MONTANA DEPARTMENT OF TRANSPORTATION
WETLAND MITIGATION MONITORING REPORT: YEAR 2006

Roundup Wetland
Roundup, Montana

Prepared for:

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

Prepared by:

POST, BUCKLEY, SCHUH & JERNIGAN
P.O. Box 239
Helena, MT 59624

December 2006

Project No: B43054.00 - 0510

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Cover Photo: Chenopodium and Kochia communities in the south lagoon. View is north.

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1.0 INTRODUCTION

This annual report summarizes methods and results of the sixth year of monitoring at the Montana Department of Transportation's (MDT) Roundup mitigation site. The Roundup wetland site was created to provide wetland mitigation credits for MDT's reconstruction of U.S. Highway 12 in Watershed #10 located in District 5, Billings District. The site is located in Musselshell County, Montana, Section 18, Township 8 North, Range 26 East, immediately south of U.S. Highway 12 and approximately one mile east of the town of Roundup (**Figure 1**). Elevations range from approximately 3,169 to 3,175 feet above sea level.

The mitigation site is located at the site of the former wastewater lagoons for the city of Roundup (**Figure 2** in **Appendix A**). This former two-celled treatment facility, covering approximately 26 acres, contained sludge of varying depths with concentrations of nitrates, and possibly heavy metals of which portions were capped during construction modification. The organic sludge was left in the west end of the southern end of the wetland bed and capped with one foot of soil to prevent potential biohazards risks. Five monitoring wells were installed around the lagoon to monitor any possible groundwater contamination from the sludge (**Figure 4** in **Appendix A**). The dike between cells was breached to allow water to access both cells (**Figures 2** and **3** in **Appendix A)**.

Construction was completed on this site in April of 2000 with a goal of creating at least 24 acres of wetlands with a diverse vegetative community. The site was designed to develop a hemi-marsh emergent wetland system with standing water depths no greater than three feet. Water depths vary within the wetland due to the natural topography behind the dike. Water was designed to enter the wetland mitigation system through two methods and locations (**Appendix D**).

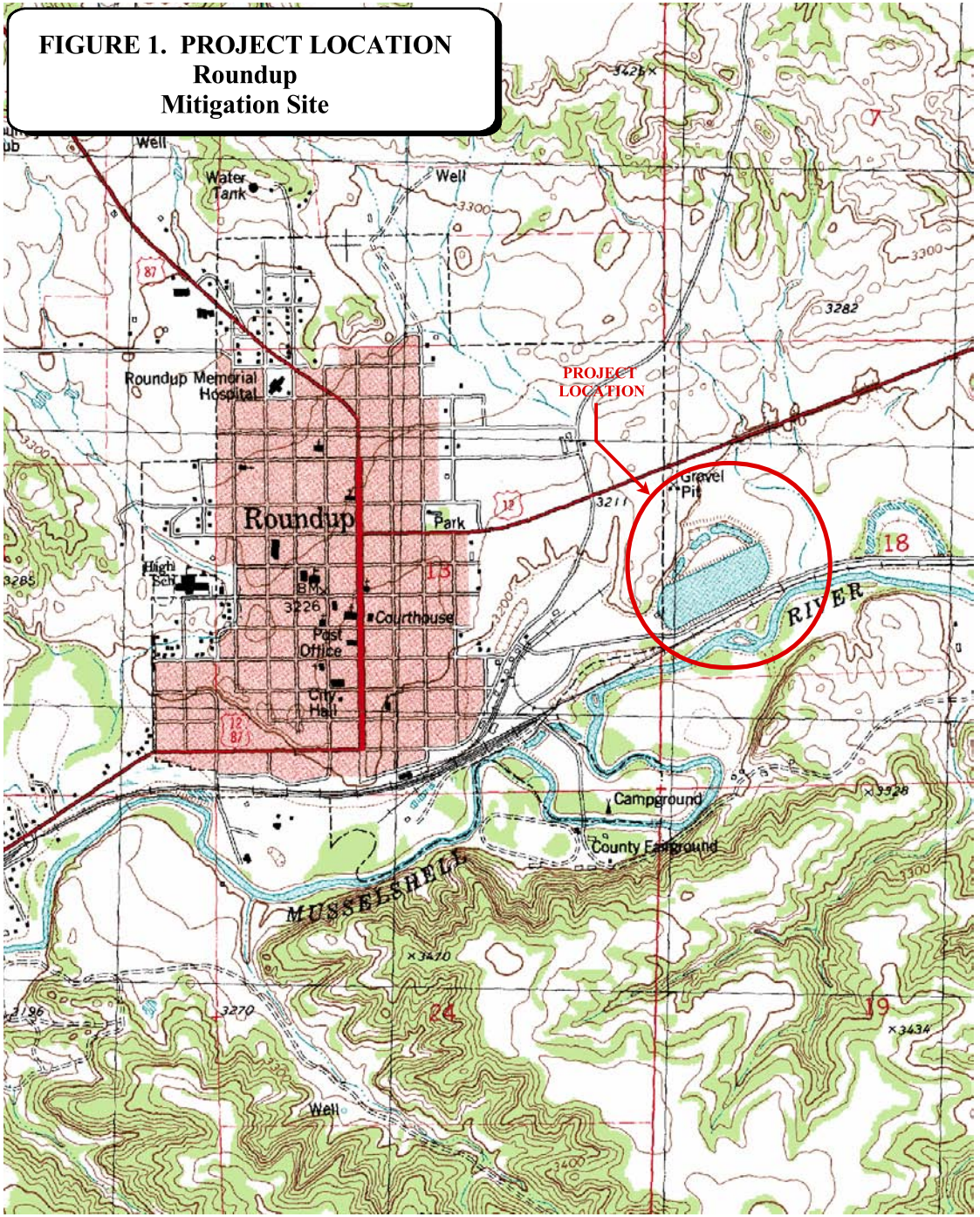
One source of hydrology is through a channel, which funnels storm water runoff from the northeastern section of the city of Roundup and U.S. Highway 12 into the southwestern end of the wetland. The estimated runoff volume for this system is 12,700 m^3 and 17,825 m^3 of water for the 5-and 25-year event, respectively (MDT 2000). A second source of hydrology is treated wastewater from the new Roundup sewage treatment facility which is discharged into the wetland to maintain the design water level elevation. There is no physical "outlet" designed for the system; water leaves only through evaporation and evapotranspiration. The site has been filling with the wastewater and stormwater since July of 2001. The Roundup lagoons are visited three times during the year: a spring and fall bird survey and during mid-summer to collect the monitoring data.

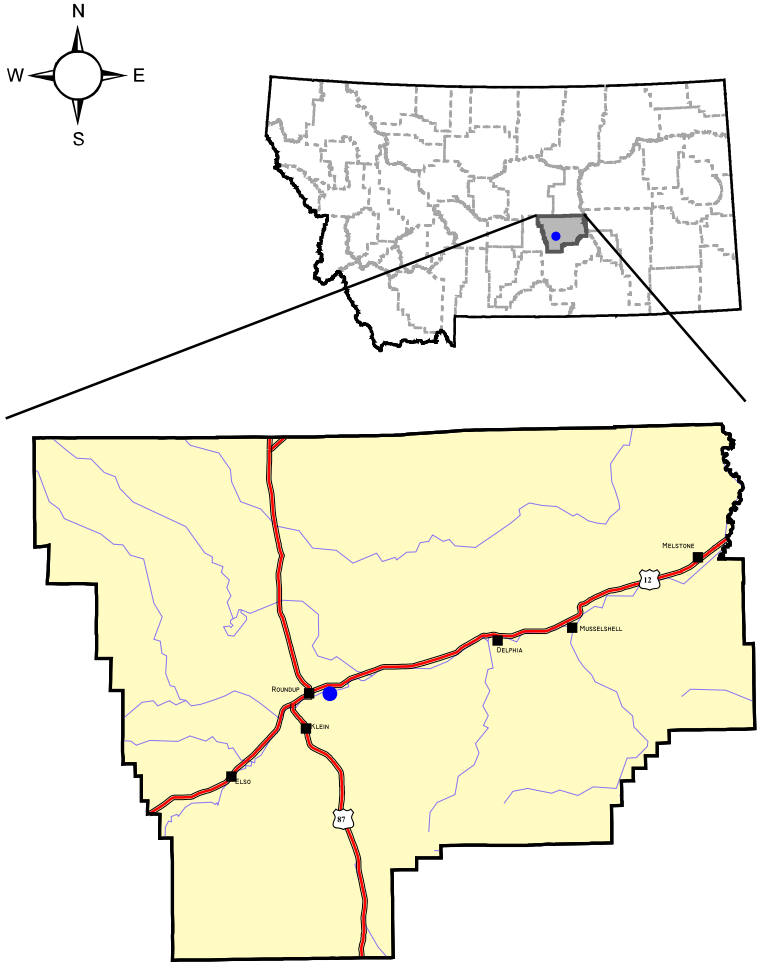
2.0 METHODS

2.1 Monitoring Dates and Activities

The Roundup wetland mitigation site was monitored on three dates in 2006: May 3 and 4 (bird observation), July 24 and 25 (monitoring event), and October 12 (bird observation). All information contained within the Wetland Mitigation Site Monitoring Form (**Appendix B**) was

FIGURE 1. PROJECT LOCATION
Roundup
Mitigation Site





800 0 800 1600 FEET

1: 24,000

PROJECT #: 130091.031
DATE: APRIL 2001
LOCATION:
PROJECT MANAGER: B. DUTTON
DRAWN BY: B. NOECKER

LAND & WATER CONSULTING, INC.

1120 CEDAR PO BOX 8254 MISSOULA, MT 59807

collected during the monitoring event. 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; functional assessment; and maintenance need assessment at bird nesting structures and inflow and outflow structures. Well monitoring was conducted on October 24th.

2.2 Hydrology

Wetland hydrology indicators were recorded using procedures outlined in the U.S. Army Corps of Engineers (COE) 1987 Wetland Delineation Manual (Environmental Laboratory 1987). Hydrology data were recorded on the Routine Wetland Delineation Data Form (**Appendix B**) at each wetland determination point. Precipitation data for 2005 and January through July, 2006 were compared to the 1914 – current averages (WRCC 2006).

All additional hydrologic data were recorded on the Wetland Mitigation Site Monitoring Form (**Appendix B**). The boundary between emergent vegetation and open water was mapped on the aerial photograph (**Figure 3** in **Appendix A**). Groundwater level and several nutrients were monitored on October 24th at five well locations located between the wetland and the Musselshell River (**Figure 4** in **Appendix A; Appendix D**). Samples were analyzed for nutrient parameters including total phosphorus, total Kjeldahl nitrogen, nitrate+nitrite nitrogen, and total ammonia. Field measurements were also recorded for groundwater elevation, temperature, dissolved oxygen, specific conductance, and pH. Additionally, concentrations of ferrous iron and hydrogen sulfide were estimated on site using field test kits. A full hydrologic report is included in **Appendix H**.

2.3 Vegetation

General vegetation types were delineated on an aerial photograph during the site visit (**Figure 3** in **Appendix A**). Coverage of the dominant species in each community type is listed on the Wetland Mitigation Site Monitoring form (**Appendix B**). A comprehensive plant species list for the entire site was compiled and will be updated as new species are encountered. Minimal woody vegetation was planted at this site by the Conservation District. Willow sprigs were planted during the early spring of 2004 by MDT.

The transect was relocated during the 2002 visit within the center of the constructed wetland (**Figure 2** in **Appendix A**). Percent cover for each species was recorded on the vegetation transect form (**Appendix B**). The transect is used to evaluate changes over time, especially the establishment and increase of hydrophytic vegetation. Transect ends were marked with metal fence posts and their locations hand-drawn on the vegetation map. Photos of the transect were taken from both ends during the site visit (**Appendix C**).

2.4 Soils

Soils were evaluated during the site visit according to the procedure outlined in the COE 1987 Wetland Delineation Manual. Soil data were 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.

2.5 Wetland Delineation

A wetland delineation was conducted within the assessment area according to the 1987 COE Wetland Delineation Manual. Wetland and upland areas within the monitoring area were investigated for the presence of wetland hydrology, hydrophytic vegetation and hydric soils. The indicator status of vegetation was derived from the National List of Plant Species that Occur in Wetlands: Northwest Region 9 (Reed 1988). The information was recorded on the COE Routine Wetland Delineation Forms (**Appendix B**). The wetland/upland and open water boundaries were used to calculate the wetland area.

2.6 Mammals, Reptiles, and Amphibians

Mammal, reptile, and amphibian species observations were recorded on the Wetland Mitigation Site Monitoring Form during the site visit **(Appendix B)**. Indirect use indicators were also recorded including tracks, scat and burrows. A comprehensive wildlife species list for the entire site was compiled and updated as new species were encountered.

2.7 Birds

Bird observations were recorded during the site visit according to the established Bird Survey Protocol (**Appendix E**). Four wood duck boxes have been installed on site. A general, qualitative bird list has been compiled using these observations.

2.8 Macroinvertebrates

One macroinvertebrate sample was collected during the site visit following the 2001 protocol (**Appendix F**). Samples were preserved as outlined in the sampling procedure and sent to Rhithron Associates for analysis. The approximate sampling location is indicated on **Figure 2** in **Appendix A**.

2.9 Functional Assessment

A functional assessment form was completed for the Roundup wetland mitigation site using the 1999 MDT Montana Wetland Assessment Method (Berglund 1999) (**Appendix B**). Field data necessary for this assessment were collected on a condensed data sheet. The remainder of the assessment was completed in the office.

2.10 Photographs

Photographs were taken showing the current land use surrounding the site, the wetland buffer, the monitored area, and the vegetation transect. A description and compass direction for each photograph were recorded on the wetland monitoring form.

During the 2001 monitoring season, each photograph point was marked on the ground with a wooden stake and the location recorded with a resource grade GPS (**Appendix E**). Photographs are retaken at the same locations each year (**Figure 2** in **Appendix A**).

2.11 GPS Data

During the 2001 monitoring season survey points were collected using a resource grade Trimble Geoexplorer III hand-held GPS unit (**Appendix E**). Points collected included: photograph locations; bird box locations, and the jurisdictional wetland boundary. In addition, during the August 2001 monitoring season survey points were collected at four landmarks recognizable on the air photo for purposes of line fitting to the topography. GPS points were not collected during the 2006 season; wetland boundaries and community types were mapped on a 2005 aerial photograph.

2.12 Maintenance Needs

The condition of inflow and outflow structures, and nesting structures or other mitigation related structures were evaluated. This examination did not entail an engineering-level analysis.

3.0 RESULTS

3.1 Hydrology

Groundwater elevation and nutrient results at monitored wells are presented below in **Table 1**. Static water elevations ranged from 3164.16 to 3169.93 feet above sea level. Groundwater elevations were generally higher during 2006 than 2005, although static water level in Well 1 was lower during the 2006 sampling event. Concentrations of nutrient parameters were generally lower during the 2006 sampling event than in 2005, especially for nitrogen parameters, although several increases were noted. Most nutrient parameters were within acceptable ranges; however, the concentration of nitrate + nitrite in Well 1 exceeded the human health standard of 10 mg/L for groundwater during 2006, as it did during 2005. Additional results and discussion are provided in the complete groundwater monitoring report (**Appendix H**).

As mentioned previously, water was designed to enter the system through two methods and locations. One method of water entry is through a drainage channel which funnels storm water and roadway runoff from the northeastern section of the city of Roundup and U.S. Highway 12 into the southwestern end of the wetland (**Appendix D**). Drought has decreased the amount of water that enters the wetland through the stormwater system. The other source of hydrology is the treated wastewater discharge from the new Roundup sewage treatment facility.

The wetland was originally designed with a flow-through system; treated water would have flowed into the wetland system and then into the Musselshell River. This design feature was eliminated by the Montana Department of Environmental Quality (MTDEQ) and the Environmental Protection Agency (EPA) primarily due to potential issues with heavy

Table 1: ***2005-2006 Roundup Wetland groundwater sampling summary.***

Well ID	Date	GW Elevation (ft)	Total Phosphorus (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Nitrate + Nitrite (mg/L)	Ammonia (mg/L)
1	11/01/05	3169.97	0.02	<0.5	14.0	<0.1
	10/24/06	3169.93	0.03	<0.5	12.4	<0.1
2	11/01/05	3168.03	4.92	25.7	<0.05	18.5
	10/24/06	3168.39	1.43	20.6	<0.05	18.8
3	11/01/05	3166.07	2.36	25.0	<0.05	19.4
	10/24/06	3166.79	3.84	15.9	0.94	14.3
4	11/01/05	3164.73	0.13	16.9	<0.05	13.2
	10/24/06	3165.02	0.14	14.9	<0.05	12.8
5	11/01/05	3164.11	0.30	7.5	<0.05	4.5
	10/24/06	3164.16	0.02	4.1	<0.05	3.5

metals/contaminants in the remaining sewage system sludge. The COE would not allow the site to be used for mitigation if it was part of the treatment system. Water levels in the wetland decrease through evaporation and evapotranspiration during the growing season.

During the July 24-25, 2006 visit, approximately 27% (6.04acres) of the assessment area was inundated with less than 4 feet of standing water. The south lagoon was less than 15% inundated during the monitoring visit. The shallow water in the south lagoon is used by the highest numbers of foraging shorebirds and waterfowl within the Roundup wetland. Inundation limits were slightly greater during spring and fall visits.

According to the Western Regional Climate Center (WRCC), the Roundup station's annual mean (1914 – current) precipitation was 12.48 inches; the average precipitation through the month of July for that period was 8.46 inches. For the year 2006, precipitation through July was 8.17 inches (8 days of data are missing in this time period) or 97% of the mean (WRCC 2006). In 2005, the annual precipitation was 17.98 inches or 144% of the mean. The drought cycle may be at an end. If so, several years of average or above average precipitation may increase the saturation level within the interior of the Roundup wetland and subsequently eliminate undesirable weedy vegetation.

3.2 Vegetation

Vegetation species identified on the site are presented in **Table 2** and in the monitoring form (**Appendix B**). Five vegetation communities were mapped on the mitigation area map (**Figure 3** in **Appendix A**). The communities include: Type 1, *Kochia scoparia*; Type 2, *Chenopodium species;* Type 3, *Alopecurus arundinaceus;* Type 4, *Kochia scoparia / Alopecurus arundinaceus* (dominant species in this type have changed since 2002)*;* Type 5, *Agropyron cristatum/Kochia scoparia*, Type 6, *Scirpus* spp., Type 7, *Chenopodium spp./Rumex spp.,* Type 8, *Hordeum jubatum/Alopecurus arundinaceus*, and Type 9, *Eleocharis palustris/ Alopecurus arundinaceus*. Dominant species within each community are listed on the Wetland Mitigation site Monitoring Form (**Appendix B**).

Table 2: ***2001-2006 Roundup Wetland vegetation species list.***

Scientific Name	Region 9 (Northwest) Wetland Indicator Status
Agropyron cristatum	-(UPL)
Alopecurus arundinaceus	- (FACW)
Chenopodium leptophyllum	FACU
Chenopodium hybridum	-(FAC)
Cirsium arvense	FACU+
Eleocharis palustris	OBL
Elymus cinereus	(UPL)
Grindelia squarrosa	FACU
Hordeum jubatum	FAC+
Kochia scoparia	FAC
Lemna minor	OBL
Melilotus officinalis	FACU
Phalaris arundinacea	FACW
Polygonum spp.	(probably FACW-OBL)
Puccinellia nuttalliana	OBL
Rhus trilobata	-(FAC)
Ribes aureum	FAC+
Rumex crispus	FACW
Rumex maritimus	FACW+
Scirpus acutus [2]	OBL
Scirpus maritimus	OBL
Scirpus pungens	OBL
Tamarix ramosissima	FACW

[1] **Bolded** species indicate those documented within the analysis area for the first time in 2006.
"-" = Species either not included or classified as "non-indicator" in the *National List of Plant Species that Occur in Wetlands: Northwest (Region 9)* (Reed 1988); status in parentheses are probable and based on the biologist's experience.
[2] *Scirpus acutus* identification is not positive; growing in inundated area.

Colonies of Scirpus, Puccinella, and Eleocharis continue to expand, although these increases in coverage do not affect overall net or gross wetland acreage. Expansion of preferred vegetation may occur slowly because of competing non-preferred vegetation, namely Chenopodium and kochia, where bare substrate occurs as the water levels decrease after spring rains.

