OCTAGON
Consulting Engineers, LLC
BIOENERGY • CIVIL • MECHANICAL

May 31, 2011

Mary Louise Hendrickson, Technical Lead
Solid Waste Licensing Program
Montana Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Re: Adkins Class III Tire Mono-Fill Landfill, Pray, Montana -- Transmittal of Licensing Application Submittal

Dear Mary Louise:

The application submittal for Adkins Class III Tire Mono-Fill Landfill is enclosed for review and approval by the MDEQ Solid Waste Licensing Program. This submittal contains the following details:

1. MDEQ standard Class III SWMS License Application
2. Check from Adkins Construction to MDEQ in the amount of $3600 to cover application review fee in accordance with ARM 17.50.410, Table 3
3. Names and addresses of surrounding land owners
4. Drawing sheet numbers A through D, plan view rendering, schematic plan views and schematic section
5. Drawing sheet numbers 1 through 4, engineering plans and section detail
6. Ownership deeds
7. Operations and Preventive Maintenance Plan
8. Letters from agencies
9. Engineer's Report with attachments including: partial copy of Pray USGS quad topo map with site location identified; groundwater evaluation with numerous well logs, well location maps and calculation of groundwater table flow direction and gradient; and description of soils
10. Engineer's Report Section 7.13 addresses balanced soil cut and fill in pit operations
11. Closure Plan cost estimate
12. Stormwater calculation spread sheets with vicinity map showing runoff flow patterns
13. Documents under cover sheet entitled "Appendix E, Well Pump Test Reports" providing groundwater analysis by Montana Bureau of Mines and Geology for a subdivision located immediately to the southwest of this pit site, as

described in Engineer's Report, Section 4, Evaluation of Groundwater and Surrounding Wells

14. Documents under cover sheet entitled "Appendix D, Water and Sanitation Information" including soils and groundwater evaluations for a proposed subdivision development located less than 2.5 miles up-gradient

We appreciate your review, comments and eventual approval of this application for license to operate a waste tire mono-fill landfill on this property. We look forward to working with you and other Licensing Program personnel involved in this review. Please feel free to call me at your convenience to schedule an on-site inspection and meeting to discuss your initial comments on this submittal.

Sincerely,
Octagon Consulting Engineers, LLC

William E. Smith, P.E., CEM
Consulting Engineer

cc: Barbara Woodbury, Park County Sanitarian w/ enclosures
Michael D Adkins, Land Owner w/ enclosures

Adkins Class III Tire Mono-Fill Landfill

Names and Addresses of Neighboring Land Owners

Northeast and East (across East River Rd)		James Patrick Warfield 3323 Twin Oaks Drive Napa, CA 94558
North (across Chicory Rd)		MAC Ranch PO Box 2169 Livingston, MT 59047
West (adjacent to west boundary)	Tract 4A S/D 459	Joseph A and Kimberly L Lombardi 59690 Mammoth Rd North Fork, CA 93643
	Tract 4B S/D 459	Mark W Tidwell 1233 S. Ranger St Ridgecrest, CA 93555
South (adjacent to south boundary)	Tract 5D S/D 458	James E and Heidi Saunders PO Box 302 Emigrant, MT 59027

#51

CLASS III SOLID WASTE MANAGEMENT SYSTEM LICENSE APPLICATION

SECTION I – APPLICANT INFORMATION

Applicant Name: Michael D. and Magdalen M Adkins

Applicant Mailing Address: PO Box 32 Pray, MT 59065

Applicant Phone: (406) 333-4408 575-4408 Applicant Fax: 406-333-9329

Applicant E-mail Address: madkins@wispwest.net

This application is for:

- ☑ New Class III SWMS ☐ Expansion of an existing facility (if so, facility license number: _____)
- ☐ Resource Recovery or Processing Facility
- ☐ Other (please explain)

MIKE ADKINS CONSTRUCTION
P.O. BOX 32 PH. 406-333-4408
PRAY, MT 59065-0032

93-168/929 9064

DATE 5-31-11

PAY TO THE ORDER OF Montana DEQ $ 3600 00

Three thousand six hundred no/100 DOLLARS

First Interstate Bank
888-752-3336
www.firstinterstatebank.com

MEMO Application fee for class 3 landfill Magdalen Adkins

[redacted] 9064

Deeds Attached

e property, attach a copy of

Facility Name: Adkins Class III Waste Tire Mono-Fill Landfill

Facility Mailing Address: P.O. Box 32 Pray, MT 59065

Facility Phone: 406-333-9833 Facility Fax: (406) 333-9329

Facility 9-1-1 Address: 19 Chicory Road

Facility Legal Location
(i.e., Section, Township, Range; describe to the nearest quarter-quarter section)

N½ NE¼ Section 18 T5South, R9East PMM

Facility Lat/Long: N 45° 24.506' W 110° 39.336'

