria were re-developed each year as new data was added. For 2004, all 122 records were utilized. Ranges of individual metrics, as well as median metric values remained remarkably consistent in each of the 4 years; minimal changes resulted from the addition of new data in 2004. The summary metric values and scores for the 2004 samples are given in Tables 3a-3d.

#### Literature cited

Bollman, W. 1998. Montana Valleys and Foothill Prairies Ecoregion. Master's Thesis. (M.S.) University of Montana. Missoula, Montana.

Bukantis, R. 1998. Rapid bioassessment macroinvertebrate protocols: Sampling and sample analysis SOP's. Working draft. Montana Department of Environmental Quality. Planning Prevention and Assistance Division. Helena, Montana.

Stribling, J.B., J. Lathrop-Davis, M.T. Barbour, J.S. White, and E.W. Leppo. 1995. Evaluation of environmental indicators for the wetlands of Montana: the multimetric approach using benthic macroinvertebrates. Report to the Montana Department of Health and Environmental Science. Helena, Montana.

Table 1. Aquatic invertebrate metrics employed in the MTDT mitigation wetland monitoring study, 2001-2004.

Metric	Metric Calculation	Expected Response to Degradation or Impairment
Total taxa	Count of unique taxa identified to lowest recommended taxonomic level	Decrease
POET	Count unique Plecoptera, Trichoptera, Ephemeroptera, and Odonata taxa identified to lowest recommended taxonomic level	Decrease
Chironomidae taxa	Count unique midge taxa identified to lowest recommended taxonomic level	Decrease
Crustacea taxa + Mollusca taxa	Count unique Crustacea taxa and Mollusca taxa identified to lowest recommended taxonomic level	Decrease
% Chironomidae	Percent abundance of midges in the subsample	Increase
Orthocladiinae/Chironomidae	Number of individual midges in the sub-family Orthocladiinae / total number of midges in the subsample.	Decrease
%Amphipoda	Percent abundance of amphipods in the subsample	Increase
%Crustacea + %Mollusca	Percent abundance of crustaceans in the subsample plus percent abundance of molluscs in the subsample	Increase
нві	Relative abundance of each taxon multiplied times that taxon's modified Hilsenhoff Biotic Index value. These numbers are summed over all taxa in the subsample.	Increase
%Dominant taxon	Percent abundance of the most abundant taxon in the subsample	Increase
%Collector-Gatherers	Percent abundance of organisms in the collector-gatherer functional group	Decrease
%Filterers	Percent abundance of organisms in the filterer functional group	Increase

**Table 2.** Montana Department of Transportation Mitigated Wetlands Monitoring Project sites. 2001 – 2004.

2001	2002	2003	2004
Beaverhead 1	Beaverhead 1	Beaverhead 1	Beaverhead 1
Beaverhead 2	Beaverhead 2		
Beaverhead 3	Beaverhead 3		Beaverhead 3
Beaverhead 4	Beaverhead 4	Beaverhead 4	
Beaverhead 5	Beaverhead 5	Beaverhead 5	Beaverhead 5
Beaverhead 6	Beaverhead 6	Beaverhead 6	Beaverhead 6
Big Sandy 1	Detti-ciricum o	Denvernen o	Denvernena o
Big Sandy 2	<u> </u>		
Big Sandy 3			
Big Sandy 4			
Johnson-Valier			
VIDA			
Cow Coulee	Cow Coulee	Cow Coulee	
Fourchette - Puffin	Fourchette - Puffin	Fourchette - Puffin	Fourchette - Puffin
Fourchette -	Fourchette -	Fourchette -	Fourchette -
Flashlight	Flashlight	Flashlight	Flashlight
Fourchette -	Fourchette -	Fourchette -	Fourchette -
Penguin	Penguin	Penguin	Penguin
Fourchette -	Fourchette -	Fourchette -	Fourchette -
Albatross	Albatross	Albatross	Albatross
Big Spring	Big Spring	Big Spring	Big Spring
Vince Ames	_ · · ·		· · ·
Ryegate			
Lavinia			
Stillwater	Stillwater	Stillwater	Stillwater
Roundup	Roundup	Roundup	Roundup
Wigeon	Wigeon	Wigeon	Wigeon
Ridgeway	Ridgeway	Ridgeway	Ridgeway
Musgrave – Rest. 1	Musgrave - Rest. 1	Musgrave - Rest. 1	Musgrave – Rest. 1
Musgrave – Rest. 2	Musgrave – Rest. 2	Musgrave - Rest. 2	Musgrave - Rest. 2
Musgrave – Enh. 1	Musgrave – Enh. 1	Musgrave – Enh. 1	Musgrave - Enh. 1
Musgrave – Enh. 2			
Ŭ	Hoskins Landing	Hoskins Landing	Hoskins Landing
	Peterson - 1	Peterson - 1	Peterson – 1
	Peterson – 2		Peterson – 2
	Peterson – 4	Peterson – 4	Peterson – 4
	Peterson – 5	Peterson - 5	Peterson – 5
	Jack Johnson -	Jack Johnson -	
	main	main	
	Jack Johnson - SW	Jack Johnson - SW	
	Creston	Creston	Creston
	Lawrence Park		
	Perry Ranch		
	SF Smith River	SF Smith River	SF Smith River
	Camp Creek	Camp Creek	Camp Creek
	Kleinschmidt	Kleinschmidt –	Kleinschmidt –
		pond	pond
		Kleinschmidt –	Kleinschmidt –
		stream	stream
		Ringling - Galt	
			Circle
			Cloud Ranch Pond
			Cloud Ranch
			Stream
			Colloid
I			Jack Creek
			Norem

Table 3a.

	BEAVER HEAD #1	BEAVER HEAD #3	BEAVER HEAD #5	BEAVER HEAD #6	BIG SPRING CREEK	CIRCLE	CLOUD RANCH POND	CLOUD RANCH STREAM	COLLOID	CRESTON
Total taxa	27	12	21	18	25	16	16	20	8	18
POET	3	0	2	3	4	2	2	4	2	3
Chironomidae taxa	7	5	5	5	8	5	6	11	1	2
Crustacea + Mollusca	7	3	4	6	7	1	6	1	1	7
% Chironomidae	0.33636	0.18888	0.39285	0.57547	0.44329	0.55855	0.41666	0.84	0.09090	0.06087
Orthocladiinae/Chir	0.05405	0.35294	0.06818	0.36065	0.27907	0.69354	0.4	0.16666	0	0
%Amphipoda	0.03636	0	0.01785	0.05660	0.05154	0	0.00925	0	0	0
%Crustacea + %Mollusca	0.31818	0.73333	0.05357	0.12264	0.18556	0.03603	0.36111	0.01	0.09090	0.73913
HBI	7.97169	7.88888	8.36363	8.15789	7.61855	7.19090	7.32291	4.84	6	6.92173
%Dominant taxon	0.2	0.57777	0.23214	0.25471	0.23711	0.38738	0.13888	0.38	0.27272	0.37391
%Collector-Gatherers	0.40909	0.75555	0.51785	0.62264	0.78350	0.05405	0.67592	0.74	0.18181	0.29565
%Filterers	0.12727	0	0	0	0.01030	0.15315	0.09259	0.17	0	0.06087
Total taxa	5	1	5	3	5	3	3	3	1	3
POET	3	1	1	3	5	1	1	5	1	3
Chironomidae taxa	5	3	3	3	5	3	3	5	1	1
Crustacea + Mollusca	5	1	3	5	5	1	5	1	1	5
% Chironomidae	3	3	3	1	1	1	1	1	5	5
Orthocladiinae/Chir	1	3	1	3	3	5	3	1	1	1
%Amphipoda	5	5	5	3	3	5	5	5	5	5
%Crustacea + %Mollusca	5	1	5	5	5	5	3	5	5	1
HBI	1	1	1	1	1	3	3	5	5	3
%Dominant taxon	5	1	5	5	5	3	5	3	5	3
%Collector-Gatherers	1	3	3	3	3	1	3	3	1	1
%Filterers	1	3	3	3	3	1	1	1	3	1
	40 0.666667	26 0.433333	38 0.633333	38 0.633333	0.733333	32 0.533333	36 0.6	38 0.633333	34 0.566667	32 0.533333
	sub- optimal	poor	sub- optimal	sub- optimal	optimal	sub- optimal	sub- optimal	sub- optimal	sub- optimal	sub-optimal

Table 3b.