Vegetation species along the transect have not changed; the wetland area has been dominated by kochia, a FAC species, since the initial monitoring season in 2001 (**Charts 1** and **2**). No other

hydrophytic species have been observed along the transect since its installation in 2002. In 2005, the kochia plants along the transect and between the north and south lagoon were shorter in height for unknown reasons; a higher saturation level may have contributed to this affect. In the spring of 2006, the transect area was burned and again the kochia community was less robust. The circumference of the lagoons was not burned because of high fire hazard in the area at the time of the burn, followed by wet conditions (Urban pers. comm.). The vegetation transect results are detailed in the Monitoring Form (**Appendix B**), summarized in tabular format (**Table 3**), and graphically illustrated (**Charts 1** and **2**).

3.3 Soils

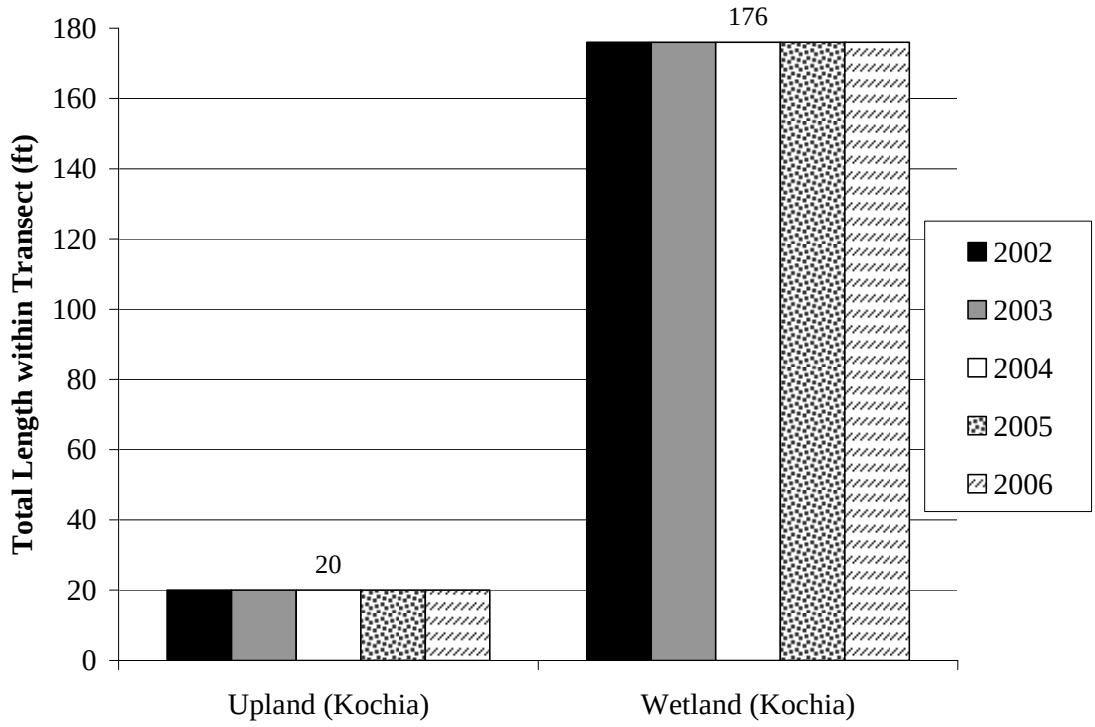
The site was mapped as part of the Musselshell County Soil Survey. The Havre-Glendive Complex (11A) is the dominant mapped soil at the site. The soil series is well drained and typical of floodplains, alluvial fans and stream terraces; it is classified as an Aridic Ustifluvent.

Table 3: ***2001-2006 transect data summary.***

Monitoring Year	2001[1]	2002	2003	2004	2005	2006
Transect Length (feet)	100	196	196	196	196	196
# Vegetation Community Transitions along Transect	1	2	2	2	2	2
# Vegetation Communities along Transect	2	2	2	2	2	2
# Hydrophytic Vegetation Communities along Transect	1	1	1	1	1	1
Total Vegetative Species	4	2	2	2	2	2
Total Hydrophytic Species	2	2	2	2	2	2
Total Upland Species	2	0	0	0	0	0
Estimated % Total Vegetative Cover	100	100[2]	100[2]	100[2]	100[2]	100[2]
% Transect Length Comprised of Hydrophytic Vegetation Communities	60	90[2]	90[2]	90[2]	90[2]	90[2]
% Transect Length Comprised of Upland Vegetation Communities	40	10[2]	10[2]	10[2]	10[2]	10[2]
% Transect Length Comprised of Unvegetated Open Water	0	0	0	0	0	0
% Transect Length Comprised of Bare Substrate	0	0	0	0	0	0

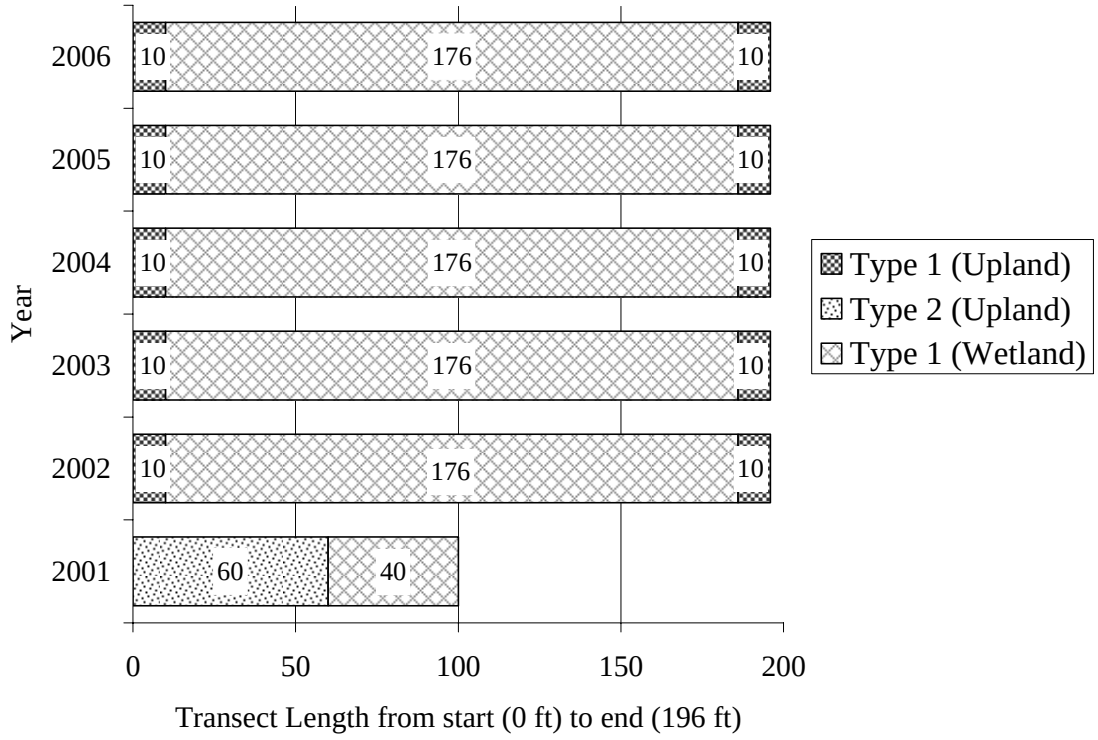
[1]Transect moved in 2002.
[2]Vegetation 100% comprised of *Kochia scoparia*, a FAC species in "Upland" and "Wetland" communities.

Chart 1: ***Length of vegetation communities along Transect 1 from 2002 to 2006.***[1]



[1] The 2001 transect is not shown for comparison as it was moved to its present position in 2002.

Chart 2: ***Transect maps showing vegetation types from start of transect (0 feet) to the end of transect (100 feet in 2001; 196 feet in 2002-2006).***



The old lagoons were constructed entirely within this complex. The Havre component is a loamy texture and the Glendive component tends to be a fine, sandy loam. Construction of the lagoons has probably changed the accuracy of this soil mapping.

Soils were sampled at one wetland site (SP-1) and one upland site (SP-2); SP-1 is located between the old dike that historically separated the north and south lagoons and SP-2 is on the constructed island adjacent to the northern lagoon pond. At SP-1 (wetland) soils were a dark gray (5Y 4/2) sandy loam at a depth of 10 inches and included yellowish red mottles (5YR 4/6). Soils were not saturated at the time of the investigation. At SP-2 (upland) on the island, the soil was a dark gray (5Y 4/2) silt loam at a depth of 10 inches. No moisture was noted in the pit.

3.4 Wetland Delineation

The 2006 delineation resulted in a total of 22.07 acres of developing aquatic habitats. The wetland boundary excludes the historic dike and the constructed islands **(Figure 3** in **Appendix A)**. Of the 22.07 gross wetland acreage, 6.04 acres were shallow, open water; most of the south lagoon was not inundated at the time of the investigation. The kochia within the area of the transect has begun to die off because of the presumed higher saturation levels and likely as a result of burning that area in the spring of 2006.

The net wetland area has oscillated over the six years of monitoring as a result of water availability and subsequent affect on open water and mud flat acreage, not as a result of the change in desirable wetland vegetation species coverage (**Table 4**). Preferred, non-weedy hydrophytic species (*Carex, Scirpus, Puccinellia, Polygonum*, etc.) have comprised less than 1% of the net wetland acreage since the site was constructed. As discussed in **Section 3.2 Vegetation**, aggressive weed control and seeding programs would have a positive affect on the development of desirable hydrophytic vegetation communities. The COE Forms are included in **Appendix B.**

Table 4: ***2001-2006 wetland acreage summary for the Roundup Wetland Mitigation Site.***

AREA	ACREAGE BY YEAR					
	2001	**2002**	**2003**	**2004**	**2005**	**2006**
Open Water	1.4	5.32	5.42	9.99	14.74	6.04
Net Wetland	17.08	9.2	11.09	9.52	7.33	16.03
Mud Flat		7.48	5.49	2.51	---	---
Gross Wetland	**18.5**	**22.0**	**22.0**	**22.02**	**22.07**	**22.07**

3.5 Wildlife

Observed wildlife species are listed in **Table 5.** Activities and densities associated with these observations are included on the **Monitoring Form** in **Appendix B**. Several mule deer, muskrats and a painted turtle were observed during the 2006 site visits. Ten new bird species were observed during 2006; a total of 68 avian species have been observed at the Roundup mitigation wetland to date.

Four wood duck boxes are located with the site (**Figure 2** in **Appendix B**). No signs of habitation were observed in July, however an adult pair was observed in the spring, and young were observed with the adults during the summer and fall.

Table 5. ***2001-2006 wildlife species observed on the Roundup Wetland Mitigation Site[1].***

AMPHIBIANS AND REPTILES	
Painted Turtle (*Chrysemys picta*)	
Bull snake (*Pituophis* **_catenifer_**)	
Rana spp.	
BIRDS	
American Avocet (*Recurvirostra americana*)	**Mallard (*Anas platyrhynchos*)**
American Coot (*Fulica americana*)	**Marbled Godwit (*Limosa fedoa*)**
American Kestrel (*Falco sparverius*)	Marsh Wren (*Cistohorus palustris*)
American Robin (*Turdus migratorius*)	**Mourning Dove** (*Zenaida macroura*)
American Wigeon (*Anas americana*)	**Northern Harrier (*Circus cyaneus*)**
Bank Swallow (*Riparia riparia*)	**Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)**
Barn Swallow (*Hirundo rustica*)	**Northern Shoveler (*Anas clypeata)***
Black-necked Stilt (*Himantopus mexicanus*)	**Pied-billed Grebe (*Podilymbus podiceps*)**
Blue-winged Teal (*Anas discors*)	**Redhead (*Aythya Americana*)**
Brewer's Blackbird (*Euphagus cyanocephalus*)	**Red-wing Blackbird (*Agelaius phoeniceus*)**
California Gull (*Larus californicus*)	**Ring-necked Duck (*Aythya collaris*)**
Canada Goose (*Branta canadensis*)	Ring-necked Pheasant (*Phasianus colchicus*)
Canvasback (*Aythya valisineria*)	Rock Dove (*Columba livia*)
Cedar Waxwing (*Bombycilla cedrorum*)	Ross Goose (*Chen rossii*)
Cinnamon Teal (*Anas cyanoptera*)	**Ruddy Duck (*Oxyura dominica*)**
Cliff Swallow (*Hirundo pyrrhonota*)	Sandhill Crane (*Grus canadensis*)
Common Merganser (*Megus merganser*)	Sandpiper (species unidentified)
Common Snipe (*Gallinago gallinago*)	**Short-billed Dowitcher ((*Limnodromus griseus*)**
Cooper's Hawk (*Accipiter cooperii*)	**Solitary Sandpiper (*Tringa solitaria*)**
Double-crested Cormorant (*Phalacrocorax auritus*)	**Song Sparrow (*Melospiza melodia*)**
Eared Grebe (*Podiceps nigricollis*)	**Spotted Sandpiper (*Actitis macularia*)**
Eastern Kingbird (*Tyrannus tyrannus*)	**Tree swallow (*Tachycineta bicolor*)**
European Starling (*Sturnus vulgaris*)	Violet Green Swallow (*Tachycineta thalassina*)
Franklin's Gull (*Larus pipixcan*)	**Western Grebe (*Aechmorphus occidentalis*)**
Gadwall (*Anas strepera*)	**Western Meadowlark (*Sturnella neglecta*)**
Great Blue Heron (*Ardea herodias*)	**Western Sandpiper (*Calidris mauri*)**
Greater Yellow legs (*Tringa melanoleuca*)	Whimbrel (*Numenius phaeopus*)
Green-winged Teal (*Anas crecca*)	White-crowned Sparrow (Zonotrichia atricapilla)
House Sparrow (*Passer domesticus*)	**Willet (*Catoptrophorus semipalmatus*)**
Killdeer (*Charadrius vociferus*)	**Wilson's Phalarope (*Phalaropus tricolor*)**
Least Sandpiper (*Calidris minitilla*)	**Wood Duck (*Aix sponsa*)**
Lesser Scaup (*Aythya affinis*)	**Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)**
Lesser Yellow Legs (*Tringa flavipes*)	Yellow-rumped Warbler (*Dendroica coronata*)
Long-billed Dowitcher (*Limnodromus scolopaceus*)	**Yellow Warbler (*Dendroica petichia*)**
MAMMALS	
Mule Deer (*Odocoileus hemionus)*	
Red Fox (*Vulpes vulpes*)	
Domestic cat	
Muskrat (*Ondatra zibethica*)	

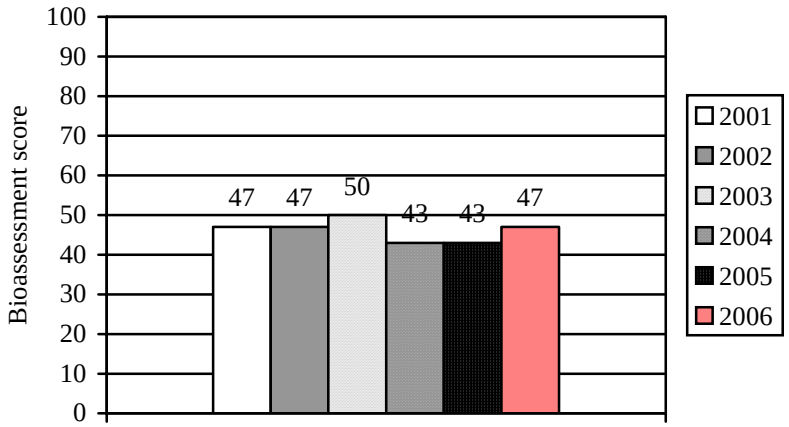
[1]**Bolded** species indicate those documented within the analysis area in 2006.

3.6 Macroinvertebrates

Macroinvertebrate sampling results are provided in **Appendix F** and **Chart 3** and were summarized by Rhithron Associates in the italicized section below (Bollman 2006).

Scores indicated poor biotic conditions at the Roundup site in all 6 studied years. Taxa richness increased slightly; 11 taxa were collected in 2006. Benthic surfaces appeared to remain dominant among potential habitats for invertebrates; benthic ostracods were the most abundant taxon. The biotic index value remained high, suggesting warm water temperatures and/or nutrient enrichment. Four midge taxa appeared in the 2006 sample; 3 of these were hemoglobin-bearers.

Chart 3: ***Bioassessment scores from 2001 to 2006.***



3.7 Functional Assessment

Completed Functional Assessment Forms are included in **Appendix B** and summarized in **Table 6**. The site rated as an overall Category II wetland and scores 158.9 Functional Units. There has been very little change in functional units since 2004. The functional units will continue to remain the same unless the wetland starts to develop a more preferred wetland vegetation community and includes higher structural diversity. The list of avian species has increased since monitoring began and has consequently increased the General Wildlife Habitat rating to high (0.9) which qualifies the wetland as a Category II wetland. Wildlife use, particularly by migratory songbirds, would further increase with the survival and proliferation of a willow shrub community.

Table 6: ***Summary of 2001-2006 wetland function/value ratings and functional points at the Roundup Wetland Mitigation Project.***

Function and Value Parameters from the 1999 MDT Montana Wetland Assessment Method	2001	2002	2003	2004	2005	2006
Listed/Proposed T&E Species Habitat	Low (0.0)	Low (0.0)	Low (0.0)	Low (0.0)	Low (0.0)	Low (0.0)
MNHP Species Habitat	Low (0.0)	High (0.8)	High (0.8)	High (0.8)	High (0.8)	High (0.8)
General Wildlife Habitat	Low (0.3)	Mod. (0.7)	High (0.9)	High (0.9)	High (0.9)	High (0.9)
General Fish/Aquatic Habitat	NA	NA	NA	NA	NA	NA
Flood Attenuation	High (1.0)	Mod. (0.6)	Mod. (0.6)	Mod. (0.6)	Mod. (0.6)	Mod. (0.6)
Short and Long Term Surface Water Storage	High (0.8)	High (1.0)	High (1.0)	High (1.0)	High (1.0)	High (1.0)
Sediment, Nutrient, Toxicant Removal	Mod. (0.7)	Mod. (0.7)	Mod. (0.7)	Mod. (0.7)	Mod. (0.7)	Mod. (0.7)
Sediment/Shoreline Stabilization	NA	High (1.0)	High (1.0)	High (1.0)	High (1.0)	High (1.0)
Production Export/Food Chain Support	Mod. (0.6)	Mod. (0.6)	Mod. (0.6)	High (0.8)	High (0.8)	High (0.8)
Groundwater Discharge/Recharge	Low (0.1)	Low (0.1)	Low (0.1)	Low (0.1)	Low (0.1)	Low (0.1)
Uniqueness	Low (0.2)	Low (0.3)	Low (0.3)	Low (0.3)	Low (0.3)	Low (0.3)
Recreation/Education Potential	Low (0.2)	High (1.0)	High (1.0)	High (1.0)	High (1.0)	High (1.0)
Actual Points/ Possible Points	3.9/10	6.8/11	7/11	7.2/11	7.2/11	7.2/11
% of Possible Score Achieved	39%	61%	64%	65%	65%	65%
Overall Category	III	III	II	II	II	II
Total Acreage of Assessed Wetlands / Open Water within Easement	**18.51**	**22.00**	**22.00**	**22.0**	**22.07**	**22.07**
Functional Units (acreage x actual points)	**72.21**	**149.60**	**154.00**	**158.40**	**158.90**	**158.90**
Net Acreage Gain	**18.51**	**22.00**	**22.00**	**22.0**	**22.07**	**22.07**
Net Functional Unit Gain	**72.21**	**149.60**	**154.00**	**158.40**	**158.90**	**158.90**
Total Functional Unit "Gain"	**72.21**	**149.60**	**154.00**	**158.40**	**158.90**	**158.90**

3.8 Photographs

Representative photos taken from photo points and transect ends are included in **Appendix C.**

3.9 Maintenance Needs/Recommendations

All dikes and inlet structures were functioning satisfactorily. All located bird boxes are in good condition.

Aquatic-labeled chemical weed treatment in the early spring of 2007 prior to the arrival of avian species, and again in late fall after most of the migration has occurred, may be the most efficient method of weed eradication at the Roundup wetland. Mowing during mid- and late-summer is an imperative step to controlling weeds that were not affected by chemical application, and removing the excess plant growth also increases complete tissue contact during the fall spraying event. A year of chemical treatment with a late fall burn prior to snowfall would decrease the heavy layer of dead material and expose bare substrate for seeding the following spring (2008). Herbicide methods are included in **Appendix G**.

A wetland seed mix, which includes a rhizomatous hydrophytic mix (i.e.: *Deschampsia cespitosa, Distichlis spicata, Scirpus maritimus, S. pungens, Juncus balticus, Eleocharis palustris,* etc.) and a cover crop (i.e. spring wheat) could be hand-seeded and raked into the circumference and wetter zones, and spreading/harrowing the seed mechanically in the drier central areas between the north and south lagoons would expedite species colonization. Western wheatgrass (*Agropyron smithii*), a fast-growing cover crop, and other desirable upland species could be seeded onto the upland berms, islands, and uplands around the entire site circumference.