RECEIVED
JUN 03 2011
DEPT. OF ENVIRO. QUALITY
WASTE & UNDERGROUND TANK
MANAGEMENT BUREAU

CLASS III SOLID WASTE MANAGEMENT SYSTEM LICENSE APPLICATION

SECTION I – APPLICANT INFORMATION

Applicant Name: Michael D. and Magdalen M Adkins

Applicant Mailing Address: PO Box 32 Pray, MT 59065

Applicant Phone: (406) 333-4408 (575-4408) Applicant Fax: 406-333-9329

Applicant E-mail Address: madkins@wispwest.net

This application is for:

☑ New Class III SWMS ☐ Expansion of an existing facility (if so, facility license number: _____)

☐ Resource Recovery or Processing Facility

☐ Other (please explain)

_____

Are you the owner of the property where the facility is located? ☑ Yes ☐ No

If yes, attach a copy of the deed or other document that verifies you are the site owner. Deeds Attached

If no, provide the name, address, and signature of the owner/lessor who holds title to the property, attach a copy of the lease/rental agreement, and complete the Landowner Certification in Section V.

Name: _____

Mailing Address: _____

SECTION II – FACILITY INFORMATION

Facility Name: Adkins Class III Waste Tire Mono-Fill Landfill

Facility Mailing Address: P.O. Box 32 Pray, MT 59065

Facility Phone: 406-333-9833 Facility Fax: (406) 333-9329

Facility 9-1-1 Address: 19 Chicory Road

Facility Legal Location
(i.e., Section, Township, Range; describe to the nearest quarter-quarter section)

N½ NE¼ Section 18 T5South, R9East PMM

Facility Lat/Long: N 45° 24.506' W 110° 39.336'

RECEIVED

JUN 03 2011

DEPT. OF ENVIRO. QUALITY
WASTE & UNDERGROUND TANK
MANAGEMENT BUREAU

SECTION II (*CONTINUED*)

Facility Geocode Location:

General description of facility location: Southwest of Intersection and between Chicory Rd and East River Rd. Intersection of Chicory Rd with E. River Rd is ~0.7 mile SW of Mill Ck Rd intersection with E. River Rd

Total acreage of proposed site: 11.7 Ac Acreage usable for the solid waste system: ~11.0 ac
Total area of deeded Tracts: 16.792 acres

SECTION III – FACILITY CAPACITY, SERVICE AREA, AND WASTE ACCEPTANCE

Total Disposal Capacity: Approx. 700,000 cy Volume. Tires will be chopped, cut, shredded. Approx 40-50 tires per cy. ~1.26 million tires/yr. >25 million Tires Total

Service Area: No Specified service Area. Waste Tires will be received from anywhere.

Population to be served by the solid waste system: None specified or identified

Describe the estimated life of the facility and attach a description of the method used to make this determination: 105K tires/month. Total capacity ~ 26 million Tires. Calculated months of operation > 247 months > 21 years. Refer to Engineer's Report for Supporting details
(*For facility expansions, provide the information pertinent to the additional life the expansion provides to the existing facility*)

Waste Type(s) Accepted: Waste Tires Only

Will any special or unusual wastes* be accepted? ☐ Yes ☒ No
(**wastes that require special handling or present unique environmental hazards*)
If yes, describe the wastes:

Do you plan to accept household quantities of hazardous wastes and/or hazardous wastes from conditionally exempt generators? ☐ Yes ☒ No
(*Note: these types and quantities of waste may be legally accepted at state licensed "Class IV" landfills, however, additional conditions must be met before such acceptance may occur*)

Does the facility plan to burn untreated wood waste? ☐ Yes ☒ No

If yes, what is the total acreage of the burn-site? _____
If yes, attach the plan that describes:
a) The type of material to be burned.
b) What will be done with the ash.
c) How often the ash will be removed from site.
d) How burn pile contaminants will be identified and removed.

What is the proposed opening date for this facility? November 1, 2011

SECTION IV – ATTACHMENTS (PLEASE NUMBER OR LABEL THE ATTACHMENTS)