	FOURCHETTE CREEK ALBATROSS RESERVOIR	FOURCHETTE CREEK FLASHLIGHT RESERVOIR	FOURCHETTE CREEK PENGUIN RESERVOIR	FOURCHETTE CREEK PUFFIN RESERVOIR	JACK CREEK	MDT CAMP CREEK	MDT HOSKINS LANDING	MDT KLEINSCHMIDT CREEK	MDT KLEINSCHMIDT POND
Total taxa	18	23	19	22	23	35	25	19	19
POET	3	5	4	3	5	12	4	4	6
Chironomidae taxa	6	9	6	4	88	14	4	6	4
Crustacea + Mollusca	3	4	5	8	7	1	6	2	4
% Chironomidae	0.135135	0.265306	0.066116	0.247934	0.352113	0.37963	0.036697	0.438776	0.047619
Orthocladiinae/Chir	0.2	0.346154	0.625	0.3	0.52	0.585366	0.5	0.627907	0.8
%Amphipoda	0.126126	0.336735	0.578512	0.041322	0.028169	0	0.018349	0.010204	0.009524
%Crustacea + %Mollusca	0.684685	0.387755	0.77686	0.371901	0.380282	0.111111	0.541284	0.061224	0.190476
HBI	7.972973	7.216495	7.7	6.950413	7.647059	4.570093	6.59633	6.561224	6.67619
%Dominant taxon	0.495495	0.336735	0.561983	0.140496	0.15493	0.111111	0.366972	0.316327	0.552381
%Collector-Gatherers	0.873874	0.816327	0.702479	0.38843	0.394366	0.416667	0.091743	0.683673	0.114286
%Filterers	0	0.010204	0.132231	0.008264	0.042254	0.12037	0.018349	0.153061	0.047619
Total taxa									
POET	3	5	3	5	5	5	5	3	3
Chironomidae taxa	3	5	5	3	5	5	5	5	5
Crustacea + Mollusca	3	5	3	3	5	5	3	3	3
% Chironomidae	1	3	3	5	5	1	5	1	3
Orthocladiinae/Chir	5	3	5	3	3	3	5	1	5
%Amphipoda	3	3	5	3	5	5	5	5	5
%Crustacea + %Mollusca	3	1	1	3	5	5	5	5	5
HBI	1	3	1	3	3	5	3	5	5
%Dominant taxon	1	3	1	3	1	5	5	5	5
%Collector-Gatherers	1	5	1	5	5	5	3	5	1
%Filterers	5	5	3	1	1	1	1	3	1
	3	3	1	3	3	1	3	1	3
	32	44	32	40	46	46	48	42	44
	0.533333	0.733333	0.533333	0.666667	0.766667	0.766667	0.8	0.7	0.733333
	sub-optimal	optimal	sub-optimal	optimal	optimal	optimal	optimal	optimal	optimal

Table 3d.

	ROUNDUP	SOUTH FORK SMITH RIVER	STILLWATER	WIGEON
Total taxa	9	20	23	16
POET	0	5	4	3
Chironomidae taxa	4	7	9	5
Crustacea + Mollusca	3	3	4	3
% Chironomidae	0.55	0.482143	0.466667	0.314815
Orthocladiinae/Chir	0.072727	0.055556	0.244898	0.647059
%Amphipoda	0	0.071429	0.12381	0.481481
%Crustacea + %Mollusca	0.42	0.116071	0.180952	0.574074
HBI	8.89	6.589286	6.47619	7.534653
%Dominant taxon	0.28	0.294643	0.133333	0.481481
%Collector-Gatherers	0.56	0.839286	0.628571	0.657407
%Filterers	0.14	0	0	0.083333
Total taxa				
POET	1	3	5	3
Chironomidae taxa	1	5	5	3
Crustacea + Mollusca	3	5	5	3
% Chironomidae	1	1	3	1
Orthocladiinae/Chir	1	1	1	3
%Amphipoda	1	1	3	5
%Crustacea + %Mollusca	5	3	3	1
HBI	3	5	5	3
%Dominant taxon	1	5	5	3
%Collector-Gatherers	5	5	5	3
%Filterers	3	5	3	3
	1	3	3	1
	26	42	46	32
	0.433333	0.7	0.766667	0.533333
	poor	optimal	optimal	Sub-optimal



## Aquatic Invertebrate Taxonomic Data Site Name MUSGRAVE LAKE RS-1

Date Collected 7 /27/2004 Order Family Taxon Count Percent Unique BI FFG Amphipoda Talitridae Hyalella 7 6.86% Yes 8 CG Basommatophora Lymnaeidae Stagnicola 3 2.94% Yes 6 SC Physidae Physidae 27 26.47% Yes 8 SC Planorbidae Gyraulus 37 36.27% Yes 8 SC Coleoptera Haliplidae Haliplus 0.98% Yes 1 5 PH 2 5 Peltodytes 1.96% Yes SH Decapoda 0.98% Decapoda 1 Yes 6 SH Diptera Ceratopogonidae Ceratopogoninae 4 3.92% Yes 6 PR Chironomidae Endochironomus 6 5.88% Yes 10 SH Pseudochironomus 3 2.94% 5 Yes CG **Ephemeroptera** Caenidae Caenis 3 2.94% Yes 7 CG Haplotaxida Naididae Nais 1 0.98% Yes 8 CG Heteroptera Corixidae Corixidae 3 2.94% Yes 10 PH Notonectidae Notonecta 1 0.98% Yes 5 PR Trombidiformes Acari 3 2.94% Yes 5 PR Grand Total 102