3.10 Current Credit Summary

The 2006 delineation showed a total of 22.07 acres of gross wetland area; 6.04 acres of open water and 16.03 acres of net wetland. The net wetland area has oscillated over the six years of mitigation monitoring as a result of water availability and subsequent affect on open water and mud flat acreage, not as a result of the change in desirable wetland vegetation species coverage Preferred, non-weedy hydrophytic species have comprised less than 1% of the Net Wetland acreage since the site was constructed. An aggressive weed control and seeding program would have a positive affect on the development of desirable hydrophytic vegetation communities. The Roundup wetland continues to rate as a Category II wetland with little change in overall area since 2002.

4.0 REFERENCES

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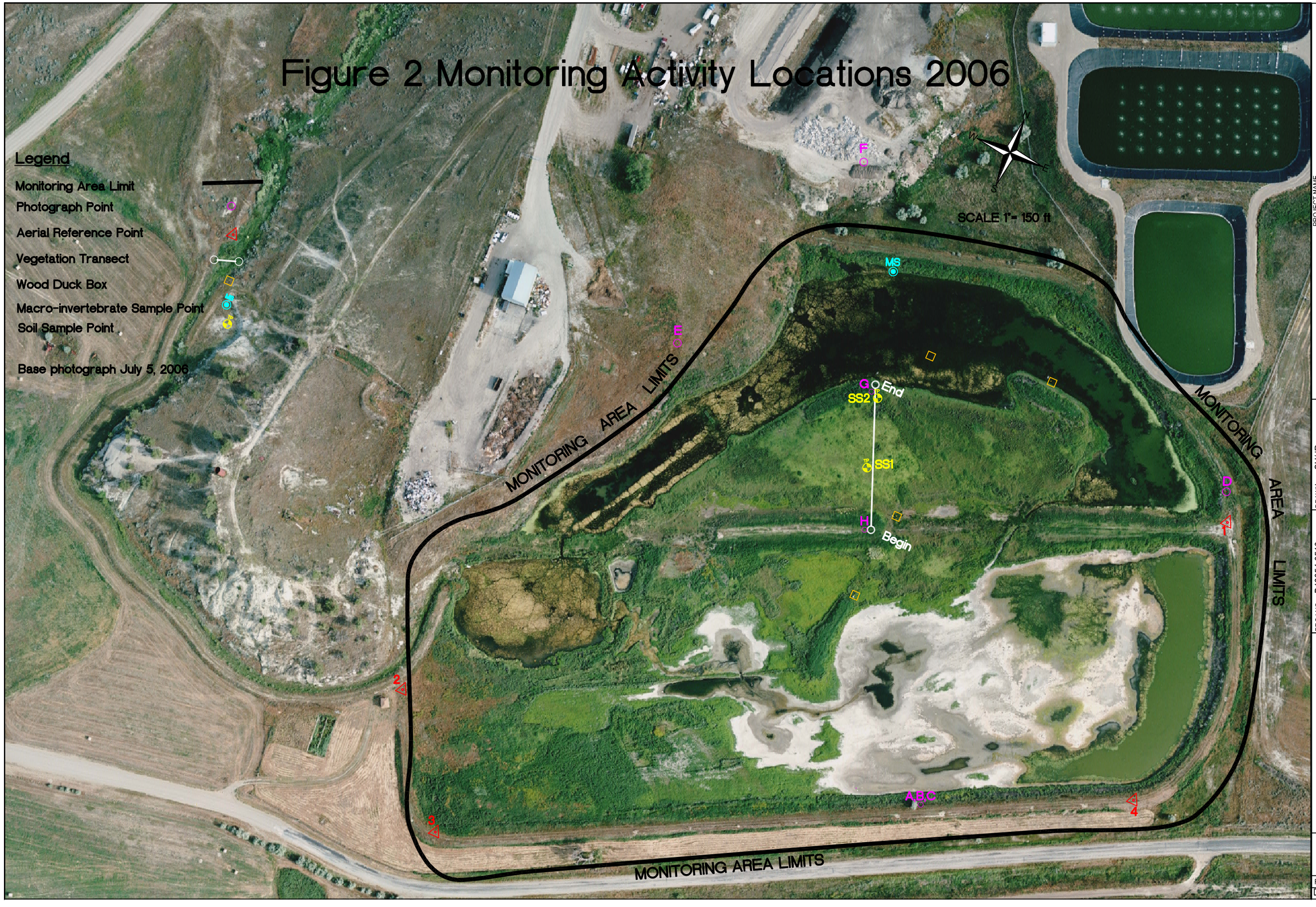
Appendix A

FIGURES 2, 3 & 4

MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, Montana

Figure 2 Monitoring Activity Locations 2006



PROJECT NAME
MDT ROUNDUP LAGOON WETLAND MITIGATION

DRAWING TITLE
MONITORING ACTIVITY LOCATIONS 2006

PROJ NO:	B43054.0510
LOCATION:	ROUNDUP, MT
SCALE:	1" = 150'
FILE NAME:	BASE2006.dwg
DRAWN:	SH/JR
PROJ MGR:	J. BERGLUND
CHECKED:	LB
APPVD:	JB

PBSJ
3810 Valley Commons Drive
Suite 4
Bozeman, MT 59718

FIGURE
2 OF -

REV -
Dec/14/2006

Figure 3 - Mapped Site Features 2006

Legend

Monitoring Area Limit

Wetland Boundary

Vegetation Community Boundary

Open Water Boundary

Base photograph July 5, 2006

Wetland Area 2004

Gross Area	22.07 Acres
Open Water	6.04 Acres
Net Area	16.03 Acres

VegetationTypes:

① Kochia scoparia
② Chenopodium spp.
③ Alopecurus arundinaceus
④ Kochia scoparia/Alopecurus arundinaceus
⑤ Agropyron cristatum/ Kochia scoparia
⑥ Scirpus maritimus/ Scirpus sp.
⑦ Chenopodium spp./Rumex spp.
⑧ Hordeum jubatum/alopecurus arundinaceus
⑨ Eleocharis palustris/alopecurus arundinaceus

N W E S

SCALE 1"= 150 ft

MONITORING AREA LIMITS

OW

Upland ①

1/2

MONITORING AREA LIMITS

PROJECT NAME	MDT ROUNDUP LAGOON WETLAND MITIGATION
DRAWING TITLE	MAPPED SITE FEATURES 2006
DRAWN: SH/JR	
PROJ MGR.: J. BERGLUND	
CHECKED: LB	APPVD: JB
PROJ NO: B430554.0510	
LOCATION: ROUNDUP, MT	
SCALE: 1" = 150'	
FILE NAME: BASE2006.dwg	

PBSJ
3810 Valley Commons Drive
Suite 4
Bozeman, MT 59718

FIGURE 3 OF -

REV -

Nov/27/2006

PROJECT NAME
MDT ROUNDUP LAGOON WETLAND MITIGATION

DRAWING TITLE
MONITORING WELL LOCATIONS

DRAWN: SH/JR
PROJ.MGR: J. BERGLUND
CHECKED: LB
APPVD: JB

PROJ NO: B43054.0510
LOCATION: ROUNDUP, MT
SCALE: 1" = 150'
FILE NAME:

PBSJ
3810 Valley Commons Drive
Suite 4
Bozeman, MT 59718

FIGURE
4 OF -
REV -

Appendix B

2006 WETLAND MITIGATION SITE MONITORING FORM
2006 BIRD SURVEY FORMS
2006 COE WETLAND DELINEATION FORMS
2006 FUNCTIONAL ASSESSMENT FORMS

MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, Montana

LWC / MDT WETLAND MITIGATION SITE MONITORING FORM

Project Name:__Roundup____ Project Number:___B43054.510_ Assessment Date:_7/24-25/06_ __
Location Roundup, MT_ MDT District:_____5_____ Milepost:____49_____
Legal description: T_8N___ R_26E___ Section_18___ Time of Day:__4:30 PM & 7 AM_
Weather Conditions:__clear_____ Person(s) conducting the assessment:
_____LB/LWC_____
Initial Evaluation Date:__8/14/01__ Visit #:_____6____ Monitoring Year:_2006_____
Size of evaluation area:__22__acres Land use surrounding wetland: sewer treatment plant; waste recovery site; hayfields_

HYDROLOGY

Surface Water Source:___stormwater and treated water from_treatment plant_____
Inundation**:** Present_X___ Absent____ Average depths:_4___ft Range of depths:_0__-_6___ft
Assessment area under inundation:_27%
Depth at emergent vegetation-open water boundary:_0.5___ft
If assessment area is not inundated are the soils saturated w/in 12" of surface**:** Yes_X___No ___
Other evidence of hydrology on site (drift lines, erosion, stained vegetation etc.):
Area partially inundated, saturated, evidence of inundation, and marginally saturated/moist soils in Kochia area.

Groundwater (*See Separate Groundwater Monitoring Report*)
Monitoring wells: Present___X____Absent_____
Record depth of water below ground surface

Well #	Depth	Well #	Depth	Well #	Depth

Additional Activities Checklist:
__X___Map emergent vegetation-open water boundary on air photo
__X___Observe extent of surface water during each site visit and look for evidence of past surface water elevations (drift lines, erosion, vegetation staining etc.)
__-___GPS survey groundwater monitoring wells locations if present

COMMENTS/PROBLEMS: _Very little water in south lagoon; *kochia* and *chenopodium* infestation still an issue and comprises nearly 100% of the vegetation within the wetland boundaries. As a result of the FAC rating of these two species, the hydrophytic vegetation qualification has been technically fulfilled (hydric soils and hydrology are present) and the area subsequently qualifies as wetland. _____

VEGETATION COMMUNITIES

Community No.:__1__ Community Title (main species):__ *Kochia scoparia* ___

Dominant Species	% Cover	Dominant Species	% Cover
Kochia scoparia	85		
Chenopodium leptophyllum	15		
Chenopodium hybridium	<1		
Elymus cinereus	<1		
Salix sprigs *(dead)*			

COMMENTS/PROBLEMS: ___ This CT occurs in upland and wetland areas, identified by "UPL:CT-1" and "Wetland: CT-1" on map. _____

Community No.:__2__ Community Title (main species):___ *Chenopodium spp.*_____

Dominant Species	% Cover	Dominant Species	% Cover
Chenopodium leptophyllum	<5	*Alopecurus arundinacea*	<1
Chenopodium hybridium	90	*Hordeum jubatum*	<1
Kochia scoparia	5	*Scirpus maritimus*	<1
Rumex maritimus	<1	*Salix* sprigs *(dead)*	
Rumex Crispus	<1		

COMMENTS/PROBLEMS: _____

Community No.:__3__ Community Title (main species):_____ *Alopecurus arundinaceus* _____

Dominant Species	% Cover	Dominant Species	% Cover
Alopecurus arundinacea	50-85		
Salix sprigs (dead)	<1		
Rumex crispus	<5		
Scirpus pungens	<5		
Phalarus arundinacea	<5		
Hordeum jubatum	<5-40		

COMMENTS/PROBLEMS: _____

Additional Activities Checklist:

__X__Record and map vegetative communities on air photo

VEGETATION COMMUNITIES (continued)

Community No.:__4__ Community Title (main species):_____ *Kochia scoparia / Alopecurus arundinaceus* _____

Dominant Species	% Cover	Dominant Species	% Cover
Alopecurus arundinacea	80	*Eleocharis palustris*	<5
Scirpus maritimus	<1	*Scirpus acutus*	<1
Polygonum spp.	<1	*Kochia scoparia*	<5
Puccinellia nuttalliana	<5	*Chenopodium leptophyllum*	<5
Rumex crispus	<1	*Rumex maritimus*	<1
Scirpus pungens	<1		

COMMENTS/PROBLEMS: _____This community is diversifying. _____

Community No.:__5__ Community Title (main species):__ *Agropyron cristatum/ Kochia scoparia* ___

Dominant Species	% Cover	Dominant Species	% Cover
Agropyron cristatum	40	*Rhus trilobata*	<1
Chenopodium leptophyllum	10	*Ribes aureum*	<1
Cirsium arvense	<5		
Grindelia spp.	<5		
Kochia scoparia	40		
Melilotus officinalis	<5		

COMMENTS/PROBLEMS: _____

Community No.:_6__ Community Title (main species):_*Scirpus* spp._____

Dominant Species	% Cover	Dominant Species	% Cover
Scirpus maritimus	50-100		
Scirpus acutus	50-100		
Scirpus pungens	50-100		
Lemna minor.	<5		

COMMENTS/PROBLEMS: Percent cover depends on where the community is located, if in the water, likely SCIACU at 100%, if on land, likely SCIPUN and SCIMAR at varying coverages. LEMMIN occurs around edges of OW.

VEGETATION COMMUNITIES (continued)

Community No.:__7__ Community Title (main species)_*Chenopodium spp./Rumex spp.*___

Dominant Species	% Cover	Dominant Species	% Cover
Chenopodium leptophyllum	5		
Rumex maritimus	95		

COMMENTS/PROBLEMS: _____

_____

_____

_____

Community No.:__8__ Community Title (main species):___*Hordeum jubatum/Alopecurus arundinaceus*

_____

Dominant Species	% Cover	Dominant Species	% Cover
Hordeum jubatum	80		
Alopecurus arundinaceus	20		

COMMENTS/PROBLEMS: _____

_____

_____

_____

Community No.:__9__ Community Title (main species) *Eleocharis palustris/ Alopecurus arundinaceus* _____

Dominant Species	% Cover	Dominant Species	% Cover
Alopecurus arundinacea	50	*Eleocharis palustris*	20
Lemna minor.	5	*Scirpus acutus*	<1
Polygonum spp.	<1	*Kochia scoparia*	<5
Puccinellia nuttalliana	<5	*Chenopodium leptophyllum*	<5
Rumex crispus	<1	*Rumex maritimus*	<1
Scirpus pungens	<1	*Scirpus maritimus*	5

COMMENTS/PROBLEMS: _____

_____

COMPREHENSIVE VEGETATION LIST

Species	Vegetation Community Number(s)	Species	Vegetation Community Number(s)
Agropyron cristatum	1		
Alopecurus arundinacea	2, 3, 4,8, 9		
Chenopodium leptophyllum	1, 2, 4, 5, 7, 9		
Chenopodium hybridum	1, 2		
Cirsium arvense	1, 5		
Eleocharis palustris	4, 9		
Elymus cinereus	1, 4		
Grindelia squarrosa	1, 5		
Hordeum jubatum	2, 3, 8		
Kochia scoparia	1, 2, 4, 5		
Lemna minor	6		
Melilotus officinalis	1, 5		
Phalarus arundinacea	3, 4		
Polygonum spp.	4		
Puccinellia nuttalliana	4		
Rhus trilobata	1, 5		
Ribes aureum	1, 5		
Rumex crispus	2, 3, 4		
Rumex maritimus	2, 4, 9		
Scirpus acutus	4, 6, 9		
Scirpus maritimus	2, 4, 6 9		
Scirpus pungens	4, 6, 9		
Salix sprigs (dead)	½, 3		
Tamarix ramosissima	2	(Should be cut/destroyed; one plant only.)	
Bold denotes observed in 2006 for the first time			

COMMENTS/PROBLEMS: Tamarisk located on east side of south lagoon.

PLANTED WOODY VEGETATION SURVIVAL

Species	Number Originally Planted	Number Observed	Mortality Causes
Willows	Unknown (hundreds?)	50-100	Likely died the first season planted.*

COMMENTS/PROBLEMS: The sprigs were often multi-stemmed and length above ground was 1 to 4 feet long. Sprigs were planted around the south and east circumference of south lagoon and near interior berm and islands. No live sprigs were found. Soil may be too tight for adequate oxygenation of cut ends to promote root growth.

WILDLIFE

BIRDS

(Attach Bird Survey Field Forms)

Were man made nesting structures installed? Yes__X__ No____Type:_wood duck_ How many?__3____ Are the nesting structures being utilized? Yes_likely, adults and young observed in summer and fall___ No____ Do the nesting structures need repairs? Yes____ No____

MAMMALS AND HERPTILES

Species	Number Observed	Indirect indication of use			
		Tracks	Scat	Burrows	Other
Mule deer	8*	X			
Muskrat (fall+summer)	1				
Painted Turtle	1				

Additional Activities Checklist:
__X___Macroinvertebrate sampling (if required)

COMMENTS/PROBLEMS: ___*8 Mule Deer were observed in the wetland during the fall visit.

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:

__X___ One photo for each of the 4 cardinal directions surrounding wetland
__X___ At least one photo showing upland use surrounding wetland – if more than one upland use exists, take additional photos
__X___ At least one photo showing buffer surrounding wetland
__X*___ One photo from each end of vegetation transect showing transect

Location	Photo Frame #	Photograph Description	Compass Reading
A		wetland view	N
B		upland use	S
C		wetland view	E
D		wetland view	W
E		wetland view	S
F		wetland view	E
G		transect end on island	S
H		transect end on old dike	N
Extra		South side south lagoon, willow sprigs	

COMMENTS/PROBLEMS: Extra photos taken of the willow sprigs._____

GPS SURVEYING

Using a resource grade GPS survey the items on the checklist below. Collect at least 3 location points with the GPS unit set at 5 second recording rate. Record file numbers fore site in designated GPS field notebook

Checklist:

__X*___ Jurisdictional wetland boundary
__-___ 4-6 landmarks recognizable on the air photo
__X___ Start and end points of vegetation transect(s)
__X___ Photo reference points
__X___ Groundwater monitoring well locations

COMMENTS/PROBLEMS: __* Data hand-drawn during 2006 monitoring event. _____

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
__X*___Survey wetland-upland boundary with a resource grade GPS survey

COMMENTS/PROBLEMS: _*Hand-drawn 2006. _____
_____
_____
_____
_____

FUNCTIONAL ASSESSMENT

(Complete and attach full MDT Montana Wetland Assessment Method field forms; also attach abbreviated field forms, if used)

COMMENTS/PROBLEMS: _____
_____
_____
_____
_____

MAINTENANCE

Were man-made nesting structures installed at this site? YES_X__ NO____
If yes, do they need to be repaired? YES____ NO_X_
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___
If no, describe the problems below.

COMMENTS/PROBLEMS:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

MDT WETLAND MONITORING – VEGETATION TRANSECT

Site: Roundup Date: 7/24-25/06 Examiner: LB/PBSJ Transect # 1

Approx. transect length: 196’ Compass Direction from Start (Upland): 14 degrees

Vegetation type A:	CT 1 (UPL soils/hydrol)	
Length of transect in this type:	10’	feet
Species:		Cover:
KOCSCO		100
CHEHYB		<1
Total Vegetative Cover:		100%

Vegetation type B:	CT 1 (WL)	
Length of transect in this type:	176’	feet
Species:		Cover:
KOCSCO (5% is dead)		100
CHEHYB		<1
Total Vegetative Cover:		100%

Vegetation type C:	CT 1 (UPL soils/hydrol)	
Length of transect in this type:	10’	feet
Species:		Cover:
KOCSCO		100
CHEHYB		<1
Total Vegetative Cover:		100%

Vegetation type D:		
Length of transect in this type:		feet
Species:		Cover:
Total Vegetative Cover:		

MDT WETLAND MONITORING – VEGETATION TRANSECT (back of form)

Cover Estimate

+ = <1%
1 = 1-5%
2 = 6-10%
3 = 11-20%
4 = 21-50%
5 = >50%

Indicator Class:

+ = Obligate
- = Facultative/Wet
0 = Facultative

Source:

P = Planted
V = Volunteer

Percent of perimeter 100%* % 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:

* Most of open water edges are vegetated w/ *Chenopodium hybridium* but this species has no indicator status (not in manual). Because this perimeter was saturated it is assumed it is a FAC-OBL spp.

