MONTANA DEPARTMENT OF TRANSPORTATION
WETLAND MITIGATION MONITORING REPORT: YEAR 2007

Roundup Wetland
Roundup, Montana

Prepared for:

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

Prepared by:

POST, BUCKLEY, SCHUH, & JERNIGAN
801 North Last Chance Gulch, Suite 101
Helena, MT 59601-3360

December 2007

PBS&J Project No: B43088.00 - 0510

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1.0 INTRODUCTION

This annual report summarizes methods and results of the seventh year of monitoring at the Montana Department of Transportation (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**).

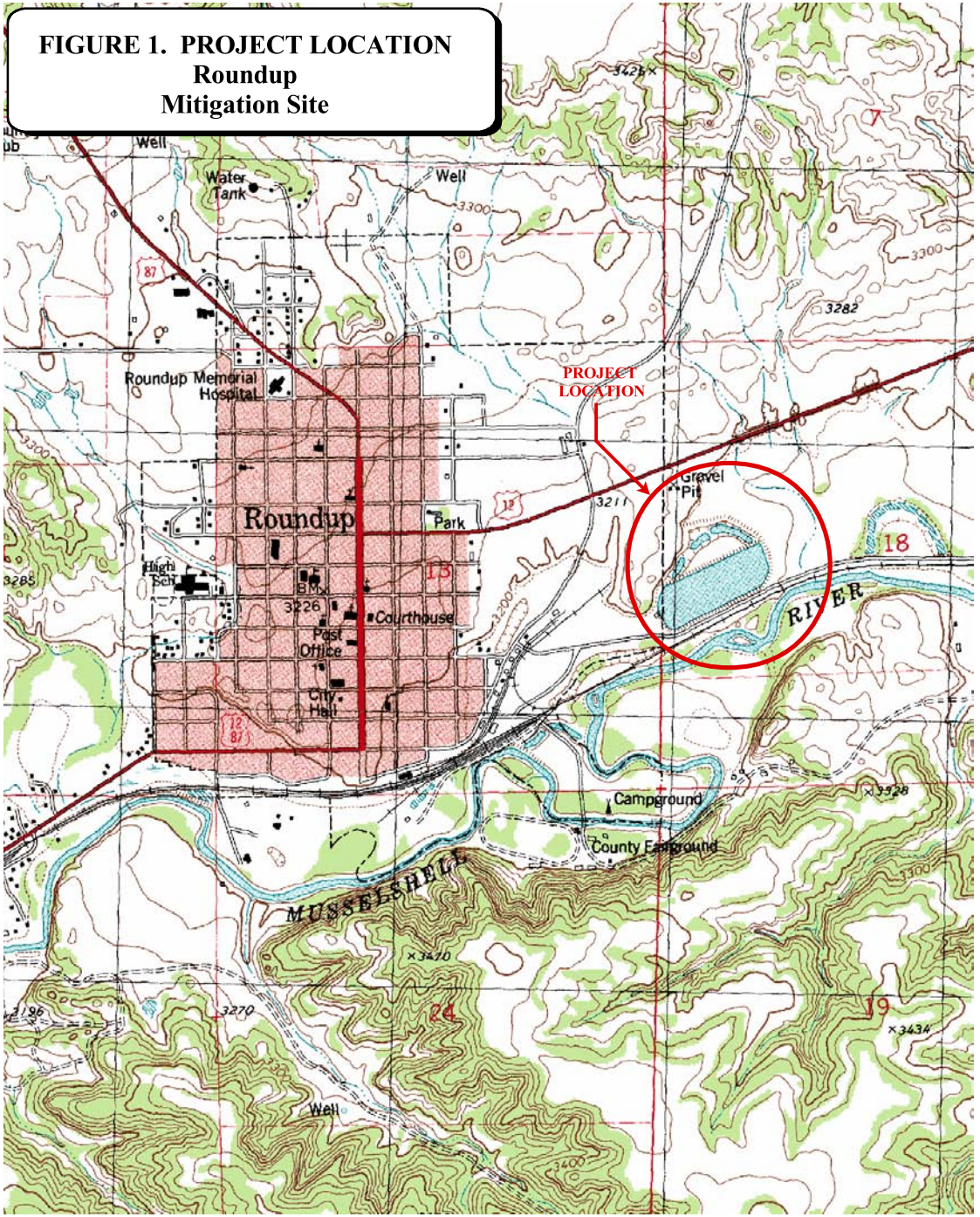
One source of hydrology is through a channel, which funnels storm water runoff from the northeastern section of the city of Roundup and U.S. Highway 12 into the southwestern end of the wetland. The estimated runoff volume for this system is 12,700 m^3 and 17,825 m^3 of water for the 5-and 25-year event, 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.

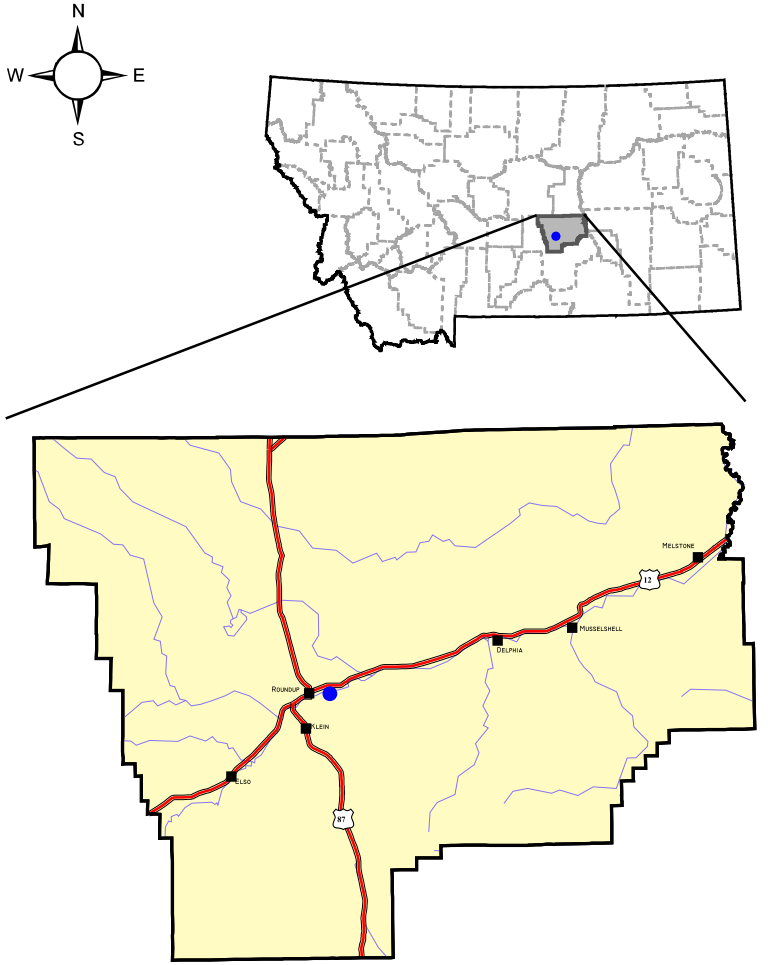
2.0 METHODS

2.1 Monitoring Dates and Activities

The Roundup wetland mitigation site was monitored on three dates in 2007: May 9 and 10 (bird observation), August 9 and 10 (monitoring event), and October 17 (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 11, 2007.

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 January through July, 2007 were compared to the 1914 – 2007 July averages (WRCC 2007).

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 11th 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 G**.

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. 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 and elongated during the 2002 visit to a site 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 sampling 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 2007 season; wetland boundaries and community types were mapped on a 2006 aerial photograph during the site visit.

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 elevations at nearby wells ranged from 3163.73 to 3169.63 feet during the 2007 sampling event. Groundwater elevations were lower than any previous sampling event and averaged 0.6 feet lower than elevations measured during the October 2006 event. Field measurements of groundwater temperature were higher in 2007, while electrical conductivity values varied among all sampling locations.

Nutrient concentrations were quite variable during 2007 (**Table 1**). As was the case in all other sampling years, the concentration of nitrate + nitrite nitrogen in Well #1 exceeded the human health standard of 10 mg/L for groundwater during 2007 (Montana DEQ 2006), with a concentration of 16.1 mg/L. Nitrate + nitrite nitrogen decreased to levels below the analytical detection limit in Well #3 during the 2007 sampling event. Additional results and discussion are provided in the complete groundwater monitoring report (**Appendix G**).

As mentioned previously, water was designed to enter the system by two methods and at two 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

Table 1: ***1998-2007 Roundup Wetland groundwater sampling 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
	10/11/07	0.01	<0.5	16.1	<0.1	16.1
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
	10/11/07	2.09	20.4	<0.05	19.0	20.4
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
	10/11/07	1.32	21.9	<0.05	18.1	21.9
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
	10/11/07	0.21	13.9	<0.05	12.6	13.9
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
	10/11/07	0.02	4.8	<0.05	2.8	4.8

into the southwestern end of the wetland (**Appendix D**). 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 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 10th and 11th, 2007 site visit, approximately 24% (4.97 acres) of the assessment area was inundated with less than 4 feet of standing water. The shallow water in the south lagoon was < 6 inches deep during the site visit, which is optimum foraging habitat for avian species. During the spring and fall visits, all of the Community Type 16 areas which included shallow water, dried mud, *Chenopdium* and *Kochia* species were inundated.

According to the Western Regional Climate Center (WRCC), the Roundup station's annual mean (1914 – July 2007) precipitation was 8.5 inches. For the year 2007, precipitation through July was 11.74 inches or 138% of the mean (WRCC 2007).

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* spp.; 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*; Type 9-*Eleocharis palustris / Alopecurus arundinaceus*; Type 10-*Desuraina Sophia*; Type 11-*Alopecurus arundinaceus / Chenopodium* spp.; Type 12-*Cirsium arvense* / *Chenopodium*; Type 13- *Conyza Canadensis*; Type 14-*Agropyron trachycaulum*; Type 15-*Elymus cinereus*; and Type 16-Shallow Water / *Chenopodium* spp. / *Kochia*. Dominant species within each community are listed on the Wetland Mitigation Site Monitoring Form (**Appendix B**).

A colony of *Scirpus maritimus* (10 x 10 feet) was observed approximately 150 feet east of the south transect end. Otherwise, there are only two known colonies of *Scirpus* (<25 feet^2) and one known *Eleocharis* colony (<10 feet^2). *Puccinella* was also observed east and west of the south transect end in narrow (<5 feet wide) strips. *Alopecurus arundinaceus* has colonized around the perimeter of the west pond and the east-west center-line north of the central upland berms between the north and south lagoons. In general, the Non-Indicator (*Alopecurus* and some *Chenopodium* species) and weedy species have increased. As-yet-undefined soils properties, such as high nitrogen levels (that may exist at the site by virtue of its functioning as a former lagoon) could be contributing to the inhibition of non-weedy species establishment.

Kochia (FAC) was the dominant vegetation along the transect from the initial monitoring season in 2001 until 2006-2007, when *Chenopodium* species began to dominate (**Charts 1** and **2**). *Chenopodium* is also dominant around the periphery of the lagoons. No other hydrophytic species have been observed along the transect since its installation in 2002. In 2005, *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 effect. 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**).

Canada thistle (*Cirsium arvense*) was observed in the area between the north and south lagoons (Community Type 12); there are scattered plants west of the central upland berm that is south of the north lagoon (not indicated on the map). Weed spraying (Canada thistle and spotted knapweed [*Centaurea maculosa*]) was performed on approximately one acre in June 2007 by MDT; the precise treatment location is unknown.

Table 2: ***2001-2007 Roundup Wetland vegetation species list.***[1]

Scientific Name	Region 9 (Northwest) Wetland Indicator Status[2]
Agropyron cristatum	Not Listed
Agropyron elongatum	Not Listed
Agropyron trachycaulum	FAC
Alopecurus arundinaceus	No Indicator
***Asclepias* spp.**	(UPL)
Aster brachyactis	FACW
Chenopodium capitatum	Not Listed
Chenopodium leptophyllum	FACU
Chenopodium hybridum	Not Listed
Cirsium arvense	FACU+
Conyza canadensis	FACU
Descuraina sophia	Not Listed
Elaeagnus angustifolia	FAC
Eleocharis palustris	OBL
Elymus cinereus	No Indicator
Grindelia squarrosa	FACU
Helianthus annuus	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	No Indicator
Ribes aureum	FAC+
Rumex crispus	FACW
Rumex maritimus	FACW+
Scirpus acutus [3]	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 2007.

[2] Indicator status in parentheses was based only on the biologist's experience. "Not Listed" indicates that the species was not listed and "No Indicator" indicates that the plant was listed, but not classified in the *National List of Plant Species that Occur in Wetlands: Northwest (Region 9)* (Reed 1988).

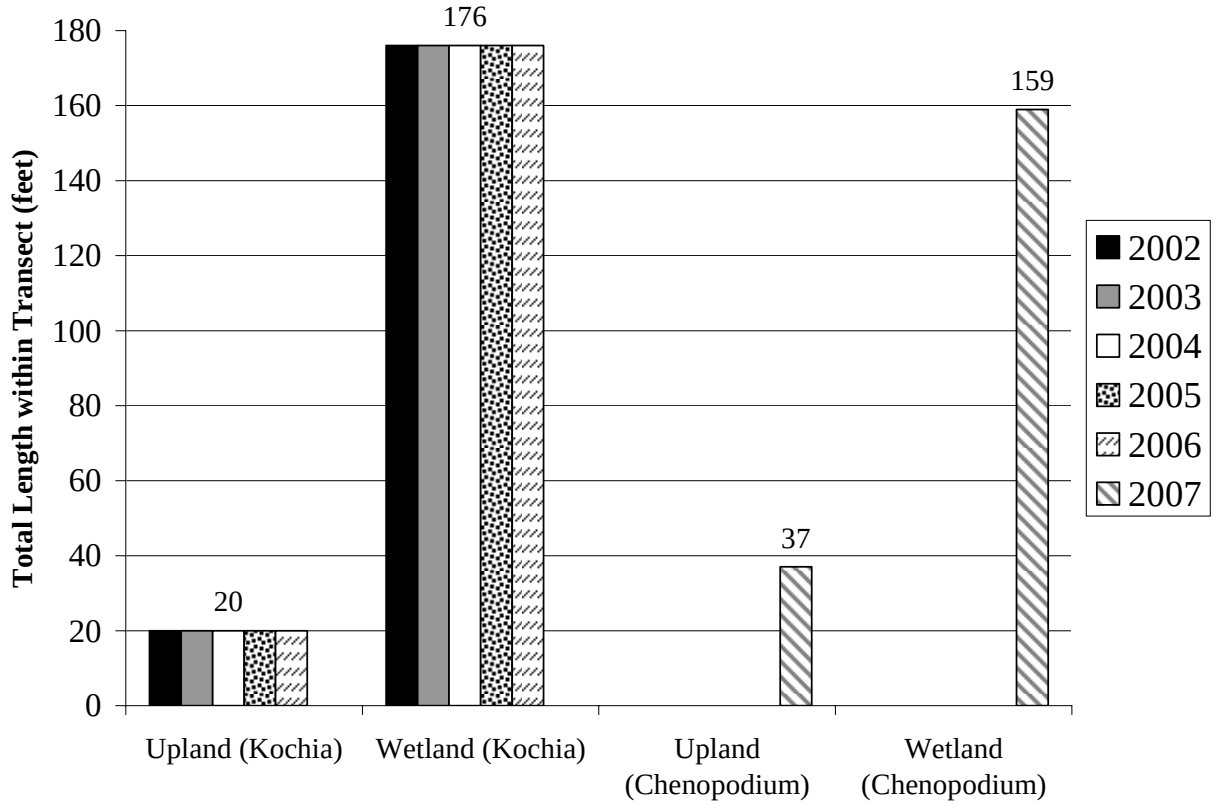
[3] *Scirpus acutus* was not positively identified as it was growing in an inundated area.