#### Activity ID:

 
 Aquatic Invertebrate Data Summary

 Project ID:
 MDT04LW

 STORET Station ID:
 MUSGRAVI

 Station Name:
 MUSGRAVI

 Sample type
 MUSGRAVE LAKE RS-1 Sample Date: 7/27/2004

Sample type												
Portion of samp	OTAL ORGANISMS	\$		7	102 50%		TAXON		ABUNDANCE	PERCENT		
	ber in total sample	P		1:	360		Gyraulus	· · · · · · · · · · · · · · · · · · ·	37	7 36.27%		
Conversion factor		-		17	7.933		Physidae		27	7 26.47%		
	ber in 1 square m	eter			829		Hyalella		7	7 6.86%		
Sampling effort							Endochironomus					
Habitat '							Ceratopogoninae SUBTOTAL 5 DOMINA	NTC	01			
Habitat type EPT abundance					3		SUBTOTAL 5 DOMINA Stagnicola	MINIS	81	79.41%		
Taxa richness					15		Acari			3 2.94% 3 2.94%		
Number EPT tax	xa				1		Caenis		3	3 2.94%		
Percent EPT				2.	94%		Corixidae		3	3 2.94% 3 2.94%		
							Pseudochironomus		3	3 2.94%		
TAXONOMIC C				TAXONOM	IC RATIOS		TOTAL DOMINANTS		96	94.12%		
GROUP	PERCENT AF		TAXA	ME	TRIC	VALUE	TOLERANCE/CONDI			00.00		
Non-insect taxa	a 77.45%	79	0	EPT/Chiror	nomidae	0.33	Community Tolerance	Quotient (CTQa	1)	98.00		
Odonata Ephemeroptera	0.00%	2	1		phemeroptera	0.00 #DIV/0!	Hilsenhoff Biotic Inde	ξ		7.70		
	0.00%	0	0	nydropsyci	nidae/Trichopt	#DIV/0:	DIVERSITY					
Plecoptera Heteroptera	3.92%	4	2				Shannon H (loge)			2.55		
Megaloptera	0.00%	0	Ō				Shannon H (loge) Shannon H (log2)			2.55 1.77		
Trichoptera	0.00%	0	0				Margalef D			3.02 0.21		
Lepidoptera	0.00%	0	0				Simpson D					
Coleoptera	2.94% 3.92%	3	2				Evenness			0.12		
Diptera		4	1				VOLTINISM	A DATE OF A STORE	" m + ** +	nnn onum		
Chironomidae	8.82%	9	2				TYPE	ABUNDANCE	# TAXA	PERCENT		
							Multivoltine	86	9	11.76% 84.31%		
							Univoltine Semivoltine	00	3	3.92%		
							Commonant	4	3	5.54/0		
							TAXA CHARACTERS		#TAXA	PERCENT	_	
l							Tolerant		7	77.45%		
0%	20%	40%	60%	80%	100%		Sensitive		0	0.00%	-	
1	■ Non-insect tax	a Odonata	■ Enhe	emeroptera [	□Plecoptera		Clinger		0	0.00%		·
1	Heteroptera	■ Megaloptera	a ■Trich		Lepidoptera		DIOACCECCATENT	DICEC				
1	■ Coleoptera	Diptera		onomidae	1		BIOASSESSMENT IN B-IBI (Karr et al. )	DICES				
							METRIC	WALLE		SCODE		
FUNCTIONAL C	COMPOSITION			FUNCTION	AL RATIOS	<u> </u>	Taxa richness	VALUE 15		SCORE 1		
GROUP	PERCENT AF	BUNDANCE	#TAXA		TRIC	VALUE	E richness	1		1		
Predator	7.84%	8	3	Scraper/Fil	lterer	#DIV/0!	P richness	0		1		
Parasite	0.00%	0	0	Scraper/Sc	raper + Filtere	1.00	T richness	0		1		
Gatherer	13.73%	14	4				Long-lived	3		3		
Filterer	0.00%	0	0				Sensitive richness	0		1		
Herbivore	0.00%	0	0				%tolerant	77.45%		1		
Piercer	3.92%	67	3				%predators	7.84%		1		
	65.69%	67	3									
Scraper	0.000/	0	2				Clinger richness			2		
Shredder	8.82%	9	3				%dominance (3)	69.61%	TOTAL SCOPE	3	28%	
Shredder Omnivore	0.00%	9 0 0	3 0 0				%dominance (3)	69.61%	TOTAL SCORE		28%	)
Shredder Omnivore	8.82% 0.00% 0.00%	0					%dominance (3)  MONTANA DEQ INDI	69.61%	TOTAL SCORE 1998) Plains		28% Mountain	,
Shredder Omnivore	0.00%	0					%dominance (3)  MONTANA DEQ INDI	69.61%	1998) Plains	Valleys and	Mountain	,
Shredder Omnivore	0.00%	0				Predator	%dominance (3)  MONTANA DEQ INDI  METRIC	69.61%  CES (Bukantis  VALUE	1998)		Mountain Ecoregions	•
Shredder Omnivore	0.00%	0				Predator	%dominance (3)  MONTANA DEQ INDI  METRIC  Taxa richness	69.61% CES (Bukantis	1998) Plains	Valleys and	Mountain	
Shredder Omnivore	0.00%	0					%dominance (3)  MONTANA DEQ INDI  METRIC	69.61%  CES (Bukantis  VALUE  15  1  7.70	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions	
Shredder Omnivore	0.00%	0				Predator Parasite	%dominance (3)  MONTANA DEQ INDI  METRIC  Taxa richness EPT richness Biotic Index %Dominant taxon	69.61%  CES (Bukantis  VALUE  15  1  7.70	Plains  Ecoregions  1 0 0 2	Valleys and Foothills  1 0 0 2	Mountain Ecoregions 0 0 0	
Shredder Omnivore	0.00%	0			N	Parasite	%dominance (3)  MONTANA DEQ INDI  METRIC  Taxa richness EPT richness Biotic Index %Dominant taxon %Collectors	69.61%  CES (Bukantis  VALUE  15 1 7.70 36.27% 13.73%	1998) Plains Ecoregions  1 0 0 2 3	Valleys and Foothills  1 0 0 2 3	Mountain Ecoregions 0 0 0 1 3	
Shredder Omnivore	0.00%	0			N		%dominance (3)  MONTANA DEQ INDI METRIC Taxa richness EPT richness Biotic Index %Dominant taxon %Collectors %EPT	69.61%  CES (Bukantis  VALUE  15 1 7.70 36.27% 13.73% 2.94%	Plains   Ecoregions   1   0   0   2   3   0	Valleys and Foothills  1 0 0 2	Mountain Ecoregions 0 0 0	
Shredder Omnivore	0.00%	0			N	Parasite	%dominance (3)  MONTANA DEQ INDI METRIC Taxa richness EPT richness Biotic Index %Dominant taxon %Collectors %EPT %EPT %Bannon Diversity	69.61%  CES (Bukantis  VALUE  15 1 7.70 36.27% 13.73% 2.94% 1.77	1998   Plains   Ecoregions   1	Valleys and Foothills  1 0 0 2 3 0	Mountain Ecoregions 0 0 0 1 3 0	
Shredder Omnivore	0.00%	0			S	Parasite	%dominance (3)  MONTANA DEQ INDI METRIC Taxa richness EPT richness Biotic Index %Dominant taxon %Collectors %EPT Shannon Diversity %Scrapers +Shredder	69.61%  CES (Bukantis  VALUE  15 1 7.70 36.27% 13.73% 2.94%	Plains Ecoregions  1 0 0 2 3 0 0 3	Valleys and Foothills  1 0 0 2 3	Mountain Ecoregions 0 0 0 1 3	
Shredder Omnivore	0.00%	0			S	Parasite Gatherer	%dominance (3)  MONTANA DEQ INDI METRIC Taxa richness EPT richness Biotic Index %Dominant taxon %Collectors %EPT Shannon Diversity %Scrapers +Shreddet Predator taxa	69.61%  CES (Bukantis  VALUE  15	Plains Ecoregions  1 0 0 2 3 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Valleys and Foothills  1 0 0 2 3 0	Mountain Ecoregions 0 0 0 1 3 0	
Shredder Omnivore	0.00%	0				Parasite Gatherer Filterer	%dominance (3)  MONTANA DEQ INDI METRIC Taxa richness EPT richness Biotic Index %Dominant taxon %Collectors %EPT Shannon Diversity %Scrapers +Shreddet Predator taxa %Multivoltine	69.61%  CES (Bukantis  VALUE  15 1 7.70 36.27% 13.73% 2.94% 1.77 74.51% 3 11.76%	Plains Ecoregions  1 0 0 2 3 0 0 3	Valleys and Foothills  1 0 0 2 3 0	Mountain Ecoregions 0 0 0 1 3 0	
Shredder Omnivore	0.00%	0				Parasite Gatherer	%dominance (3)  MONTANA DEQ INDI METRIC Taxa richness EPT richness Biotic Index %Dominant taxon %Collectors %EPT Shannon Diversity %Scrapers +Shreddet Predator taxa %Multivoltine %H of T TOTAL SCORES	69.61%  CES (Bukantis  VALUE  15 1 7.70 36.27% 13.73% 2.94% 1.77 74.51% 3 11.76% #DIV/0!	1998) Plains Ecoregions  1 0 0 2 3 0 0 1 1 3 11 3	Valleys and Foothills  1 0 0 0 2 3 3 0 0 3 #DIV/0! #DIV/0!	Mountain Ecoregions 0 0 0 1 1 3 0	
Shredder Omnivore	0.00%	0			S	Parasite Gatherer Filterer Herbivore	%dominance (3)  MONTANA DEQ INDI METRIC Taxa richness EPT richness Biotic Index %Dominant taxon %Collectors %EPT Shannon Diversity %SScrapers +Shredder Predator taxa %Multivoltine %H of T TOTAL SCORES PERCENT OF MAXIM	69.61%  CES (Bukantis  VALUE  15 1 7.70 36.27% 13.73% 2.94% 1.77 74.51% 3 11.76% #DIV/0!	1998) Plains Ecoregions  1 0 0 2 3 0 0 1 1 3 43,33	Valleys and Foothills  1 0 0 2 3 3 0 #DIV/0! #DIV/0! #DIV/0!	Mountain Ecoregions 0 0 0 1 1 3 0 7 33.33	
Shredder Omnivore	0.00%	0			S	Parasite Gatherer Filterer	%dominance (3)  MONTANA DEQ INDI METRIC Taxa richness EPT richness Biotic Index %Dominant taxon %Collectors %EPT Shannon Diversity %Scrapers +Shreddet Predator taxa %Multivoltine %H of T TOTAL SCORES	69.61%  CES (Bukantis  VALUE  15 1 7.70 36.27% 13.73% 2.94% 1.77 74.51% 3 11.76% #DIV/0!	1998) Plains Ecoregions  1 0 0 2 3 0 0 1 1 3 11 3	Valleys and Foothills  1 0 0 0 2 3 3 0 0 3 #DIV/0! #DIV/0!	Mountain Ecoregions 0 0 0 1 1 3 0	
Shredder Omnivore	0.00%	0				Parasite Gatherer Filterer Herbivore	%dominance (3)  MONTANA DEQ INDI METRIC Taxa richness EPT richness Biotic Index %Dominant taxon %Collectors %EPT Shannon Diversity %SScrapers +Shredder Predator taxa %Multivoltine %H of T TOTAL SCORES PERCENT OF MAXIM	69.61%  CES (Bukantis  VALUE  15 1 7.70 36.27% 13.73% 2.94% 1.77 74.51% 3 11.76% #DIV/0!	1998) Plains Ecoregions  1 0 0 2 3 0 0 1 1 3 43.33 MODERATE	Valleys and Foothills  1 0 0 2 3 3 0 #DIV/0! #DIV/0! #DIV/0!	Mountain Ecoregions 0 0 0 1 1 3 0 7 33.33	
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Shredder Omnivore	0.00%	0				Parasite Gatherer Filterer Herbivore	%dominance (3)  MONTANA DEQ INDI METRIC Taxa richness EPT richness Biotic Index %Dominant taxon %Collectors %Scrapers + Shredder Predator taxa %Multivottine %H off T TOTAL SCORES PERCENT OF MAXIM IMPAIRMENT CLASS	69.61%  CES (Bukantis  VALUE  15 1 7.70 36.27% 13.73% 2.94% 1.77 74.51% 3 11.76% #DIV/0!	1998) Plains Ecoregions  1 0 0 2 3 0 0 1 1 3 43.33 MODERATE	Valleys and Foothills  1 0 0 2 3 3 0 #DIV/0! #DIV/0! #DIV/0! #DIV/0! metric batteries	Mountain Ecoregions 0 0 0 1 1 3 0 3 3 7 33.33 MODERATE	
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# Aquatic Invertebrate Taxonomic Data Site Name MUSGRAVE LAKE RS-2