3

BIRD SURVEY – FIELD DATA SHEET

Page__1_of_1__
Date: **see below**

SITE: Roundup: 2006 May, July and October Surveys

Bird Species	#	Behavior	Habitat	Bird Species	#	Behavior	Habitat
SPRING: (5/3/06)				**MID-SEASON (7/25/06):**			
American Avocet	5	F	OW/MA	American Avocet	2	BR/DEF	OW/MF
American Coot	7	F	OW	American Wigeon	5	F	OW
American Wigeon	10	F	OW	Barn Swallow	20+	F	MA/OW/UPL
Blue-winged teal	50-100	F	OW	Canada Goose	35	F/BR	OW
Bufflehead	2	F	OW	Cedar Waxwing	5	F	UPL
California Gull	12	L	MA	Gadwall	1	F	OW
Canada Goose	12	N/F	OW/WL	Great Blue Heron	1	F	OW
Cinnamon Teal	3	F	OW	Killdeer	3	BR/F	MA
Eared Grebe	3	OW/MA	F	Least Sandpiper	1	F	MA
Gadwall	50-100	F	OW	Mallard	30+	F	OW
Green-winged Teal	25-50	F	OW	Mourning Dove	1	F	UPL
Great Blue Heron	2	F/L	OW	Northern Rough-winged Swallow	20+	BD/F	MA
Killdeer	10	BR	MA	Red-wing Blackbird	50-100	F/FO	MA/OW/UPL
Least Sandpiper	11	F	MA	Short-billed Dowitcher	1 (?)	F	MA
Lesser Scaup	12	F	OW	Solitary Sandpiper	1	F	MA
Lesser Yellowlegs	5	F	MA	Song Sparrow	3	BD	MA
Mallard	16	F	OW	Spotted Sandpiper	1	F	MA
Marbled Godwit	8	F	*	Tree Swallow	2	F	OW/MA
Northern Shoveler	50-100	F	OW	Western Meadowlark	3	F	MA
Pied-billed Grebe	1	F	OW	Wilson's Phalarope	7	F	OW/MA
Redhead	2	BR	OW	Wood Duck	3	F	OW
Red-winged Blackbird	15+	BR	MA	Yellow-headed Blackbird	3	F	MA
Ruddy Duck	12	F	OW	Yellow Warbler	1	BR	UPL
Song Sparrow	*	BD	MA	**FALL (10/12/06):**			
Spotted Sandpiper	1	F	MA	American Coot	6	F	OW
Western Sandpiper	1	F	MA	American Wigeon	20+	F	OW
Willet	2	F/BD	OW/MF	Blue-winged Teal	1	F	MA
Wilson's Phalarope	1	F	OW/MA	Canada Goose	1	L	OW
Wood Duck	2 (pair)	BR	OW	Cooper's Hawk	1	F	UPL
Yellow-headed Blackbird	1	BR	BR	Green-winged Teal	40+	F	OW
				Gadwall	2	F	OW
				Mallard	50+	F	OW
				Northern Harrier (female)	1	F	MA/OW
				Northern Shoveler	10	F	OW
				Redhead	2	F	OW
				Ring-necked Duck	4	F	OW
				Ruddy Duck	19	F	OW
				Wood Duck	6	F	OW
				Unidentified Gull	5	F0	MA/OW
				Western Grebe	1	F	OW

Notes: Summer: CAGO-~10 adults and ~ 25 young; MALL several broods and adults intermixed; WODU includes brood; AMWI includes brood; Fall: NOHA female flying low over water and foraging waterfowl

DEF: Defensive Behavior, likely brood present

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: Roundup				Date: 7/24/06	
Applicant/Owner: MDT				County: Musselshell	
Investigator: LB/LWC				State: MT	
Do Normal Circumstances exist on the site:	X	Yes	No	Community ID:	Kochia (btw stake G and H)
Is the site significantly disturbed (Atypical Situation)?	X	Yes	No	Transect ID:	1
Is the area a potential Problem Area?:		Yes	X No	Plot ID:	SP-1
(If needed, explain on reverse.)					

VEGETATION

	Dominant Plant Species	Stratum	Indicator		Dominant Plant Species	Stratum	Indicator
1	*Kochia scoparia*	H	FAC	9			
2				10			
3				11			
4				12			
5				13			
6				14			
7				15			
8				16			

Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-). 1/1

Qualifies as wetland given the FAC inclusion in wetland indicators. Area between transect stakes was burned in the spring, 2006. Kochia in general <3 ft tall; previous years it has been 5-6ft tall.

HYDROLOGY

X Recorded Data (Describe in Remarks):
- Stream, Lake, or Tide Gauge
- X Aerial Photographs
- Other

No Recorded Data Available

Field Observations:

Depth of Surface Water: - (in.)

Depth to Free Water in Pit: - (in.)

Depth to Saturated Soil: - (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- Inundated
- Saturated in Upper 12 Inches
- Water Marks
- Drift Lines
- Sediment Deposits
- X Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- Oxidized Root Channels in Upper 12 Inches
- Water-Stained Leaves
- Local Soil Survey Data
- FAC-Neutral Test
- Other (Explain in Remarks)

Remarks:

Area likely wetter (though not detectable today) as indicated by the dying Kochia.

SOILS

Map Unit Name (Series and Phase): Havre-Glendive Complex (11A)

Drainage Class: well

Field Observations

Taxonomy (Subgroup): NA

Confirm Mapped Type? ____ Yes X No

Profile Description:

Depth inches	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
10”	A	5Y4/2	5 YR 4/6	lg., common, distinct	sandy loam

Hydric Soil Indicators:

____	Histosol	____	Concretions
____	Histic Epipedon	____	High Organic Content in surface Layer in Sandy Soils
____	Sulfidic Odor	____	Organic Streaking in Sandy Soils
____	Aquic Moisture Regime	____	Listed on Local Hydric Soils List
____	Reducing Conditions	____	Listed on National Hydric Soils List
X	Gleyed or Low-Chroma Colors	____	Other (Explain in Remarks)

Hydric soil; damp but not saturated.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	X	Yes	____	No	
Wetland Hydrology Present?	X	Yes	____	No	
Hydric Soils Present?	X	Yes	____	No	Is this Sampling Point Within a Wetland? X Yes ____ No

Remarks:

Kochia was again only 2-3 ft during the monitoring event, perhaps as a result of the spring burning. This change in kochia height is the only change that has occurred along the transect since monitoring began; in other areas of the wetland, desirable wetland vegetation has increased less than 500 sqft in 6 years. The weed infestation is preventing the natural spread of desired vegetation. If the level of water was increase 6 inches it could profoundly decrease the weed infestation, however drought conditions have likely not allowed this to occur. In the event higher water levels could be reached, weeds would still need to be eradicated from the high areas (constructed berms and lagoon peripheries) and replanted with species such as AGRSMI, FESIDA, etc.

The entire “wetland” – the area that has been classified as wetland as a result of kochia and chenopodium being FAC-FACW species – would benefit from treatment with an aquatic-labeled herbicide, harrowing where possible w/ a 4-wheeler, and reseeding w/ wetland grass species, preferably a rhizomatous species to out-compete the aggressive kochia and cheno.

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

Project/Site:	Roundup			Date:	7/24/06
Applicant/Owner:	MDT			County:	Musselshell
Investigator:	LB/LWC			State:	MT
Do Normal Circumstances exist on the site:	X	Yes	No	Community ID:	Kochia (Stake G on island)
Is the site significantly disturbed (Atypical Situation)?	X	Yes	No	Transect ID:	1
Is the area a potential Problem Area?:		Yes	X No	Plot ID:	SP-2
(If needed, explain on reverse.)					

VEGETATION

	Dominant Plant Species	Stratum	Indicator		Dominant Plant Species	Stratum	Indicator
1	*Kochia scoparia*	H	FAC	9			
2				10			
3				11			
4				12			
5				13			
6				14			
7				15			
8				16			

Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-). 1/1

Qualifies as wetland given the FAC inclusion in wetland indicators.

HYDROLOGY

X Recorded Data (Describe in Remarks):
- Stream, Lake, or Tide Gauge
- X Aerial Photographs
- Other

No Recorded Data Available

Field Observations:

Depth of Surface Water: - (in.)

Depth to Free Water in Pit: - (in.)

Depth to Saturated Soil: - (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- Inundated
- Saturated in Upper 12 Inches
- Water Marks
- Drift Lines
- Sediment Deposits
- Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- Oxidized Root Channels in Upper 12 Inches
- Water-Stained Leaves
- Local Soil Survey Data
- FAC-Neutral Test
- Other (Explain in Remarks)

Remarks:

This SP is located on the constructed island and though it has the same spp. profile as SP-1 the island would likely have less hydrology because it is elevated.

SOILS

Map Unit Name (Series and Phase): Havre-Glendive Complex (11A)

Drainage Class: well

Field Observations

Taxonomy (Subgroup): NA

Confirm Mapped Type? _____ Yes _____ No

Profile Description:

Depth inches	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
10	A-B (berm)	5Y 4/2			silt loam

Hydric Soil Indicators:

_____ Histosol
_____ Histic Epipedon
_____ Sulfidic Odor
_____ Aquic Moisture Regime
_____ Reducing Conditions
_____ Gleyed or Low-Chroma Colors
_____ Concretions
_____ High Organic Content in surface Layer in Sandy Soils
_____ Organic Streaking in Sandy Soils
_____ Listed on Local Hydric Soils List
_____ Listed on National Hydric Soils List
_____ Other (Explain in Remarks)

Non-hydric soil.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? X Yes ____ No
Wetland Hydrology Present? ____ Yes X No
Hydric Soils Present? ____ Yes X No

Is this Sampling Point Within a Wetland? ____ Yes X No

Remarks:

Island is not within WL boundary. No changes in this area since monitoring began.

Approved by HQUSACE 2/92

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

1. Project Name: Roundup Wetland **2. Project #:** B43054 **Control #:** _____

3. Evaluation Date: 7/25/2006 **4. Evaluator(s):** LB/LWC **5. Wetland / Site #(s):** _____

6. Wetland Location(s) i. T: 8 N **R:** 26 E **S:** 18 **T:** __ N **R:** __ E **S:** _____

ii. Approx. Stationing / Mileposts: _____

iii. Watershed: 10040202 **GPS Reference No. (if applies):** _____

Other Location Information: _____

7. A. Evaluating Agency MDT

8. Wetland Size (total acres): _____ (visually estimated)
22.07 (measured, e.g. GPS)

B. Purpose of Evaluation:

- ☐ Wetlands potentially affected by MDT project
- ☐ Mitigation wetlands; pre-construction
- ☒ Mitigation wetlands; post-construction
- ☐ Other

9. Assessment Area (total acres): _____ (visually estimated)
22.07 (measured, e.g. GPS)

10. CLASSIFICATION OF WETLAND AND AQUATIC HABITATS IN AA

HGM CLASS [1]	SYSTEM [2]	SUBSYSTEM [2]	CLASS [2]	WATER REGIME [2]	MODIFIER [2]	% OF AA
Depression	Palustrine	None	Emergent Wetland	Permanently Flooded	Excavated	30
Depression	Palustrine	None	Unconsolidated Bottom	Temporarily Flooded	Excavated	65
Depression	Palustrine	None	Aquatic Bed	Permanently Flooded	Excavated	5
---	---	---	---	---	---	

[1] = Smith et al. 1995. [2] = Cowardin et al. 1979.

11. ESTIMATED RELATIVE ABUNDANCE (of similarly classified sites within the same Major Montana Watershed Basin)
Common **Comments:** _____

12. GENERAL CONDITION OF AA

i. Regarding Disturbance: (Use matrix below to select appropriate response.)

Conditions Within AA	Predominant Conditions Adjacent (within 500 Feet) To AA		
	Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings.	Land not cultivated, but moderately grazed or hayed or selectively logged or has been subject to minor clearing; contains few roads or buildings.	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density.
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 disturbance
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 hydrological alteration; high road or building density.	---	---	---

Comments: (types of disturbance, intensity, season, etc.) roads and dump and sewarge lagoon in adjacent land

ii. Prominent weedy, alien, & introduced species: Chenopodium and Kochia (both severe)

iii. Briefly describe AA and surrounding land use / habitat: sewage treatment palnt to east, dump and industry to west.

13. STRUCTURAL DIVERSITY (Based on 'Class' column of #10 above.)

Number of 'Cowardin' Vegetated Classes Present in AA	≥3 Vegetated Classes or ≥ 2 if one class is forested	2 Vegetated Classes or 1 if forested	≤ 1 Vegetated Class
Select Rating	---	Moderate	---

Comments: The migratory bird diversity would increase if shrubs were introduced to the edges of the wetland, particularly the north lagoon because of its perennial water presence. Sprigs did not work with the soil and hydrologic conditions, perhaps containerized and fencing to prevent deer browse.

14A. HABITAT FOR FEDERALLY LISTED OR PROPOSED THREATENED OR ENDANGERED PLANTS AND ANIMALS

i. AA is Documented (D) or Suspected (S) to contain (check box):

Primary or Critical habitat **(list species)**	☐ D	☐ S
Secondary habitat **(list species)**	☐ D	☐ S
Incidental habitat **(list species)**	☐ D	☐ S
No usable habitat	☐ D	☐ S

ii. **Rating** (Based on the strongest habitat chosen in 14A(i) above, find the corresponding rating of High (H), Moderate (M), or Low (L) for this function.

Highest Habitat Level	doc/primary	sus/primary	doc/secondary	sus/secondary	doc/incidental	sus/incidental	none
Functional Point and Rating	---	---	---	---	---	---	0 (L)

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).

i. AA is Documented (D) or Suspected (S) to contain (check box):

Primary or Critical habitat **(list species)**	☐ D	☒ S	Rana sp. observed, may be primary habitat
Secondary habitat **(list species)**	☐ D	☐ S	_____
Incidental habitat **(list species)**	☐ D	☐ S	_____
No usable habitat	☐ D	☐ S	_____

iii. **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 function.

Highest Habitat Level:	doc/primary	sus/primary	doc/secondary	sus/secondary	doc/incidental	sus/incidental	none
Functional Point and Rating	---	.8 (H)	---	---	---	---	---

If documented, list the source (e.g., observations, records, etc.)**:** _____

14C. General Wildlife Habitat Rating

i. **Evidence of overall wildlife use in the AA:** (Check either substantial, moderate, or low)

☒ **Substantial** (based on any of the following)
- ☒ observations of abundant wildlife #s or high species diversity (during any period)
- ☒ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ presence of extremely limiting habitat features not available in the surrounding area
- ☒ interviews with local biologists with knowledge of the AA

☐ **Low** (based on any of the following)
- ☐ few or no wildlife observations during peak use periods
- ☐ little to no wildlife sign
- ☐ sparse adjacent upland food sources
- ☐ interviews with local biologists with knowledge of AA

☐ **Moderate** (based on any of the following)
- ☐ observations 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

ii. **Wildlife Habitat Features** (Working from top to bottom, select appropriate AA attributes to determine the exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition in the AA (see #10). Duration of Surface Water: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; A= absent.

Structural Diversity (from #13)	☐High								☒Moderate								☐Low			
Class Cover Distribution (all vegetated classes)	☐Even				☐Uneven				☒Even				☐Uneven				☐Even			
Duration of Surface Water in ≥ 10% 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
Low disturbance at AA (see #12)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moderate disturbance at AA (see #12)	--	--	--	--	--	--	--	--	H	--	--	--	--	--	--	--	--	--	--	--
High disturbance at AA (see #12)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

iii. **Rating** (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 (L) for this function.)

Evidence of Wildlife Use from 14C(i)	**Wildlife Habitat Features Rating** from 14C(ii)			
	☐ Exceptional	☒ High	☐ Moderate	☐ Low
Substantial	--	.9 (H)	--	--
Moderate	--	--	--	--
Low	--	--	--	--

Comments: The avian diversity is substantial at this site, particularly waterfowl and shorebirds. Red fox, deer, muskrat also observed

14D. GENERAL FISH/AQUATIC HABITAT RATING ☒ **NA** (proceed to 14E)

If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, then check the NA box above.

Assess if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [*e.g.* fish use is precluded by perched culvert or other barrier, etc.]. If fish use occurs in the AA but is not desired from a resource management perspective (*e.g.* fish use within an irrigation canal], then Habitat Quality [14D(i)] below should be marked as "Low", applied accordingly in 14D(ii) below, and noted in the comments.

i. **Habitat Quality** (Pick the appropriate AA attributes in matrix to pick the exceptional (E), high (H), moderate (M), or low (L) quality rating.

Duration of Surface Water in AA	☐ Permanent/Perennial			☐ Seasonal / Intermittent			☐ Temporary / Ephemeral		
Cover - % of waterbody in AA containing cover objects (*e.g.* submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation)	>25%	10-25%	<10%	>25%	10-25%	<10%	>25%	10-25%	<10%
Shading - >75% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities	--	--	--	--	--	--	--	--	--
Shading – 50 to 75% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities.	--	--	--	--	--	--	--	--	--
Shading - < 50% of streambank or shoreline of AA contains riparian or wetland scrub-shrub or forested communities.	--	--	--	--	--	--	--	--	--

ii. **Modified Habitat Quality:** Is fish use of the AA precluded or significantly reduced by a culvert, dike, other man-made structure or activity **or** is the waterbody included on the 'MDEQ list of waterbodies in need of TMDL development' with 'Probable Impaired Uses' listed as cold or warm water fishery or aquatic life support**?**
☐ **Y** ☐ **N** If yes, reduce the rating from 14D(i) by one level and check the modified habitat quality rating: ☐ E ☐ H ☐ M ☐ L

iii. **Rating** (Use the conclusions from 14D(i) and 14D(ii) above and the matrix below to pick the functional point and rating of exceptional (E), high (H), moderate (M), or low (L).)

Types of Fish Known or Suspected Within AA	**Modified Habitat Quality** from 14D(ii)			
	☐ Exceptional	☐ High	☐ Moderate	☐ Low
Native game fish	--	--	--	--
Introduced game fish	--	--	--	--
Non-game fish	--	--	--	--
No fish	--	--	--	--

Comments: _____

14E. FLOOD ATTENUATION ☐ **NA** (proceed to 14G)

Applies only to wetlands subject to flooding via in-channel or overbank flow.
If wetlands in AA do not flooded from in-channel or overbank flow, check NA above.

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

Estimated wetland area in AA subject to periodic flooding	☒ ≥ 10 acres			☐ <10, >2 acres			☐ ≤2 acres		
% of flooded wetland classified as forested, scrub/shrub, or both	75%	25-75%	<25%	75%	25-75%	<25%	75%	25-75%	<25%
AA contains **no outlet or restricted outlet**	--	--	.6 (M)	--	--	--	--	--	--
AA contains **unrestricted outlet**	--	--	--	--	--	--	--	--	--

ii. **Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA?** (check)
☐**Y** ☒**N** **Comments:** _____

14F. SHORT AND LONG TERM SURFACE WATER STORAGE ☐ **NA** (proceed to 14G)

Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow.
If no wetlands in the AA are subject to flooding or ponding, check NA above.

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.)
Abbreviations: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral.

Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding.	☒ >5 acre feet			☐ <5, >1 acre feet			☐ ≤1 acre foot		
Duration of surface water at wetlands within the AA	P/P	S/I	T/E	P/P	S/I	T/E	P/P	S/I	T/E
Wetlands in AA flood or pond **≥ 5 out of 10 years**	1 (H)	--	--	--	--	--	--	--	--
Wetlands in AA flood or pond **< 5 out of 10 years**	--	--	--	--	--	--	--	--	--

Comments: _____

14G. SEDIMENT/NUTRIENT/TOXICANT RETENTION AND REMOVAL ☐ **NA** (proceed to 14H)

Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input.
If no wetlands in the AA are subject to such input, check NA above.

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.)

Sediment, Nutrient, and Toxicant Input Levels Within AA	AA receives or surrounding land use has potential to deliver low 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.				Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use has potential to deliver high 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.			
% cover of wetland vegetation in AA	☐ ≥ 70%		☒ < 70%		☐ ≥ 70%		☐ < 70%	
Evidence of flooding or ponding in AA	☐ Yes	☐ No	☒ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No
AA contains **no or restricted outlet**	--	--	.7 (M)	--	--	--	--	--
AA contains **unrestricted outlet**	--	--	--	--	--	--	--	--

Comments: _____

14H. SEDIMENT/SHORELINE STABILIZATION ☐ **NA** (proceed to 14I)

Applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body that is subject to wave action. If this does not apply, check NA above.

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

% Cover of wetland streambank or shoreline by species with deep, binding rootmasses.	Duration of Surface Water Adjacent to Rooted Vegetation		
	☒Permanent / Perennial	☐Seasonal / Intermittent	☐Temporary / Ephemeral
≥ 65 %	1 (H)	--	--
35-64 %	--	--	--
< 35 %	--	--	--

Comments: "Wetland" veg. actually Chenopodium (FAC) and Kochia (FAC)

14I. PRODUCTION EXPORT / FOOD CHAIN SUPPORT

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.
A = acreage of vegetated component in the AA. **B** = structural diversity rating from #13. **C** = Yes (Y) or No (N) as to whether or not the AA contains a surface or subsurface outlet; **P/P** = permanent/perennial; **S/I** = seasonal/intermittent; **T/E/A**= temporary/ephemeral/absent.