Table 3: ***2001-2007 transect data summary.***

Monitoring Year	2001[1]	2002	2003	2004	2005	2006	2007
Transect Length (feet)	100	196	196	196	196	196	196
# Vegetation Community Transitions along Transect	1	2	2	2	2	2	2
# Vegetation Communities along Transect	2	2	2	2	2	2	2
# Hydrophytic Vegetation Communities along Transect	1	1	1	1	1	1	1
Total Vegetative Species	4	2	2	2	2	2	5[3]
Total Hydrophytic Species	2	2	2	2	2	2	3
Total Upland Species	2	0	0	0	0	0	2
Estimated % Total Vegetative Cover[2]	100	100	100	100	100	100	100
% Transect Length Comprised of Hydrophytic Vegetation Communities[2]	60	90	90	90	90	90	81
% Transect Length Comprised of Upland Vegetation Communities[2]	40	10	10	10	10	10	19
% Transect Length Comprised of Unvegetated Open Water	0	0	0	0	0	0	0
% Transect Length Comprised of Bare Substrate	0	0	0	0	0	0	0

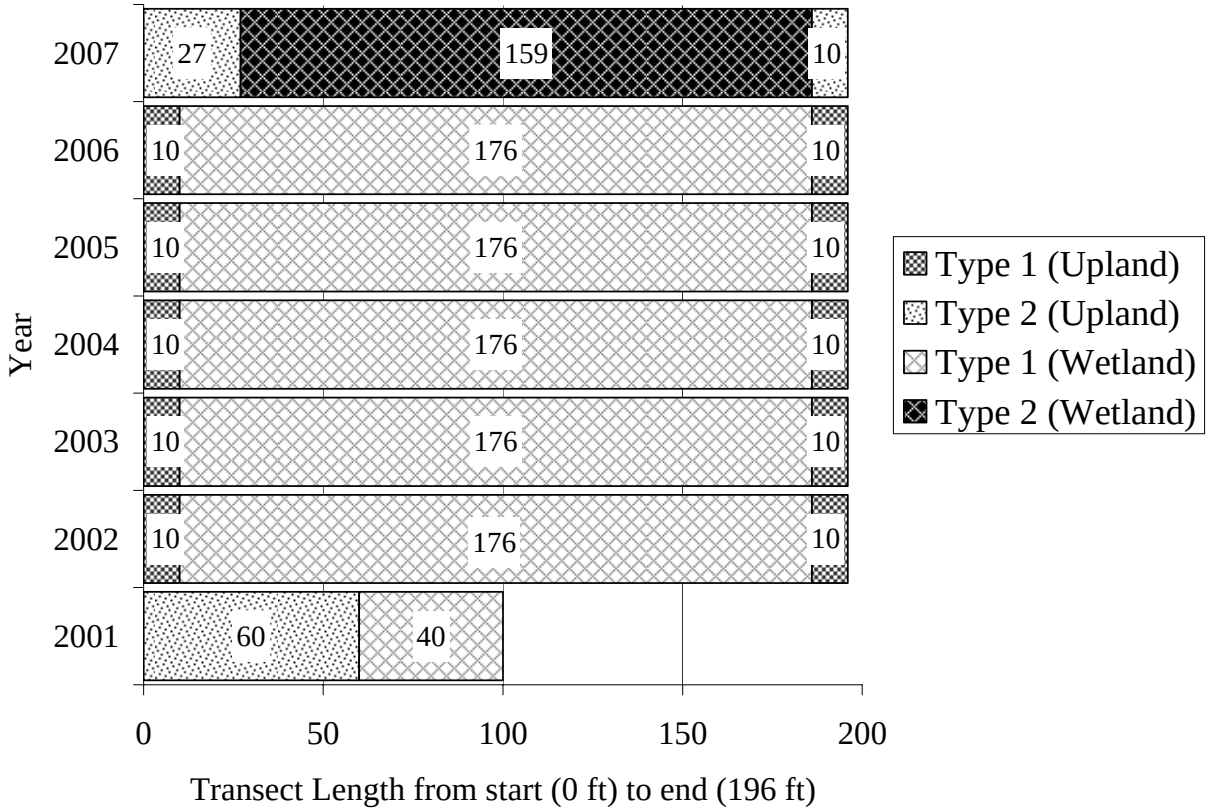
[1] Transect moved in 2002.
[2] Vegetation with no listing were assumed to be upland species unless stated otherwise in Footnote 3.
[3] Species assigned Indicator Status as follows: *Kochia scoparia*, a FAC species in "Upland" and "Wetland" communities; *Agropyron trachycaulum*, FAC; *Descuraina Sophia*, No Listing (likely UPL); 2 of the 3 known *Chenopodium* on site have a No Listing (likely FAC-FACW based on behavior).

Chart 1: ***Length of vegetation communities along Transect 1 from 2002 to 2007.***[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 2002-2007).***



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.

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-olive (5Y 4/1, 4/3) sandy loam from 0 to 10 inches and included yellowish red mottles (5YR 4/4). Soils were saturated at a depth of 2 inches. 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 2007 delineation resulted in a total of 21.07 acres of developing aquatic habitats, a 1-acre decrease since 2006. It is possible that this "decrease" occurred at some areas that were

marginally defined as wetlands originally, and that "natural" upland species reflective of conditions in these areas are beginning to emerge. The wetland boundary excludes the historic dike, the constructed islands and colonies of upland grasses and weeds **(Figure 3** in **Appendix A)**. Of the 21.07 wetland acreage, 4.97 acres were shallow, open water (<4 feet deep); very shallow inundation (< 6 inches) was observed in approximately 50% of the south lagoon. The kochia within the area of the transect has begun to die off because of the presumed higher saturation levels and possibly as a result of burning that area in the spring of 2006. *Chenopodium* species are colonizing these areas formally occupied by kochia – possibly due to succession. The COE Data Forms are included in **Appendix B.**

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**). Non-weedy hydrophytic species (e.g. *Carex, Scirpus, Eleocharis, Puccinellia,* and *Polygonum*) have comprised less than 1% of the net wetland acreage since the site was constructed.

Table 4: ***2001-2007 wetland acreage summary for the Roundup Wetland Mitigation Site.***

Habitat	ACREAGE BY YEAR						
	2001	2002	2003	2004	2005	2006	2007
Open Water	1.40	5.32	5.42	9.99	14.74	6.04	4.97
Net Wetland	17.08	9.20	11.09	9.52	7.33	16.03	16.10
Mudflat		7.48	5.49	2.51	---	---	---
Gross Wetland	**18.50**	**22.00**	**22.00**	**22.02**	**22.07**	**22.07**	**21.07**

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, as well as muskrats and unidentified frogs were observed during the 2007 site visits. Seven new bird species were observed during 2007; a total of 75 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 approximately 6 adults and 3 broods were observed during the mid-season visit.

Table 5. ***2001-2007 wildlife species observed on the Roundup Wetland Mitigation Site[1].***

AMPHIBIAN AND REPTILE	
Painted Turtle (*Chrysemys picta*)	**Frog (*Rana* spp.)**
Bull Snake (*Pituophis catenifer*)	
BIRD	
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*)
Bufflehead (*Bucephala albeola*)	**Ring-billed Gull (Larus delawarensis)**
Brewer's Blackbird (*Euphagus cyanocephalus*)	**Red-necked Phalarope (*Phalaropus lobatus*)**
California Gull (*Larus californicus*)	**Red-winged Blackbird (*Agelaius phoeniceus*)**
Canada Goose (*Branta canadensis*)	**Ring-necked Duck (*Aythya collaris*)**
Canvasback (*Aythya valisineria*)	Ring-necked Pheasant (*Phasianus colchicus*)
Cedar Waxwing (*Bombycilla cedrorum*)	Rock Dove (*Columba livia*)
Cinnamon Teal (*Anas cyanoptera*)	Ross Goose (*Chen rossii*)
Cliff Swallow (*Hirundo pyrrhonota*)	Ruddy Duck (*Oxyura dominica*)
Common Merganser (*Megus merganser*)	**Sandhill Crane (*Grus canadensis*)**
Common Snipe (*Gallinago gallinago*)	Sandpiper (species unidentified)
Common Yellowthroat (*Geothypis trichas*)	**Semipalmated Sandpiper (*Charadrius semipalmatus*)**
Cooper's Hawk (*Accipiter cooperii*)	Short-billed Dowitcher ((*Limnodromus griseus*)
Double-crested Cormorant (*Phalacrocorax auritus*)	Solitary Sandpiper (*Tringa solitaria*)
Eared Grebe (*Podiceps nigricollis*)	**Song Sparrow (*Melospiza melodia*)**
Eastern Kingbird (*Tyrannus tyrannus*)	Spotted Sandpiper (*Actitis macularia*)
European Starling (*Sturnus vulgaris*)	**Tree swallow (*Tachycineta bicolor*)**
Franklin's Gull (*Larus pipixcan*)	**Violet Green Swallow (*Tachycineta thalassina*)**
Gadwall (*Anas strepera*)	Western Grebe (*Aechmorphus occidentalis*)
Great Blue Heron (*Ardea herodias*)	Western Meadowlark (*Sturnella neglecta*)
Greater Yellow legs (*Tringa melanoleuca*)	Western Sandpiper (*Calidris mauri*)
Green-winged Teal (*Anas crecca*)	Whimbrel (*Numenius phaeopus*)
Hooded Merganser (*Lophodytes cucllatus*)	White-crowned Sparrow (Zonotrichia atricapilla)
House Sparrow (*Passer domesticus*)	Willet (*Catoptrophorus semipalmatus*)
Killdeer (*Charadrius vociferus*)	**Wilson's Phalarope (*Phalaropus tricolor*)**
Lazuli Bunting (*Passerina amoena*)	**Wood Duck (*Aix sponsa*)**
Least Sandpiper (*Calidris minitilla*)	Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)
Lesser Scaup (*Aythya affinis*)	Yellow-rumped Warbler (*Dendroica coronata*)
Lesser Yellow Legs (*Tringa flavipes*)	Yellow Warbler (*Dendroica petichia*)
Long-billed Dowitcher (*Limnodromus scolopaceus*)	
MAMMAL	
Mule Deer (*Odocoileus hemionus)*	Domestic cat
Red Fox (*Vulpes vulpes*)	**Muskrat (*Ondatra zibethica*)**

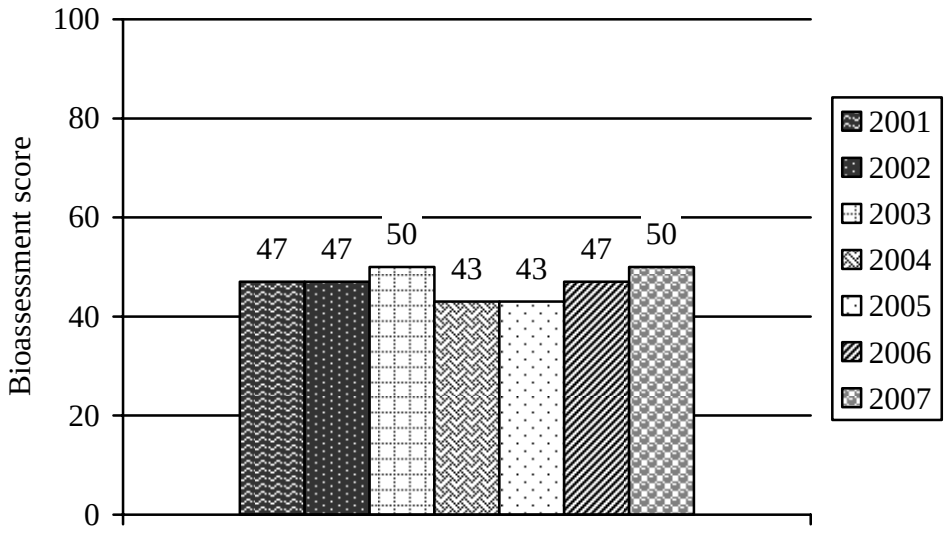
[1]**Bolded** species indicate those documented within the analysis area in 2007.

3.6 Macroinvertebrates

Macroinvertebrate sampling results are provided in **Appendix F** and **Chart 3** and were summarized by Rhithron Associates, Inc. in the italicized section below (Bollman 2007).

> *Scores indicated poor biotic conditions at the Roundup site in all 7 studied years. Very low taxa richness persisted here, with the fauna made up mostly of ostracods. Benthic surfaces appeared to remain dominant among potential habitats for invertebrates. The presence of Cricotopus (*Isocladius*) spp. suggests that filamentous algae may have been present. Otherwise, it seems likely that aquatic habitats were underdeveloped at this site.*

Chart 3: Bioassessment scores from 2001 to 2007.



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 137 Functional Units. The slight drop in the FU is the result of a 1-acre decrease in wetland acreage as a result of the development of the weedy upland communities (Types 10, 12, 13 and the Great Basin Wild Rye Community Type 15) between the north and south lagoons. Also, the score for sediment shoreline stabilization was reduced as wetlands adjacent to the shoreline are currently dominated by species lacking binding root systems (kochia and goosefoot). 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 2001-2007 wetland function/value ratings and functional points at the Roundup Wetland Mitigation Site.***

Function and Value Parameters from the 1999 MDT Montana Wetland Assessment Method	2001	2002	2003	2004	2005	2006	2007[1]
Listed/Proposed T&E Species Habitat	Low (0.0)	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)	High (0.8)
General Wildlife Habitat	Low (0.3)	Mod. (0.7)	High (0.9)	High (0.9)	High (0.9)	High (0.9)	High (0.9)
General Fish/Aquatic Habitat	NA	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)	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)	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)	Mod. (0.7)
Sediment/Shoreline Stabilization	NA	High (1.0)	High (1.0)	High (1.0)	High (1.0)	High (1.0)	Low (0.3)
Production Export/Food Chain Support	Mod. (0.6)	Mod. (0.6)	Mod. (0.6)	High (0.8)	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)	Low (0.1)
Uniqueness	Low (0.2)	Low (0.3)	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)	High (1.0)
Actual Points/ Possible Points	3.9/10	6.8/11	7/11	7.2/11	7.2/11	7.2/11	6.5/11
% of Possible Score Achieved	39%	61%	64%	65%	65%	65%	59%
Overall Category	III	III	II	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**	**21.07**
Functional Units (acreage x actual points)	**72.21**	**149.60**	**154.00**	**158.40**	**158.90**	**158.90**	**137.00**
Net Acreage Gain	**18.51**	**22.00**	**22.00**	**22.00**	**22.07**	**22.07**	**21.07**
Net Functional Unit Gain	**72.21**	**149.60**	**154.00**	**158.40**	**158.90**	**158.90**	**137.00**
Total Functional Unit "Gain"	**72.21**	**149.60**	**154.00**	**158.40**	**158.90**	**158.90**	**137.00**

[1] For futher details see completed 2007 MDT functional assessment forms in Appendix B

3.8 Photographs

Representative photos taken from photo points and transect ends are included in **Appendix C.** An extra photo was taken of the weedy conditions along the vegetation transect**.**

3.9 Maintenance Needs/Recommendations

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

Some areas were treated for weeds within the wetland complex during 2007 by MDT staff. Unless all weedy areas can be flooded continuously for a prolonged period (likely more than 1 year), continuation of a weed management program is recommended (**Table 7**). When the weeds have attained a 6 inch growth (see footnote in **Table 7** regarding kochia treatment), herbicides should be applied. Spot spraying done according to label restrictions would be advisable in mid-summer in areas not thoroughly sprayed in early summer. The site will likely require several years of this program, perhaps in reduced areas over time, to secure complete management of the weed infestation.

Table 7. ***Weed treatment recommendations.***

Treatment	Timing	Rate	Target Species
Milestone[2]	June[1]	7 ounces/acre	Canada thistle; other thistles
Vista[2]	June[1]	1 pint/ac	*Kochia scoparia*[1]; mustards; *Chenopodium*, *Cynoglossum officinale* (none seen to date); *Conium maculatum*.
Amine 4 (2,4-D Aquatic Label)	June[1]	1.5 to 2 pts/acre	Will improve control of other chemicals on specific weeds.
Syl-Tac[2] (surfactant)	June[1]	1 pint/acre	All sprayed species.

[1] June or when weeds have attained 6 inches of growth.
[2] Milestone, Vista and Syl-tac are not aquatic labeled but may be used in areas adjacent to water; labels will specify limitations of each product.

3.10 Current Credit Summary

The 2007 wetland delineation boundary included 4.97 acres of open water and 16.1 acres of net wetland area for a total of 21.07 wetland acres, a 1-acre decrease since 2006. The colonization of three new weedy upland vegetation communities (Types 10, 12 and 13) and one new upland grass community comprised of Great Basin Wild Rye (Type 15) resulted 1-acre decrease in wetland acreage. The Roundup wetland continues to rate as a Category II wetland with little change since 2002. However, there was a slight drop in FU in 2007, from 158.9 in 2006 to 137 in 2007, as a result of the decrease in wetland acreage and a reduction in the sediment/shoreline stabilization score.