Date Collected 7 /27/2004

Order	Family	Taxon	Count	Percent	Unique	ві	FFG
		Nematoda	_1	0.87%	Yes	5	PA
		Ostracoda	57	49.57%	Yes	8	CG
		Consenda	7	6.09%	Yes	8	CG
Amphipoda		Copepoda	,	0.09%	ies	٥	CG
• • •	Talitridae					_	
Arhynchobdellid	3	Hyalella	1	0.87%	Yes	8	CG
ninynenobaema	Erpobdellidae						
		Erpobdella	1	0.87%	Yes	8	PR
Basommatophor		Erpobdellidae	2	1.74%	Yes	8	PR
Dasoniniacophor	Lymnaeidae						
V2000 10		Stagnicola	18	15.65%	Yes	6	SC
Coleoptera	Dytiscidae						
	Dytiscidae	Dytiscidae	2	1.74%	Yes	5	PR
		Rhantus	1	0.87%	Yes	5	PR
	Haliplidae	Haliplus	1	0.87%	Yes	5	PH
	Hydraenidae	Taupius	1	0.0770	165	,	111
		Ochthebius	1	0.87%	Yes	4	SC
	Hydrophilidae	Hydrophilidae	1	0.87%	Yes	5	PR
		Tropisternus	1	0.87%	Yes	5	PR
Diptera	7020757 9730	**************************************					
	Chironomidae	Acricotopus	1	0.87%	Yes	10	CG
		Chironomus	1	2.61%	Yes	10	CG
		Cricotopus (Isocladius)	3	2.61%	Yes	7	SH
		Glyptotendipes Procladius	3	2.61% 0.87%	Yes Yes	10 9	SH
	Stratiomyidae	Procidatus	1	0.0770	162	9	IK
1220 US TO	•	Odontomyia	4	3.48%	Yes	7	CG
Haplotaxida	Naididae						
	Naturale	Nais	2	1.74%	Yes	8	CG
Heteroptera							
	Notonectidae	Notonectidae	2	1.74%	Yes	10	PR
Trombidiformes		Notonechaae	2	1.7470	162	10	110
		Acari	2	1.74%	Yes	5	PR
Grand Total		ricui	115	1.7770	163	J	110