A	☒ Vegetated component >5 acres						☐ Vegetated component 1-5 acres						☐ Vegetated component <1 acre					
B	☐ High		☒ Moderate		☐ Low		☐ High		☐ Moderate		☐ Low		☐ High		☐ Moderate		☐ Low	
C	☐Y	☐N	☐Y	☒N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N	☐Y	☐N
P/P	--	--	--	.8H	--	--	--	--	--	--	--	--	--	--	--	--	--	--
S/I	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
T/E/A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Comments:

14J. GROUNDWATER DISCHARGE/RECHARGE (D/R) (Check the indicators in i & ii below that apply to the AA)

i. ☐ **Discharge Indicators**
- ☐ Springs are known or observed.
- ☐ Vegetation growing during dormant season/drought.
- ☐ Wetland occurs at the toe of a natural slopes.
- ☐ Seeps are present at the wetland edge.
- ☐ AA permanently flooded during drought periods.
- ☐ Wetland contains an outlet, but no inlet.
- ☐ Other

ii. ☐ **Recharge Indicators**
- ☐ Permeable substrate presents without underlying impeding layer.
- ☐ Wetland contains inlet but not outlet.
- ☐ Other

iii. **Rating:** Use the information from 14J(i) and 14j(ii) above and the table below to arrive at the functional point and rating of high (H) or low (L) for this function.

Criteria	Functional Point and Rating
AA has known Discharge/Recharge area or one or more indicators of D/R present	--
No Discharge/Recharge indicators present	1 (L)
Available Discharge/Recharge information inadequate to rate AA D/R potential	--

Comments: may be a seep on north side, area lined otherwise.

14K. UNIQUENESS

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.

Replacement Potential	AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MTNHP.			AA does not contain previously cited rare types and structural diversity (#13) is high or contains plant association listed as "S2" by the MTNHP.			AA does not contain previously cited rare types or associations and structural diversity (#13) is low-moderate.		
Estimated Relative Abundance from #11	☐rare	☐common	☐abundant	☐rare	☐common	☐abundant	☐rare	☒common	☐abundant
Low disturbance at AA (#12i)	--	--	--	--	--	--	--	--	--
Moderate disturbance at AA (#12i)	--	--	--	--	--	--	--	.3L	--
High disturbance at AA (#12i)	--	--	--	--	--	--	--	--	--

Comments:

14L. RECREATION / EDUCATION POTENTIAL

i. Is the AA a known recreational or educational site? ☐ **Yes (Rate ☒ High (1.0)**, then proceed to 14L(ii) only] ☐ **No** [Proceed to 14L(iii)]

ii. Check categories that apply to the AA: ☒ Educational / scientific study ☐ Consumptive rec. ☐ Non-consumptive rec. ☐ Other

iii. Based on the location, diversity, size, and other site attributes, is there a strong potential for recreational or educational use?
☐ **Yes** [Proceed to 14L (ii) and then 14L(iv).] ☐ **No** [Rate as low in 14L(iv)]

iv. Rating (Use the matrix below to arrive at the functional point and rating of high (H), moderate (M), or low (L) for this function.

Ownership	Disturbance at AA from #12(i)		
	☐ Low	☐ Moderate	☐ High
Public ownership	--	--	--
Private ownership	--	--	--

Comments: excellent bird watching area.

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	L	0.00	1	
B. MT Natural Heritage Program Species Habitat	H	0.80	1	
C. General Wildlife Habitat	H	0.90	1	
D. General Fish/Aquatic Habitat	NA	0.00	--	
E. Flood Attenuation	M	0.60	1	
F. Short and Long Term Surface Water Storage	H	1.00	1	
G. Sediment/Nutrient/Toxicant Removal	M	0.70	1	
H. Sediment/Shoreline Stabilization	H	1.00	1	
I. Production Export/Food Chain Support	H	0.80	1	
J. Groundwater Discharge/Recharge	L	0.10	1	
K. Uniqueness	L	0.30	1	
L. Recreation/Education Potential	H	1.00	1	
	Totals:	7.20	11.00	154
	Percent of Total Possible Points:		**65%** (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.)

☐ **I** ☒ **II** ☐ **III** ☐ **IV**

Appendix C

REPRESENTATIVE PHOTOGRAPHS

MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, Montana

2006 ROUNDUP WETLAND MITIGATION SITE

Location: A **Description:** Wetland view
Compass Reading: N

Location: B **Description:** Wetland view
Compass Reading: S

Location: C **Description:** Wetland view
Compass Reading: E

Location: D **Description:** Wetland view
Compass Reading: W

Location: E **Description:** Wetland view
Compass Reading: S

Location: F **Description:** Wetland view
Compass Reading: E

Location: G **Description:** Transect end
Compass Reading: S

Location: H **Description:** Transect end on old dike
Compass Reading: N

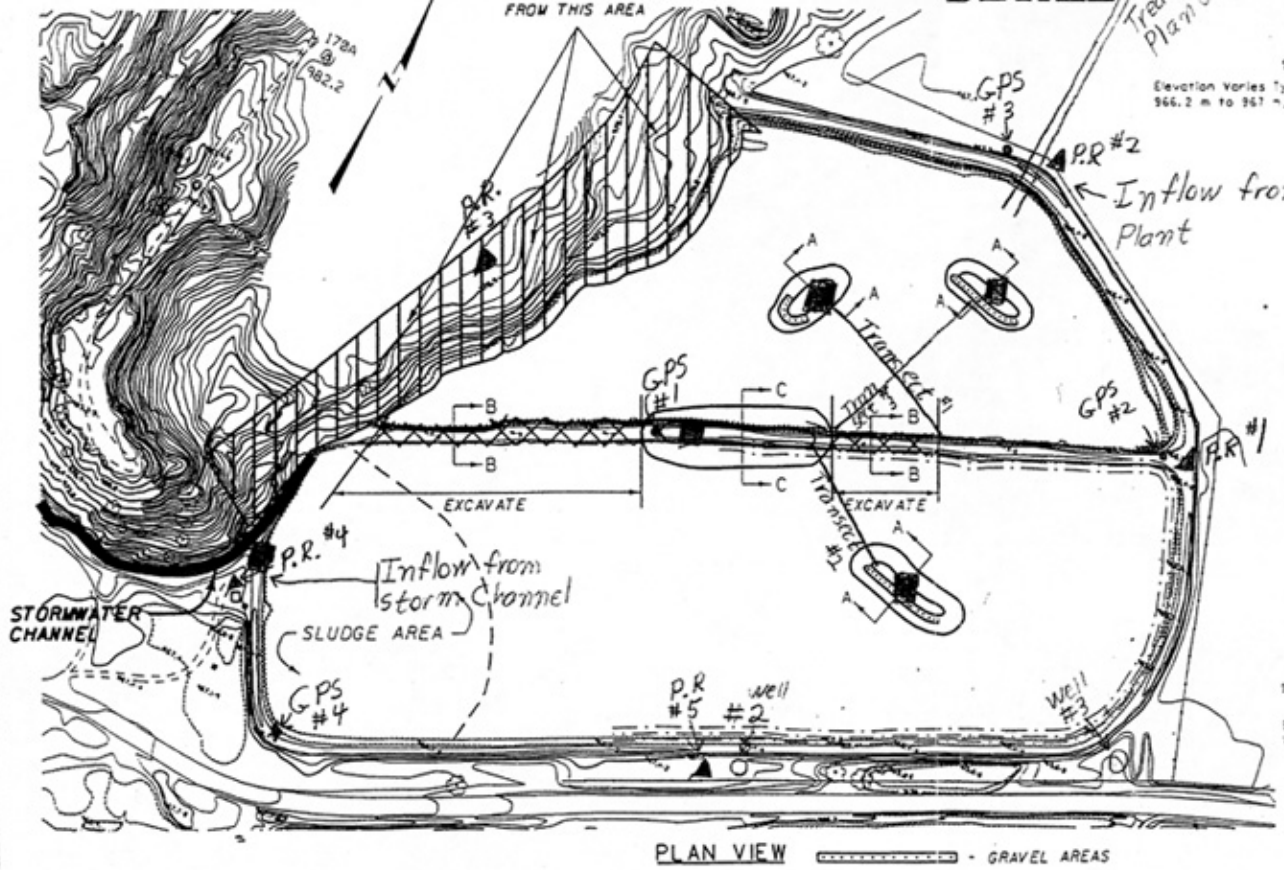
Appendix D

ROUNDUP EAST LAGOON WETLAND FINAL PLAN

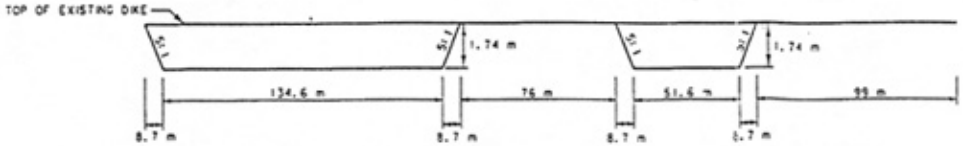
MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, Montana

Figure 2

DETAIL

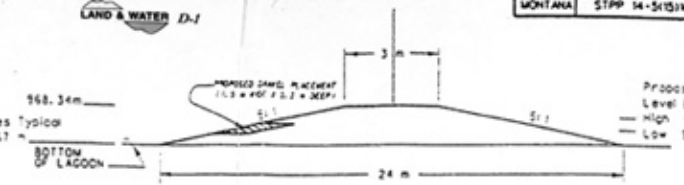


PLAN VIEW — GRAVEL AREAS



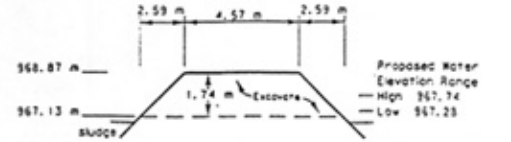
LONGITUDINAL SECTION OF EXISTING DIKE (between north & south lagoon cells)

NOT TO SCALE



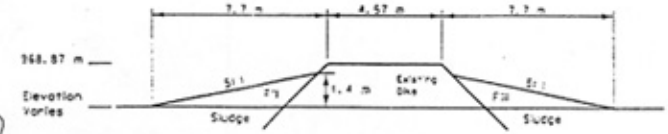
SECTION A-A (Islands)

NOT TO SCALE



SECTION B-B (Existing Dike Excavation)

NOT TO SCALE



SECTION C-C (Remaining Portion of Existing Dike)

NOT TO SCALE

▲ Photo Reference points
○ Well
• G.P.S Point
▩ Wood Duck Box

SCALE = 1:1250

ROUNDUP EAST
LAGOON WETLAND

FINAL PLAN

Appendix E

BIRD SURVEY PROTOCOL
GPS PROTOCOL

MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, 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); scrub-shrub (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

2006 MACROINVERTEBRATE SAMPLING PROTOCOL AND DATA

MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, 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 Mitigated Wetland Monitoring Project: Aquatic Invertebrate Monitoring Summary 2001 – 2006

Prepared for PBS&J, Inc.
Prepared by W.Bollman, Rhithron Associates, Inc.

INTRODUCTION

Among other monitoring activities, aquatic invertebrate assemblages were collected at a number of mitigated wetlands throughout Montana. This report summarizes data generated from six years of collection. Over all years of sampling, a total of 182 invertebrate samples were collected. Table 2 summarizes sites and sampling years.

METHODS

Sample processing

Aquatic invertebrate samples were collected at mitigated wetland sites in the summer months of 2001, 2002, 2003, 2004, 2005 and 2006 by personnel of PBS&J, 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, and over the water surface, and included disturbing and scraping substrates at each sampled site. These sample components were composited and preserved in ethanol at each wetland site. Samples were 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 from each sample. In some instances, the entire sample contained fewer than 100 organisms; in these cases, all organisms from the sample were taken. Animals were identified to lowest practical taxonomic levels using relevant published resources. Quality control (QC) procedures were applied to sample sorting, taxonomic determinations and enumeration, and data entry. QC statistics are presented in Table 3. The identified samples have been archived at Rhithron's laboratory.

Assessment

The method employed to assess these wetlands is based on an index incorporating a battery of 12 bioassessment metrics or attributes (Table 1) 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 (Statistica™), 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, 2004, 2005 and 2006, and Kleinschmidt Creek, sampled in 2003, 2004, 2005 and 2006, were assessed using the tested metric battery developed for montane streams of Western Montana (Bollman 1998).Invertebrate assemblages at these sites differed from those of the other sites, and suggested montane or foothill stream conditions rather than wetland conditions. For the wetland sites, "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 since our understanding of the interrelationships of natural environmental factors and anthropogenic disturbances is tentative. Thus, the further interpretive remarks accompanying the raw taxonomic and metric data in this summary are offered cautiously. Year-to-year comparisons depend on an assumption that specific sites were revisited in each year, and that equivalent sampling methods were utilized at each site revisit.

Bioassessment metrics

An index based on the performance of 12 metrics was constructed, as described above. Table 2 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.

Metric scoring criteria were re-examined each year as new data was added. For 2005, all 151 records were utilized. Ranges of individual metrics, as well as median metric values remained remarkably consistent over all 5 years of analysis. Since metric value distributions changed insignificantly with the addition of the 2006 data, no changes were made to scoring criteria this year. Summary metric values and scores for the 2006 samples are given in Tables 3a-3d.

Quality control

Quality control procedures for initial sample processing and subsampling involved checking sorting efficiency. These checks were conducted on 100% of the samples by independent technicians who microscopically re-examined 20% of sorted substrate from each sample. All organisms that were missed were counted and this number was added to the total number obtained in the original sort. Sorting efficiency was evaluated by applying the following calculation:

$$SE = \frac{n_1}{n_2} \times 100$$

Where: SE is the sorting efficiency, expressed as a percentage, n_1 is the total number of specimens in the first sort, and n_2 is the total number of specimens in the first and second sorts combined.

Quality control procedures for taxonomic determinations involved checking accuracy, precision and enumeration. Four samples were randomly selected and all organisms re-identified by independent taxonomists. A Bray-Curtis similarity statistic (Bray and Curtis 1957) was generated to evaluate identifications.

Table 1. Montana Department of Transportation Mitigated Wetlands Monitoring Project sites. 2001 – 2006.

Site identifier	2001	2002	2003	2004	2005	2006
Beaverhead 1	+	+	+	+	+	+
Beaverhead 2	+	+				
Beaverhead 3	+	+		+	+	+
Beaverhead 4	+	+	+			
Beaverhead 5	+	+	+	+	+	+
Beaverhead 6	+	+	+	+	+	+
Big Sandy 1	+					
Big Sandy 2	+					
Big Sandy 3	+					
Big Sandy 4	+					
Johnson-Valier	+					
VIDA	+					
Cow Coulee	+	+	+			
Fourchette – Puffin	+	+	+	+		
Fourchette – Flashlight	+	+	+	+		
Fourchette – Penguin	+	+	+	+		
Fourchette – Albatross	+	+	+	+		
Big Spring	+	+	+	+	+	
Vince Ames	+					
Ryegate	+					
Lavinia	+					
Stillwater	+	+	+	+	+	
Roundup	+	+	+	+	+	+
Wigeon	+	+	+	+	+	+
Ridgeway	+	+	+	+	+	+
Musgrave – Rest. 1	+	+	+	+	+	+
Musgrave – Rest. 2	+	+	+	+	+	+
Musgrave – Enh. 1	+	+	+	+	+	+
Musgrave – Enh. 2	+					+
Hoskins Landing		+	+	+	+	
Hoskins Landing						
Peterson - 1		+	+	+	+	+
Peterson – 2		+		+	+	+
Peterson – 4		+	+	+	+	+
Peterson – 5		+	+	+	+	+
Jack Johnson - main		+	+			
Jack Johnson - SW		+	+			
Creston		+	+	+	+	
Lawrence Park		+				
Perry Ranch		+			+	
SF Smith River		+	+	+	+	+
Camp Creek		+	+	+	+	+
Camp Creek						+
Kleinschmidt		+	+	+	+	+
Kleinschmidt – stream			+	+	+	+
Ringling - Galt			+			
Circle				+		
Cloud Ranch Pond				+	+	
Cloud Ranch Stream				+		
American Colloid				+	+	+
Jack Creek				+	+	
Jack Creek						
Norem				+	+	+
Rock Creek Ranch					+	+
Wagner Marsh					+	+
Alkali Lake 1						+
Alkali Lake 2						+

Table 2. Aquatic invertebrate metrics employed in the MTDT mitigated wetland monitoring study, 2001-2005.

Metric	Metric calculation	Expected response to degradation or impairment
Total taxa	Count of unique taxa identified to lowest recommended taxonomic level	Decrease
POET	Count of unique Plecoptera, Trichoptera, Ephemeroptera, and Odonata taxa identified to lowest recommended taxonomic level	Decrease
Chironomidae taxa	Count of unique midge taxa identified to lowest recommended taxonomic level	Decrease
Crustacea taxa + Mollusca taxa	Count of 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
HBI	Relative abundance of each taxon multiplied by that taxon's modified Hilsenhoff Biotic Index (tolerance) 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

RESULTS

(Note: Individual site discussions were removed from this report by PBS&J and are included in the macroinvertebrate sections of individual monitoring reports. Summary tables (4a – 4d) are provided on the following pages.)

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Quality Assurance

Table 3 gives the results of quality assurance procedures for sample sorting and taxonomic determinations and enumeration.

Table 3. *Results of quality control procedures for subsampling and taxonomy.*

Sample ID	Site name	SE	Bray-Curtis similarity
MDT06PBSJ001	MUSGRAVE LAKE ES-1	91.67%	
MDT06PBSJ002	MUSGRAVE LAKE ES-2	94.44%	
MDT06PBSJ003	MUSGRAVE LAKE RS-1	87.30%	
MDT06PBSJ004	MUSGRAVE LAKE RS-2	100.00%	
MDT06PBSJ005	ROCK CREEK RANCH	96.49%	95.25%
MDT06PBSJ006	Alkali Lake Sample 1	100.00%	
MDT06PBSJ007	Alkali Lake Sample 2	100.00%	
MDT06PBSJ008	Peterson Ranch Pond # 4	100.00%	
MDT06PBSJ009	Peterson Ranch Pond # 1	97.35%	
MDT06PBSJ010	Peterson Ranch Pond # 5	91.67%	
MDT06PBSJ011	South Fork Smith River	100.00%	
MDT06PBSJ012	Beaverhead 1	100.00%	
MDT06PBSJ013	Beaverhead 3	95.65%	
MDT06PBSJ014	Beaverhead 5	100.00%	
MDT06PBSJ015	Beaverhead 6	94.12%	98.38%
MDT06PBSJ016	Peterson Ranch Pond # 2	91.67%	99.66%
MDT06PBSJ017	American Colloid	100.00%	
MDT06PBSJ018	Norem	100.00%	
MDT06PBSJ019	Cloud Ranch	85.56%	98.89%
MDT06PBSJ020	Jack Creek Pond	100.00%	
MDT06PBSJ021	Jack Creek Stream	100.00%	
MDT06PBSJ022	Camp Creek 1	99.10%	
MDT06PBSJ023	Camp Creek 2	100.00%	
MDT06PBSJ024	Kleinschmidt Pond	100.00%	
MDT06PBSJ025	Kleinschmidt Stream	96.49%	
MDT06PBSJ026	Hoskins Landing 1	97.35%	
MDT06PBSJ027	Hoskins Landing 2	96.49%	
MDT06PBSJ028	Wagner Marsh	100.00%	
MDT06PBSJ029	Wigeon Reservoir	100.00%	
MDT06PBSJ030	Ridgeway	98.21%	
MDT06PBSJ031	Roundup	100.00%	

Table 4a. Metric values and scores for Montana Department of Transportation mitigated wetland sites. 2006.