- ☑ Attach the proposed facility Operation and Maintenance (O&M) Plan. The O&M Plan should include, at a minimum the days and hours the site will be open; traffic direction and control; number of workers on-site; general description of waste management system; management of soil stockpiles for wind and water erosion; equipment to be used; types of waste to be accepted; litter control; rodent and insect control; how often waste will be covered (quarterly min.); if salvaging, reuse, or recycling will be part of the O&M Plan, provide the details for such activities; if composting will be part of the O&M Plan, provide the details on what will be composted, the composting method to be used, where composting will occur on-site, and what will be done with the finished compost.
- ☑ Attach a map that shows the location of the proposed facility in relation to the local population center, adjacent residences, and access roadways. REFER TO ATTACHED MAPS
- ☑ Attach a description of adjacent use of land and provide a list of names and mailing addresses of all persons owning land adjacent to the proposed facility. REFER TO MAPS & ENGINEER'S REPORT
- ☑ Attach a map that shows the location of wetlands, springs, and natural drainages on and within one-mile of the facility boundary NO WETLANDS OR SPRINGS KNOWN TO EXIST W/IN 1 MILE
- ☑ Attach a map that shows the locations of public and private water supplies within one-mile of the facility boundary. Attach copies of well logs for these public and private water supplies. REFER TO MAP
- ☑ If the site is located within the 100-year floodplain, attach a copy of the floodplain map. NO FLOOD PLAIN
- ☑ Attach a map of the proposed facility showing: REFER TO ATTACHED MAPS W/IN 0.7 MILE
  - a) Fencing.
  - b) Access control features.
  - c) Surface water run-on/run-off controls.
  - d) Property boundary.
  - e) Location of building(s), scales, etc...
  - f) Location of on-site roadways.
  - g) Location of on-site disposal area(s) and/or burn site(s)
- ☑ Attach the drainage control plan that describes the measures used to prevent surface water run-on from entering, and surface water run-off from leaving, the waste management areas.
- ☑ Attach the geologic and soil information for the proposed site that includes a site geologic map and a soil profile to a depth ten (10) to twenty (20) feet below the lowest point solid waste will be deposited.
- ☑ Attach a hydrogeologic report that includes existing well-logs and information on groundwater depth, availability, quality, and quantity.
- ☑ Attach the cut and fill plan. REFER TO SECTION 7.13 OF ENGINEER'S REPORT
- ☑ Attach a copy of the information confirming that the existing bridges and roads will support loaded vehicles and additional traffic. Describe how the site operations affect the existing local transportation networks and traffic flows. ALL BRIDGES ARE ON STATE HWY. REFER TO ENG'S REPT.
- ☑ Attach a closure plan for the landfill that includes:
  - a) soil specifications for the final cover (if applicable).
  - b) revegetation requirements
  - c) steps that will be taken to prevent erosion and ponding on the final cover.
  - d) proposed use of land after facility has closed.
- ☑ Attach a copy of the Montana Natural Heritage Program's (NHP) database information on sensitive, threatened, or endangered species or habitats on and within one-mile of the facility boundary. The NHP database may be accessed at: http://mtnhp.org/ REFER TO ATTACHED DATA & MAP
- ☑ Attach a copy of the cultural resource file search completed for the site. The search is conducted by the State Historic Preservation Office (SHPO). SHPO charges a fee for this search. A copy of the "File Search Request Form" may be accessed at http://mhs.mt.gov/shpo/forms.asp. REFER TO ATTACHED LETTER
- ☑ Attach a copy of the proposed deed notation in accordance with the requirements in ARM 17.50.1113. REFER TO ENG'S REPT.
- ☑ Attach a copy of the general liability insurance policy in accordance with the requirements in ARM 17.50.1114. COMING UNDER SEPARATE COVER

SECTION V - CERTIFICATIONS

LANDOWNER CERTIFICATION

I am the: *(check one)*

Property Owner ☑ Designated Representative of the Property Owner ☐
(Provide verification of status as representative)

By signing this form, I hereby certify that I am aware of the proposed solid waste management system. The applicant has my permission to use the site in accordance with the laws and rules of Montana governing solid waste management and any conditions or provisions imposed by the licensing agency. If the owner/operator of the solid waste management system fails to perform in accordance with any provision or provisions of the license issued pursuant to this application, as the landowner, I will be responsible for executing facility closure and post-closure activities pursuant to the requirements of the license and the solid waste laws and rules.

Property Owner Signature: Magdalen Adkins Michael D Adkins Date: May 31, 2011
(attach a copy of the deed or other document that verifies the site owner)

ZONING CERTIFICATION

I hereby certify that the site of the planned solid waste management system is in accordance with local government zoning and ordinances (to be signed by appropriate local government official having knowledge of local zoning ordinances).

Printed Name: REFER TO ATTACHED COPY OF APPLICATION PAGE PLUS LETTER OF EXPLANATION FROM Philip FLETCHER,

Signature: _____ Title: PARK CO. DIRECTOR OF PLANNING

Representing: _____ Date: _____

APPLICANT CERTIFICATION

I am the party responsible for operation of this proposed facility. I certify that the above-described solid waste management system will be constructed and operated in accordance with Sections 75-10-201 through
75-10-233, Montana Code Annotated (MCA), the rules adopted pursuant thereto, and in accordance with conditions which have or may be imposed in the license.