4.0 REFERENCES

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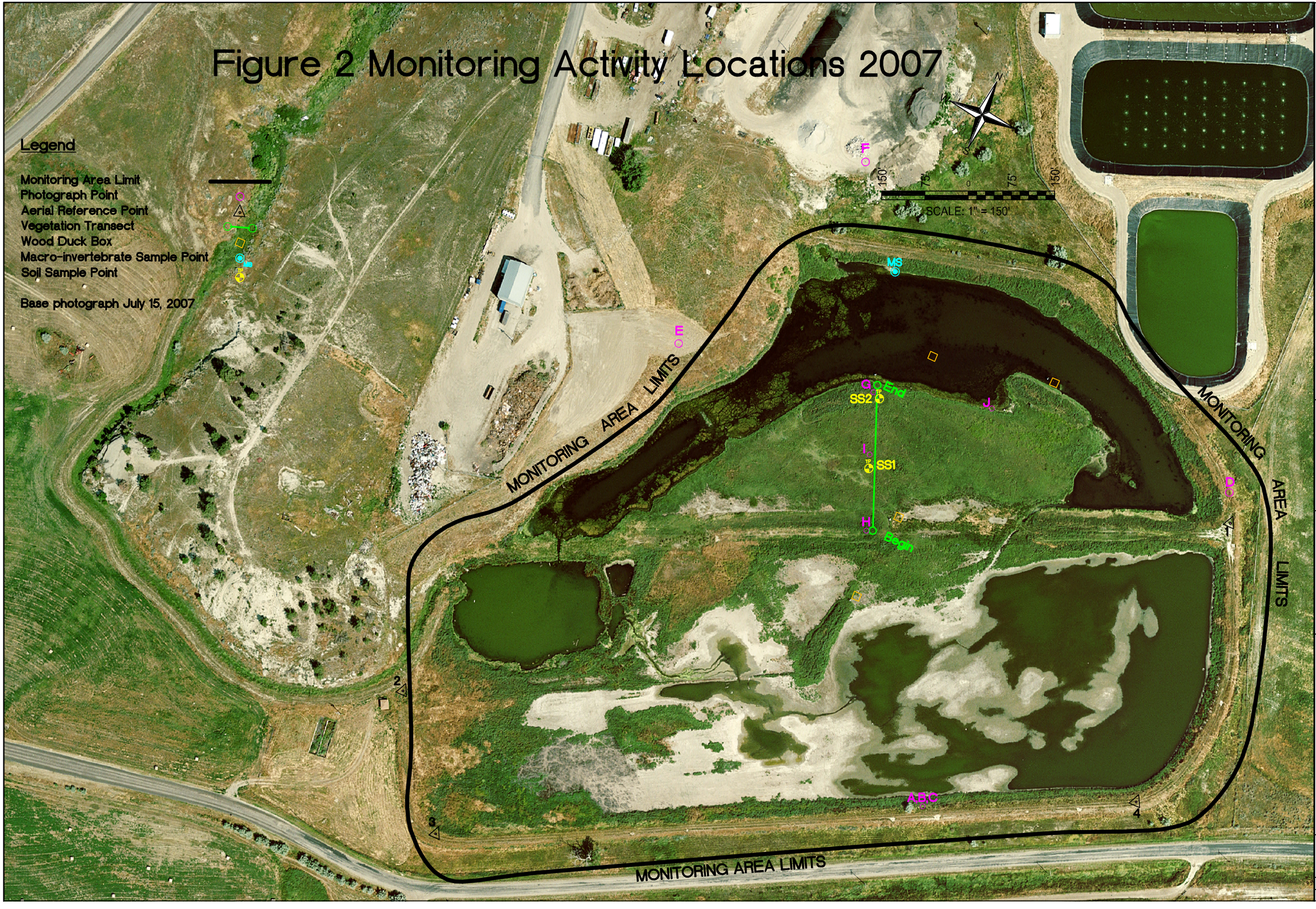
Appendix A

FIGURES 2, 3, & 4

MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, Montana

Figure 2 Monitoring Activity Locations 2007



PROJECT NAME
MDT ROUNDUP LAGOON WETLAND MITIGATION

DRAWING TITLE
MONITORING ACTIVITY LOCATIONS 2007

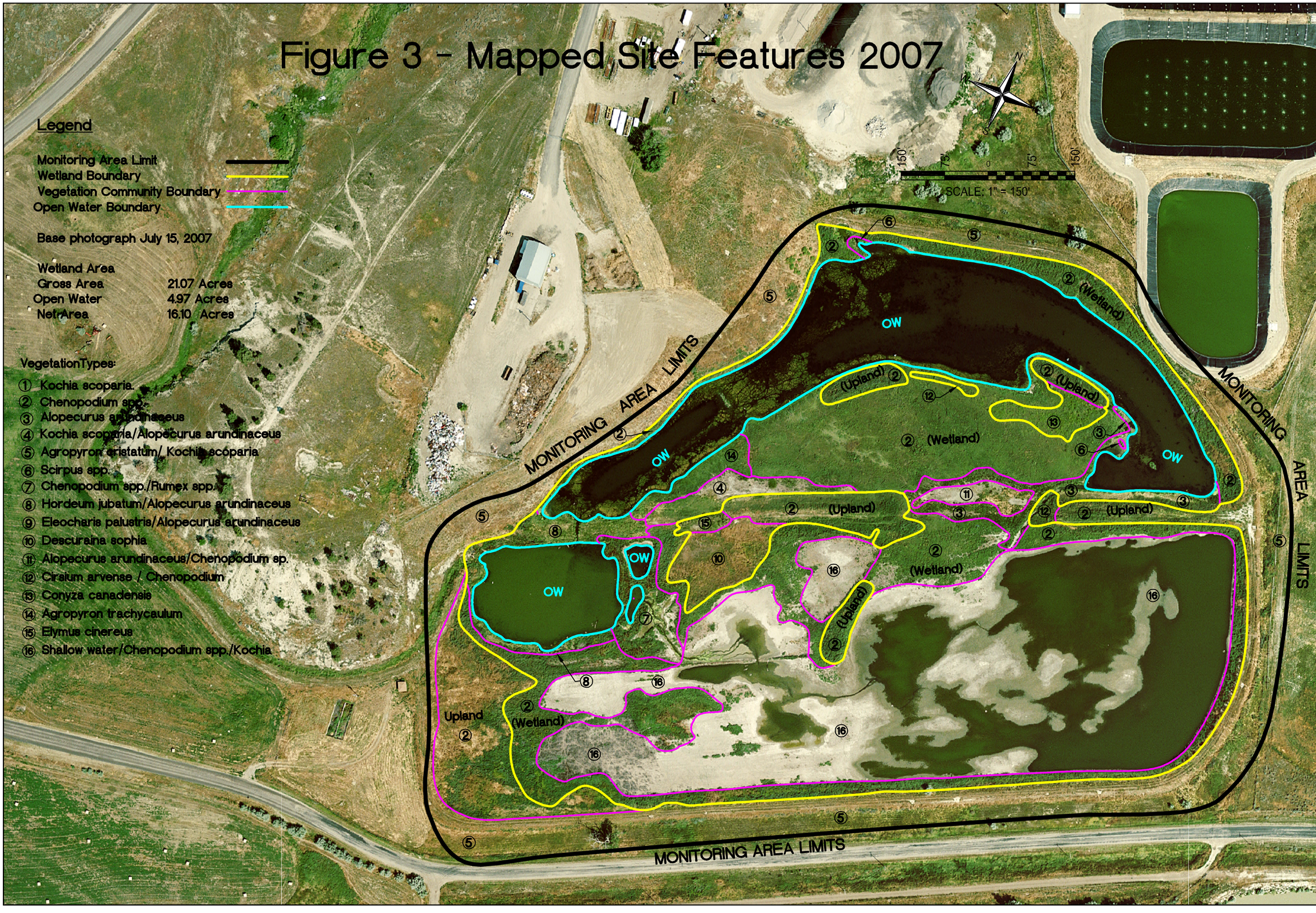
PROJ NO:	B43088.0510
LOCATION:	ROUNDUP, MT
SCALE:	1" = 150'
FILE NAME:	BASE2007.dwg
DRAWN:	SH/JR
PROJ MGR:	J. BERGLUND
CHECKED:	LB
APPV'D:	JB

PBSJ
3810 Valley Commons Drive
Suite 4
Bozeman, MT 59718

FIGURE
2 OF -

REV -
Nov/16/2007

Figure 3 – Mapped Site Features 2007



PROJECT NAME
MDT ROUNDUP LAGOON WETLAND MITIGATION

DRAWING TITLE
MAPPED SITE FEATURES 2007

DRAWN:	SH/JR
PROJ MGR:	J. BERGLUND
CHECKED:	LB
APPVD:	JB
PROJ NO:	B43088.0510
LOCATION:	ROUNDUP, MT
SCALE:	1" = 150'
FILE NAME:	BASE2007.dwg

PBSJ
3810 Valley Commons Drive
Suite 4
Bozeman, MT 59718

FIGURE
3 OF
REV -
Nov/20/2007


Figure 4 Monitoring Well Locations
US Highway 12
N
E
S
W
300'
150'
0
150'
300'
SCALE: 1" = 300'
Monitoring Well Location
Well #1
Well #2
Well #3
Well #4
Well #5
Musselshell River
PROJECT NAME
MDT ROUNDUP LAGOON WETLAND MITIGATION
DRAWING TITLE
MONITORING WELL LOCATIONS
PROJ NO: B430880510
LOCATION: ROUNDUP, MT
SCALE: 1" = 300'
FILE NAME: BASE2007.dwg
DRAWN: SH/JR
PROJ MGR: J. BERGLUND
CHECKED: LB
APPVD: JB
PBSJ
3810 Valley Commons Drive
Suite 4
Bozeman, MT 59718
FIGURE
4
OF
REV -
Nov/08/2007

Appendix B

2007 WETLAND MITIGATION SITE MONITORING FORM
2007 BIRD SURVEY FORMS
2007 COE WETLAND DELINEATION FORMS
2007 FUNCTIONAL ASSESSMENT FORMS

MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, Montana

PBS&J / MDT WETLAND MITIGATION SITE MONITORING FORM

Project Name:__Roundup____ Project Number:___B43088.510_ Assessment Date:_7/10-11/07__
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/PBS&J_____
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:_24%
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: _The following statement still applies in 2007: *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	15	*Asclepias sp.*	<1
Chenopodium leptophyllum +/or hybridium	80	*Aster brachyactis*	<1
Elymus cinereus	<1	*Descuraina sophia*	<1
Salix sprigs *(dead)*			
Agropyron elongatum	<5		
Agropyron trachycaulum	<5		

COMMENTS/PROBLEMS: ___ This CT occurs in upland and wetland areas, identified by "UPL:CT-1" and "Wetland: CT-1" on map. Between lagoons the kochia forms an understory community (2-3 years ago kochia was 4-5 ft tall), and on west side of south lagoon, and in some scattered areas, the plant is tumbleweed-like sized and forms the overstory.

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

Dominant Species	% Cover	Dominant Species	% Cover
Chenopodium leptophyllum +/or hybriduim	95	*Alopecurus arundinacea*	<1
Elaeagnus angustifolia	<1	*Hordeum jubatum*	<1
Kochia scoparia	5	*Scirpus maritimus*	<1
Rumex maritimus +/or crispus	<1		
Salix sprigs *(dead)*			

COMMENTS/PROBLEMS: __ This CT occurs in upland and wetland areas, identified by "Upland:CT-2" and "Wetland: CT-2" on map. _____

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

Dominant Species	% Cover	Dominant Species	% Cover
Alopecurus arundinacea	35	*Chenopodium sp.*	5
Salix sprigs (dead)	<1	*Elaeagnus angustifolia*	<1
Rumex crispus +/or maritimus	<1	*Aster brachyactis*	<1
Scirpus pungens	<1		
Phalarus arundinacea	25		
Hordeum jubatum	35		

COMMENTS/PROBLEMS: _____

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

Dominant Species	% Cover	Dominant Species	% Cover
Alopecurus arundinacea	40	*Agropyron elongata*	10
Scirpus maritimus	<1	*Kochia scoparia*	20
Aster brachyactis	5	*Chenopodium leptophyllum +/or hybridium*	<5
Puccinellia nuttalliana	5	*Chenopodium capitatum*	20
Rumex crispus+/or maritimus	<1	*Hordeum jubatum*	<5
Scirpus pungens	<1		

COMMENTS/PROBLEMS: *Eleocharis palustris, Scirpus acutus, Polygonum spp. not observed, however still may be present in very small quantities..* _____

VEGETATION COMMUNITIES (continued)

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 +/or hybridium	25	*Ribes aureum*	<1
Cirsium arvense	<5		
Grindelia spp.	<5		
Kochia scoparia	25		
Melilotus officinalis	<5		

COMMENTS/PROBLEMS: _community composition varies around site_____
_____

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		
Chenopodium leptophyllum +/or hybridium	<1		

COMMENTS/PROBLEMS: _____
_____

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

Dominant Species	% Cover	Dominant Species	% Cover
Chenopodium leptophyllum +/or hybridium	45	*Aster brachyactis*	<1
Rumex maritimus +/or crispus	45	*Eleocharis palustirs*	<1
Alopecurus arundinaceus	5		
Circium arvense	5		
Scipus maritimus	<1		
Hordeum jubatum	<1		

COMMENTS/PROBLEMS: _____
_____

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

Dominant Species	% Cover	Dominant Species	% Cover
Hordeum jubatum	5		
Alopecurus arundinaceus	90		
Chenopodium leptophyllum +/or hybridium	5		

COMMENTS/PROBLEMS: _____
_____

VEGETATION COMMUNITIES (continued)

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 +/or hybridium*	<5
Rumex crispus+/or maritimus	<1	*Scirpus maritimus*	5
Scirpus pungens	<1		

COMMENTS/PROBLEMS: _____
_____

Community No.:__10__ Community Title (main species)_*Descuraina sophia*___

Dominant Species	% Cover	Dominant Species	% Cover
Descuraina sophia	95		
Chenopodium leptophyllum +/or hybridium	5		

COMMENTS/PROBLEMS: _____
_____

Community No.:__11__ Community Title (main species):___*Alopecurus arundinaceus/Chenopodium spp.*

Dominant Species	% Cover	Dominant Species	% Cover
Alopecurus arundinaceus	60	Bare ground	10
Chenopodium leptophyllum +/or hybridium	10	*Chenopodium capitatum*	5
Puccinellia nuttalliana	5		
Scirpus acutus	<1		
Hordeum jubatum	<1		
Scirpus maritimus	10		

COMMENTS/PROBLEMS: _____
_____

Community No.:__12_ Community Title (main species) *Cirsium arvense / Chenopodium* _____

Dominant Species	% Cover	Dominant Species	% Cover
Alopecurus arundinacea	5		
Chenopodium leptophyllum +/or hybridium	15		
Cirsium arvense	80		
Aster brachyactis	<1		

COMMENTS/PROBLEMS: _____
_____

VEGETATION COMMUNITIES (continued)

Community No.:__13__ Community Title (main species)_ *Conyza canadensis* ___

Dominant Species	% Cover	Dominant Species	% Cover
Descuraina sophia	<5		
Chenopodium leptophyllum +/or hybridium	<5		
Conyza canadensis	90		
Elymus cinereus	<5		
Elaeagnus angustifolia	<5		

COMMENTS/PROBLEMS: _____
_____

Community No.:__14__ Community Title (main species):__ *Agropyron trachycaulum*_____

Dominant Species	% Cover	Dominant Species	% Cover
Agropyron trachycaulum	80		
Circium arvense	15		
Rumex crispus+/or maritimus	<1		
Helianthus annuus	<1		
Aster brachyactis	<5		

COMMENTS/PROBLEMS: _____
_____

Community No.:__15_ Community Title (main species) ___ *Elymus cinereus* ___

Dominant Species	% Cover	Dominant Species	% Cover
Elymus cinereus	95		
Chenopodium leptophyllum +/or hybridium	5		
Grindelia squarrosa	<1		

COMMENTS/PROBLEMS: _____

Community No.:__16__ Community Title (main species)_*Shallow water/Chenopodium spp./Kochia*___

Dominant Species	% Cover	Dominant Species	% Cover
Chenopodium leptophyllum/hybridium/ capitatum	40		
Shallow inundation or mud or dried mud	60		

COMMENTS/PROBLEMS: _____The percent cover of shallow inundation will change throughout the year, which will thus alter the cover of annual *Chenopodium* and other weed cover. No desirable wetland vegetation noted in this general area. _____

Additional Activities Checklist:
__X__Record and map vegetative communities on air photo

COMPREHENSIVE VEGETATION LIST

Species	Vegetation Community Number(s)	Species	Vegetation Community Number(s)
Agropyron cristatum	1		
Agropyron elongatum	1,4,		
Agropyron trachycaulum	1,13		
Alopecurus arundinacea	2, 3, 4,7, 9,11,		
Asclepias sp.	1		
Aster brachyactis	1,3,7,12,14		
Chenopodium capitatum	4,11		
Chenopodium leptophyllum	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13,15		
Chenopodium hybridum	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13,15		
Cirsium arvense	1, 5,7,,14		
Conyza canadensis	13		
Descuraina sophia	1,,13		
Elaeagnus angustifolia	1,2,3,13		
Eleocharis palustris	4, 7,		
Elymus cinereus	1, 13,15		
Grindelia squarrosa	1,5,15		
Helianthus annuus	14		
Hordeum jubatum	2, 3,4,7,8,11		
Kochia scoparia	1, 2, 4, 5,9		
Lemna minor	6,9		
Melilotus officinalis	1, 5		
Phalarus arundinacea	3, 4		
Polygonum spp.	4,9		
Puccinellia nuttalliana	4,9,11		
Rhus trilobata	1, 5		
Ribes aureum	1, 5		
Rumex crispus	2, 3, 4,7,9,14		
Rumex maritimus	2, 3, 4,7,9,14		
Scirpus acutus	4, 6, 9,11		
Scirpus maritimus	2, 4, 6,7,9,11		
Scirpus pungens	3, 6, 9		
Salix sprigs (dead)	1,2,3		
Tamarix ramosissima	2		
Bold denotes observed in 2007 for the first time			

COMMENTS/PROBLEMS: Russian olive more prevalent, tamarisk not observed but given location still may be present; weedy vegetation an increasing problem.