	BEAVERHEAD #1	BEAVERHEAD #3	BEAVERHEAD #5	BEAVERHEAD #6	ROUNDUP	WIDGEON	RIDGEWAY	MUSGRAVE RS-1
Total taxa	12	11	4	15	11	11	21	23
POET	1	0	1	3	2	1	3	4
Chironomidae taxa	5	3	1	7	4	3	10	7
Crustacea + Mollusca	1	4	2	3	2	2	5	7
% Chironomidae	52.38%	25.22%	0.69%	63.06%	18.87%	6.42%	37.25%	9.62%
Orthocladiinae/Chir	0.181818	0.965517	0	0.142857	0.2	0.285714	0.289474	0.7
%Amphipoda	0.00%	0.00%	0.00%	0.90%	0.00%	6.42%	11.76%	1.92%
%Crustacea + %Mollusca	9.52%	69.57%	98.62%	3.60%	73.58%	79.82%	45.10%	51.92%
HBI	7.857143	7.773913	7.97931	7.243243	8.09434	8.100917	7.127451	7.403846
%Dominant taxon	33.33%	39.13%	97.93%	27.93%	72.64%	73.39%	28.43%	23.08%
%Collector-Gatherers	61.90%	68.70%	100.00%	84.68%	87.74%	6.42%	49.02%	47.12%
%Filterers	0.00%	2.61%	0.00%	1.80%	0.00%	0.00%	0.00%	4.81%
Total taxa	1	1	1	3	1	1	5	5
POET	1	1	1	3	1	1	3	5
Chironomidae taxa	3	3	1	5	3	3	5	5
Crustacea + Mollusca	1	3	1	1	1	1	3	5
% Chironomidae	1	3	5	1	3	5	3	5
Orthocladiinae/Chir	1	5	1	1	3	3	3	5
%Amphipoda	5	5	5	5	5	3	3	5
%Crustacea + %Mollusca	5	1	1	5	1	1	3	3
HBI	1	1	1	3	1	1	3	3
%Dominant taxon	5	3	1	5	1	1	5	5
%Collector-Gatherers	3	3	5	5	5	1	3	3
%Filterers	3	3	3	3	3	3	3	3
Total score	30	32	26	40	28	24	42	52
Percent of maximum score	0.5	0.533333	0.433333	0.666667	0.466667	0.4	0.7	0.866667
Impairment classification	**poor**	**poor**	**poor**	**sub-optimal**	**poor**	**poor**	**optimal**	**optimal**

Table 4b. Metric values and scores for Montana Department of Transportation mitigated wetland sites. 2006.

	MUSGRAVE RS- 2	MUSGRAVE ES- 1	MUSGRAVE ES- 2	HOSKINS LANDING 1	HOSKINS LANDING 2	PETERSON RANCH 1	PETERSON RANCH 2	PETERSON RANCH 4	PETERSON RANCH 5
Total taxa	10	21	10	22	29	19	17	28	26
POET	1	2	1	5	4	2	2	3	4
Chironomidae taxa	2	7	4	6	6	7	4	13	9
Crustacea + Mollusca	3	6	0	5	9	5	6	5	6
% Chironomidae	3.96%	10.89%	10.00%	18.18%	11.71%	64.08%	7.48%	27.52%	14.29%
Orthocladiinae/Chir	0	0.181818	0.125	0.055556	0.307692	0.757576	0.75	0.6	0.75
%Amphipoda	0.00%	2.97%	0.00%	5.05%	1.80%	1.94%	22.43%	2.75%	15.18%
%Crustacea + %Mollusca	8.91%	75.25%	0.00%	20.20%	23.42%	8.74%	42.06%	19.27%	40.18%
HBI	6.326733	6.940594	6	7.111111	7.585586	6.631068	6.719626	7.293578	7.321429
%Dominant taxon	70.30%	38.61%	83.75%	25.25%	42.34%	47.57%	28.04%	20.18%	16.07%
%Collector-Gatherers	15.84%	8.91%	3.75%	64.65%	62.16%	72.82%	31.78%	34.86%	50.89%
%Filterers	0.00%	0.00%	0.00%	6.06%	5.41%	3.88%	3.74%	8.26%	0.89%
Total taxa	1	5	1	5	5	3	3	5	5
POET	1	1	1	5	5	1	1	3	5
Chironomidae taxa	1	5	3	3	3	5	3	5	5
Crustacea + Mollusca	1	5	1	3	5	3	5	3	5
% Chironomidae	5	5	5	3	5	1	5	3	5
Orthocladiinae/Chir	1	1	1	1	3	5	5	5	5
%Amphipoda	5	5	5	3	5	5	3	5	3
%Crustacea + %Mollusca	5	1	5	5	5	5	3	5	3
HBI	5	3	5	3	3	5	5	3	3
%Dominant taxon	1	3	1	5	3	3	5	5	5
%Collector-Gatherers	1	1	1	3	3	3	1	1	3
%Filterers	3	3	3	1	3	3	3	1	3
Total score	30	38	32	40	48	42	42	44	50
Percent of maximum score	0.5	0.633333	0.533333	0.666667	0.8	0.7	0.7	0.733333	0.833333
Impairment classification	**poor**	**sub-optimal**	**poor**	**sub-optimal**	**optimal**	**optimal**	**optimal**	**optimal**	**optimal**

Table 4c. Metric values and scores for Montana Department of Transportation mitigated wetland sites. 2006

	SOUTH FORK SMITH RIVER	CAMP CREEK 1*	CAMP CREEK 2*	KLEINSCH MIDT POND	KLEINSCH MIDT STREAM*	CLOUD RANCH	COLLOID	JACK CREEK POND	JACK CREEK STREAM
Total taxa	14	31	29	20	22	13	7	7	5
POET	4	8	8	5	1	1	2	0	0
Chironomidae taxa	3	10	8	6	8	6	4	4	0
Crustacea + Mollusca	4	1	3	2	5	3	0	2	2
% Chironomidae	18.02%	45.87%	16.07%	8.04%	77.68%	23.81%	84.21%	75.00%	0.00%
Orthocladiinae/Chir	0.05	0.26	0.277778	0.222222	0.448276	0.65	0.25	0.555556	0
%Amphipoda	18.02%	0.00%	0.00%	25.00%	0.00%	4.76%	0.00%	0.00%	5.00%
%Crustacea + %Mollusca	58.56%	0.92%	3.57%	25.89%	5.36%	11.90%	0.00%	16.67%	7.50%
HBI	7.540541	4.504587	4.294643	7.241071	5.928571	7.535714	6.315789	8.833333	7.325
%Dominant taxon	25.23%	24.77%	37.50%	25.00%	33.93%	36.90%	52.63%	33.33%	60.00%
%Collector-Gatherers	41.44%	48.62%	31.25%	62.50%	46.43%	64.29%	21.05%	58.33%	67.50%
%Filterers	15.32%	6.42%	7.14%	3.57%	38.39%	2.38%	0.00%	0.00%	0.00%
Total taxa	1	5	5	3	5	1	1	1	1
POET	5	5	5	5	1	1	1	1	1
Chironomidae taxa	3	5	5	3	5	3	3	3	1
Crustacea + Mollusca	3	1	1	1	3	1	1	1	1
% Chironomidae	3	1	5	5	1	3	1	1	5
Orthocladiinae/Chir	1	3	3	3	3	5	3	5	1
%Amphipoda	3	5	5	1	5	3	5	5	3
%Crustacea + %Mollusca	3	5	5	5	5	5	5	5	5
HBI	3	5	5	3	5	3	5	1	3
%Dominant taxon	5	5	3	5	5	3	1	5	1
%Collector-Gatherers	1	3	1	3	3	3	1	3	3
%Filterers	1	1	1	3	1	3	3	3	3
Total score	32	44	44	40	42	34	30	34	28
Percent of maximum score	0.533333	*0.733333*	*0.733333*	0.666667	*0.7*	0.566667	0.5	0.566667	0.466667
Impairment classification	**poor**	***optimal***	***optimal***	**sub-optimal**	***optimal***	**sub-optimal**	**poor**	**sub-optimal**	**poor**

*Sites indicated by asterisks were dominated by lotic fauna, and were evaluated with the MDEQ index for streams in the text and charts. Scores and impairment classifications in this table (italicized) are included only for completeness and are not reliable indications of conditions at these sites. See text.

Table 4d. Metric values and scores for Montana Department of Transportation mitigated wetland sites. 2006.

	NOREM	ROCK CREEK RANCH	WAGNER MARSH	ALKALI LAKE 1	ALKALI LAKE 2
Total taxa	6	15	11	6	5
POET	1	0	0	0	0
Chironomidae taxa	2	4	4	3	0
Crustacea + Mollusca	1	4	3	1	1
% Chironomidae	82.93%	8.40%	13.51%	42.86%	0.00%
Orthocladiinae/Chir	0	0.2	0.6	0.666667	0
%Amphipoda	0.00%	0.00%	0.00%	0.00%	0.00%
%Crustacea + %Mollusca	7.32%	65.55%	23.42%	7.14%	9.52%
HBI	7.317073	7.638655	7.036036	7.785714	7.904762
%Dominant taxon	65.85%	47.06%	45.95%	42.86%	52.38%
%Collector-Gatherers	68.29%	56.30%	47.75%	28.57%	9.52%
%Filterers	17.07%	0.00%	0.90%	0.00%	0.00%
Total taxa	1	3	1	1	1
POET	1	1	1	1	1
Chironomidae taxa	1	3	3	3	1
Crustacea + Mollusca	1	3	1	1	1
% Chironomidae	1	5	5	1	5
Orthocladiinae/Chir	1	3	5	5	1
%Amphipoda	5	5	5	5	5
%Crustacea + %Mollusca	5	1	5	5	5
HBI	3	1	3	1	1
%Dominant taxon	1	3	3	3	1
%Collector-Gatherers	3	3	3	1	1
%Filterers	1	3	3	3	3
Total score	24	34	38	30	26
Percent of maximum score	0.4	0.566667	0.633333	0.5	0.433333
Impairment classification	**poor**	**sub-optimal**	**sub-optimal**	**poor**	**poor**

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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.

Taxa Listing

Project ID: MDT06PBSJ
RAI No.: MDT06PBSJ031

RAI No.: MDT06PBSJ031 **Sta. Name:** Roundup
Client ID:
Date Coll.: 7/26/2006 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Non-Insect							
Ostracoda	77	72.64%	Yes	Unknown		8	CG
Physidae							
Physidae	1	0.94%	Yes	Unknown		8	SC
Odonata							
Coenagrionidae							
Enallagma sp.	2	1.89%	Yes	Larva		7	PR
Ephemeroptera							
Baetidae							
Callibaetis sp.	1	0.94%	Yes	Larva		9	CG
Heteroptera							
Corixidae							
Sigara sp.	2	1.89%	Yes	Adult		5	PH
Coleoptera							
Dytiscidae							
Dytiscidae	1	0.94%	Yes	Larva		5	PR
Diptera							
Ceratopogonidae							
Ceratopogoninae	2	1.89%	Yes	Larva		6	PR
Chironomidae							
Chironomidae							
Chironomus sp.	11	10.38%	Yes	Larva		10	CG
Glyptotendipes sp.	3	2.83%	Yes	Larva		10	SH
Orthocladius sp.	4	3.77%	Yes	Larva		6	CG
Tanypus sp.	2	1.89%	Yes	Larva		10	PR
Sample Count	**106**						

Metrics Report

Project ID: MDT06PBSJ
RAI No.: MDT06PBSJ031
Sta. Name: Roundup
Client ID:
STORET ID:
Coll. Date: 7/26/2006

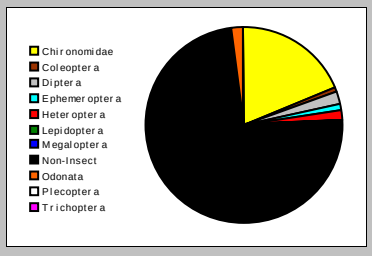
Abundance Measures

Sample Count: 106
Sample Abundance: 795.00 13.33% of sample used

Coll. Procedure:
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Non-Insect	2	78	73.58%
Odonata	1	2	1.89%
Ephemeroptera	1	1	0.94%
Plecoptera			
Heteroptera	1	2	1.89%
Megaloptera			
Trichoptera			
Lepidoptera			
Coleoptera	1	1	0.94%
Diptera	1	2	1.89%
Chironomidae	4	20	18.87%

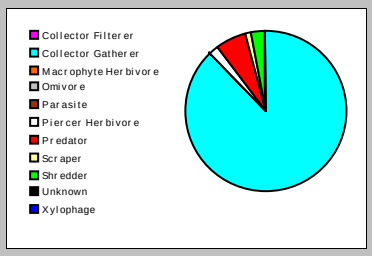


Dominant Taxa

Category	A	PRA
Ostracoda	77	72.64%
Chironomus	11	10.38%
Orthocladius	4	3.77%
Glyptotendipes	3	2.83%
Tanypus	2	1.89%
Sigara	2	1.89%
Enallagma	2	1.89%
Ceratopogoninae	2	1.89%
Physidae	1	0.94%
Dytiscidae	1	0.94%
Callibaetis	1	0.94%

Functional Composition

Category	R	A	PRA
Predator	4	7	6.60%
Parasite			
Collector Gatherer	4	93	87.74%
Collector Filterer			
Macrophyte Herbivore			
Piercer Herbivore	1	2	1.89%
Xylophage			
Scraper	1	1	0.94%
Shredder	1	3	2.83%
Omivore			
Unknown			

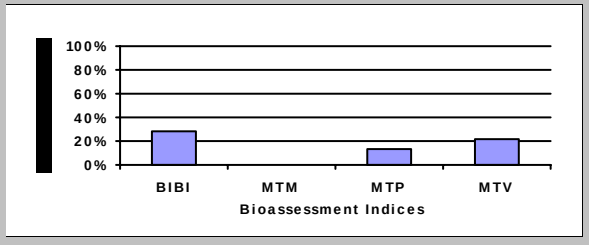


Metric Values and Scores

Metric	Value	BIBI	MTP	MTV	MTM
Composition					
Taxa Richness	11	1	0		0
Non-Insect Percent	73.58%				
E Richness	1	1		0	
P Richness	0	1		0	
T Richness	0	1		0	
EPT Richness	1		0		0
EPT Percent	0.94%		0		0
Oligochaeta+Hirudinea Percent					
Baetidae/Ephemeroptera	1.000				
Hydropsychidae/Trichoptera	0.000				
Dominance					
Dominant Taxon Percent	72.64%		0		0
Dominant Taxa (2) Percent	83.02%				
Dominant Taxa (3) Percent	86.79%	1			
Dominant Taxa (10) Percent	99.06%				
Diversity					
Shannon H (loge)	1.123				
Shannon H (log2)	1.621		0		
Margalef D	2.144				
Simpson D	0.538				
Evenness	0.087				
Function					
Predator Richness	4		2		
Predator Percent	6.60%	1			
Filterer Richness	0				
Filterer Percent	0.00%			3	
Collector Percent	87.74%		1		0
Scraper+Shredder Percent	3.77%		1		0
Scraper/Filterer	0.000				
Scraper/Scraper+Filterer	0.000				
Habit					
Burrower Richness	3				
Burrower Percent	15.09%				
Swimmer Richness	2				
Swimmer Percent	2.83%				
Clinger Richness	0	1			
Clinger Percent	0.00%				
Characteristics					
Cold Stenotherm Richness	0				
Cold Stenotherm Percent	0.00%				
Hemoglobin Bearer Richness	3				
Hemoglobin Bearer Percent	15.09%				
Air Breather Richness	1				
Air Breather Percent	0.94%				
Voltinism					
Univoltine Richness	4				
Semivoltine Richness	1	1			
Multivoltine Percent	92.45%		0		
Tolerance					
Sediment Tolerant Richness	0				
Sediment Tolerant Percent	0.00%				
Sediment Sensitive Richness	0				
Sediment Sensitive Percent	0.00%				
Metals Tolerance Index	3.958				
Pollution Sensitive Richness	0	1		0	
Pollution Tolerant Percent	15.09%	5		1	
Hilsenhoff Biotic Index	8.094		0		0
Intolerant Percent	0.00%				
Supertolerant Percent	89.62%				
CTQa	99.000				

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	14	28.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	4	13.33%	Severe
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	4	22.22%	Moderate
MTM	Montana DEQ Mountains (Bukantis 1998)	0	0.00%	Severe



Appendix G

WEED MANAGEMENT

MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, Montana

Kochia scoparia Characteristics

Disturbance of the soil and vegetation associated with construction activities, whether on upland reclamation projects or wetland mitigation project sites, typically renders the sites susceptible to weed infestation. Summer-cypress (*Kochia scoparia*), or more commonly referred to as kochia, is an undesirable annual weed that has become a troublesome weed across Montana that colonizes readily on disturbed sites.

Kochia is an early-emerging forb that reproduces exclusively by seed. One plant can produce over 50,000 seeds per year under favorable conditions. Seeds have little or no seedbank viability, they either germinate or decay in 1 year (Booth, 1987). Seeds of kochia have a dormancy period of 2 to 3 months and germinate early in the spring. Kochia has an extensive root system, often penetrating to depths of 6 to 8 feet. Kochia is considered a drought tolerant plant and does not tolerate spring flooding (Boerboom, 1993). This forb is typically found in open unshaded areas on disturbed sites and grows well on a variety of soils types and is often found on saline/alkaline soils.

Herbicide Control

Kochia can be effectively controlled with a variety of herbicides. Grazing and mowing will not control kochia or stop seed production (Anderson, 1994). The effect of fire on kochia is that the plant is often killed, but depending upon the burning season and intensity, seeds still may be viable in the soil for germination.

Herbicides must be used with care in riparian areas in order to protect non-target vegetation and prevent water contamination (**Table 7**). In addition, recent studies have indicated that amphibians are highly susceptible to herbicides. Herbicides that are labeled for riparian areas include 2,4-D, glyphosate (Rodeo label), and triclopyr (Garlon, Redeem). Effective herbicides for the control of kochia on upland areas include Vista (fluroxypry), Curtail (clopyralid) and Redeem (triclopyri and clopyralid). Herbicides such as Rodeo are non-target and kill all vegetation. Herbicides such as Vista, Curtail and Redeem are selective and kill only broadleaf plants.

Kochia is a difficult-to-control weed with an aggressive root system. While the species exhibits varying degrees of tolerance to dicamba (Banvel, Weedmaster), Vista controls even dicamba-resistant/tolerant kochia. Dicamba should not be used in areas adjacent to riparian areas or waterbodies.

Herbicides that readily leach, and herbicides with strict label prohibitions against contamination of water should be used only where there is certainty that they will not drift or enter stormwater runoff into adjacent riparian areas or waterbodies. These herbicides include clopyralid (Stinger, Transline, Curtail), dicamba (Banvel, Weedmaster), metsulfuron (Ally, Escort) and picloram (Tordon).

Management Suggestions

Based on LWC's 2003 monitoring data, kochia dominates this mitigation wetland site. Effective weed control measures for 2004 may include the following:

- Burning off old kochia skeletons to remove the canopy cover in the early spring.
- Spray (using the appropriate herbicide) early in the spring while the kochia plants are actively growing and the kochia seedlings are 3 to 4 inches tall.
- Reseed in the spring with a seed mix formulated with some quick germinating species (e.g. barley, and includes MDT recommended wetland seed mix) to help control the invasion of other annual and undesirable weedy species. A specified amount of time is needed prior to reseeding as not to injure the seed or newly seeded grass and forb species with herbicide soil residual effects. This reseeding time is directly related to the chemical and the amount of herbicide applied.
- Visit the site later in the summer to assess the weed control and seedling efforts, identify locations, if any, of new weed infestation or areas particularly susceptible to new infestations. Spot-spraying may be needed and some areas may need to be reseeded in the fall.

The specific herbicide, application rate, and timing should be approved by the Yellowstone County Weed Supervisor (Scott Bockness), MDT's botanist, MDT's weed control specialist, and the adjacent land owner. It is recommended that herbicides be applied by a licensed applicator.

Table 7: ***Summary of herbicide recommendations for use in the control of Kochia scoparia.***

Herbicide	Active Ingredient	Area of Use	Target Species
Rodeo	2,4-D, glyphosate	riparian[1]	non-target[2]
Garlon	triclopyr	riparian	selective[4]
Redeem	triclopyr	riparian, upland	selective
Vista	fluroxypry	upland	selective
Curtail	clopyralid	upland; avoid[3]	selective
Roundup	glyphomax	avoid	non-target
Stinger	clopyralid	avoid	selective
Transline	clopyralid	avoid	selective
Banvel	dicamba	avoid	selective
Weedmaster	dicamba	avoid	selective
Ally	metsulfuron	avoid	selective
Escort	metsulfuron	avoid	selective
Tordon	picloram	avoid	selective

[1] Safe for use within or adjacent to riparian areas or waterbodies.
[2] Non-target: kills all species.
[3] Not safe adjacent to water bodies or riparian areas.
[4] Kills broadleaf

Appendix H

2006 ROUNDUP WASTEWATER LAGOONS/MDT WETLAND GROUNDWATER MONITORING REPORT

MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, Montana

MONTANA DEPARTMENT OF TRANSPORTATION

ROUNDUP WASTEWATER LAGOONS/MDT WETLAND GROUNDWATER MONITORING REPORT 2006

Roundup Wetland
Roundup, Montana

Prepared for:

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

Prepared by:

POST, BUCKLEY, SCHUH & JERNIGAN
801 N. Last Chance Gulch, Suite 100
Helena, MT 59601

November 2006

Project No: B43054.00 - 0510

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TABLES

APPENDICES

1.0 INTRODUCTION

This report summarizes the methods and results of groundwater monitoring conducted at the Montana Department of Transportation's (MDT) Roundup mitigation site in 2006. The Roundup wetland site was created to provide wetland mitigation credits for MDT's reconstruction of U.S. Highway 12 in Watershed #10 located in District 5, Billings District. The site is located in Musselshell County, Montana, Section 18, Township 8 North, Range 26 East, immediately south of U.S. Highway 12 and approximately one mile east of the town of Roundup. The mitigation site is located at the site of the former wastewater lagoons for the city of Roundup.