#### Activity ID:

Station Name: MUSGRAVE LAKE RS-2 Sample Date: 7/27/2004

Station Name:		SGRAVE LAKE R	₹S-2			<b>Sample Date:</b> 7/27/2004			
Sample type SUBSAMPLE TO	TAL ORGANISM	S		115		DOMINANCE			
Portion of sampl	le used	0		93.33%		TAXON	ABUNDANCE	PERCENT	
Estimated numb	per in total samp	le		123		Ostracoda	57	49.57%	
Conversion factor	or			1.441		Stagnicola	18	15.65%	
Estimated numb Sampling effort	oer in 1 square m	ieter		166		Copepoda Odontomyia	- 7 4	6.09% 3.48%	
Sampling enort						Chironomus	3	2.61%	
Habitat type						Chironomus SUBTOTAL 5 DOMINANTS	89	77.39%	
EPT abundance				0		Cricotopus (Isocladius)	3	2.61%	
Taxa richness				22		Glyptotendipes	3	2.61%	
Number EPT tax	a			0		Nais	2	1.74%	
Percent EPT				0.00%		Erpobdellidae	2	1.74%	
TAXONOMIC CO	OMPOSITION			TAXONOMIC RATIOS		Acari TOTAL DOMINANTS	101	1.74% 87.83%	
GROUP	PERCENT A	BUNDANCE #	*TAXA	METRIC	VALUE	TOLERANCE/CONDITION INDICE	S		
Non-insect taxa	79.13%	91	9	EPT/Chironomidae	0.00	Community Tolerance Quotient (CT		93.27	
Odonata	0.00%	0	0	Baetidae/Ephemeropte	era #DIV/0!	Hilsenhoff Biotic Index		7.52	
Ephemeroptera	0.00%	0	0	Hydropsychidae/Tricho	opt #DIV/0!	DIVERSITY			
Plecoptera Heteroptera	0.00% 1.74%	2	0			Shannon H (loge)		2.66	
Megaloptera	0.00%	0	0			Shannon H (loge) Shannon H (log2)		1.84	
Trichoptera	0.00%	0	0			Margalef D		4.42	
Lepidoptera	0.00%	0	0			Simpson D		0.27	
Coleoptera	6.09%	7	6			Evenness		0.08	
Diptera Chironomidae	3.48% 9.57%	4 11	<u>I</u>			VOLTINISM TYPE ABUNDANCI	E # TAXA	PERCENT	
Chironomidae	9.57%	11				Multivoltine 7	78 9	67.83%	
					i	Univoltine 2	28 6	24.35%	
					i	Semivoltine	7 6	6.09%	
					i				
					i	TAXA CHARACTERS	#TAXA	PERCENT	
-					1	Tolerant	5	21.74% 0.00%	
0%	20%	40%	60%	80% 100	)%	Sensitive Clinger	2	3.48%	
	Non-insect taxa			roptera Plecoptera				J. TJ /0	
•	Heteroptera	Megaloptera	Trichopte			BIOASSESSMENT INDICES			
-	Coleoptera	☑Diptera	☐ Chironor	midae		B-IBI (Karr et al. )			
						METRIC VALUE		SCORE	
FUNCTIONAL C	OMPOSITION	DUNDANOE	#/DA37A	FUNCTIONAL RATIOS	ATAI TIE	Taxa richness 22		3	
GROUP Predator	PERCENT A 11.30%	BUNDANCE 13	#TAXA	METRIC Scraper/Filterer	VALUE #DIV/0!	E richness 0 P richness 0		1	
Parasite	0.87%	1	1	Scraper/Scraper + Filte	ere 1.00	T richness 0		1	
Gatherer	65.22%	75	7	beraper/ beraper + The	1.00	Long-lived 6		5	
Filterer	0.00%	0	0			Sensitive richness 0		1	
Herbivore	0.00%	0	0			%tolerant 21.74%		3	
Piercer	0.87%	1	1			%predators 11.30%		3	
Scraper	16.52% 5.22%	19 6	2 2			Clinger richness 2 %dominance (3) 71.30%		3	
Shredder Omnivore	0.00%	0	0			%dominance (3) 71.30%	TOTAL SCORE	22	44%
Unknown	0.00%	0	ő			MONTANA DEQ INDICES (Bukant	is 1998)		
				•			Plains	Valleys and	Mountain
						METRIC VALUE	Ecoregions	Foothills	Ecoregions
						Taxa richness 22	2	2	1
1					■ Predator	EPT richness 0	0	0	0
1						Biotic Index 7.52	0	0	0
					■ Parasite	%Dominant taxon 49.57%	1 2	1	0
	/		A	Mary 1		%Collectors 65.22% %EPT 0.00%	0	0	0
			ALL		■Gatherer	7022 1 0.0076	U	v	•
						Shannon Diversity 1.84	1		
			differ				1 2	2	0
	/		A STATE OF THE STA			%Scrapers +Shredder 21.74% Predator taxa 9	1 2 3	2	0
			A REFERENCE OF THE PARTY OF THE		Filterer	%Scrapers +Shredder         21.74%           Predator taxa         9           %Multivoltine         67.83%	1 2 3 1		0
			A STATE OF THE STA		■Filterer	%Scrapers +Shredder         21.74%           Predator taxa         9           %Multivoltine         67.83%           %H of T         #DIV/0!	3	#DIV/0!	-
			A REPORT OF THE PARTY OF THE PA		■Filterer	%Scrapers +Shredder         21.74%           Predator taxa         9           %Multivoltine         67.83%           %H of T         #DIV/0!	3 1	#DIV/0! #DIV/0!	3
			A STATE OF THE STA		■ Filterer ■ Herbivore	%SCrapers +Shredder         21.74%           Predator taxa         9           %Multivoltine         67.83%           %H of T         #DIV/0!           TOTAL SCORES         PERCENT OF MAXIMUM	3	#DIV/0!	-
					■Filterer	%Scrapers +Shredder         21.74%           Predator taxa         9           %Multivoltine         67.83%           %H of T         #DIV/0!	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0!	3 14.29
					■ Filterer ■ Herbivore	%SCrapers +Shredder         21.74%           Predator taxa         9           %Multivoltine         67.83%           %H of T         #DIV/0!           TOTAL SCORES         PERCENT OF MAXIMUM	3 1 12 40.00	#DIV/0! #DIV/0! #DIV/0! #DIV/0!	3 14.29
					■ Filterer ■ Herbivore ■ Piercer	%Scrapers +Shreddet 21.74%. Predator taxa 9 %Multivoltine 67.83%. %H of T #DIV/0! TOTAL SCORES PERCENT OF MAXIMUM IMPAIRMENT CLASS	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0!	3 14.29
					■ Filterer ■ Herbivore	%Scrapers +Shreddet 21.74%. Predator taxa 9 %Multivoltine 67.83%. WH of T #DIV/0! TOTAL SCORES PERCENT OF MAXIMUM IMPAIRMENT CLASS	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0!	3 14.29
					■ Filterer ■ Herbivore ■ Piercer □ Scraper	%Scrapers +Shreddet 21.74% 9 %Multivoltine 67.83% 9 %Multivoltine 67.83% #DIV/0! TOTAL SCORES PERCENT OF MAXIMUM IMPAIRMENT CLASS	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! ctric batteries	3 14.29 SEVERE
					■ Filterer ■ Herbivore ■ Piercer	%Scrapers +Shreddet 21.74% 9 %Multivoltine 67.83% 9 %Multivoltine 67.83% #DIV/0! TOTAL SCORES PERCENT OF MAXIMUM IMPAIRMENT CLASS	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! ctric batteries	3 14.29
					■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet 21.74% 9 %Multivoltine 67.83% 9 %Multivoltine 67.83% #DIV/0! TOTAL SCORES PERCENT OF MAXIMUM IMPAIRMENT CLASS	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! tric batteries	3 14.29 SEVERE
					■ Filterer ■ Herbivore ■ Piercer □ Scraper	%Scrapers +Shreddet 21.74% Predator tax.  %Multivotine 67.83% SH of T #DIV/0! TOTAL SCORES PERCENT OF MAXIMUM IMPAIRMENT CLASS	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! tric batteries	3 14.29 SEVERE
					■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet 21.74% Predator tax.  %Multivotine 67.83% SH of T #DIV/0! TOTAL SCORES PERCENT OF MAXIMUM IMPAIRMENT CLASS	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! stric batteries	3 14.29 SEVERE
	OLERANCES				■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet 21.74% Predator tax.  %Multivotine 67.83% SH of T #DIV/0! TOTAL SCORES PERCENT OF MAXIMUM IMPAIRMENT CLASS	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! stric batteries	3 14.29 SEVERE ains Ecoregions alleys and Foothills
Sediment tolerar	nt taxa		1		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet 21.74% Predator tax.  %Multivotine 67.83% SH of T #DIV/0! TOTAL SCORES PERCENT OF MAXIMUM IMPAIRMENT CLASS	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! stric batteries	3 14.29 SEVERE ains Ecoregions alleys and Foothills
Sediment tolerar Percent sedimen	nt taxa it tolerant		15.65%		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet 21.74%  %Multivoltine 67.83%, %H of T #DIV/0!  TOTAL SCORES  PERCENT OF MAXIMUM IMPAIRMENT CLASS    0   0   0     8   00   0     9   0	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! stric batteries	3 14.29 SEVERE ains Ecoregions alleys and Foothills
Sediment tolerar Percent sedimen Sediment sensiti	nt taxa it tolerant ive taxa		15.65%		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet 21.74% Predator tax.  %Multivotine 67.83% SH of T #DIV/0! TOTAL SCORES PERCENT OF MAXIMUM IMPAIRMENT CLASS	3 1 12 40.00 MODERATE	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! stric batteries	3 14.29 SEVERE ains Ecoregions alleys and Foothills