PLANTED WOODY VEGETATION SURVIVAL

Species	Number Originally Planted	Number Observed (Dead)	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	12 (fall)	X (also)			
Muskrat	1				
Unidentified frogs	+++				

Additional Activities Checklist:
__X___Macroinvertebrate sampling (if required)

COMMENTS/PROBLEMS:

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
I		Weeds	S
J		Weeds	NW
K		ALOARU	E
L		Weeds	W

COMMENTS/PROBLEMS: Extra photos taken of weed issues at site.

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 2007 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 2007. _____
_____
_____
_____
_____

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: 7/10/07 Examiner: LB/PBSJ Transect # 1

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

Vegetation type A:	CT 2 (Upland)
Length of transect in this type:	27 feet
Species:	Cover:
KOCSCO	5
CHEHYB	95
HELANN	<1
Total Vegetative Cover:	100%

Vegetation type B:	CT 2 (Wetland)
Length of transect in this type:	159 feet
Species:	Cover:
KOCSCO	10
CHEHYB	90
DESSOP	<5
AGRTRA	<1
Total Vegetative Cover:	100%

Vegetation type C:	CT 2 (Upland)
Length of transect in this type:	10' feet
Species:	Cover:
CHEHYB	90
KOCSCO	10
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 leptophylulm* (FACW) or *C. 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

Date: **see below**

SITE: Roundup: 2007 May, July and October Surveys

Bird Species	#	Behavior	Habitat	Bird Species	#	Behavior	Habitat
SPRING: (5/9-10/07)				**MID-SEASON (7/11/07):**			
American Avocet	10	F	OW/MA	Canada Goose	25 (several broods)	F/BR	OW
American Coot	6	F	OW	Cliff Swallow	Many	F/FO	OW/MA/UPL
American Wigeon	2 (pr)	F	OW	Common Yellowthroat	1	BR	MA
Barn Swallow	20	F	OW/MA/UPL	Great Blue Heron	1	F	MA
Blue-winged teal	8	F	OW	Killdeer	100	BR/F	MA
Bufflehead	6	F	OW	Lazuli Bunting	1	BR	MA
Canada Goose	42*	N/F	OW/WL/UPL	Mallard	75 (many broods)	F	OW
Cinnamon Teal	6	F	OW	Red-winged Blackbird	30	F/FO	MA/OW/UPL
Cliff Swallow	10-20	F	OW/MA	Red-necked Phalarope	2 (pr)	F	MA
Gadwall	12	F	OW	Ring-billed Gull	1	L	MA
Green-winged Teal	10	F	OW	Sandhill Crane	1 (defensive)	BD	MA
Great Blue Heron	2	F/L	OW	Semipalmated Sandpiper	5	F	MA
Hooded Merganser	2 (pr)	F	OW	Violet Green	Many	F/FO	OW/MA/UPL
Killdeer	15	BR	MA	Wilson's Phalarope	30	F	OW/MA
Lesser Scaup	6	F	OW	Wood Duck	20 (3 broods)	F	OW
Mallard	22	F	OW	**FALL (10/17/07):**			
Northern Shoveler	20	F	OW	Canada Goose	4	flush	OW
Red-winged Blackbird	30	BR	MA/OW/UPL	Eared Grebe	1	F	OW
Ring-necked Duck	1	F	OW	Green-winged Teal	80	F	OW/MA
Song Sparrow	1	BD	MA	Mallard	25	F	OW
Tree Swallow	25-50	F	OW/MA	Northern Shoveler	25	F	OW/MA
Violet-green Swallow	25-50	F	OW/MA	Wood Duck	2	F	OW/MA
Wilson's Phalarope	30	F	OW/MA				
Wood Duck	4 (pair)	BR	OW				

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: 7/10/07
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	*Chenopodium Hybridium/Leptophylum*	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

Chenopodium has almost completely replaced *Kochia*. Preferred wetland vegetation is not replacing the weedy species.

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: 2 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- Inundated
- X 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:

The kochia may be dying out because of greater saturation, however it is being replaced by other weedy species (Cheno).

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.
0-10	A	5Y 4/1,4/3	5 YR 4/4	Mod, 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)

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:

Chenopodium replacing *Kochia*, site increasingly weedy and includes yellow sweet clover, mustards and Canada thistle. Still qualifies for the most part as a wetland because of the FAC status of kochia and *Chenodium* species, however desirable wetland vegetation very minimal (likely <0.25 acre).

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

Project/Site:	Roundup			Date:	7/10/07
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?: (If needed, explain on reverse.)		Yes	X No	Plot ID:	SP-2

VEGETATION

	Dominant Plant Species	Stratum	Indicator		Dominant Plant Species	Stratum	Indicator
1	*Kochia scoparia*	H	FAC	9			
2	*Chenopodium sp.*	H	FAC-FACW	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-). 2/2

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:

Unchanged upland sample point, more weedy species (yellow sweet clover, thistle, mustards) are invading these upland islands though not at specific SP.

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

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

3. Evaluation Date: 7/10/2007 **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)
21.07 (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)
21.07 (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	76
Depression	Palustrine	None	Unconsolidated Bottom	Temporarily Flooded	Excavated	12
Depression	Palustrine	None	Aquatic Bed	Permanently Flooded	Excavated	12
---	---	---	---	---	---	

[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), yellow sweet clover, Canada thistle, mustard

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.)**:** LB observed (possible leopard) frogs but did not get a clear view of the pattern.

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 %	--	--	--
35-64 %	--	--	--
< 35 %	.3 (L)	--	--

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	0.1 (L)
Available Discharge/Recharge information inadequate to rate AA D/R potential	--

Comments: 0.1 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	L	0.30	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:	6.50	11.00	151.7
	Percent of Total Possible Points:		**59%** (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

2007 REPRESENTATIVE PHOTOGRAPHS

MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, Montana

2007 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

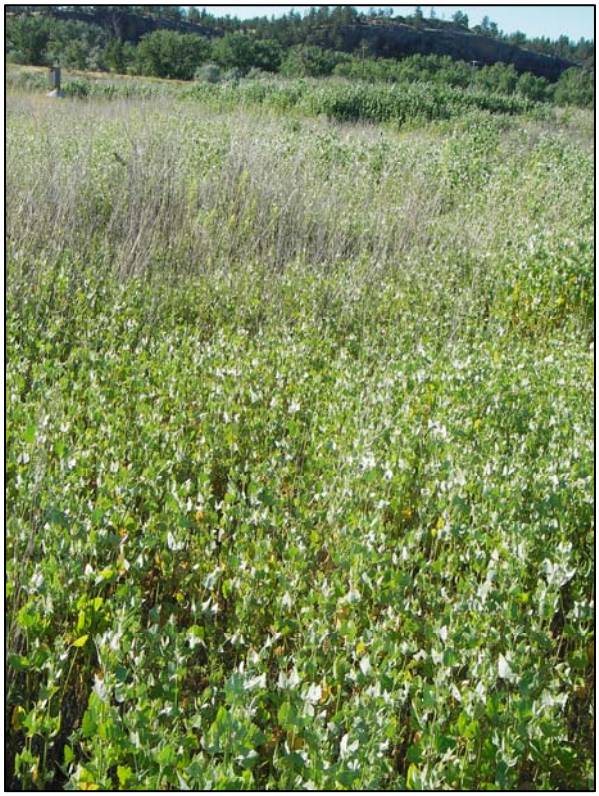
Location: D **Description:** Wetland view
Compass Reading: W

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



Location: I **Description:** Mid-transect, illustrating *Chenopodium* infestation. **Compass Reading:** S

Location: J **Description:** South edge of north lagoon depicting *Chenopodium* and dead weed stalks.
Compass Reading: NW

Location: K **Description:** View East from south end of transect over *Alopecurus arundinacea* community.
Compass Reading: E

Location: L **Description:** Weed colony near south edge of north lagoon (*Melilotus, Kochia and Chenopodium*).
Compass Reading: W

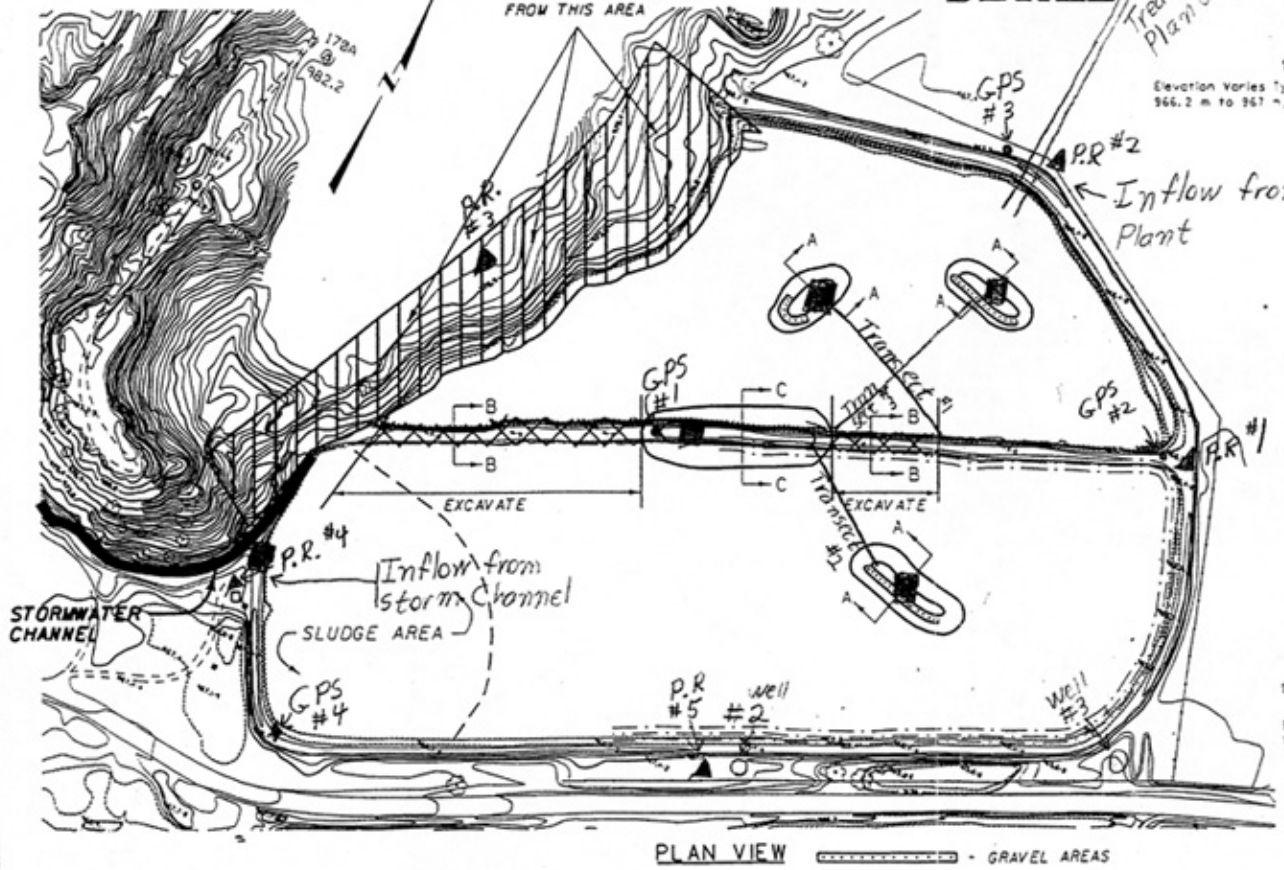
Appendix D

ROUNDUP EAST LAGOON WETLAND FINAL PLAN

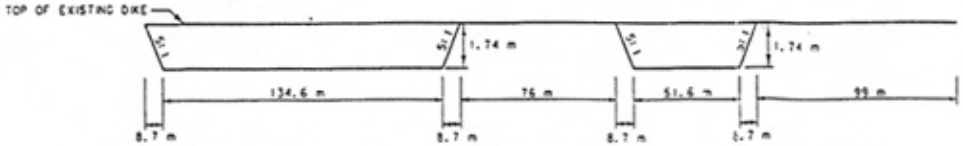
MDT Wetland Mitigation Monitoring
Roundup Wetland
Roundup, Montana

Figure 2

DETAIL

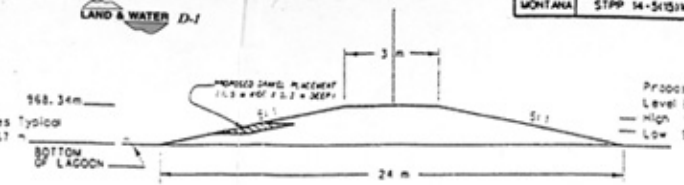


PLAN VIEW — GRAVEL AREAS



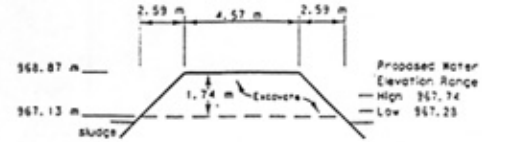
LONGITUDINAL SECTION OF EXISTING DIKE (between north & south lagoon cells)

NOT TO SCALE



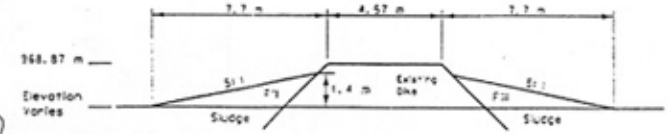
SECTION A-A (Islands)

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

This protocol was developed by the Montana Department of Transportation (MDT) to monitor bird use within their Wetland Mitigation Sites. Though each wetland mitigation site is vastly different, the bird survey data collection methods were standardized to order to increase repeatability. The protocol uses an "area search within a restricted time frame" to collect data on bird species, density, behavior, and habitat-type use.

Survey Area

Sites that can be entirely walked: Sites where the entire perimeter or area can be walked include, but are not limited to: small ponds, enhanced historic river channels, and wet meadows. If the wetland is not uncomfortably inundated, walk several meandering transects to sufficiently cover the wetland. Meandering transects can be used, even if a small portion of the area is inaccessible (e.g. cannot cross due to inundation). Use binoculars to identify the bird species, to count the number of individuals, and to identify their behavior and habitat type. Data can be recorded directly onto the bird survey form or into a field notebook. The number of meandering transects and their direction (or location) should be recorded in the field notebook and/or drawn onto the aerial photograph or topographic map. Meandering transects are not formal and should not be staked. Each site should be walked and surveyed to the fullest extent within the set time limit.