Applicant Printed Name: Michael D. Adkins Magdalen Adkins

Applicant Signature: Michael D Adkins Magdalen Adkins

Title: Property Owners Date: May 31, 2011

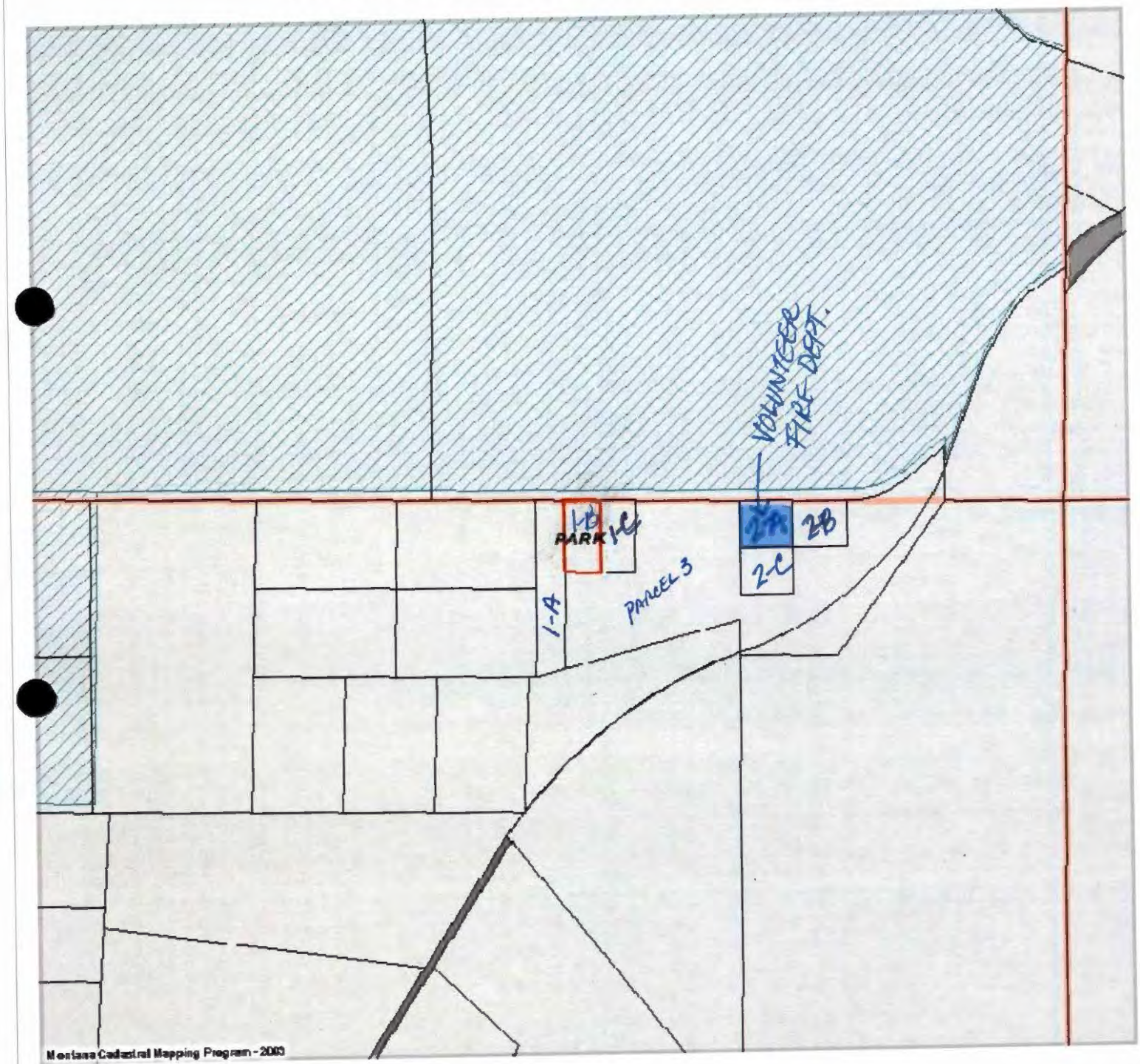
bing Maps

My Notes

bing Maps

My Notes

Montana Cadastral Mapping Project



Map Legend

- Selection Layer
- Parcels
- Township
- Section
- 100K Township
- Conservation Easements
- County
- Ownership
- Private
- Local Government
- State Government
- Tribal
- US Government
- US Department of Agriculture
- USDA Forest Service
- US Department of Defense
- US Department of Interior
- USDI Bureau of Indian Affairs
- USDI Bureau of Land Management
- USDI Bureau of Reclamation
- USDI Fish and Wildlife Service
- USDI National Park Service
- Right of Way
- Undetermined
- Water

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Primary Information

Property Category:	Real Property	**Subcategory:**	Real Property
Geocode:	49-0520-18-1-70-10-0000	**Assessment Code:**	0006643025
Primary Owner:	DOLSMAN GARY A PO BOX 491 GARDINER, MT 59030-0491	**Property Address:**	CHICORY RD LIVINGSTON, MT 59047
	NOTE: See the Owner tab for all owner information		
Certificate of Survey:	1906	**COS Parcel:**	1-A
Subdivision:			
Legal Description:	S18, T05 S, R09 E, C.O.S. 1906, PARCEL 1-A		
Last Modified:	5/24/2011 12:49:34 PM		