Sediment tolerar Percent sedimen Sediment sensiti Percent sedimen	nt taxa it tolerant ive taxa it sensitive		15.65% 0 0.00%		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet 21.74%  %Serapers +Shreddet 21.74%  9  %Multivoltine 67.83%  %H of T #DIV/0!  TOTAL SCORES  PERCENT OF MAXIMUM  IMPAIRMENT CLASS     0   0   0     0   0     0   0     0   0	3 1 12 40.00 MODERATE Montana DEQ me	#DIV/OI #DIV/OI #DIV/OI #DIV/OI #DIV/OI #DIV/OI #DIV OI #DIV OI	3 14.29 SEVERE ains Ecoregions alleys and Foothills
Sediment tolerar Percent sedimen Sediment sensiti Percent sedimen Metals tolerance	nt taxa it tolerant ive taxa it sensitive e index (McGuire)		15.65% 0 0.00% 3.81		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	### Shredder 21.74%  ### Shredder 21.74%  ### Shredder 3  ###	3 1 12 40.00 MODERATE Montana DEQ me	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV	3 14.29 SEVERE sains Ecoregions alleys and Foothills fountain Ecoregions
Sediment tolerar Percent sedimen Sediment sensiti Percent sedimen Metals tolerance Cold stenotherm	nt taxa  it tolerant  ive taxa  it sensitive  index (McGuire)  taxa		15.65% 0 0.00% 3.81 0		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet 21.74% Predator taxa 9 %Multivoltine 67.83% WH of T #DIV/0! TOTAL SCORES PERCENT OF MAXIMUM IMPAIRMENT CLASS    100	3 1 12 40.00 MODERATE Montana DEQ me	#DIV/OI #DIV/OI #DIV/OI #DIV/OI #DIV/OI #DIV/OI #DIV / OI #DIV / O	3 14.29 SEVERE  Lains Ecoregions alleys and Foothills fountain Ecoregions
Sediment tolerar Percent sedimen Sediment sensiti Percent sedimen Metals tolerance Cold stenotherm Percent cold ster	nt taxa  it tolerant ive taxa it sensitive index (McGuire) i taxa notherms		15.65% 0 0.00% 3.81		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet	3 1 12 40.00 MODERATE Montana DEQ me	#DIV/OI #DIV/OI #DIV/OI #DIV/OI #DIV/OI #DIV/OI #DIV / OI #DIV / O	3 14.29 SEVERE  Lains Ecoregions alleys and Foothills fountain Ecoregions  MODERATE
Sediment tolerar Percent sedimen Sediment sensiti Percent sedimen Metals tolerance Cold stenotherm Percent cold ster HABITUS MEAS	nt taxa at tolerant ive taxa it sensitive e index (McGuire) a taxa notherms		15.65% 0 0.00% 3.81 0 0.00%		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	### Standers + Shredder	3 1 12 40.00 MODERATE Montana DEQ me  vised index (Bollr% 6ccs (Bramblett and	#DIV/OI #DIV/O	3 14.29 SEVERE  Lains Ecoregions alleys and Foothills fountain Ecoregions  MODERATE  10 0
Sediment tolerar Percent sedimen Sediment sensiti Percent sedimen Metals tolerance Cold stenotherm Percent cold ster HABITUS MEAS Hemoglobin beas	nt taxa tt tolerant ive taxa tt sensitive index (McGuire) n taxa notherms  SURES rer richness		15.65% 0 0.00% 3.81 0 0.00%		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet	3 1 12 40.00 MODERATE Montana DEQ me  vised index (Bollr% 6cs (Bramblett and 0 0.00%	#DIV/OI #DIV/OI #DIV/OI #DIV/OI #DIV/OI #DIV/OI tric batteries  PI  Vi  Impairment clas Johnson 2002 Pool E richness	3 14.29 SEVERE  Lains Ecoregions alleys and Foothills fountain Ecoregions  MODERATE 1 0 0
Sediment tolerar Percent sedimen Sediment sensiti Percent sedimen Metals tolerance Cold stenotherm Percent cold sten HABITUS MEAS Hemoglobin beau Percent hemoglo	nt taxa tt tolerant ive taxa tt sensitive index (McGuire) h taxa notherms  SURES rer richness bbin bearers		15.65% 0 0.00% 3.81 0 0.00%		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	### Shreddet 21.74%  ### Shreddet 21.74%  ### Shreddet 3  ###	3 1 12 40.00 MODERATE Montana DEQ me  wised index (Bollr % cs (Bramblett and 0 0.00% 4.35%	#DIV/OI #DIV/O	ains Ecoregions alleys and Foothills ountain Ecoregions  MODERATE  0 0 0 0 0,00%
Percent sedimen Sediment sensiti Percent sedimen Metals tolerance Cold stenotherm Percent cold ster HABITUS MEAS Hemoglobin bear Percent hemoglo Air-breather rich	nt taxa tt tolerant ive taxa tt sensitive e index (McGuire) t taxa notherms  BURES erer richness abin bearers nness		15.65% 0 0.00% 3.81 0 0.00% 3 6.96% 5		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet   21.74%	3 1 12 40.00 MODERATE Montana DEQ me vised index (Bollin % cs (Bramblett and 0 0.00% 4.35% 65.22%	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! tric batteries  PV:  Mana 1998) Impairment clas Johnson 2002 Pool E richness Trichness Percent EPT Percent non-ins	3 14.29 SEVERE  Lains Ecoregions alleys and Foothills countain Ecoregions  SE MODERATE  0 0 0,00% cect 79,13%
Sediment tolerar Percent sedimen Sediment sensiti Percent sedimen Metals tolerance Cold stenotherm Percent cold ster HABITUS MEAS Hemoglobin beau Percent hemoglo Air-breather rich Percent air-breat	nt taxa it tolerant ive taxa it sensitive i index (McGuire) i taxa notherms sures ere richness obin bearers mess there		15.65% 0 0.00% 3.81 0 0.00%		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	## Strangers + Shreddet 21,74%.  ## Strangers + Shreddet 21,74%.  ## Multivotine 67,83%.  ## Of T # DIV/0!  ##	3 1 12 40.00 MODERATE Montana DEQ me wised index (Bollr % cs (Bramblett and 0 0.00% 4.35% 65.22% 0	#DIV/OI #DIV/O	3 14.29 SEVERE  ains Ecoregions alleys and Foothills ountain Ecoregions  MODERATE  0 0 0 0 0 0.00% sect 79,13% s
Sediment tolerar Percent sedimen Sediment sensiti Percent sedimen Metals tolerance Cold stenotherm Percent cold ster HABITUS MEAS Hemoglobin beas Hemoglobin b	nt taxa tt tolerant ive taxa tt sensitive t taxa tt sensitive t taxa notherms  SURES rer richness blin bearers nness thers sess		15.65% 0 0.00% 3.81 0 0.00% 3 6.96% 5 7.83% 2		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	%Scrapers +Shreddet   21.74%	3 1 12 40.00 MODERATE Montana DEQ me  wised index (Bolling to the content of the	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0!  *DIV/0!  *DIV/0!  *DIV/0!  *DIV/0!  *DIV/0!  *DIV/0!  *Trichness Prode Trichness Percent EPT Percent non-ins Filterer richnerish	3 14.29 SEVERE  sains Ecoregions alleys and Foothills countain Ecoregions  MODERATE  0 0 0,00% cect 79.13% s 0 0 sees 6
Sediment tolerar Percent sedimen Sediment sensiti Percent sedimen Metals tolerance Cold stenother Percent old sten HABITUS MEAS Hemoglobin beau Percent hemoglo Air-breather rich Percent air-breat Burrower richne Percent burrowe Swimmer richne	nt taxa it tolerant ive taxa it sensitive index (McGuire) it taxa notherms  SURES rer richness bin bearers nness thers sess res		15.65% 0 0.00% 3.81 0 0.00% 3 6.96% 5 7.83% 2 5.22% 3		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	## Strangers + Shredder 21.74% Predator taxa 9  ## Multivoltine 67.83% ## of T # DIV/0!  ## TOTAL SCORES  PERCENT OF MAXIMUM  IMPAIRMENT CLASS  ## 80 ## 70 ## 60 ## 80 ## 70 ## 60 ## 40 ## 30 ## 20 ## 10	3 1 12 40.00 MODERATE Montana DEQ me  wised index (Bolling to the content of the	#DIV/OI #DIV/O	3 14.29 SEVERE  sains Ecoregions alleys and Foothills countain Ecoregions  MODERATE  0 0 0,00% cect 79.13% s 0 0 sees 6
Sediment tolerar Percent sedimen Sediment sensiti Percent sedimen Metals tolerance Cold stenotherm Percent cold sten Habitus MEAS Hemoglobin bear Percent hemoglo Air-breather rich Percent air-breat Burrower richne Percent burrower Percent burrower	nt taxa it tolerant ive taxa it sensitive index (McGuire) it taxa notherms  SURES rer richness bin bearers nness thers sess res		15.65% 0 0.00% 3.81 0 0.00% 3 6.96% 5 7.83% 2 5.22%		■ Filterer ■ Herbivore ■ Piercer □ Scraper ■ Shredder	## Strangers + Shreddel 21,74%. Predator tax 9  ## Multivotine 67,83%. ## Of T #DIV/0!  TOTAL SCORES PERCENT OF MAXIMUM  IMPAIRMENT CLASS  ## Of O	3 1 12 40.00 MODERATE Montana DEQ me wised index (Bollr % cs (Bramblett and 0 0.00% 4.35% 65.20% 0.00% 6	#DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0! #DIV/0!  *DIV/0!  *DIV/0!  *DIV/0!  *DIV/0!  *DIV/0!  *DIV/0!  *Trichness Prode Trichness Percent EPT Percent non-ins Filterer richnerish	3 14.29 SEVERE  sains Ecoregions alleys and Foothills countain Ecoregions  MODERATE  0 0 0,00% cect 79.13% s 0 0 sees 6