Sites than cannot be entirely walked: Sites where the entire perimeter or area cannot be walked include, but are not limited to: very large sites (i.e. perimeter of 2-3 miles), and large-bodied waters (i.e. reservoirs), where deep water habitat (> 6 feet) is close to shore. For large-bodied waters where only one area was graded to create or enhance the development of wetland, bird surveys should be walked along meandering transects within or around the graded area (see above.). For sites that cannot be walked, bird surveys should be conducted from many lookout posts, established at key vantage points. The general location of lookout posts should be recorded in the field notebook or drawn onto the aerial photograph or topographic map. Lookout post locations do not need to be staked. Both binoculars and spotting scopes may be used in order to accurately identify and count the birds. Depending upon the size of the open water, more time may be spent viewing the mitigation area from lookout posts than is spent traveling between posts.

Survey Time

Ideally, bird surveys should be conducted in the morning hours when bird activity is often greatest (i.e. sunrise to no later than 11:00 am). Surveys can be completed before 11am if all transects have been walked or all lookout posts have been viewed with no new bird activity observed. For some sites bird surveys may need to be performed in the late afternoon or evening due to traveling constraints or weather. The overall limiting time factor will be the number of budgeted hours for the project.

Data Recording

Bird Species List: Record each bird species observed onto the Bird Survey-Field Data Sheet (or field notebook). Record the bird's common name using the appropriate 4-letter code. The 4-letter code uses the first two letters of the first two word's of the bird's common name or if one name, the first four letters. For example, Mourning Dove is coded as MODO while Mallard is coded as MALL. If an unknown individual is observed, use the 4-letter protocol, but define your

abbreviation at the bottom of the field data sheet. For example, unknown shorebird is UNSB; unknown brown bird is UNBR; unknown warbler is UNWA; and unknown waterfowl is 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 parenthesis; do not fill in the habitat column. For example, a flock of black, medium-sized birds could be coded as UNBB / FO (25).

Bird Density: For each observation record the actual or estimated number of individuals observed per species and per behavior. Totals can be tallied in the office and entered onto the Bird Survey-Field Data Sheet.

Bird Behavior: Bird behavior must be identified by what is known. When a species is observed, the behavior that is immediately exhibited is recorded. Only behaviors that have discreet descriptive terms should be used. The following terms are recommended: breeding pair (BP); foraging (F); flyover (FO); loafing (L), which is defined as sleeping, roosting, or floating with head tucked under wing; and nesting (N). If other behaviors that have a specific descriptive word are observed then it can be used and should later be added to the protocol. Descriptive words or phrases such as "migrating" or "living on site" are unknown behaviors.

Bird Species Habitat Use: When a species is observed, the habitat is also recorded. The following broad habitat categories are used:

- aquatic bed (AB), defined as rooted-floating, floating-leaved, or submergent vegetation.
- marsh (MA), defined as emergent (e.g. cattail, bulrush) vegetation with surface water.
- wet meadow (WM), defined as grasses, sedges, or rushes with little to no surface water.
- scrub-shrub (SS), defined as shrub covered wetland.
- forested (FO), defined as tree covered wetland.
- open water (OW), defined as unvegetated surface water.
- upland (UP), defined as the upland buffer.

Other categories can be used and defined on the data sheet and should later be added to the protocol.

Other Fields

Bird Visit: Each bird survey (i.e. spring, fall, and mid-season) should be completed on separate Bird Survey-Field Data Sheets.

Time: Record the start time and end time on the Bird Survey-Field Data Sheet.

Date: Record the date of the bird survey.

Weather: Record the weather conditions (i.e. temperature, wind, condition).

Notes: Note if a particular individual bird is using a constructed nest box and note the condition of constructed nest box(es). Also record any comments about the site, wildlife, wetland conditions, etc.

GPS MAPPING AND AERIAL PHOTO REFERENCING PROCEDURE

From 2001 through 2006, PBS&J mapped the vegetation community boundaries, photograph points, and other sampling locations in the field using the resource-grade Trimble GEO III GPS (Global Positioning System) unit. The data were collected with a minimum of three positions per feature using Course/Acquisition code. The collected data were then transferred to a personal computer (PC) and differentially corrected to the nearest operating Community Base Station. The corrected data were then exported to ACAD drawings in Montana State Plain Coordinates NAD 83 international feet.

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

In 2007, some sites continued to be mapped using the Trimble GEO III GPS unit while most sites were mapped using the resource-grade Magellan MobileMapper Office GPS unit. The Magellan GPS unit has a comparable accuracy level to the Trimble Geo III unit.

Each year, MDT photographs each mitigation site from the air. These aerial photographs are not geo-referenced, but serve as a visual aid to map wetland development and vegetation communities, and to show approximate locations for various monitoring activities (i.e. photograph points, transects, or macroinvertebrate sampling). Reference points that are observable on the aerial photo (i.e. road, stream channel, or fence) were also marked with the GPS unit in order to better position the aerial photograph. This positioning did not remove any of the distortion inherent to all photos. All mapped features and community boundaries were reviewed by the wetland biologist, to increase the figure's accuracy.

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

2007 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.
- 1-liter, wide-mouth, plastic sample jars provided by Rhithron Associates, Inc. (Quart sized, wide-mouthed canning jars can be substituted.)
- 95% ethanol (alternatively isopropyl alcohol).
- Pre-printed sample labels (printed on rite-in-the-rain paper); two labels per sample.
- Pencil.
- Clear packaging tape.
- 3-5 gallon plastic pail.
- Large tea strainer or framed screen.
- Cooler with ice for storing sample.

Site Selection

Select a site that is accessible with hip waders or rubber boots. If the substrate is too soft, place a wide board down to walk on. Choose a site that is representative of the overall condition of the wetland. Annual sampling should occur at the same site within the wetland.

Sampling Procedure

Wetland invertebrates (macroinvertebrates) inhabit the substrate, the water column, the stems and leaves of aquatic vegetation, and the water surface. At the given location, each habitat type is sampled and combined into a single 1-liter sample jar. Pre-cautions are made to minimize disturbing the sample site in order to maximize the number of animals collected.

Fill the pail with approximately 1 gallon of wetland water. Ideally, sample the water column from near-shore outward to a depth of 3 feet. Sample the water column using a long sweep of the net, keeping the net at about half the depth of the water. Sample the water surface with a long sweep of the net. Aquatic vegetation is sampled by pulling the net beneath the water surface, for at least a meter in distance. The substrate is sampled by pulling the net along the bottom, bumping it against the substrate several times as you pull. Be sure to place some muck, mud, and/or vegetation into the jar. After sampling a habitat, rinse the net in the bucket and look for insects, crustaceans, and other aquatic invertebrates. It is not necessary to sample habitats in any specific order, but all habitats, if present, are to be sampled. Habitats can be sampled more than once.

Fill about 1 cup of ethanol into the sample jar. Sieve the contents of the bucket through the straining device and pour or carefully scrape the contents of the strainer into the sample jar. Top off the jar with enough ethanol to cover all the material and leave as little headroom as possible. Alternatively, sampled materials can be lifted out of the net and put directly into the jar. Be sure to include some muck, mud, and/or vegetation into the jar. Each macroinvertebrate sampling site should have only one sampling jar.

Using pencil, complete two labels with the required information: project name, project number, date, collector's name, and habitats sampled. Do not complete the label with ink as it will dissolve in ethanol. For wetlands with at least two macroinvertebrate sampling sites, number the site consecutively followed by the total number of sites (e.g. Sample 2 of 3 sites). Place one label into the jar and seal the jar. Dry the jar off, if necessary, and tape the second label to the outside of the jar.

Photograph each macroinvertebrate sampling site.

Sample Handling/Delivery

In the field, keep sample jars cool by placing in a cooler with a small amount of ice.
Deliver samples to the PBS&J office in Missoula, where they will be inventoried and delivered to Rhithron Associates, Inc.

MDT Mitigated Wetland Monitoring Project: Aquatic Invertebrate Monitoring
Summary 2001 – 2007

Prepared for Post, Buckley, Schuh, and Jernigan (PBS&J)
Prepared by W.Bollman, Rhithron Associates, Inc.

INTRODUCTION

Aquatic invertebrate assemblages were collected at a number of mitigated wetlands throughout Montana. This report summarizes data generated from seven years of collection. Over all years of sampling, a total of 182 invertebrate samples were collected. Table 1 lists the currently monitored sites at which aquatic invertebrates were collected in 2007, and summarizes the sampling history of each.

METHODS

Sample processing

Aquatic invertebrate samples were collected at mitigated wetland sites in the summer months of 2001, 2002, 2003, 2004, 2005, 2006 and 2007 by personnel of PBS&J. Sampling procedures utilized were based on the protocols developed by the Montana Department of Environmental Quality (MT DEQ) for wetland sampling. 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.

Standard sorting protocols were applied to achieve representative subsamples of a minimum of 100 organisms. Caton sub-sampling devices (Caton 1991), divided into 30 grids, each approximately 5 cm by 6 cm, were used. Grid contents were examined under stereoscopic microscopes using 10x-30x magnification. All aquatic invertebrates from each selected grid were sorted from the substrate, and placed in 95% ethanol for subsequent identification. Grid selection, examination, and sorting continued until at least 100 organisms were sorted. A large/rare search was conducted to collect any taxa not found in the subsampling procedure.

Organisms were individually examined using 10x – 80x stereoscopic dissecting scopes (Leica S8E and S6E) and identified to the lowest practical taxonomic levels using appropriate published taxonomic references. Identification, counts, life stages, and information about the condition of specimens were recorded on bench sheets. To obtain accuracy in richness measures, organisms that could not be identified to the target level specified in MDEQ protocols were designated as “not unique” if other specimens from the same group could be taken to target levels. Organisms designated as “unique” were those that could be definitively distinguished from other organisms in the sample. Identified organisms were preserved in 95% ethanol in labeled vials, and archived at the Rhithron laboratory. Midges were morphotyped using 10x – 80x stereoscopic dissecting microscopes (Leica S8E and S6E) and representative specimens were slide mounted and examined at 200x – 1000x magnification using an Olympus BX 51 compound microscope. Slide mounted organisms were also archived at the Rhithron laboratory.

Quality assurance systems

Quality control procedures for initial sample processing and subsampling involved checking sorting efficiency. These checks were conducted on 96% of the samples by independent observers 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:

$$SE = \frac{n_1}{n_{1+2}} \times 100$$

where: SE is the sorting efficiency, expressed as a percentage, n_1 is the total number of specimens in the first sort, and n_{1+2} is the total number of specimens in the first and second sorts combined.

Quality control procedures for taxonomic determinations of invertebrates involved checking accuracy, precision and enumeration. At least 10% of samples are targeted for quality assurance procedures. For this project, three samples were randomly selected and all organisms re-identified and counted by an independent taxonomist. Taxa lists and enumerations were compared by calculating a Bray-Curtis similarity statistic (Bray and Curtis 1957) for each

selected sample. Routinely, discrepancies between the original identifications and the QC identifications are discussed among the taxonomists, and necessary rectifications to the data are made. Discrepancies that cannot be rectified by discussions are routinely sent out to taxonomic specialists for identification. However, taxonomic certainty for identifications in this project was high, and no external verifications were necessary.

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 the 12 metrics were developed specifically for this project, since mitigated wetlands were not included in original criteria development.

Scoring criteria for wetland metrics were developed by generally following the tactic used by Stribling et al. (1995). Boxplots were generated using a statistical software package (Statistica™), and distributions, median values, ranges, and quartiles for each metric were examined. 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, which is expressed as a percentage of the maximum possible score (60). 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. Data from a total of 167 samples were used to develop criteria.

Several sites in this study supported aquatic fauna characteristic of lotic habitats rather than lentic wetland habitats; these sites were excluded from mitigated wetland scoring criteria development, and were evaluated with a metric battery specific to flowing water habitats. In 2007, the lotic sites were Camp Creek (2 sites), Cloud Ranch stream, Kleinschmidt stream, Jack Creek, and Woodson Creek-Ringling stream. Invertebrate assemblages at these sites were generally characteristic of montane or foothill stream conditions and were assessed using the tested metric battery developed for montane streams of Western Montana (Bollman 1998).

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. However, the nature of the action needed is not determined solely by the index score or impairment classification, 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 - wetlands

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.

Summary metric values and scores for the 2007 samples are given in Tables 4a-4c and 5.

In 2007, thermal preference of the invertebrate assemblages was calculated when possible, using the tool developed by Brandt 2001.

Bioassessment metrics – lotic habitats

For sites supporting rheophilic invertebrate assemblages, bioassessment was based on a metric battery and scoring criteria developed for montane regions of Montana (MVFP index: Bollman 1998). The six metrics constituting the bioassessment index used for MVFP sites in this study were selected because, both individually and as an integrated metric battery, they are robust at distinguishing impaired sites from relatively unimpaired sites (Bollman 1998). They have been demonstrated to be more variable with anthropogenic disturbance than with natural environmental gradients (Bollman 1998). Each of the six metrics, and their expected responses to various stressors is described below.

1. Ephemeroptera (mayfly) taxa richness. The number of mayfly taxa declines as water quality diminishes. Impairments to water quality which have been demonstrated to adversely affect the ability of mayflies to flourish include elevated water temperatures, heavy metal contamination, increased turbidity, low or high pH, elevated specific conductance and toxic chemicals. Few mayfly species are able to tolerate certain disturbances to instream habitat, such as excessive sediment deposition.
2. Plecoptera (stonefly) taxa richness. Stoneflies are particularly susceptible to impairments that affect a stream on a reach-level scale, such as loss of riparian canopy, streambank instability, channelization, and alteration of morphological features such as pool frequency and function, riffle development and sinuosity. Just as all benthic organisms, they are also susceptible to smaller scale habitat loss, such as by sediment deposition, loss of interstitial spaces between substrate particles, or unstable substrate.
3. Trichoptera (caddisfly) taxa richness. Caddisfly taxa richness has been shown to decline when sediment deposition affects habitat. In addition, the presence of certain case-building caddisflies can indicate good retention of woody debris and lack of scouring flow conditions.
4. Number of sensitive taxa. Sensitive taxa are generally the first to disappear as anthropogenic disturbances increase. The list of sensitive taxa used here includes organisms sensitive to a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others. Unimpaired streams of western Montana typically support at least four sensitive taxa (Bollman 1998).
5. Percent filter feeders. Filter-feeding organisms are a diverse group; they capture small particles of organic matter, or organically enriched sediment material, from the water column by means of a variety of adaptations, such as silken nets or hairy appendages. In forested montane streams, filterers are expected to occur in insignificant numbers. Their abundance increases when canopy cover is lost and when water temperatures increase and the accompanying growth of filamentous algae occurs. Some filtering organisms, specifically the Arctopsychid caddisflies (*Arctopsyche* spp. and *Parapsyche* spp.) build silken nets with large mesh sizes that capture small organisms such as chironomids and early-instar mayflies. Here they are considered predators, and, in this study, their abundance does not contribute to the percent filter feeders metric.
6. Percent tolerant taxa. Tolerant taxa are ubiquitous in stream sites, but when disturbance increases, their abundance increases proportionately. The list of taxa used here includes organisms tolerant of a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others.

Table 1. Montana Department of Transportation Mitigated Wetlands Monitoring Project sites: sampling history. Only those sites monitored in 2007 are included. An asterisk (*) indicates lotic sites.

Site Identifier	2001	2002	2003	2004	2005	2006	2007
Roundup	+	+	+	+	+	+	+
Ridgeway	+	+	+	+	+	+	+
Hoskins Landing MS-1		+	+	+	+		+
Hoskins Landing MS-2							+
Peterson Ranch pond 1		+	+	+	+	+	+
Peterson Ranch pond 2		+		+	+	+	+
Peterson Ranch pond 4		+	+	+	+	+	+
Peterson Ranch pond 5		+	+	+	+	+	+
Camp Creek MS-1*		+	+	+	+	+	+
Camp Creek MS-2*						+	+
Kleinschmidt		+	+	+	+	+	+
Kleinschmidt – stream*			+	+	+	+	+
Cloud Ranch Pond				+	+		+
Cloud Ranch Stream*				+			+
Jack Creek – pond				+	+		+
Jack Creek – McKee*							+
Norem				+	+	+	+
Rock Creek Ranch					+	+	+
Wagner Marsh					+	+	+
Alkali Lake 1						+	+
Charley Creek							+
Woodson pond MI 1							+
Woodson stream MI 2*							+
Little Muddy Creek							+
Selkirk Ranch							+
DH Ranch							+

Table 2. Aquatic invertebrate metrics employed for wetland (lentic) invertebrate assemblages in the MDT mitigated wetlands study, 2001 – 2007.