General Property Information

Neighborhood:	750	**Property Type:**	VR - Vacant Land Rural
Living Units:	0	**Levy District:**	49-0C15-75
Zoning:		**Ownership %:**	100

Linked Property:

No linked properties exist for this parcel

Exemptions:

No exemptions exist for this parcel

Condo Ownership:

General:	0	**Limited:**	0

Property Factors

Topography:		**Fronting:**	0 - None
Utilities:	1	**Parking Type:**	
Access:	0 Show Code Table 0	**Parking Quantity:**	
Location:	0 - Rural Land	**Parking Proximity:**	

Land Summary

Land Type	Acres	Value
Grazing	0.000	0
Fallow	0.000	0
Irrigated	0.000	0
Continuous Crop	0.000	0

Wild Hay	0.000	0
Farmsite	0.000	0
ROW	0.000	0
NonQual Land	0.000	0
Total Ag Land	0.000	0
Total Forest Land	0.000	0
Total Market Land	2.000	75,740

Deed Information:

Deed Date	Book	Page	Recorded Date	Document Number	Document Type
07/08/2009			07/08/2009	D356092	Quit Claim Deed
05/27/2004	R204	1254			
03/16/2004	R201	766			

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Party #1

Default Information: DOLSMAN GARY A
PO BOX 491
GARDINER, MT 59030-0491

Ownership %: 100.000

Primary Owner: Yes

Interest Type: Conversion

Last Modified: 7/16/2009 9:30:56 AM

Other Names

Name	Type
No Other Names	

Other Addresses

No Other Addresses

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals
Market Land Info Dwellings Other Bldgs/Improvements Commercial

Appraisal History

Tax Year	Land Value	Building Value	Total Value	Method
2011	75,740	0	75,740	COST
2010	75,740	0	75,740	COST
2009	75,740	0	75,740	COST

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary **Owners** **Appraisals**

Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Market Land Item #1				
Method:	Acre	**Type:**	1 - Primary Site	
Width:		**Depth:**		
Square Feet:		**Acres:**	2.000	
Valuation				
Class Code:	2101	**Value:**		75,740

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals
Market Land Info Dwellings Other Bldgs/Improvements Commercial

Primary Information

Property Category:	Real Property	**Subcategory:**	Real Property
Geocode:	49-0520-18-1-70-17-0000	**Assessment Code:**	0006643015
Primary Owner:	ADKINS MAGDALEN M PO BOX 32 PRAY, MT 59065	**Property Address:**	CHICORY RD LIVINGSTON, MT 59047
	NOTE: See the Owner tab for all owner information		
Certificate of Survey:	1906	**COS Parcel:**	1-C
Subdivision:			
Legal Description:	S18, T05 S, R09 E, C.O.S. 1906, PARCEL 1-C		
Last Modified:	5/24/2011 12:49:34 PM		

General Property Information

Neighborhood:	750	**Property Type:**	VR - Vacant Land Rural
Living Units:	0	**Levy District:**	49-0C15-75
Zoning:		**Ownership %:**	100

Linked Property:

No linked properties exist for this parcel

Exemptions:

No exemptions exist for this parcel

Condo Ownership:

General:	0	**Limited:**	0

Property Factors

Topography:		**Fronting:**	0 - None
Utilities:	1	**Parking Type:**	
Access:	0 Show Code Table	**Parking Quantity:**	
	0		
Location:	0 - Rural Land	**Parking Proximity:**	

Land Summary

Land Type	Acres	Value
Grazing	0.000	0
Fallow	0.000	0
Irrigated	0.000	0
Continuous Crop	0.000	0

Wild Hay	0.000	0
Farmsite	0.000	0
ROW	0.000	0
NonQual Land	0.000	0
Total Ag Land	0.000	0
Total Forest Land	0.000	0
Total Market Land	1.000	62,460

Deed Information:

Deed Date	Book	Page	Recorded Date	Document Number	Document Type
02/13/2009			02/13/2009	D353699	Quit Claim Deed
05/27/2004	R204	1253			

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals
Market Land Info Dwellings Other Bldgs/Improvements Commercial

Party #1

Default Information: ADKINS MAGDALEN M
PO BOX 32
PRAY, MT 59065

Ownership %: 100.000

Primary Owner: Yes

Interest Type: Joint Tenant

Last Modified: 2/24/2009 9:13:16 AM

Other Names

Name	Type
ADKINS MICHAEL D	L Additional Legal Owners

Other Addresses

No Other Addresses

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals
Market Land Info Dwellings Other Bldgs/Improvements Commercial

Appraisal History

Tax Year	Land Value	Building Value	Total Value	Method
2011	62,460	0	62,460	COST
2010	62,460	0	62,460	COST
2009	62,460	0	62,460	COST

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals
Market Land Info Dwellings Other Bldgs/Improvements Commercial