# Aquatic Invertebrate Taxonomic Data Site Name MUSGRAVE LAKE ES-1

Order Family Taxon Count Percent Unique BI FFG Ostracoda 15 13.27% Yes 8 CG Amphipoda Talitridae Hyalella 2 1.77% Yes 8 CG Basommatophora Lymnaeidae Stagnicola 11 9.73% Yes 6 SC Physidae Physidae 9 7.96% Yes 8 SC Planorbidae Gyraulus 23 20.35% Yes SC Helisoma 1 0.88% Yes SC Coleoptera Dytiscidae Dytiscidae 1 0.88% Yes 5 PR Haliplidae Haliplus 2 1.77% Yes 5 PH Hydrophilidae Helophorus 0.88% SH 1 Yes 11 Hydrophilidae 2 1.77% No 5 PR Diplostraca 1.77% Cladocera 8 CF 2 Yes Diptera Ceratopogonidae 18.58% PR Ceratopogoninae 21 Yes 6 Chironomidae 0.88% 8 CG Ablabesmyia 1 Yes 0.88% 10 CG 1 Yes Acricotopus Cricotopus (Isocladius) 2 1.77% SH Yes 7 4 3.54% 8 Dicrotendipes Yes CG 1.77% Parakiefferiella 2 Yes CG 6 1 0.88% CG Paratanytarsus Yes 6 Ephemeroptera Caenidae 0.88% 7 CG Caenis 1 Yes Haplotaxida Tubificidae 0.88% 10 CG Tubificidae 1 Yes Heteroptera Corixidae Corixidae 4 3.54% 10 PH Yes Odonata Lestidae Lestes 2 1.77% 9 PR Yes Trombidiformes Acari 4 3.54% Yes 5 PR Grand Total 113