There are five groundwater monitoring wells in the vicinity of the Roundup wetland **(Figure 1)**. The 4-inch diameter PVC monitoring wells were installed in March 1998, and have previously been sampled in April 1998 and November 2005. The wells are stick-up wells, with approximately 2 feet of casing above the ground surface. The wells were installed south of the wastewater lagoons and north of the Musselshell River. One well (Well #1) is located upstream (west) of the lagoons; two wells (Well #2 and #3) are located adjacent to the lagoons; and two wells (Well #4 and #5) are located downstream (east) of the lagoons.

Water samples were collected from each monitoring well on October 24, 2006. Samples were analyzed for nutrient parameters including total phosphorus, total Kjeldahl nitrogen, nitrate+nitrite nitrogen, and total ammonia. Field measurements were also recorded for groundwater elevation, temperature, dissolved oxygen, specific conductance, and pH. Additionally, concentrations of ferrous iron and hydrogen sulfide were estimated on site using field test kits.

2.0 METHODS

Static water measurements were collected from each well prior to sampling. Depth to water was measured with an electric static water tape from the top of the PVC casing, and corresponding groundwater elevations were calculated by subtracting depth to water from the known PVC casing elevation.

Dissolved oxygen (DO) concentrations were measured in each well before sampling using an Oxy-Guard® dissolved oxygen meter which was calibrated to site elevation prior to use. Dissolved oxygen concentrations were measured at approximately one foot above the bottom of each well within the screened interval.

Four of the monitoring wells (Well #1, #2, #4 and #5) were sampled using battery operated submersible pumps and disposable vinyl tubing. The pumps were operated using a vehicle battery, and were set approximately one foot above the bottom of each well within the screened interval. The pumps yielded approximately 2.5 gallons per minute. A minimum of three well volumes were purged from each well before sample collection.

Figure 1 Monitoring Well Locations

PROJECT NAME
MDT ROUNDUP LAGOON WETLAND MITIGATION

DRAWING TITLE
MONITORING WELL LOCATIONS

PROJ NO:	B43054.0510
LOCATION:	ROUNDUP, MT
SCALE:	1" = 150'
FILE NAME:	
DRAWN:	SH/JR
PROJ MGR:	J. BERGLUND
CHECKED:	LB
APPVD:	JB

PBSJ
3810 Valley Commons Drive
Suite 4
Bozeman, MT 59718

FIGURE
1 OF
REV -

Field parameters, including water temperature, conductivity and pH, were monitored at five minute increments while pumping. Field parameters were measured using a Hach® SensIon water quality meter which was calibrated in the field prior to use.

Well #3 was sampled using a disposable bailer because of its distance from the road. Approximately three well volumes were purged from the well before sample collection, and field measurements were recorded after each well volume was purged from the well.

Concentrations of ferrous iron (Fe) were estimated in the field using a Hach® colorimeter. Additionally, concentrations of hydrogen sulfide (H_2S) were estimated in the field using a Hach® Model HS-C field test kit.

After purging a minimum of three well volumes, water samples were collected from each well in 500 ml polyethylene bottles. The sample bottles were rinsed twice with well water before collection, and were acidified with H_2SO_4 preservative. Samples were stored on ice and delivered to the analytical laboratory approximately 24 hours after collection. Samples were analyzed for nutrient parameters including total phosphorus, total Kjeldahl nitrogen, nitrate+nitrite nitrogen, and total ammonia. Total nitrogen was calculated by summing the concentrations of total Kjeldahl nitrogen and nitrate+nitrite nitrogen. The analytical methods and detection limits are provided below in **Table 1**.

Table 1. ***Analytical methods and detection limits.***

Nutrient Parameter	Analytical Method	Detection Limit
Total Phosphorus (TP)	EPA 365.1	0.01 mg/L
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	0.5 mg/L
Nitrate+Nitrite Nitrogen (NO_2+NO_3)	EPA 353.2	0.1 mg/L
Total Ammonia Nitrogen (NH_4)	EPA 350.1	0.1 mg/L

3.0 GROUNDWATER MONITORING RESULTS

Groundwater monitoring results, including groundwater elevations, field parameter results, and nutrient parameter results are presented and summarized below in **Sections 3.1, 3.2** and **3.3**.

3.1 Groundwater Elevation Results

Depths to groundwater ranged from approximately 3.7 to 10.9 feet below ground surface, and corresponding groundwater elevations ranged from 3164.16 to 3169.93 feet during the 2006 sampling event (**Table 2**). Groundwater elevations were generally slightly higher during the 2006 sampling event than in November 2005, although groundwater elevation in Well #1 was lower during 2006 than in 2005.

Table 2. ***Groundwater elevations.***

Well ID	Well Depth (ft)	Screened Interval (ft)	PVC Casing Elevation (ft)	Date	Depth to Water (ft)	Groundwater Elevation (ft)
1	22.0	17.0-22.0	3182.81	04/09/98	12.47	3170.34
				04/28/98	12.63	3170.18
				11/01/05	12.84	3169.97
				10/24/06	12.88	3169.93
2	16.0	10.5-15.5	3174.61	04/09/98	6.17	3168.44
				04/28/98	6.42	3168.19
				11/01/05	6.58	3168.03
				10/24/06	6.22	3168.39
3	16.0	11.0-16.0	3174.61	04/09/98	7.75	3166.50
				04/28/98	7.85	3166.40
				11/01/05	8.18	3166.07
				10/24/06	7.82	3166.79
4	16.2	11.2-16.2	3174.56	04/09/98	9.54	3165.02
				04/28/98	9.61	3164.95
				11/01/05	9.83	3164.73
				10/24/06	9.83	3165.02
5	16.0	11.0-16.0	3169.82	04/09/98	5.36	3164.46
				04/28/98	5.45	3164.37
				11/01/05	5.71	3164.11
				10/24/06	5.66	3164.16

The groundwater elevations indicate that groundwater flows in an easterly direction in the vicinity of the wastewater lagoons. Groundwater flow directions are roughly parallel with the Musselshell River, which also flows in an easterly direction.

3.2 Field Parameter Results

Field measurements of dissolved oxygen, water temperature, conductivity, pH, ferrous iron, and hydrogen sulfide are presented below in **Table 3**. Dissolved oxygen concentrations were recorded in-situ prior to sampling, while the remaining field parameters were recorded after purging three well volumes from each well. Groundwater sampling and monitoring forms are included in **Appendix A**.

Water temperature and pH readings were lower at all locations during the 2006 sampling event than in 2005, while conductivity measurements were higher at all locations in 2006. Dissolved oxygen concentrations decreased at three locations and increased at the remaining two locations, but were generally quite low at all sites.

In general, concentrations of ferrous iron and hydrogen sulfide were comparable to previous results with some exceptions. Ferrous iron concentrations decreased from 2005 at two locations and increased at two locations, but remained unchanged at one site. Yellow tinted water was noted at Well #2, #3 and #4, and consequently, these wells yielded the highest concentrations of ferrous iron, ranging from 4.2 to 5.1 mg/L. Hydrogen sulfide concentrations decreased at two locations, and remained unchanged at

Table 3. ***Field parameter results.***

Well ID	Date	Dissolved Oxygen (mg/L)	Water Temp. (oC)	Conductivity (us/cm)	pH	Ferrous Iron (mg/L)	Hydrogen Sulfide (mg/L)
1	04/09/98	NM	11.5	620	7.1	~0.1	<0.1
	11/01/05	0.5	11.6	330	8.2	~0.0	~0.1
	10/24/06	3.0	11.1	450	7.3	~0.0	<0.1
2	04/09/98	NM	11.0	626	7.6	~3-4	<0.1
	11/01/05	0.2	12.9	489	7.8	~4.6	~0.3
	10/24/06	0.3	11.9	726	7.4	~5.1	~0.2
3	04/09/98	NM	11.0	604	7.6	~3-4	<0.1
	11/01/05	0.3	11.2	477	7.9	~4.5	~0.1
	10/24/06	0.2	10.5	735	7.8	~4.2	~0.1
4	04/09/98	NM	9.0	604	7.4	~7-8	<0.1
	11/01/05	0.5	12.3	500	7.8	~4.1	~0.1
	10/24/06	0.1	11.6	543	7.3	~5.1	~0.1
5	04/09/98	NM	9.0	647	7.3	(note)	<0.1
	11/01/05	1.5	13.1	445	7.7	~0.3	~0.5
	10/24/06	0.6	12.3	619	7.2	~0.01	~0.1

NM = not measured
Note – Fe was not detected in field, but water turned orange when bleach was added (Morrison-Maierle, April 1998)

three locations. A sulfur odor was noted in Well #2, #3, #4 and #5, and hydrogen sulfide concentrations were estimated to be above detection at these four locations.

3.3 Nutrient Parameter Results

Water samples from each well were analyzed for nutrient parameters including total phosphorus, total Kjeldahl nitrogen, nitrate + nitrite nitrogen, and total ammonia nitrogen during the 2006 sampling event. Total nitrogen was subsequently calculated by summing the concentrations of total Kjeldahl and nitrate + nitrite nitrogen. The analytical results, including those from the 1998 and 2005 sampling events, are presented below in **Table 4**. The laboratory analytical summary report is included in **Appendix B**.

Total phosphorus (TP) concentrations were higher during the 2006 sampling event than in 2005 at three locations, and lower in 2006 at two locations. TP concentrations in Well #1, #3 and #4 increased over the previous sampling year, with Well #3 displaying the highest relative increase (63%). TP concentrations decreased in Well #2 and #5, with Well #2 having the largest relative decrease (71%).

Concentrations of total Kjeldahl nitrogen (TKN) decreased from previous sampling results at four locations in 2006, but remained below detection in Well #1. The largest relative decrease occurred in Well #5 (45%).

Concentrations of nitrate + nitrite nitrogen (NO_2+NO_3) were below the analytical detection limit at three sites in 2006 (Well #2, #4 and #5), but above detection in Well #1 and #3. NO_2+NO_3 concentration decreased from the previous sampling event in well 1,

but increased in Well #3. NO_2+NO_3 concentrations were previously below the analytical detection limit at Well #3.

Ammonia nitrogen (NH_4) concentrations were below the analytical detection limit in Well #1 during the 2006 sampling event. Of the remaining four wells, three had lower concentrations of NH_4 in 2006 than in 2005, while concentrations in Well #2 increased slightly. Well #3 had the largest relative decrease in NH_4 concentrations in 2006 (26%).

Concentrations of total nitrogen (TN) were lower in 2006 than in 2005 at all sampling locations. Well #5 had the largest relative decrease in TN concentration in 2006 (45%). These results are similar to those for TKN, which had decreasing concentrations at four wells during 2006.

Table 4. ***Nutrient parameter results.***

Well ID	Date	Total Phosphorus (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Nitrate + Nitrite (mg/L)	Ammonia (mg/L)	Total Nitrogen (mg/L)
1	04/09/98	0.01	<0.5	24.4	<0.1	24.4
	11/01/05	0.02	<0.5	14.0	<0.1	14.0
	10/24/06	0.03	<0.5	12.4	<0.1	12.4
2	04/09/98	1.71	15.5	<0.05	15.0	15.5
	11/01/05	4.92	25.7	<0.05	18.5	25.7
	10/24/06	1.43	20.6	<0.05	18.8	20.6
3	04/09/98	0.29	15.8	<0.05	15.7	15.8
	11/01/05	2.36	25.0	<0.05	19.4	25.0
	10/24/06	3.84	15.9	0.94	14.3	16.8
4	04/09/98	0.02	8.9	<0.05	5.7	8.9
	11/01/05	0.13	16.9	<0.05	13.2	16.9
	10/24/06	0.14	14.9	<0.05	12.8	14.9
5	04/09/98	0.01	3.5	0.28	1.8	3.8
	11/01/05	0.30	7.5	<0.05	4.5	7.5
	10/24/06	0.02	4.1	<0.05	3.5	4.1

4.0 CONCLUSIONS

Groundwater elevations were higher in four wells during the 2006 sampling event than were recorded during 2005, which indicates that the sampling site may have received more precipitation during 2006 than the previous sample year. Consequently, field parameters also varied in 2006 from previous sample years. Field measurements of water temperature and pH were lower at all sample locations during 2006, while concentrations of conductivity were higher at all sample locations.

Nutrient concentrations were quite variable during 2006, although some trends do exist, especially for total nitrogen (TN). Concentrations of total nitrogen decreased from previous sample results at all sample locations during 2006. The concentration of nitrate + nitrite nitrogen in Well #1 exceeded the human health standard of 10 mg/L for groundwater during 2006 (Montana DEQ 2006), although the concentration decreased from the 2005 sampling event. Previous monitoring results (Olympus 2005) have

suggested that a source of nitrate + nitrite nitrogen not related to the lagoons is impacting groundwater up-gradient of the lagoons; however, nitrate + nitrite nitrogen was above the analytical detection limit in Well #3 during the 2006 sampling event, but had not been above detection in previous sampling efforts. Well #3 is immediately adjacent to the wastewater lagoons.

Analytical results suggest that the lagoons appear to be a source of nutrients in the vicinity of the wastewater lagoons, especially for total phosphorus, total Kjeldahl nitrogen, and total ammonia nitrogen; however, nutrient concentrations were generally lower during the 2006 sampling event than were recorded during 2005.

Well caps and locks were installed on all monitoring wells; however, seals on the well caps are worn and could be removed simply by pulling on the well cap. To prevent future contamination or tampering, it is recommended that the well caps be replaced with tight fitting seals. Furthermore, a disposable bailer was lost in Well #3 during sampling and could not be retrieved. The bailer did not impede sampling efforts during this event and it will not affect future sampling results; however, an effort should be made during future sampling events to remove the bailer.

Based on the conclusions in this report, MDT is planning to conduct annual groundwater monitoring and sampling for one additional year, which is planned for 2007. Following the 2007 sampling event, MDT will evaluate the groundwater data and present a recommendation to DEQ on continuing (or discontinuing) groundwater monitoring and sampling at this site.

5.0 REFERENCES

Montana DEQ. 2006. *Circular DEQ-7 – Montana Numeric Water Quality Standards.* Montana Department of Environmental Quality. Helena, MT.

Olympus Technical Services, Inc. 2005. *Groundwater Monitoring Report - Former Roundup Wastewater Lagoons/MDT Wetland*. Prepared for Montana Department of Transporation. Billings, MT.

Appendix A

GROUNDWATER SAMPLING AND MONITORING FORMS

ROUNDUP WASTEWATER LAGOONS/MDT WETLAND GROUNDWATER MONITORING REPORT 2006

Groundwater Sampling and Monitoring Form

Project: Rounsaville GW sampling

Project # B43054.00 TASK 0510

Date: 10/24/06 Time: 0830

L&W Personnel: JB Samp. Loc. Well #1

Aquifer Type: UNCONFINED Well Type: mon.

Total Depth: 22.9 SWL: 12.88 feet

Measuring Point Description: TOP of PVC

Casing Type: PVC Well Diam: 4"

Well Log: ☐ Yes ☒ No Well Locked: ☐ Yes ☒ No Mount Type: ☐ Flush ☒ Stickup:

Purge & Sampling Equipment

Instrument	Calibration	Operational Notes:
HACH - Fe	10/24/06	
HACH FERRO PROBE	10/24/06	

Sampling Location Sketch:

Well Evaucation & Monitoring Data

Time	Temp (deg C)	pH	Eh (mV)	Conductivity mS	TDS (mg/L)	DO mg/L	Q (gpm)	Elapsed (gallons)
8:52	12.0					3.0	2.5	0
8:57	11.3	7.41		6.11			↓	12.5
9:00	11.2	7.30		5.02				20
9:05	11.1	7.29		4.47				32.5
9:10	11.1	7.31		4.50				45

Bore Volume Calculation: $(pi^2/4)*(TD-SWL)*(7.48\ gal/ft^3)$ = [redacted] (4" bore calc.) [redacted] → 6.48

Water Description: CLEAR, NO ODOR

Sampling Data

Sample Number	Sampling Parameter	Preservative	Sample Time	Bottle	Other
B43054-1	NUTS	H_2SO_4	0900	1	
HACH	Fe				
HACH	H_2S				

Laboratory:

Comments:

Fe = 0.00 NO RED IN SAMPLE

H_2S = 0.00 NO COLOR CHANGE ON TEST STRIP

NUTS = TP/TKN, NO_2+NO_3, NH_4

Standard Operating Procedures

Number	Description
3401, 3402, 3403	Corning Checkmate 90: pH, Eh, Conductivity, TDS, DO
4203	Well Static Water Level Measurement Using Solinst Well Probe
5201	Monitoring Well Purging & Sampling
5211	Major Minerals (INORGANICS) Sampling
5212	Volatile Organic Analysis (VOA) Sampling
5213	Bioremediation Sampling
5214	Groundwater TPH-DRO Sampling
6210	Groundwater Equipment Decontamination
8210	Sample Packaging & Shipping for Groundwater Samples
8300, 8400, 8510	Field QA/QC, Sample Custody, Sample ID and Analytical Results

Groundwater Sampling and Monitoring Form

Project: ROUNDUP Project # B43057.00 0510

Date: 10/22/04 Time: 0920

L&W Personnel: JB Samp. Loc. WELL #2

Aquifer Type: UNCONFINED Well Type: MON.

Total Depth: 16.0 SWL: 6.82 feet

Measuring Point Description: TOP OF PVC

Casing Type: PVC Well Diam: 4"

Well Log: ☐ Yes ☒ No Well Locked: ☒ Yes ☐ No Mount Type: ☐ Flush ☐ Stick-up:

Purge & Sampling Equipment

Instrument	Calibration	Operational Notes:
HACH - Fe	10/21	
HACH - H2S	10/24	

Sampling Location Sketch:

Well Evaucation & Monitoring Data

Time	Temp (deg C)	pH	Eh (mV)	Conductivity (uS)	TDS (mg/L)	DO mg/L	Q (gpm)	Elapsed (gallons)
0940		[illegible]				0.3	2.5	0
0945	12.1	7.38		735		↓	↓	18.5
0950	12.0	7.39		726				85
0955	11.9	7.43		726				37.5
1000	11.9	7.44		726		↓	↓	500

Bore Volume Calculation: $(pf^2/4)\cdot(TD-SWL)\cdot(7.48\ gal/ft^3)$ = 6.38 # bore calc.)

Water Description: YELLOW @ FIRST, THEN CLEAR, SULFUR ODOR

Sampling Data

Sample Number	Sampling Parameter	Preservative	Sample Time	Bottle	Other
B43057 - 2	NUTS	H_2SO_4	1010	1	
HACH	Fe				
HACH	H_2O				

Laboratory:

Comments:

RUST ON CASING
WELL CAP NOT SEALED, BUT LOCK ON WELL

Fe = 5.10
H_2S = ~0.2 (BETWEEN 0.1 + 0.3 ON COLOR CARD)

Standard Operating Procedures

Number	Description
3401, 3402, 3403	Corning Checkmate 90: pH, Eh, Conductivity, TDS, DO
4203	Well Static Water Level Measurement Using Solinst Well Probe
5201	Monitoring Well Purging & Sampling
5211	Major Minerals (INORGANICS) Sampling
5212	Volatile Organic Analysis (VOA) Sampling
5213	Bioremediation Sampling
5214	Groundwater TPH-DRO Sampling
6210	Groundwater Equipment Decontamination
8210	Sample Packaging & Shipping for Groundwater Samples
8300, 8400, 8510	Field QA/QC, Sample Custody, Sample ID and Analytical Results

Groundwater Sampling and Monitoring Form

Project: Rounvp GW

Project # B43054 0510

Date: 10/24/06 Time: 1030

L&W Personnel: JB Samp. Loc. WELL #3

Aquifer Type: UNCONF. Well Type: MW

Total Depth: 16.0 SWL: 7.92 feet

Measuring Point Description: TOP OF PVC

Casing Type: PVC Well Diam:

Well Log: ☐ Yes ☒ No Well Locked: ☒ Yes ☐ No Mount Type: ☐ Flush ☒ Stickup:

Purge & Sampling Equipment

Instrument	Calibration	Operational Notes:
Hach-Fe	10/24	
Hach-H2S	10/24	

Sampling Location Sketch:

Well Evaucation & Monitoring Data

Time	Temp (deg C)	pH	Eh (mV)	Conductivity (uS)	TDS (mg/L)	DO mg/L	Q (gpm)	Elapsed (gallons)
1055						0.2		
1100	12.1	7.67		741				~5
1105	10.5	7.74		736				~10
1110	10.5	7.75		735				~15

Bore Volume Calculation: $(pi^2/4)\cdot(TD-SWL)\cdot(7.48\ gal/ft^3) = 5.39$ (* bore calc.)