Market Land Item #1				
Method:	Acre	**Type:**	1 - Primary Site	
Width:		**Depth:**		
Square Feet:		**Acres:**	1.000	
Valuation				
Class Code:	2101	**Value:**		62,460

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/12/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Primary Information

Property Category:	Real Property	**Subcategory:**	Real Property
Geocode:	49-0520-18-1-70-15-0000	**Assessment Code:**	0006643020
Primary Owner:	ADKINS MAGDALEN M PO BOX 32 PRAY, MT 59065-0032	**Property Address:**	CHICORY RD LIVINGSTON, MT 59047
	NOTE: See the Owner tab for all owner information		
Certificate of Survey:	1906	**COS Parcel:**	1-B
Subdivision:			
Legal Description:	S18, T05 S, R09 E, C.O.S. 1906, PARCEL 1-B		
Last Modified:	5/24/2011 12:49:34 PM		

General Property Information

Neighborhood:	750	**Property Type:**	VR - Vacant Land Rural
Living Units:	0	**Levy District:**	49-0C15-75
Zoning:		**Ownership %:**	100

Linked Property:

No linked properties exist for this parcel

Exemptions:

No exemptions exist for this parcel

Condo Ownership:

General:	0	**Limited:**	0

Property Factors

Topography:		**Fronting:**	0 - None
Utilities:	1	**Parking Type:**	
Access:	0 | Show Code Table | 0	**Parking Quantity:**	
Location:	0 - Rural Land	**Parking Proximity:**	

Land Summary

Land Type	Acres	Value
Grazing	0.000	0
Fallow	0.000	0
Irrigated	0.000	0
Continuous Crop	0.000	0

Wild Hay	0.000	0
Farmsite	0.000	0
ROW	0.000	0
NonQual Land	0.000	0
Total Ag Land	0.000	0
Total Forest Land	0.000	0
Total Market Land	1.000	62,460

Deed Information:

Deed Date	Book	Page	Recorded Date	Document Number	Document Type
03/16/2004	R201	766			

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/12/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Party #1

Default Information: ADKINS MAGDALEN M
PO BOX 32
PRAY, MT 59065-0032

Ownership %: 100.000

Primary Owner: Yes

Interest Type: Conversion

Last Modified: 9/16/2009 11:21:52 AM

Other Names

Name **Type**

No Other Names

Other Addresses

No Other Addresses

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/12/2011

Summary Owners Appraisals
Market Land Info Dwellings Other Bldgs/Improvements Commercial

Appraisal History

Tax Year	Land Value	Building Value	Total Value	Method
2011	62,460	0	62,460	COST
2010	62,460	0	62,460	COST
2009	62,460	0	62,460	COST

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/12/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Market Land Item #1				
Method:	Acre	**Type:**	1 - Primary Site	
Width:		**Depth:**		
Square Feet:		**Acres:**	1.000	
Valuation				
Class Code:	2101	**Value:**		62,460

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/12/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Primary Information

Property Category:	Real Property	**Subcategory:**	Real Property
Geocode:	49-0520-18-1-70-25-0000	**Assessment Code:**	0006643060
Primary Owner:	PARK COUNTY RURAL FIRE DIST #1 PO BOX 1134 LIVINGSTON, MT 59047-1134	**Property Address:**	17 CHICORY RD LIVINGSTON, MT 59047
	NOTE: See the Owner tab for all owner information		
Certificate of Survey:	1810	**COS Parcel:**	2-A
Subdivision:			
Legal Description:	S18, T05 S, R09 E, C.O.S. 1810, PARCEL 2-A		
Last Modified:	5/24/2011 12:49:34 PM		

General Property Information

Neighborhood:	750	**Property Type:**	EP - Exempt Property
Living Units:	0	**Levy District:**	49-0C15-75
Zoning:		**Ownership %:**	100

Linked Property:

No linked properties exist for this parcel

Exemptions:

No exemptions exist for this parcel

Condo Ownership:

General:	0	**Limited:**	0

Property Factors

Topography:		**Fronting:**	0 - None
Utilities:	1	**Parking Type:**	
Access:	0 Show Code Table 0	**Parking Quantity:**	
Location:	0 - Rural Land	**Parking Proximity:**	

Land Summary

Land Type	Acres	Value
Grazing	0.000	0
Fallow	0.000	0
Irrigated	0.000	0

Continuous Crop	0.000	0
Wild Hay	0.000	0
Farmsite	0.000	0
ROW	0.000	0
NonQual Land	0.000	0
Total Ag Land	0.000	0
Total Forest Land	0.000	0
Total Market Land	1.000	62,460

Deed Information:

Deed Date	Book	Page	Recorded Date	Document Number	Document Type
03/19/2003	R185	1212			
03/19/2003	R185	1213			

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/12/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Party #1

Default Information: PARK COUNTY RURAL FIRE DIST #1
PO BOX 1134
LIVINGSTON, MT 59047-1134