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 section of individual project monitoring reports. Summary tables for lentic (4a – 4c) and lotic (5) sites and project specific taxa listings and metrics reports are provided on the following pages.)

Quality Assurance

Table 3 gives the results of quality assurance procedures for sample sorting efficiency (SE) and Bray-Curtis similarity statistics for comparisons of taxonomic determinations and enumeration. Sorting efficiency averaged 97.54% for the project, and taxonomic similarity averaged 97.44%.

Table 3. Results of quality control procedures for subsampling and taxonomic and enumeration similarity.

Site name	SE	Bray-Curtis similarity
Roundup	100.00%	
Ridgeway	100.00%	
Hoskins Landing MS-1	100.00%	
Hoskins Landing MS-2	93.40%	
Peterson Ranch pond 1	100.0%	95.38%
Peterson Ranch pond 2	96.64%	
Peterson Ranch pond 4	91.66%	
Peterson Ranch pond 5	96.64%	
Camp Creek MS-1	100.00%	
Camp Creek MS-2	100.00%	96.94%
Kleinschmidt – pond	100.00%	
Kleinschmidt – stream	99.10%	
Cloud Ranch Pond	95.65%	
Cloud Ranch Stream	91.61%	
Jack Creek – pond	n.a.	
Jack Creek - McKee	96.49%	
Norem	100.00%	100.00%
Rock Creek Ranch	100.00%	
Wagner Marsh	100.00%	
Alkali Lake 1	98.04%	
Charley Creek	100.00%	
Woodson pond	91.37%	
Woodson stream	100.00%	
Little Muddy Creek	92.31%	
Selkirk Ranch	95.56%	
DH Ranch	100.00%	

Table 4a. Metric values and scores for wetland (lentic) sites in the MDT mitigated wetland study – 2007 sampling.

	ROUNDUP	RIDGEWAY	HOSKINS LANDING MS-1	HOSKINS LANDING MS-2	PETERSON RANCH 1	PETERSON RANCH 2	PETERSON RANCH 4	PETERSON RANCH 5
Total taxa	7	13	18	21	17	18	26	18
POET	0	2	3	5	2	0	6	4
Chironomidae taxa	5	5	2	8	8	12	12	6
Crustacea + Mollusca	1	2	5	4	4	5	4	4
% Chironomidae	7.62%	30.00%	18.75%	52.68%	36.45%	51.79%	42.59%	14.78%
Orthocladiinae/Chir	0.38	0.17	0.00	0.03	0.08	0.16	0.09	0.12
%Amphipoda	0.00%	10.00%	0.00%	0.00%	0.93%	0.00%	21.30%	1.74%
%Crustacea + %Mollusca	89.52%	15.00%	26.79%	8.04%	10.28%	43.75%	28.70%	37.39%
HBI	8.02	7.11	7.23	6.55	7.42	7.76	6.53	7.23
%Dominant taxon	89.52%	30.00%	17.86%	35.71%	39.25%	23.21%	17.59%	30.43%
%Collector-Gatherers	92.38%	70.00%	78.57%	82.14%	49.53%	71.43%	38.89%	26.96%
%Filterers	0.00%	0.00%	0.89%	6.25%	9.35%	3.57%	1.85%	5.22%
Total taxa	1	1	3	5	3	3	5	3
POET	1	1	3	5	1	1	5	5
Chironomidae taxa	3	3	1	5	5	5	3	3
Crustacea + Mollusca	1	1	3	3	3	3	1	3
% Chironomidae	5	3	3	1	3	1	1	5
Orthocladiinae/Chir	3	1	1	1	1	1	3	1
%Amphipoda	5	3	5	5	5	5	5	5
%Crustacea + %Mollusca	1	5	5	5	5	3	5	3
HBI	1	3	3	5	3	1	5	3
%Dominant taxon	1	5	5	3	3	5	1	5
%Collector-Gatherers	5	3	3	5	3	3	3	1
%Filterers	3	3	3	1	1	3	5	3
Total score	**30**	**32**	**38**	**44**	**36**	**34**	**42**	**40**
Percent of maximum score	**50.00%**	**53.33%**	**63.33%**	**73.33%**	**60.00%**	**56.67%**	**70.00%**	**66.67%**
Impairment classification	**poor**	**sub-optimal**	**optimal**	**optimal**	**sub-optimal**	**sub-optimal**	**optimal**	**optimal**

Table 4b. Metric values and scores for wetland (lentic) sites in the MDT mitigated wetland study – 2007 sampling.

	KLEIN-SCHMIDT POND	CLOUD RANCH POND	JACK CREEK POND	NOREM	ROCK CREEK RANCH	WAGNER MARSH	ALKALI LAKE 1	CHARLEY CREEK
Total taxa	25	13	9	6	18	11	9	13
POET	5	2	0	1	2	2	0	0
Chironomidae taxa	8	11	5	2	4	4	2	3
Crustacea + Mollusca	8	1	4	1	4	0	2	3
% Chironomidae	18.63%	81.54%	92.79%	31.58%	4.76%	11.39%	1.96%	27.17%
Orthocladiinae/Chir	0.53	0.38	0.03	0.00	0.60	0.44	0.50	0.68
%Amphipoda	10.78%	3.08%	0.00%	0.00%	17.14%	0.00%	0.00%	22.83%
%Crustacea + %Mollusca	36.27%	3.08%	7.21%	21.05%	23.81%	0.00%	61.76%	53.26%
HBI	7.35	7.22	9.73	6.63	6.33	7.28	8.07	6.88
%Dominant taxon	13.73%	18.46%	62.16%	26.32%	29.52%	45.57%	60.78%	29.35%
%Collector-Gatherers	53.92%	84.62%	70.27%	57.89%	29.52%	15.19%	70.59%	32.61%
%Filterers	11.76%	9.23%	0.90%	0.00%	0.95%	0.00%	0.00%	0.00%
Total taxa	5	1	1	1	3	1	1	1
POET	5	1	1	1	1	1	1	1
Chironomidae taxa	5	5	3	1	3	3	1	3
Crustacea + Mollusca	5	1	3	1	3	1	1	1
% Chironomidae	3	1	1	3	5	5	5	3
Orthocladiinae/Chir	5	3	1	1	5	3	5	5
%Amphipoda	3	5	5	5	3	5	5	3
%Crustacea + %Mollusca	3	5	5	5	5	5	3	3
HBI	3	3	1	5	5	3	1	5
%Dominant taxon	5	5	1	5	5	3	1	5
%Collector-Gatherers	3	5	3	3	1	1	3	1
%Filterers	1	1	3	3	3	3	3	3
Total score	**46**	**36**	**28**	**34**	**42**	**34**	**30**	**34**
Percent of maximum score	**76.67%**	**60.00%**	**46.67%**	**56.67%**	**70.00%**	**56.67%**	**50.00%**	**56.67%**
Impairment classification	**optimal**	**sub-optimal**	**poor**	**sub-optimal**	**poor**	**sub-optimal**	**poor**	**sub-optimal**

Table 4c. Metric values and scores for wetland (lentic) sites in the MDT mitigated wetland study – 2007 sampling.

	WOODSON POND	LITTLE MUDDY CREEK	SELKIRK RANCH	DH RANCH
Total taxa	12	2	16	8
POET	0	0	2	1
Chironomidae taxa	9	0	8	4
Crustacea + Mollusca	1	1	2	2
% Chironomidae	85.71%	0.00%	77.27%	27.50%
Orthocladiinae/Chir	0.32	0.00	0.61	0.00
%Amphipoda	0.00%	0.00%	0.00%	0.00%
%Crustacea + %Mollusca	2.86%	75.00%	8.18%	64.17%
HBI	9.34	8.50	7.82	7.38
%Dominant taxon	33.33%	75.00%	46.36%	39.17%
%Collector-Gatherers	55.24%	75.00%	32.73%	27.50%
%Filterers	0.00%	0.00%	8.18%	17.50%
Total taxa	1	1	3	1
POET	1	1	1	1
Chironomidae taxa	5	1	5	3
Crustacea + Mollusca	1	1	1	1
% Chironomidae	1	5	1	3
Orthocladiinae/Chir	3	1	5	1
%Amphipoda	5	5	5	5
%Crustacea + %Mollusca	5	1	5	1
HBI	1	1	1	3
%Dominant taxon	5	1	3	3
%Collector-Gatherers	3	3	1	1
%Filterers	3	3	1	1
Total score	**34**	**24**	**32**	**24**
Percent of maximum score	**56.67%**	**40.00%**	**53.33%**	**40.00%**
Impairment classification	**sub-optimal**	**poor**	**sub-optimal**	**poor**

Table 5. Metric values and scores for stream (lotic) sites in the MDT mitigated wetland study – 2007 sampling.

	CAMP CREEK MS-1	CAMP CREEK MS-2	KLEIN-SCHMIDT STREAM	CLOUD RANCH STREAM	JACK CREEK - MCKEE	WOODSON STREAM
E Richness	6	6	0	2	1	1
P Richness	0	0	0	2	0	0
T Richness	4	6	2	4	4	0
Pollution Sensitive Richness	3	4	0	1	0	0
Filterer Percent	4.85%	5.56%	7.14%	3.57%	2.83%	16.67%
Pollution Tolerant Percent	32.04%	34.26%	9.82%	14.29%	58.49%	8.33%
E Richness	3	3	0	1	0	0
P Richness	0	0	0	2	0	0
T Richness	2	3	1	2	2	0
Pollution Sensitive Richness	2	3	0	1	0	0
Filterer Percent	3	2	2	3	3	1
Pollution Tolerant Percent	1	1	2	1	0	2
Total score	**11**	**12**	**5**	**10**	**5**	**3**
Percent of maximum score	**61.11%**	**66.67%**	**27.78%**	**55.56%**	**27.78%**	**16.67%**
Impairment classification	**slight**	**slight**	**moderate**	**slight**	**moderate**	**severe**

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Taxa Listing

Project ID: MDT07PBSJ
RAI No.: MDT07PBSJ017

RAI No.: MDT07PBSJ017 **Sta. Name:** Roundup
Client ID:
Date Coll.: 7/9/2007 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Non-Insect							
Ostracoda	94	89.52%	Yes	Unknown		8	CG
Heteroptera							
Corixidae							
Corixidae	2	1.90%	Yes	Larva		10	PH
Coleoptera							
Dytiscidae							
Dytiscidae	1	0.95%	Yes	Larva		5	PR
Chironomidae							
Chironomidae							
Ablabesmyia sp.	1	0.95%	Yes	Larva		8	CG
Chironomini	1	0.95%	No	Larva	Early Instar	6	CG
Chironomus sp.	1	0.95%	Yes	Larva		10	CG
Cricotopus (Isocladius) sp.	3	2.86%	Yes	Larva		7	SH
Tanypus sp.	2	1.90%	Yes	Larva		10	PR
Sample Count	**105**						

Metrics Report

Project ID: MDT07PBSJ
RAI No.: MDT07PBSJ017
Sta. Name: Roundup
Client ID:
STORET ID:
Coll. Date: 7/9/2007

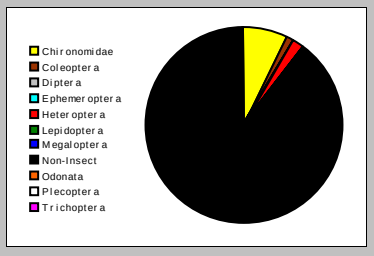
Abundance Measures

Sample Count: 105
Sample Abundance: 630.00 16.67% of sample used

Coll. Procedure:
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Non-Insect	1	94	89.52%
Odonata			
Ephemeroptera			
Plecoptera			
Heteroptera	1	2	1.90%
Megaloptera			
Trichoptera			
Lepidoptera			
Coleoptera	1	1	0.95%
Diptera			
Chironomidae	4	8	7.62%

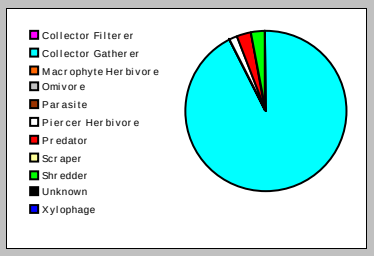


Dominant Taxa

Category	A	PRA
Ostracoda	94	89.52%
Cricotopus (Isocladius)	3	2.86%
Tanypus	2	1.90%
Corixidae	2	1.90%
Dytiscidae	1	0.95%
Chironomus	1	0.95%
Chironomini	1	0.95%
Ablabesmyia	1	0.95%

Functional Composition

Category	R	A	PRA
Predator	2	3	2.86%
Parasite			
Collector Gatherer	3	97	92.38%
Collector Filterer			
Macrophyte Herbivore			
Piercer Herbivore	1	2	1.90%
Xylophage			
Scraper			
Shredder	1	3	2.86%
Omivore			
Unknown			

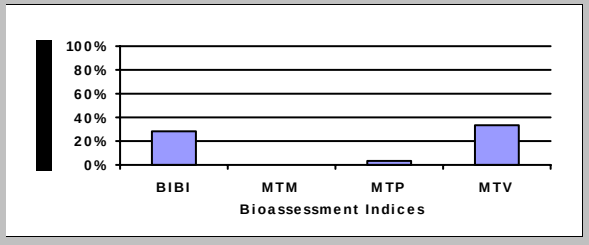


Metric Values and Scores

Metric	Value	BIBI	MTP	MTV	MTM
Composition					
Taxa Richness	7	1	0		0
Non-Insect Percent	89.52%				
E Richness	0	1		0	
P Richness	0	1		0	
T Richness	0	1		0	
EPT Richness	0		0		0
EPT Percent	0.00%		0		0
Oligochaeta+Hirudinea Percent					
Baetidae/Ephemeroptera	0.000				
Hydropsychidae/Trichoptera	0.000				
Dominance					
Dominant Taxon Percent	89.52%		0		0
Dominant Taxa (2) Percent	92.38%				
Dominant Taxa (3) Percent	94.29%	1			
Dominant Taxa (10) Percent	100.00%				
Diversity					
Shannon H (loge)	0.480				
Shannon H (log2)	0.692		0		
Margalef D	1.292				
Simpson D	0.817				
Evenness	0.046				
Function					
Predator Richness	2		0		
Predator Percent	2.86%	1			
Filterer Richness	0				
Filterer Percent	0.00%			3	
Collector Percent	92.38%		1		0
Scraper+Shredder Percent	2.86%		0		0
Scraper/Filterer	0.000				
Scraper/Scraper+Filterer	0.000				
Habit					
Burrower Richness	1				
Burrower Percent	1.90%				
Swimmer Richness	1				
Swimmer Percent	1.90%				
Clinger Richness	1	1			
Clinger Percent	2.86%				
Characteristics					
Cold Stenotherm Richness	0				
Cold Stenotherm Percent	0.00%				
Hemoglobin Bearer Richness	3				
Hemoglobin Bearer Percent	3.81%				
Air Breather Richness	1				
Air Breather Percent	0.95%				
Voltinism					
Univoltine Richness	1				
Semivoltine Richness	1	1			
Multivoltine Percent	97.14%		0		
Tolerance					
Sediment Tolerant Richness	0				
Sediment Tolerant Percent	0.00%				
Sediment Sensitive Richness	0				
Sediment Sensitive Percent	0.00%				
Metals Tolerance Index	4.800				
Pollution Sensitive Richness	0	1		0	
Pollution Tolerant Percent	4.76%	5		3	
Hilsenhoff Biotic Index	8.019		0		0
Intolerant Percent	0.00%				
Supertolerant Percent	95.24%				
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)	1	3.33%	Severe
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	6	33.33%	Moderate
MTM	Montana DEQ Mountains (Bukantis 1998)	0	0.00%	Severe



Appendix G

2007 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 2007

Roundup Wetland
Roundup, Montana

Prepared for:

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

Prepared by:

801 N. Last Chance Gulch, Suite 100
Helena, MT 59601

November 2007

Project No: B43088.00 0510

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FIGURES

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 October 2007. 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, November 2005, and October 2006. 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 11, 2007. 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.