Date Collected 7 /27/2004

#### Activity ID:

Sample Date: 7/27/2004

SUBSAMPLE TOTAL ORGANISMS	Station Name:	MU:	SGRAVE LAKE E	S-1				Sample Da	te: 7	/27/2004					
Decided For   Commonweight   Commo	Sample type	TAL ODGANION	0			110		DOMINAN	on.						
December   1997   199	Portion of sample	LAL ORGANISM	5						jE.		ABUNDANCE	PERCENT			
Proceedings   1   1   1   276,	Estimated number	er in total samp	le								2	3 20.35	%		
State   Stat	Conversion factor	r						Ceratopogo	ninae		2	1 18.58	%		
Mailet   No.   Processor   1	Estimated number	er in 1 square n	neter			760		Ostracoda					% v		
Technol types	Sampling enort							Physidae			1	9.73	%		
Trace references	Habitat type							SUBTOTAL	5 DOMINAL	NTS		9 69.91	%		
Decomprises	EPT abundance							Acari					%		
According	Taxa richness							Diorotondi	200				% %		
TAXONOMIC COMPONITION   PROPERTY ADDRESS   1	Percent EPT	4						Cladocera	jes			2 1.77	%		
Committee   Triple   Committ								Hyalella				2 1.77	%		
Non-insert task   60,18%   68   9   EFF (Thismosniche   0.00   Community Difference Counterin (CTC)   66,53		MPOSITION	D.III.D. 1110D #/				*******	TOTAL DO	MINANTS		9	5 84.07	%		
Colonian   1.779	Non-insect taxa	60 18%	BUNDANCE #	I'AXA Q	FPT/Chi	METRIC ironomidae	VALUE 0.09	Communit	Tolerance (	Quotient (CTQ)	a)	96.0	)3		
Schemenored	Odonata		2	1	Baetidae	/Ephemeroptera		Hilsenhoff	Biotic Index	2dollent je i Qa	aj				
Metaropera   3.6%   4   1	Ephemeroptera	0.88%	1	1											
Magniferta   0.00%   0   0     Searce   Hubby   2.86   1.1	Plecoptera	0.00%		0				DIVERSIT	7			2.4	-0		
Trick-borner	Megaloptera	0.00%		- 1				Shannon E	(log2)						
Consider	Trichoptera	0.00%						Margalef D	10521						
Dippera	Lepidoptera							Simpson D							
Chiesenembre 9.73%   11   6   TPF   ABUNANCE   #1AVA   PRECENT   100   50   50   50   50   50   50   5	Coleoptera			4					vr			0.3	.1		
Montained lates	Chironomidae	9.73%		6				TYPE	1	ABUNDANCE	# TAXA	PERCENT			
											9	28.32%			
TAX CHARACTERS	I L														
Non-insect task   Odonata   Odonat								Semivoltin		6_	4	5.31%			
Non-insect task   Odonata   Odonat								TAXA CHA	RACTERS		#TAXA	PERCENT			
Principle   Prin								Tolerant			9	46.90%			
Processor   Proc	0%	20%	40%	60%	80%	100%		Sensitive			0	0.00%			
Billeteroptera   Dispersa   Dis								Clinger			1	1.77%			
Predict				Tricho	ptera	Lepidoptera		BIOASSES	SMENT IND	ICES					
FUNCTIONAL COMPOSITION		Coleoptera	■ Diptera	☐ Chiron	nomidae			B-IBI (Kar	retal.)						
ORDIT   PERCENT ABUNDANCE   FTAMA   METRIC   VALUE   Enchances   1	DVINOMIONAL OC	DIA DOCUMION			DIII	OWAL DAMIOS		MET	RIC	VALUE					
Predator   26.55%   30   S   Seraper/Filterer   22.00   P richness   0   1		PERCENT A	BUNDANCE	#TAXA	FUNCTI	METRIC	VALUE	E richness	288			<u>3</u>			
Parasite   0.00%   0   0   Scraers   Filtere   0.96   Trichness   0   1	Predator	26.55%	30		Scraper/	Filterer	22.00	P richness		0		i			
Filter   1.77%   2	Parasite	0.00%	0	0				T richness		0		1			
Herbivore   0.00%   0   0   50   50   50   50   50   5			28	9					.1			3			
Percer   5.31%   6   2   %geedators   26.55%   5			0	- 1				%tolerant	cnness			3			
Common	Piercer			2				%predator	5			5			
Shredder	Scraper		44	4				Clinger ric	nness	1		1			
WARTHOUSE   Washing   Walleys and   Worth   Walleys	Shredder	2.65%		2				%dominan	ce (3)		TOTAL GOOD	3		4.40/	
### Predator   Predato	Unknown							MONTANA	DEO INDIC	ES (Bukantis	1998)	5 22		44%	
Predator   Parasite													l Mount	tain	
Preciator								METRIC	V		Ecoregions	Foothills	Ecoreg	ions	
Parasite							<b>-</b> D 1.	Taxa richn	ess	22			1		
Parasite							Predator	EPT richne	SS						
Community tolerances							<b>53</b> D	%Dominar	t taxon	20.35%					
Gathere   Shannon Diversity   2.56   2   3   3   2		/					Parasite	%Collector	3	26.55%					
Filterer   Price   P							-0.1					0	0		
Filterer			V				Gatherer	Shannon I	iversity +Shraddar	2.56		2	2		
## of T ## of		/	\		\			Predator ta	xa						
## Herbivore   ToTAL SCORES   18 #DIV/0  9   9   9   9   9   9   9   9   9   9						ı	■ Filterer	%Multivolt	ine	28.32%		-			
Piercer  Shredder  Omnivore  Shredder  Omnivore  Shredder  Omnivore  Shredder  Omnivore  Sediment tolerant taxa  3 3								%H of T	DEC	#DIV/0!	10	#DIV/0!	-		
Piercer  Scraper  Shredder  Omnivore  Schiment tolerant taxa  Percent sediment tolerant  Sodiment sensitive taxa  Oererent sediment sensitive  Output  Abstrace index (McGuire)  Cold stenotherm taxa  Oererent sediment sensitive  Relats tolerance index (McGuire)  Cold stenotherms  Output  Montana Valleys and Foothills revised index (Bollman 1998)  Fercent cold stenotherms  Religion  Montana Valleys and Foothills revised index (Bollman 1998)  Fercent cold stenotherms  Religion  Religion  Filter richness  Percent EPT  O.88%  Outpowder inchess  Dercent inchess  1 Filter richness  1 Filter richness  1 Percent inchess  1 Percent in			À				■ Herbivore	PERCENT	OF MAXIMII	М	90 00 18	#DIV/0!		36	
Priercer  Shredder  Omnivore  Shredder  Omnivore  Shredder  Omnivore  Shredder  Omnivore  Omnivo		\	M			1		IMPAIRME	NT CLASS		SLIGHT	#DIV/0!			
COMMUNITY TOLERANCES Sediment tolerant taxa 3 Percent sediment sensitive taxa 0 Percent sediment sensitive taxa 1 Percent sediment sensitive taxa 2 Percent sediment sensitive sen		\					■ Piercer								
COMMUNITY TOLERANCES Sediment tolerant taxa 3 Percent sediment tolerant 30.97% Sediment sensitive taxa 0 Percent sediment sensitive taxa 1 Sediment sensitive taxa 0 Percent max. 16.67% Impairment class SEVERE Percent cold stenotherm taxa 1 Sediment sensitive taxa 1 Sediment sensi	-										MOTHER DEQ				
Sediment sensitive taxa							□ Scraper	g 100				7			
Sediment sensitive taxa								8 90							
Sediment sensitive taxa							Shredder	₹ 70				4	■Plaine F	Coregions	
Sediment sensitive taxa								.E 60				-			
Sediment sensitive taxa			-				Omnivore	8 50		_		1	■Valleys	and Foothills	
Sediment sensitive taxa	_							5 30					■Mounta	in Ecoregions	
Sediment sensitive taxa								# 20				4			
Sediment sensitive taxa	Sediment toleran	t taxa		3				P 10				1			
Percent sediment sensitive   0.00%   Montana Valleys and Foothills revised index (Bollman 1998)   Impairment class   SEVERE	Sediment sensitiv	toierant						- 0				_			
Metals tolerance index (McGuire)         3.69         Montana Valleys and Footbills revised index (Bollman 1998)           Cold stenotherm taxa         0         Percent max.         16.67%         Immairment class         SEVERE           Percent cold stenotherms         0.00%         Montana Plains ecoregions metrics (Bramblett and Johnson 2002)         Foot           HABITUS MEASURES         EPT richness         1         E richness         1           Hemoglobin bearer richness         4         Percent EPT         0.88%         T richness         0           Percent perc	Percent sediment	sensitive		0.00%											
Cold stenotherm taxa   0   Percent max.   16.67%   Impairment class   SEVERE	Metals tolerance i	index (McGuire		3.69				Montana V	alleys and	Foothills revis	sed index (Bo	lman 1998)			
Riffle	Cold stenotherm	taxa		0 0000/				Percent ma	X.	16.67%	(December 1)	Impairment	class	SEVERE	
HABITUS MEASURES	Percent cold sten	otnerms		0.00%				montana l Riffle	iains ecores	gions metrics	(Bramblett a	na Johnson 2 Pool	002)		
Hemoglobin bearer richness     4     Percent EPT $0.88\%$ T richness     0       Percent percent bengolobin bearers $2.566\%$ Percent Cligochaetes and Leeches $0.88\%$ Percent EPT $0.88\%$ Air-breather richness $2$ Percent 2 dominants $38.94\%$ Percent non-insect $60.18\%$ Percent air-breathers $2.65\%$ Filterer richness $1$ Filterer richness $1$ Burrower richness $2$ Percent intolerant $0.00\%$ Univoltine richness $1$ Percent burrowers $22.12\%$ Univoltine richness $10$ Percent supertolerant $57.52\%$ Swimmer richness $3$ Percent clingers $1.77\%$	HABITUS MEASU	URES							SS		1			1	
Percent hemoglobin bearers   25.66%   Percent Obscochaetes and Leeches   0.88%   Percent EPT   0.88%     Ali-Dreather richness   2   Percent 2 dominants   38.94%   Percent 0.61%     Percent air-breathers   2.65%   Filterer richness   1   Filterer richness   1     Burrower richness   2   Percent intolerant   0.00%   Univoltine richness   1     Percent burrowers   22.12%   Univoltine richness   10     Percent burrowers   3   Percent clingers   1.7%     Percent supertolerant   57.52%     Swimmer richness   3   Percent clingers   1.77%     Percent supertolerant   57.52%     Percent burrowers   1.77%   Percent supertolerant   1.77%     Percent Dispersion   1.77%   Percent EPT   0.88%     Percent EPT   0.88%   Percent EPT   0.88%     Percent EPT   0.	Hemoglobin beare	er richness						Percent EF	T			T richness			
Percent air-breathers     2.65%     Filterer richness     1     Filterer richness     1       Burrower richness     2     Percent intolerant     0.00%     Univoltine richness     10       Percent burrowers     22.12%     Univoltine richness     10     Percent supertolerant     57.52%       Swimmer richness     3     Percent clingers     1.77%	Percent hemoglob	bin bearers						Percent Ol	gochaetes ar	nd Leeches		Percent EPT	*		
Burrower richness 2 Percent intolerant 0.00% Univoltine richness 10 Percent burrowers 22.12% Univoltine richness 10 Percent supertolerant 57.52% Swimmer richness 3 Percent clingers 1.77%	Air-breather richi	ness hers						Filterer ric	ominants			Percent non	-insect	60.18%	
Percent burrowers     22.12%     Univoltine richness     10     Percent supertolerant     57.52%       Swimmer richness     3     Percent clingers     1.77%				2								Univoltine r	chness	10	
Swimmer richness 3 Percent clingers 1.77%				22 12%										57.52%	
reicent swimmers 1.08% Swimmer richness 3				22.12/0											
	Swimmer richnes	SS		3				Percent cli	ngers		1.77%	•			