Ownership %: 100.000
Primary Owner: Yes
Interest Type: Conversion
Last Modified: 11/16/2007 3:10:25 AM

Other Names
Name **Type**
No Other Names

Other Addresses
No Other Addresses

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/12/2011

Summary Owners Appraisals
Market Land Info Dwellings Other Bldgs/Improvements Commercial

Appraisal History

Tax Year	Land Value	Building Value	Total Value	Method
2011	62,460	0	62,460	COST
2010	62,460	0	62,460	COST
2009	62,460	0	62,460	COST

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/12/2011

Summary **Owners** **Appraisals**

Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Market Land Item #1				
Method:	Acre	**Type:**	1 - Primary Site	
Width:		**Depth:**		
Square Feet:		**Acres:**	1.000	
Valuation				
Class Code:	2153	**Value:**		62,460

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Primary Information

Property Category:	Real Property	**Subcategory:**	Real Property
Geocode:	49-0520-18-1-70-20-0000	**Assessment Code:**	0006643050
Primary Owner:	PINDER II GERALD L & SANDRA L 9 CHICORY RD LIVINGSTON, MT 59047-8704	**Property Address:**	9 CHICORY RD LIVINGSTON, MT 59047
	NOTE: See the Owner tab for all owner information		
Certificate of Survey:	1810	**COS Parcel:**	2-B
Subdivision:			
Legal Description:	S18, T05 S, R09 E, C.O.S. 1810, PARCEL 2-B		
Last Modified:	5/24/2011 12:49:34 PM		

General Property Information

Neighborhood:	750	**Property Type:**	RR - Residential Rural
Living Units:	1	**Levy District:**	49-0C15-75
Zoning:		**Ownership %:**	100

Linked Property:

No linked properties exist for this parcel

Exemptions:

No exemptions exist for this parcel

Condo Ownership:

General:	0	**Limited:**	0

Property Factors

Topography:		**Fronting:**	0 - None
Utilities:	1	**Parking Type:**	
Access:	0 Show Code Table 0	**Parking Quantity:**	
Location:	0 - Rural Land	**Parking Proximity:**	

Land Summary

Land Type	Acres	Value
Grazing	0.000	0
Fallow	0.000	0
Irrigated	0.000	0

Continuous Crop	0.000	0
Wild Hay	0.000	0
Farmsite	0.000	0
ROW	0.000	0
NonQual Land	0.000	0
Total Ag Land	0.000	0
Total Forest Land	0.000	0
Total Market Land	1.015	62,659

Deed Information:

Deed Date	Book	Page	Recorded Date	Document Number	Document Type
03/26/2006	D334	119			
03/17/2003	R185	986			

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Party #1

Default Information: PINDER II GERALD L & SANDRA L
9 CHICORY RD
LIVINGSTON, MT 59047-8704

Ownership %: 100.000
Primary Owner: Yes
Interest Type: Conversion
Last Modified: 1/16/2008 9:46:11 AM

Other Names
Name **Type**
No Other Names

Other Addresses
No Other Addresses

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Primary Information

Property Category:	Real Property	**Subcategory:**	Real Property
Geocode:	49-0520-18-1-70-30-0000	**Assessment Code:**	0006643070
Primary Owner:	ADKINS MAGDALEN M PO BOX 32 PRAY, MT 59065-0032	**Property Address:**	CHICORY RD LIVINGSTON, MT 59047
	NOTE: See the Owner tab for all owner information		
Certificate of Survey:	1810	**COS Parcel:**	2-C
Subdivision:			
Legal Description:	S18, T05 S, R09 E, C.O.S. 1810, PARCEL 2-C		
Last Modified:	5/24/2011 12:49:35 PM		

General Property Information

Neighborhood:	750	**Property Type:**	RR - Residential Rural
Living Units:	1	**Levy District:**	49-0C15-75
Zoning:		**Ownership %:**	100
Linked Property:	No linked properties exist for this parcel		
Exemptions:	No exemptions exist for this parcel		
Condo Ownership:			
General:	0	**Limited:**	0

Property Factors

Topography:		**Fronting:**	0 - None
Utilities:	1	**Parking Type:**	
Access:	0 Show Code Table	**Parking Quantity:**	
	0		
Location:	0 - Rural Land	**Parking Proximity:**	

Land Summary

Land Type	Acres	Value
Grazing	0.000	0
Fallow	0.000	0
Irrigated	0.000	0
Continuous Crop	0.000	0

Wild Hay	0.000	0
Farmsite	0.000	0
ROW	0.000	0
NonQual Land	0.000	0
Total Ag Land	0.000	0
Total Forest Land	0.000	0
Total Market Land	1.000	62,460

Deed Information:

Deed Date	Book	Page	Recorded Date	Document Number	Document Type
03/19/2003	R185	1214			