All five site-related monitoring wells were sampled using decontaminated battery operated low-flow submersible pumps and new disposable vinyl tubing. The pumps were powered with a vehicle battery, and were set within the screened interval. The pumps yielded approximately 0.6 gallon 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 ten minute intervals while pumping. Field parameters were measured using a WTW® water quality multi-meter, which was calibrated in the field prior to use.

Concentrations of ferrous iron (Fe) were estimated in the field using a Hach® colorimeter, which was calibrated in the field prior to use. 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 1 liter polyethylene bottles. The sample bottles were rinsed twice with well water before collection, and were preserved with H_2SO_4. Samples were stored on ice and were delivered to Energy Laboratories in Billings, MT approximately five 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	0.05 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

Groundwater elevations ranged from 3163.73 to 3169.63 feet during the 2007 sampling event (**Table 2**). Groundwater elevations were lower than any previous sampling event and averaged 0.6 feet lower than elevations measured during the October 2006 event.

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.

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
				10/11/07	13.18	3169.63
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
				10/11/07	6.81	3167.80
3	16.0	11.0-16.0	3174.25	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
				10/11/07	8.40	3165.85
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
				10/11/07	10.26	3164.30
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
				10/11/07	6.09	3163.73

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 during or after purging three well volumes from each well. Groundwater sampling and monitoring forms are included in **Appendix A**.

Electrical conductivity measurements varied, with some sample locations exhibiting an increase and some showing a decrease. Overall, the greatest difference from data taken during the 2006 event appeared in Well #3 with a decrease from 7,350 us/cm to 6,260 us/cm in 2007.

Water temperatures were higher at all locations during the 2007 sampling event than in 2006. Dissolved oxygen concentrations varied little with the exception of well #1, which decreased 1.9 mg/L from October 2006.

In general, concentrations of ferrous iron and hydrogen sulfide exhibited little change when compared to previous results. Water from wells #2, #3 and #4 exhibited a yellow

tint and moderate to strong sulfur odor and, consequently, these wells yielded the highest concentrations of ferrous iron, ranging from 4.99 mg/L to greater than 5.1 mg/L.

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

Well #	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	6200	7.1	~0.1	<0.1
	11/01/05	0.5	11.6	3300	8.2	~0.0	~0.1
	10/24/06	3.0	11.1	4500	7.3	~0.0	<0.1
	10/11/07	1.1	12.7	5040	7.45	~0.0	<0.1
2	04/09/98	NM	11.0	6260	7.6	~3-4	<0.1
	11/01/05	0.2	12.9	4890	7.8	~4.6	~0.3
	10/24/06	0.3	11.9	7260	7.4	~5.1	~0.2
	10/11/07	0.6	13.3	7160	7.48	>5.10	~0.1
3	04/09/98	NM	11.0	6040	7.6	~3-4	<0.1
	11/01/05	0.3	11.2	4770	7.9	~4.5	~0.1
	10/24/06	0.2	10.5	7350	7.8	~4.2	~0.1
	10/11/07	0.7	11.9	6260	7.56	4.99	~0.1
4	04/09/98	NM	9.0	6040	7.4	~7-8	<0.1
	11/01/05	0.5	12.3	5000	7.8	~4.1	~0.1
	10/24/06	0.1	11.6	5430	7.3	~5.1	~0.1
	10/11/07	0.7	12.9	6100	7.28	>5.10	<0.1
5	04/09/98	NM	9.0	6470	7.3	(note)	<0.1
	11/01/05	1.5	13.1	4450	7.7	~0.3	~0.5
	10/24/06	0.6	12.3	6190	7.2	~0.1	~0.1
	10/11/07	0.5	13.6	5890	7.25	~0.0	<0.1

> = Ferrous iron present in levels above equipment reporting limits
NM = not measured
Note – Fe was not detected in field, but water turned orange when bleach was added (Morrison-Maierle, April 1998)

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 2007 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, 2005, and 2006 sampling events, are presented below in **Table 4**. The laboratory analytical summary report is included in **Appendix B**.

Total phosphorus (TP) concentrations were slightly higher during the 2007 sampling event than in 2006 at two locations, lower at two locations, and unchanged from 2006 in Well #5. TP concentrations in Well #3 exhibited the greatest change from 2006, with a 2.52 mg/L decrease to 1.32 mg/L.

Concentrations of total Kjeldahl nitrogen (TKN) showed a slight decrease from previous sampling results at two locations in 2007, an increase at two locations and remained below detection in Well #1. The largest change from 2006 occurred in Well #3 with a 6.0 mg/L increase.

Concentrations of nitrate + nitrite nitrogen (NO_2+NO_3) were below the analytical detection limit at all sites except for Well #1 in 2007. NO_2+NO_3 concentrations increased in Well #1 from 12.4 mg/L to 16.1 mg/L. NO_2+NO_3 concentration decreased from the previous sampling event in 2006 in Well #3 from 0.94 mg/L to below the analytical detection limit.

Ammonia nitrogen (NH_4) concentrations remained below the analytical detection limit in Well #1 during the 2007 sampling event. Of the remaining four wells, two had lower concentrations of NH_4 in 2007 than in 2006, while two exhibited increased concentrations. Well #3 showed the largest change since 2006 with an increase to 18.1 mg/L from 14.3 mg/L.

Concentrations of total nitrogen (TN) were higher in 2007 than in 2006 at three sampling locations and lower at two locations. Well #3 exhibited the greatest change overall with an increase from 16.8 mg/L in 2006 to 21.9 mg/L in 2007. Well #1 showed a notable increase from 12.4 mg/L in 2006 to 16.1 mg/L in 2007.

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
	10/11/07	0.01	<0.5	16.1	<0.1	16.1
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
	10/11/07	2.09	20.4	<0.05	19.0	20.4
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
	10/11/07	1.32	21.9	<0.05	18.1	21.9
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
	10/11/07	0.21	13.9	<0.05	12.6	13.9
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
	10/11/07	0.02	4.8	<0.05	2.8	4.8

4.0 CONCLUSIONS

Groundwater elevations were lower in all five wells during the 2007 sampling event than any previous sampling event. Field parameters also varied in 2007 from previous sample years. Field measurements of water temperature were higher while electrical conductivity values varied among all sampling locations.

Nutrient concentrations were quite variable during 2007. As was the case in all other sampling years, the concentration of nitrate + nitrite nitrogen in Well #1 exceeded the human health standard of 10 mg/L for groundwater during 2007 (Montana DEQ 2006), with a concentration of 16.1 mg/L. Nitrate + nitrite nitrogen decreased to levels below the analytical detection limit in Well #3 during the 2007 sampling event.

Analytical results suggest that the lagoons may be a source of nutrients in the vicinity of the wastewater lagoons, with analytical results from the 2007 event showing varied increased and decreased concentration throughout the sample locations. Therefore, it is difficult to extrapolate specific trends from the 2007 sampling event data.

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 new tight fitting seals or locking steel covers be welded to each stickup casing.

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 2008. Following the 2008 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 Transportation. Billings, MT.

PBS&J. 2006. *Roundup Wastewater Lagoons/MDT Wetland Groundwater Monitoring Report 2006.* Prepared for Montana Department of Transportation. Helena, Mt.

Appendix A

GROUNDWATER SAMPLING AND MONITORING FORMS

ROUNDUP WASTEWATER LAGOONS/MDT WETLAND GROUNDWATER MONITORING REPORT 2007

PBS&J

GROUNDWATER SAMPLING & MONITORING FORM

ver. 9/24/07 S. Jarsky

Project: Roundup/MDT Wetlands GWM
Roundup, Montana

Project #: B43088.00 0510

Date: 10-11-07 **Time:** 1355

Personnel: S. Jarsky **Form#:** ---

Sample Location: Well #1 **F.B. #:** ---

Aquifer Type: Unconfined **Well Type:** monitoring

Total Depth: 22.8 *feet* **SWL:** 13.18 *feet*

Measuring Point Description: top PVC, black mark north

Casing Type: PVC **Well ϕ:** 4"

Well Log: ☑ Yes ☐ No **Well Locked:** ☑ Yes ☐ No **Mount Type:** ☐ Flush ☑ Stickup:

Purge & Sampling Equipment

Instrument	Calibration	Operational Notes:
LoFlo 12v Pump	N/A	Set at 20 feet
WTW Multimeter (pH/eH/Cond/TDS)	10/11/07	
In-Situ DO meter	/	Calibrated to 88 % saturation (elev: 3300')
Hach HS-C field colorimeter	X	

Standard Operating Procedures

Number	Description
3401, 3402	Corning Checkmate 90: pH, Eh, Conductivity, TDS
4203	Well Static H2O Level Measurement w/ Solinst Well Probe
5201	Monitoring Well Purging & Sampling
5211	Major Minerals (INORGANICS) Sampling
5212	Volatile Organic Analysis (VOA) Sampling
6210	Groundwater Equipment Decontamination
8210	Sample Packaging & Shipping for Groundwater Samples
8300 8400 8500	Field QA/QC, Sample Custody, Sample ID and Analytical Results

Well Evaucation & Monitoring Data

Time	Temp (deg C)	pH	Eh (mV)	Conductivity (uS)	Q (gpm)	Elapsed (gallons)
1404	-	-	-	-	-	-
1414	12.8	7.65	-48	5060	.6	6
1424	12.6	7.48	-39	5070	.6	12
1434	12.7	7.45	-37	5040	.6	18

Bore Volume Calculation: $(\pi\phi^2/4)\cdot(TD-SWL)\cdot(7.48\ gal/ft^3)$ = 6.5 gal (2" casing calc = .163)

Water Description: clear, no odor

Sampling Data

Bottle Label	Sampling Parameter	Preservative	Sample Time	Other
B43088-1	TP, TKN, Nox, NH4	H2SO4	1440	500 ml plastic

Samples analyzed by:	Energy Laboratories Billings, MT

Comments:

Dissolved Oxygen @ 20 = 1.1 ppm

Fe = 0.0 mg/L

H2S = 0.0 mg/L

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PBS&J

GROUNDWATER SAMPLING & MONITORING FORM

ver. 9/24/07 S. Jarsky

Project: Roundup/MDT Wetlands GWM — *Roundup, Montana*
Project #: B43088.00 0510

Date: 10-11-07 **Time:** 1300

Personnel: S. Jarsky **Form#:** ---

Sample Location: Well #2 **F.B. #:** ---

Aquifer Type: Unconfined **Well Type:** monitoring

Total Depth: 16 *feet* **SWL:** 6.81 *feet*

Measuring Point Description: top PVC, black mark north

Casing Type: PVC **Well ϕ:** 4"

Well Log: ☑ Yes ☐ No **Well Locked:** ☑ Yes ☐ No **Mount Type:** ☐ Flush ☑ Stickup:

Purge & Sampling Equipment

Instrument	Calibration	Operational Notes:
LoFlo 12v Pump	N/A	Set at 12 feet
WTW Multimeter (pH/eH/Cond/TDS)	10/11/07	
In-Situ DO meter		Calibrated to 88 % saturation (elev. 3300')
Hach HS-C field colorimeter	X	

Standard Operating Procedures

Number	Description
3401, 3402	Corning Checkmate 90: pH, Eh, Conductivity, TDS
4203	Well Static H2O Level Measurement w/ Solinst Well Probe
5201	Monitoring Well Purging & Sampling
5211	Major Minerals (INORGANICS) Sampling
5212	Volatile Organic Analysis (VOA) Sampling
6210	Groundwater Equipment Decontamination
8210	Sample Packaging & Shipping for Groundwater Samples
8300 8400 8500	Field QA/QC, Sample Custody, Sample ID and Analytical Results

Well Evaucation & Monitoring Data

Time	Temp (deg C)	pH	Eh (mV)	Conductivity (uS)	Q (gpm)	Elapsed (gallons)
1302	—	—	—	—	—	—
1312	13.5	7.54	-42	7180	.5	5
1322	13.4	7.48	-39	7160	.5	10
1332	13.3	7.48	-39	7160	.5	15

Bore Volume Calculation: $(\pi\phi^2/4)\cdot(TD-SWL)\cdot(7.48\ gal/ft^3)$ = 6 gal (2" casing calc = .163)

Water Description: Slight yellow tint, strong sulfur/organics odor

Sampling Data

Bottle Label	Sampling Parameter	Preservative	Sample Time	Other
B43088-2	TP, TKN, Nox, NH4	H2SO4	1335	500 ml plastic

Samples analyzed by: Energy Laboratories, Billings, MT

Comments:

Dissolved Oxygen @ 12 = 0.6 ppm

Fe = 5.10 mg/L

H2S = 0.1 mg/L

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GROUNDWATER SAMPLING & MONITORING FORM

ver. 9/24/07 S. Jarsky

Project: Roundup/MDT Wetlands GWM
Roundup, Montana

Project #: B43088.00 0510

Date: 10/11/07 **Time:** 1200

Personnel: S. Jarsky **Form#:** —

Sample Location: Well #3 **F.B. #:** —

Aquifer Type: Unconfined **Well Type:** monitoring

Total Depth: 16 *feet* **SWL:** 8.40' *feet*

Measuring Point Description: top PVC, black mark north

Casing Type: PVC **Well ϕ:** 4"

Well Log: ☑ Yes ☐ No **Well Locked:** ☑ Yes ☐ No **Mount Type:** ☐ Flush ☑ Stickup

Purge & Sampling Equipment

Instrument	Calibration	Operational Notes:
LoFlo 12v Pump	N/A	Set at 12 feet
WTW Multimeter (pH/eH/Cond/TDS)	10/11/07	
In-Situ DO meter	↓	Calibrated to 88 % saturation (elev: 3300')
Hach HS-C field colorimeter	↓	

Standard Operating Procedures

Number	Description
3401, 3402	Coming Checkmate 90: pH, Eh, Conductivity, TDS
4203	Well Static H2O Level Measurement w/ Solinst Well Probe
5201	Monitoring Well Purging & Sampling
5211	Major Minerals (INORGANICS) Sampling
5212	Volatile Organic Analysis (VOA) Sampling
6210	Groundwater Equipment Decontamination
8210	Sample Packaging & Shipping for Groundwater Samples
8300 8400 8500	Field QA/QC, Sample Custody, Sample ID and Analytical Results

Well Evaucation & Monitoring Data

Time	Temp (deg C)	pH	Eh (mV)	Conductivity (uS)	Q (gpm)	Elapsed (gallons)
1208	—	—	—	—	—	—
1218	12.1	7.44	-37	6240	.5	5
1228	11.9	7.55	-43	6250	.5	10
1238	11.9	7.56	-43	6260	.5	15

Bore Volume Calculation: $(\pi\phi^2/4)\cdot(TD-SWL)\cdot(7.48\ gal/ft^3)$ = 5 gal (2" casing calc = .163)

Water Description: clear, strong sulfur/organics odor

Sampling Data

Bottle Label	Sampling Parameter	Preservative	Sample Time	Other
B43088-3	TP, TKN, Nox, NH4	H2SO4	1245	500 ml plastic

Samples analyzed by:	Energy Laboratories Billings, MT

Comments:

Dissolved Oxygen @ 12 = 0.7 ppm

Fe = 4.99 mg/L

H2S = 0.1 mg/L

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GROUNDWATER SAMPLING & MONITORING FORM

ver. 9/24/07 S. Jarsky

Project: Roundup/MDT Wetlands GWM
Roundup, Montana

Project #: B43088.00 0510

Date: 10/11/07 **Time:** 1110

Personnel: S. Jarsky **Form#:** —

Sample Location: Well #4 **F.B. #:** —

Aquifer Type: Unconfined **Well Type:** monitoring

Total Depth: 16 *feet* **SWL:** 10.26 *feet*

Measuring Point Description: top PVC, black mark north

Casing Type: PVC **Well ϕ:** 4"

Well Log: ☑ Yes ☐ No **Well Locked:** ☑ Yes ☐ No **Mount Type:** ☐ Flush ☑ Stickup:

Purge & Sampling Equipment

Instrument	Calibration	Operational Notes:
LoFlo 12v Pump	N/A	Set at 13 feet
WTW Multimeter (pH/eH/Cond/TDS)	10/11/07	
In-Situ DO meter		Calibrated to 88 % saturation (elev: 3300')
Hach HS-C field colorimeter	X	