Water Description: YELLOW @ FIRST, TAN CLEAR, SULFUR ODOR

Sampling Data

Sample Number	Sampling Parameter	Preservative	Sample Time	Bottle	Other
B43054-3	NUTS	H2SO4	1115	1	
HACH	Fe				
HACH	H2S				

Laboratory:

Comments:

Fe = 4.24

H2S = 0.1

SAMPLED W/ BAILER, BAILED ~20 GAL

LOST BAILER IN WELL

WELL LOCKED, BUT NOT SEALED

Standard Operating Procedures

Number	Description
3401, 3402, 3403	Corning Checkmate 90: pH, Eh, Conductivity, TDS, DO
4203	Well Static Water Level Measurement Using Solinst Well Probe
5201	Monitoring Well Purging & Sampling
5211	Major Minerals (INORGANICS) Sampling
5212	Volatile Organic Analysis (VOA) Sampling
5213	Bioremediation Sampling
5214	Groundwater TPH-DRO Sampling
6210	Groundwater Equipment Decontamination
8210	Sample Packaging & Shipping for Groundwater Samples
8300, 8400, 8510	Field QA/QC, Sample Custody, Sample ID and Analytical Results

Groundwater Sampling and Monitoring Form

Project: Navorp GW

Project # B43054 0510

Date: 10/04/06 Time: 11:50

L&W Personnel: JB Samp. Loc. WSW #4

Aquifer Type: UNCON. Well Type: MON

Total Depth: 18.0 SWL: 9.83 feet

Measuring Point Description: TOP OF PVC

Casing Type: PVC Well Diam: 4

Well Log: ☐ Yes ☒ No Well Locked: ☒ Yes ☐ No Mount Type: ☐ Flush ☒ Stickup:

Purge & Sampling Equipment

Instrument	Calibration	Operational Notes:
HACH Fe	10/04	
HACH - FIELD	10/4	

Sampling Location Sketch:

Well Evaucation & Monitoring Data

Time	Temp (deg C)	pH	Eh (mV)	Conductivity (uS)	TDS (mg/L)	DO mg/L	Q (gpm)	Elapsed (gallons)
12:10	11.5					0.1	2.5	0
12:15	11.6	7.20		520				12.5
12:20	11.6	7.23		520				25
12:25	11.6	7.29		521				37.5
12:30	11.6	7.30		523		↓	↓	50

Bore Volume Calculation: $(pi^2/4)*(TD-SWL)*(7.48\ gal/ft^3)$ = 5.33 4 (# bore calc.)

Water Description: YELLOW TINT, THEN CLEAR, SLIGHT ODOR

Sampling Data

Sample Number	Sampling Parameter	Preservative	Sample Time	Bottle	Other
B43054-4	NUTS	H_2SO_4	12:30	1	
~~Field~~	Fe				
~~Field~~	H_2S				

Laboratory:

Comments:

Fe = 5.10

H_2S = 0.1

WELL LOCKED, BUT NOT SEALED

Standard Operating Procedures

Number	Description
3401, 3402, 3403	Corning Checkmate 90: pH, Eh, Conductivity, TDS, DO
4203	Well Static Water Level Measurement Using Solinst Well Probe
5201	Monitoring Well Purging & Sampling
5211	Major Minerals (INORGANICS) Sampling
5212	Volatile Organic Analysis (VOA) Sampling
5213	Bioremediation Sampling
5214	Groundwater TPH-DRO Sampling
6210	Groundwater Equipment Decontamination
8210	Sample Packaging & Shipping for Groundwater Samples
8300, 8400, 8510	Field QA/QC, Sample Custody, Sample ID and Analytical Results

Groundwater Sampling and Monitoring Form

Project: Rounup GW Project # B43054 057

Date: 10/27/04 Time: 12:50

L&W Personnel: JDB Samp. Loc. WELL #5

Aquifer Type: UNCONF. Well Type: MON

Total Depth: 16.0 SWL: 5.66 feet

Measuring Point Description: TOP OF PVC

Casing Type: PVC Well Diam: 4

Well Log: ☐ Yes ☒ No Well Locked: ☒ Yes ☐ No Mount Type: ☐ Flush ☒ Stickup

Purge & Sampling Equipment

Instrument	Calibration	Operational Notes:
HACH-Fe	10/04	
HACH-H2S	10/04	

Sampling Location Sketch:

Well Evaucation & Monitoring Data

Time	Temp (deg C)	pH	Eh (mV)	Conductivity (uS)	TDS (mg/L)	DO mg/L	Q (gpm)	Elapsed (gallons)
13:25						0.6	2.5	0
13:30	12.1	9.16		622				12.5
13:35	12.3	7.17		620				25
13:40	12.3	7.18		619				37.5

Bore Volume Calculation: $(pi^2/4)*(TD-SWL)*(7.48\ gal/ft^3)$ = 6.75 (6" bore calc.)

Water Description: CLEAR, SLIGHT ODOR

Sampling Data

Sample Number	Sampling Parameter	Preservative	Sample Time	Bottle	Other
B43054-5	NUTS	H_2SO_4	13:45	1	
HACH	Fe				
HACH	H_2S				

Laboratory:

Comments:

Fe = 0.01
H2S 0.1

WELL LOCKED, BUT DOES NOT SEAL

Standard Operating Procedures

Number	Description
3401, 3402, 3403	Corning Checkmate 90: pH, Eh, Conductivity, TDS, DO
4203	Well Static Water Level Measurement Using Solinst Well Probe
5201	Monitoring Well Purging & Sampling
5211	Major Minerals (INORGANICS) Sampling
5212	Volatile Organic Analysis (VOA) Sampling
5213	Bioremediation Sampling
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8210	Sample Packaging & Shipping for Groundwater Samples
8300, 8400, 8510	Field QA/QC, Sample Custody, Sample ID and Analytical Results

Appendix B

LABORATORY ANALYTICAL RESULTS

ROUNDUP WASTEWATER LAGOONS/MDT WETLAND GROUNDWATER MONITORING REPORT 2006

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

ANALYTICAL SUMMARY REPORT

November 07, 2006

PBS and J
PO Box 239
Helena, MT 59624

Workorder No.: H06100231

Project Name: Roundup GW Monitoring

Energy Laboratories Inc received the following 5 samples from PBS and J on 10/25/2006 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H06100231-001	Well 1	10/24/06 9:00	10/25/06	Aqueous	Nitrogen, Ammonia Nitrogen, Nitrate + Nitrite Nitrogen, Total Kjeldahl Phosphorus, Total
H06100231-002	Well 2	10/24/06 10:10	10/25/06	Aqueous	Same As Above
H06100231-003	Well 3	10/24/06 11:15	10/25/06	Aqueous	Same As Above
H06100231-004	Well 4	10/24/06 12:30	10/25/06	Aqueous	Same As Above
H06100231-005	Well 5	10/24/06 13:45	10/25/06	Aqueous	Same As Above

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative or Report.

If you have any questions regarding these tests results, please call.

Report Approved By: Jennifer Hughes

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LABORATORY ANALYTICAL REPORT

Client: PBS and J
Project: Roundup GW Monitoring
Lab ID: H06100231-001
Client Sample ID: Well 1

Report Date: 11/07/06
Collection Date: 10/24/06 09:00
DateReceived: 10/25/06
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
NUTRIENTS							
Nitrogen, Ammonia as N	ND	mg/L		0.1		E350.1	10/26/06 12:47 / sld
Nitrogen, Kjeldahl, Total as N	ND	mg/L		0.5		E351.2	11/03/06 14:37 / eli-b
Nitrogen, Nitrate+Nitrite as N	12.4	mg/L	D	0.1		E353.2	10/27/06 10:06 / sld
Phosphorus, Total as P	0.03	mg/L		0.01		E365.1	10/31/06 13:33 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: PBS and J
Project: Roundup GW Monitoring
Lab ID: H06100231-002
Client Sample ID: Well 2

Report Date: 11/07/06
Collection Date: 10/24/06 10:10
DateReceived: 10/25/06
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
NUTRIENTS							
Nitrogen, Ammonia as N	18.8	mg/L	D	0.3		E350.1	10/26/06 13:16 / sld
Nitrogen, Kjeldahl, Total as N	20.6	mg/L		0.5		E351.2	11/03/06 14:57 / eli-b
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.05		E353.2	10/27/06 10:08 / sld
Phosphorus, Total as P	1.43	mg/L		0.01		E365.1	10/30/06 15:31 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: PBS and J
Project: Roundup GW Monitoring
Lab ID: H06100231-003
Client Sample ID: Well 3

Report Date: 11/07/06
Collection Date: 10/24/06 11:15
DateReceived: 10/25/06
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
NUTRIENTS							
Nitrogen, Ammonia as N	14.3	mg/L	D	0.3		E350.1	10/26/06 13:25 / sld
Nitrogen, Kjeldahl, Total as N	15.9	mg/L		0.5		E351.2	11/03/06 14:57 / eli-b
Nitrogen, Nitrate+Nitrite as N	0.94	mg/L		0.05		E353.2	10/27/06 10:10 / sld
Phosphorus, Total as P	3.84	mg/L		0.01		E365.1	10/31/06 13:36 / sld

Report Definitions:
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QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: PBS and J
Project: Roundup GW Monitoring
Lab ID: H06100231-004
Client Sample ID: Well 4

Report Date: 11/07/06
Collection Date: 10/24/06 12:30
DateReceived: 10/25/06
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
NUTRIENTS							
Nitrogen, Ammonia as N	12.8	mg/L	D	0.7		E350.1	10/26/06 13:27 / sld
Nitrogen, Kjeldahl, Total as N	14.9	mg/L		0.5		E351.2	11/03/06 14:58 / eli-b
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.05		E353.2	10/27/06 10:16 / sld
Phosphorus, Total as P	0.14	mg/L		0.01		E365.1	10/31/06 13:37 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: PBS and J
Project: Roundup GW Monitoring
Lab ID: H06100231-005
Client Sample ID: Well 5

Report Date: 11/07/06
Collection Date: 10/24/06 13:45
DateReceived: 10/25/06
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
NUTRIENTS							
Nitrogen, Ammonia as N	3.5	mg/L	D	0.3		E350.1	10/26/06 13:29 / sld
Nitrogen, Kjeldahl, Total as N	4.1	mg/L		0.5		E351.2	11/03/06 14:40 / eli-b
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.05		E353.2	10/27/06 10:18 / sld
Phosphorus, Total as P	0.02	mg/L		0.01		E365.1	10/31/06 13:38 / sld

Report Definitions:
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QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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QA/QC Summary Report

Client: PBS and J
Project: Roundup GW Monitoring

Report Date: 11/07/06
Work Order: H06100231

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E350.1								Analytical Run: NUTRIENTS_061026A	
Sample ID: ICV-1	Initial Calibration Verification Standard							10/26/06 11:54	
Nitrogen, Ammonia as N	1.01	mg/L	0.10	101	90	110			
Method: E350.1								Batch: A2006-10-26_5_NH3_03	
Sample ID: LCS-2	Laboratory Control Sample				Run: NUTRIENTS_061026A			10/26/06 11:57	
Nitrogen, Ammonia as N	16.3	mg/L	0.71	105	90	110			
Sample ID: LFB-3	Laboratory Fortified Blank				Run: NUTRIENTS_061026A			10/26/06 11:59	
Nitrogen, Ammonia as N	0.540	mg/L	0.10	108	90	110			
Sample ID: MBLK-5	Method Blank				Run: NUTRIENTS_061026A			10/26/06 12:03	
Nitrogen, Ammonia as N	ND	mg/L	0.03						
Sample ID: H06100204-003ADUP	Sample Duplicate				Run: NUTRIENTS_061026A			10/26/06 12:36	
Nitrogen, Ammonia as N	0.200	mg/L	0.10				14	20	
Sample ID: H06100232-002AMS	Sample Matrix Spike				Run: NUTRIENTS_061026A			10/26/06 13:07	
Nitrogen, Ammonia as N	1.02	mg/L	0.10	102	90	110			
Sample ID: H06100232-002AMSD	Sample Matrix Spike Duplicate				Run: NUTRIENTS_061026A			10/26/06 13:09	
Nitrogen, Ammonia as N	1.00	mg/L	0.10	100	90	110	2.0	20	
Sample ID: H06100232-001BDUP	Sample Duplicate				Run: NUTRIENTS_061026A			10/26/06 13:30	
Nitrogen, Ammonia as N	9.22	mg/L	0.14				8.5	20	
Method: E351.2								Batch: B_R84837	
Sample ID: H06100210-001B	Sample Matrix Spike				Run: SUB-B84837			11/03/06 14:17	
Nitrogen, Kjeldahl, Total as N	5.83	mg/L	0.50	113	90	110			S
Sample ID: H06100210-001B	Sample Matrix Spike Duplicate				Run: SUB-B84837			11/03/06 14:18	
Nitrogen, Kjeldahl, Total as N	5.87	mg/L	0.50	113	90	110	0.6	10	S
Sample ID: MBLK	Method Blank				Run: SUB-B84837			11/03/06 14:02	
Nitrogen, Kjeldahl, Total as N	ND	mg/L	0.03						
Sample ID: B06101877-004BMS	Sample Matrix Spike				Run: SUB-B84837			11/03/06 14:34	
Nitrogen, Kjeldahl, Total as N	30.5	mg/L	0.50	110	90	110			
Sample ID: B06101877-004BMSD	Sample Matrix Spike Duplicate				Run: SUB-B84837			11/03/06 14:36	
Nitrogen, Kjeldahl, Total as N	30.4	mg/L	0.50	110	90	110	0.2	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

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QA/QC Summary Report

Client: PBS and J
Project: Roundup GW Monitoring

Report Date: 11/07/06
Work Order: H06100231

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E353.2								Analytical Run: NUTRIENTS_061027A	
Sample ID: ICV-1	Initial Calibration Verification Standard							10/27/06 09:46	
Nitrogen, Nitrate+Nitrite as N	0.970	mg/L	0.050	97	90	110			
Method: E353.2								Batch: A2006-10-27_5_NO3_0	
Sample ID: LCS-2	Laboratory Control Sample				Run: NUTRIENTS_061027A			10/27/06 09:50	
Nitrogen, Nitrate+Nitrite as N	25.4	mg/L	0.30	96	90	110			
Sample ID: LFB-3	Laboratory Fortified Blank				Run: NUTRIENTS_061027A			10/27/06 09:52	
Nitrogen, Nitrate+Nitrite as N	0.520	mg/L	0.050	104	90	110			
Sample ID: MBLK-5	Method Blank				Run: NUTRIENTS_061027A			10/27/06 09:56	
Nitrogen, Nitrate+Nitrite as N	ND	mg/L	0.01						
Sample ID: H06100228-001BDUP	Sample Duplicate				Run: NUTRIENTS_061027A			10/27/06 10:02	
Nitrogen, Nitrate+Nitrite as N	1.00	mg/L	0.050				3.0	20	
Sample ID: H06100231-005AMS	Sample Matrix Spike				Run: NUTRIENTS_061027A			10/27/06 10:20	
Nitrogen, Nitrate+Nitrite as N	0.980	mg/L	0.050	98	90	110			
Sample ID: H06100231-005AMSD	Sample Matrix Spike Duplicate				Run: NUTRIENTS_061027A			10/27/06 10:22	
Nitrogen, Nitrate+Nitrite as N	1.00	mg/L	0.050	100	90	110	2.0	20	
Method: E365.1								Analytical Run: FIA202-HE_061030B	
Sample ID: ICV	Initial Calibration Verification Standard							10/30/06 15:22	
Phosphorus, Total as P	0.244	mg/L	0.010	98	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard							10/30/06 15:25	
Phosphorus, Total as P	0.262	mg/L	0.010	105	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard							10/30/06 15:37	
Phosphorus, Total as P	0.254	mg/L	0.010	101	90	110			
Method: E365.1								Batch: R33690	
Sample ID: LCS	Laboratory Control Sample				Run: FIA202-HE_061030B			10/30/06 15:23	
Phosphorus, Total as P	5.76	mg/L	0.010	94	90	110			
Sample ID: LFB	Laboratory Fortified Blank				Run: FIA202-HE_061030B			10/30/06 15:24	
Phosphorus, Total as P	0.252	mg/L	0.010	96	90	110			

Qualifiers:

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QA/QC Summary Report

Client: PBS and J
Project: Roundup GW Monitoring

Report Date: 11/07/06
Work Order: H06100231

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E365.1								Analytical Run: FIA202-HE_061031A	
Sample ID: ICV	Initial Calibration Verification Standard								10/31/06 13:27
Phosphorus, Total as P	0.249	mg/L	0.010	100	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								10/31/06 13:30
Phosphorus, Total as P	0.257	mg/L	0.010	103	90	110			
Method: E365.1									Batch: R33715
Sample ID: LCS	Laboratory Control Sample				Run: FIA202-HE_061031A				10/31/06 13:28
Phosphorus, Total as P	5.84	mg/L	0.010	95	90	110			
Sample ID: LFB	Laboratory Fortified Blank				Run: FIA202-HE_061031A				10/31/06 13:29
Phosphorus, Total as P	0.253	mg/L	0.010	98	90	110			
Sample ID: MBLK	Method Blank				Run: FIA202-HE_061031A				10/31/06 13:31
Phosphorus, Total as P	0.009	mg/L	0.0004						
Sample ID: H06100278-002BDUP	Sample Duplicate				Run: FIA202-HE_061031A				10/31/06 13:43
Phosphorus, Total as P	9.29	mg/L	0.010				5.8	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

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Energy Laboratories Inc

Sample Receipt Checklist

Client Name **PBS and J**

Date and Time Received: **10/25/2006 10:12:00 AM**

Work Order Number **H06100231**

Received by rlt

Login completed by: Roxanne L. Tubbs (Signature) 10/25/2006 10:12:0 (Date)

Reviewed by JDH HBB (Initials) 10/26/06 (Date)

Carrier name Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	1.5 °C
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Adjusted? _____ Checked by _____

Contact and Corrective Action Comments:

None

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT, provide as much information as possible. Refer to corresponding notes on reverse side.

Company Name: PBS&J	Project Name, PWS #, Permit #, Etc.: Lovano GW monitoring
Report Mail Address: JOHN BABCOCK / PBS&J 801 N. LAST CHANCE GULCH STE.100 HELENA, MT 59601	Contact Name, Phone, Fax, E-mail: JOHN BABCOCK 459-4782 cell 495-1379 FAX JBABCOCK@PBSJ.com Sampler Name if other than Contact:
Invoice Address: JEFF BERGLUND / PBSJ 801 N. LAST CHANCE GULCH STE.100 HELENA, MT 59601	Invoice Contact & Phone #: JEFF BERGLUND 495-1377 Purchase Order #: B43054.00 ELI Quote #:

Report Required For: POTW/WWTP ☐ DW ☐ Other _____

Special Report Formats - ELI must be notified prior to sample submittal for the following:

NELAC ☐ A2LA ☐ Level IV ☐

Other _____

EDD/EDT ☐ Format _____

Number of Containers
Sample Type: A W S V B O
Air Water Soils/Solids Vegetation Bioassay Other

ANALYSIS REQUESTED

Notify ELI prior to RUSH sample submittal for additional charges and scheduling

Shipped by: hand del

Cooler ID(s) _____

Receipt Temp 1.5 °C

Custody Seal Y N
Intact Y N
Signature Y N
Match

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	TP	TKN	NO_2+NO_3	NH_4	SEE ATTACHED	Normal Turnaround (TAT)	RUSH Turnaround (TAT)	Comments:	LABORATORY USE ONLY Lab ID
1	Well 1	10/24/06	0900	WATER	X	X	X	X		X			H06100331-001
2	Well 2	"	1010	"	X	X	X	X		X			002
3	Well 3	"	1115	"	X	X	X	X		X			003
4	Well 4	"	1230	"	X	X	X	X		X			004
5	Well 5	"	1345	"	X	X	X	X		X			005
6													
7													
8													
9													
10													

Custody Record MUST be Signed

Relinquished by (print): JOHN BABCOCK	Date/Time: 10/25/06	Signature:	Received by (print): ROXANNE TURNER	Date/Time: 10.25.06 10:12	Signature:
Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:

Sample Disposal: Return to client: _____ Lab Disposal: X

LABORATORY USE ONLY
Sample Type: _____ # of fractions _____

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.

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