Standard Operating Procedures

Number	Description
3401, 3402	Coming Checkmate 90: pH, Eh, Conductivity, TDS
4203	Well Static H2O Level Measurement w/ Solinst Well Probe
5201	Monitoring Well Purging & Sampling
5211	Major Minerals (INORGANICS) Sampling
5212	Volatile Organic Analysis (VOA) Sampling
6210	Groundwater Equipment Decontamination
8210	Sample Packaging & Shipping for Groundwater Samples
8300 8400 8500	Field QA/QC, Sample Custody, Sample ID and Analytical Results

Well Evaucation & Monitoring Data

Time	Temp (deg C)	pH	Eh (mV)	Conductivity (uS)	Q (gpm)	Elapsed (gallons)
1114	—	—	—	—	—	—
1124	13.3	7.20	-24	6040	.5	5
1134	13.0	7.28	-28	6090	.5	10
1144	12.9	7.28	-28	6100	.5	15

Bore Volume Calculation: $(\pi\phi^2/4)\cdot(TD-SWL)\cdot(7.48\ gal/ft^3)$ = — 4 gal (2" casing calc = .163)

Water Description: Slight yellow tint, moderate sulfur odor

Sampling Data

Bottle Label	Sampling Parameter	Preservative	Sample Time	Other
B43088-4	TP, TKN, Nox, NH4	H2SO4	1145	500 ml plastic

Samples analyzed by:	Energy Laboratories Billings, MT

Comments:

Dissolved Oxygen @ 13 = 0.7 ppm

Fe = 75.10 mg/L

H2S = <0.1 mg/L

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PBS&J

GROUNDWATER SAMPLING & MONITORING FORM

ver. 9/24/07 S. Jarsky

Project: Roundup/MDT Wetlands GWM — *Roundup, Montana*

Project #: B43088.00 0510

Date: 10/11/07 **Time:** 1000

Personnel: S. Jarsky **Form#:** —

Sample Location: Well #5 **F.B. #:** —

Aquifer Type: Unconfined **Well Type:** monitoring

Total Depth: 16 *feet* **SWL:** 6.09 *feet*

Measuring Point Description: top PVC, black mark north

Casing Type: PVC **Well ϕ:** 4"

Well Log: ☑ Yes ☐ No **Well Locked:** ☑ Yes ☐ No **Mount Type:** ☐ Flush ☑ Stickup:

Purge & Sampling Equipment

Instrument	Calibration	Operational Notes:
LoFlo 12v Pump	N/A	Set at 10 feet
WTW Multimeter (pH/eH/Cond/TDS)	10/11/07	
In-Situ DO meter	↓	Calibrated to 88 % saturation (elev: 3300')
Hach HS-C field colorimeter	↓	

Standard Operating Procedures

Number	Description
3401, 3402	Corning Checkmate 90: pH, Eh, Conductivity, TDS
4203	Well Static H2O Level Measurement w/ Solinst Well Probe
5201	Monitoring Well Purging & Sampling
5211	Major Minerals (INORGANICS) Sampling
5212	Volatile Organic Analysis (VOA) Sampling
6210	Groundwater Equipment Decontamination
8210	Sample Packaging & Shipping for Groundwater Samples
8300 8400 8500	Field QA/QC, Sample Custody, Sample ID and Analytical Results

Well Evaucation & Monitoring Data

Time	Temp (deg C)	pH	Eh (mV)	Conductivity (uS)	Q (gpm)	Elapsed (gallons)
1018	—	—	—	—	—	—
1028	13.5	8.00	-67	2490	.7	7.0
1038	13.5	7.37	-33	2640	.7	14.0
1048	13.6	7.27	-27	5900	.7	21.0
1058	13.6	7.25	-27	5890	.7	28.0

Bore Volume Calculation: $(\pi\phi^2/4)\cdot(TD-SWL)\cdot(7.48\ gal/ft^3)$ = ~6.5 gal (2" casing calc = .163)

Water Description: clear, no odor

Sampling Data

Bottle Label	Sampling Parameter	Preservative	Sample Time	Other
B43088-5	TP, TKN, Nox, NH4	H2SO4	1100	500 ml plastic

Samples analyzed by:	Energy Laboratories Billings, MT

Comments:

Dissolved Oxygen @ 10 = 0.5 ppm

Fe = 0.0 mg/l

H2S = <.1 mg/l

Appendix B

LABORATORY ANALYTICAL RESULTS

ROUNDUP WASTEWATER LAGOONS/MDT WETLAND
GROUNDWATER MONITORING REPORT 2007

ENERGY LABORATORIES, INC. • P.O. Box 30916 • 1120 South 27th Street • Billings, MT 59107-0916
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ANALYTICAL SUMMARY REPORT

October 24, 2007

Seth Jarsky
PBS and J
1120 Cedar Street
Missoula, MT 59802-

Workorder No.: B07101041

Project Name: B43088 Roundup

Energy Laboratories Inc received the following 5 samples from PBS and J on 10/11/2007 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B07101041-001	B43088-1	10/11/07 14:40	10/11/07	Aqueous	Nitrogen, Ammonia Nitrogen, Nitrate + Nitrite Nitrogen, Total Kjeldahl Nitrogen, Total (TKN+NO3+NO2) Phosphorus, Total
B07101041-002	B43088-2	10/11/07 13:35	10/11/07	Aqueous	Same As Above
B07101041-003	B43088-3	10/11/07 12:45	10/11/07	Aqueous	Same As Above
B07101041-004	B43088-4	10/11/07 11:45	10/11/07	Aqueous	Same As Above
B07101041-005	B43088-5	10/11/07 11:00	10/11/07	Aqueous	Same As Above

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

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

Report Approved By:

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LABORATORY ANALYTICAL REPORT

Client: PBS and J
Project: B43088 Roundup
Lab ID: B07101041-001
Client Sample ID: B43088-1

Report Date: 10/24/07
Collection Date: 10/11/07 14:40
DateReceived: 10/11/07
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	10/18/07 11:11 / bls
Nitrogen, Nitrate+Nitrite as N	16.1	mg/L		0.05		E353.2	10/19/07 13:17 / bls
Nitrogen, Kjeldahl, Total as N	ND	mg/L		0.5		E351.2	10/15/07 11:57 / ddb
Nitrogen, Total	16.1	mg/L		0.5		Calculation	10/22/07 14:41 / klc
Phosphorus, Total as P	0.01	mg/L		0.01		E365.1	10/12/07 16:53 / ddb

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: PBS and J
Project: B43088 Roundup
Lab ID: B07101041-002
Client Sample ID: B43088-2

Report Date: 10/24/07
Collection Date: 10/11/07 13:35
DateReceived: 10/11/07
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
NUTRIENTS							
Nitrogen, Ammonia as N	19.0	mg/L		0.1		E350.1	10/18/07 11:07 / bls
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.05		E353.2	10/19/07 13:16 / bls
Nitrogen, Kjeldahl, Total as N	20.4	mg/L		0.5		E351.2	10/15/07 12:00 / ddb
Nitrogen, Total	20.4	mg/L		0.5		Calculation	10/22/07 14:41 / klc
Phosphorus, Total as P	2.09	mg/L	D	0.02		E365.1	10/12/07 17:09 / ddb

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: B43088 Roundup
Lab ID: B07101041-003
Client Sample ID: B43088-3

Report Date: 10/24/07
Collection Date: 10/11/07 12:45
DateReceived: 10/11/07
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
NUTRIENTS							
Nitrogen, Ammonia as N	18.1	mg/L		0.1		E350.1	10/18/07 11:08 / bls
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.05		E353.2	10/19/07 13:19 / bls
Nitrogen, Kjeldahl, Total as N	21.9	mg/L		0.5		E351.2	10/15/07 12:00 / ddb
Nitrogen, Total	21.9	mg/L		0.5		Calculation	10/22/07 14:41 / klc
Phosphorus, Total as P	1.32	mg/L		0.01		E365.1	10/12/07 17:10 / ddb

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: PBS and J
Project: B43088 Roundup
Lab ID: B07101041-004
Client Sample ID: B43088-4

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

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
NUTRIENTS							
Nitrogen, Ammonia as N	12.6	mg/L		0.1		E350.1	10/18/07 11:15 / bls
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.05		E353.2	10/19/07 13:21 / bls
Nitrogen, Kjeldahl, Total as N	13.9	mg/L		0.5		E351.2	10/15/07 12:01 / ddb
Nitrogen, Total	13.9	mg/L		0.5		Calculation	10/22/07 14:41 / klc
Phosphorus, Total as P	0.21	mg/L		0.01		E365.1	10/12/07 16:58 / ddb

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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LABORATORY ANALYTICAL REPORT

Client: PBS and J
Project: B43088 Roundup
Lab ID: B07101041-005
Client Sample ID: B43088-5

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

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
NUTRIENTS							
Nitrogen, Ammonia as N	2.8	mg/L		0.1		E350.1	10/18/07 11:16 / bls
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.05		E353.2	10/19/07 13:08 / bls
Nitrogen, Kjeldahl, Total as N	4.8	mg/L		0.5		E351.2	10/15/07 11:41 / ddb
Nitrogen, Total	4.8	mg/L		0.5		Calculation	10/22/07 14:41 / klc
Phosphorus, Total as P	0.02	mg/L		0.01		E365.1	10/12/07 16:59 / ddb

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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QA/QC Summary Report

Client: PBS and J
Project: B43088 Roundup

Report Date: 10/24/07
Work Order: B07101041

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E350.1								Analytical Run: FIA203-B_071018A	
Sample ID: ICV	Initial Calibration Verification Standard							10/18/07 08:41	
Nitrogen, Ammonia as N	16.4	mg/L	0.11	103	90	110			
Method: E350.1								Batch: R101132	
Sample ID: MBLK	Method Blank				Run: FIA203-B_071018A			10/18/07 08:43	
Nitrogen, Ammonia as N	ND	mg/L	0.02						
Sample ID: LFB	Laboratory Fortified Blank				Run: FIA203-B_071018A			10/18/07 08:44	
Nitrogen, Ammonia as N	1.05	mg/L	0.10	106	90	110			
Sample ID: B07101041-001AMS	Sample Matrix Spike				Run: FIA203-B_071018A			10/18/07 11:13	
Nitrogen, Ammonia as N	0.923	mg/L	0.10	94	90	110			
Sample ID: B07101041-001AMSD	Sample Matrix Spike Duplicate				Run: FIA203-B_071018A			10/18/07 11:14	
Nitrogen, Ammonia as N	0.929	mg/L	0.10	95	90	110	0.6	10	
Method: E351.2								Analytical Run: FIA202-B_071015A	
Sample ID: ICV	Initial Calibration Verification Standard							10/15/07 11:12	
Nitrogen, Kjeldahl, Total as N	7.11	mg/L	0.50	101	90	110			
Method: E351.2								Batch: R100944	
Sample ID: MBLK	Method Blank				Run: FIA202-B_071015A			10/15/07 11:13	
Nitrogen, Kjeldahl, Total as N	ND	mg/L	0.03						
Sample ID: LFB	Laboratory Fortified Blank				Run: FIA202-B_071015A			10/15/07 11:14	
Nitrogen, Kjeldahl, Total as N	5.23	mg/L	0.50	105	90	110			
Sample ID: B07101041-001AMS	Sample Matrix Spike				Run: FIA202-B_071015A			10/15/07 11:58	
Nitrogen, Kjeldahl, Total as N	5.41	mg/L	0.50	109	90	110			
Sample ID: B07101041-001AMSD	Sample Matrix Spike Duplicate				Run: FIA202-B_071015A			10/15/07 11:59	
Nitrogen, Kjeldahl, Total as N	5.42	mg/L	0.50	109	90	110	0.2	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

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QA/QC Summary Report

Client: PBS and J
Project: B43088 Roundup

Report Date: 10/24/07
Work Order: B07101041

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E353.2								Analytical Run: FIA203-B_071019B	
Sample ID: ICV	Initial Calibration Verification Standard							10/19/07 08:26	
Nitrogen, Nitrate+Nitrite as N	6.65	mg/L	0.050	98	90	110			
Method: E353.2								Batch: R101179	
Sample ID: MBLK	Method Blank				Run: FIA203-B_071019B			10/19/07 08:27	
Nitrogen, Nitrate+Nitrite as N	0.005	mg/L	0.002						
Sample ID: LFB	Laboratory Fortified Blank				Run: FIA203-B_071019B			10/19/07 08:28	
Nitrogen, Nitrate+Nitrite as N	1.04	mg/L	0.050	106	90	110			
Sample ID: B07101041-005AMS	Sample Matrix Spike				Run: FIA203-B_071019B			10/19/07 13:09	
Nitrogen, Nitrate+Nitrite as N	1.02	mg/L	0.050	103	90	110			
Sample ID: B07101041-005AMSD	Sample Matrix Spike Duplicate				Run: FIA203-B_071019B			10/19/07 13:10	
Nitrogen, Nitrate+Nitrite as N	1.01	mg/L	0.050	102	90	110	1.1	10	
Method: E365.1								Analytical Run: FIA202-B_071012C	
Sample ID: ICV	Initial Calibration Verification Standard							10/12/07 16:20	
Phosphorus, Total as P	24.3	mg/L	0.18	97	90	110			
Method: E365.1								Batch: R100893	
Sample ID: MBLK	Method Blank				Run: FIA202-B_071012C			10/12/07 16:21	
Phosphorus, Total as P	0.008	mg/L	0.002						
Sample ID: LFB	Laboratory Fortified Blank				Run: FIA202-B_071012C			10/12/07 16:22	
Phosphorus, Total as P	0.0984	mg/L	0.010	91	90	110			
Sample ID: B07101041-003AMS	Sample Matrix Spike				Run: FIA202-B_071012C			10/12/07 16:56	
Phosphorus, Total as P	1.56	mg/L	0.010	86	90	110			S
Sample ID: B07101041-003AMSD	Sample Matrix Spike Duplicate				Run: FIA202-B_071012C			10/12/07 16:57	
Phosphorus, Total as P	1.56	mg/L	0.010	85	90	110	0.1	10	S

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

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Energy Laboratories Inc
Workorder Receipt Checklist

B07101041

PBS and J

Login completed by: Eric L. Frank
Reviewed by: Staci Fread
Reviewed Date: 10/11/2007 6:09:32 PM

Date and Time Received: 10/11/2007 4:10 PM
Received by: dlf
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 ☐	4°C On Ice
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Contact and Corrective Action Comments:

Samples 2, and 3, for Nutrients were received at pH ~5, 2 mL H2SO4 added to preserve to pH <2. Samples 4, and 5 for Nutrients were received at pH ~3, 2 mL H2SO4 added to preserve to pH <2.

Page ____ of ____

Chain of Custody and Analytical Request Record

ENERGY LABORATORIES

PLEASE PRINT- Provide as much information as possible.

Company Name: PBS+J	Project Name, PWS, Permit, Etc.: B43088 / Roundup	Sample Origin State: MT	EPA/State Compliance: Yes ☐ No ☐
Report Mail Address: 1120 Cedar St Missoula MT 59802	Contact Name: Seth Jarsky Phone/Fax: 406-531-6096 Email:		Sampler: (Please Print) Seth Jarsky
Invoice Address: Same	Invoice Contact & Phone: Chris Matt 406-721-0354	Purchase Order: B43088	Quote/Bottle Order:

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

☐ DW ☐ GSA ☐ POTW/WWTP ☐ State: _____ ☐ Other: _____
☐ A2LA ☐ EDD/EDT (Electronic Data) Format: _____ ☐ LEVEL IV ☐ NELAC

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

ANALYSIS REQUESTED

SEE ATTACHED

Normal Turnaround (TAT)

RUSH

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

Comments:

Shipped by: HAND
Cooler ID(s):
Receipt Temp: 4 °C
On ice: Yes No
Custody Seal Y N
Intact Y N
Signature Match Y N

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	TP, TKN, NO_3+3, NH_4	Total Nitrogen	LABORATORY USE ONLY
1	B43088-1	10/11/07	1440	W	X	X	B710141-001
2	B43088-2	"	1335	"	X	X	-002
3	B43088-3	"	1245	"	X	X	-003
4	B43088-4	"	1145	"	X	X	-004
5	B43088-5	X	1100	X	X	X	-005
6							-006
7							
8							
9							
10							

Custody Record MUST be Signed

Relinquished by (print): Seth Jarsky Date/Time: 10/11/07 1610 Signature:
Relinquished by (print): Date/Time: Signature:
Received by (print): Date/Time: Signature:
Received by (print): Date/Time: Signature:
Received by Laboratory: Debbie Fosgard 10-11-07 1610

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

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.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.