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Party #1

Default Information: ADKINS MAGDALEN M
PO BOX 32
PRAY, MT 59065-0032

Ownership %: 100.000

Primary Owner: Yes

Interest Type: Conversion

Last Modified: 11/16/2007 3:10:25 AM

Other Names

Name **Type**

No Other Names

Other Addresses

No Other Addresses

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals
Market Land Info Dwellings Other Bldgs/Improvements Commercial

Appraisal History

Tax Year	Land Value	Building Value	Total Value	Method
2011	62,460	86,590	149,050	COST
2010	62,460	86,590	149,050	COST
2009	62,460	86,590	149,050	COST

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Market Land Item #1				
Method:	Acre	**Type:**	1 - Primary Site	
Width:		**Depth:**		
Square Feet:		**Acres:**	1.000	
Valuation				
Class Code:	2101	**Value:**		62,460

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals
Market Land Info **Dwellings** Other Bldgs/Improvements Commercial

Existing Dwellings

Dwelling Type	Style	YearBuilt	
SFR	03 - Ranch	2004	Select

Dwelling Information

Residential Type:	SFR	**Style:**	03 - Ranch
Year Built:	2004	**Roof Material:**	10 - Asphalt Shingle
Effective Year:		**Roof Type:**	3 - Gable
Story Height:	1.0	**Attic Type:**	0 - None
Grade:	5	**Exterior Walls:**	1 - Frame
Class Code:	3301	**Exterior Wall Finish:**	5 - Maintenance Free Aluminum/Vinyl/Steel
Year Remodeled:		**Degree Remodeled:**	

Mobile Home Details

Manufacturer:		**Serial #:**		**Width:**	0
Model:				**Length:**	0

Basement Information

Foundation:	2 - Concrete	**Finished Area:**	0	**Daylight:**	
Basement Type:	0 - None	**Quality:**			

Heating/Cooling Information

Type:	Central	**System Type:**	5 - Forced Air		
Fuel Type:	3 - Gas	**Heated Area:**	0		

Living Accomodations

Bedrooms:	2	**Full Baths:**	2	**Addl Fixtures:**	3
Family Rooms:	0	**Half Baths:**	0		

Additional Information

Fireplaces:		**Stacks:**	0	**Stories:**	0
		Openings:	0	**Prefab/Stove:**	0

Garage Capacity:	0	**Cost & Design:**	0	**Flat Add:**	0
% Complete:	0	**Description:**		**Description:**	

Dwelling Amenities

View:		**Access:**	

Area Used In Cost

Basement:	0	**Additional Floors:**	0	**Attic:**	0
First Floor:	960	**Half Story:**	0	**Unfinished Area:**	0
Second Floor:	0			**SFLA:**	960

Depreciation Information

CDU:	Average (7)	**Physical Condition:**		**Utility:**	
Desirability:		**Property:**			
		Location:			

Depreciation Calculation

Age:	4.00	**Pct Good:**	0.95	**RCNLD:**	86,590

Additions / Other Features

Additions

Lower	First	Second	Third	Area	Year	Cost
	33 - Deck, Wood			16		160
	33 - Deck, Wood			48		480

Other Features

Quantity	Type	Value
1	BD - Built-in Dishwasher	500
1	EF - Exhaust Fan	200

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Primary Information

Property Category:	Real Property	**Subcategory:**	Real Property
Geocode:	49-0520-18-1-70-01-0000	**Assessment Code:**	0006643000
Primary Owner:	ADKINS MIKE PO BOX 32 PRAY, MT 59065-0032	**Property Address:**	19 CHICORY RD LIVINGSTON, MT 59047

NOTE: See the Owner tab for all owner information

Certificate of Survey:	1772	**COS Parcel:**	3
Subdivision:			
Legal Description:	S18, T05 S, R09 E, C.O.S. 1772, PARCEL 3		
Last Modified:	5/24/2011 12:49:34 PM		

General Property Information

Neighborhood:	750	**Property Type:**	CR - Commercial Rural
Living Units:	2	**Levy District:**	49-0C15-75
Zoning:	2	**Ownership %:**	100

Linked Property:

No linked properties exist for this parcel

Exemptions:

No exemptions exist for this parcel

Condo Ownership:

General:	0	**Limited:**	0

Property Factors

Topography: level	1	**Fronting:**	4 - Residential Street
Utilities: well septic	7, 8	**Parking Type:**	
Access: semi-improved road	2	**Parking Quantity:**	
Location:	0 - Rural Land	**Parking Proximity:**	

Show Code Table

Land Summary

Land Type	Acres	Value
Grazing	0.000	0
Fallow	0.000	0
Irrigated	0.000	0

Continuous Crop	0.000	0
Wild Hay	0.000	0
Farmsite	0.000	0
ROW	0.000	0
NonQual Land	0.000	0
Total Ag Land	0.000	0
Total Forest Land	0.000	0
Total Market Land	12.792	366;598

Deed Information:

Deed Date	Book	Page	Recorded Date	Document Number	Document Type
12/14/2001	R167	117			
07/19/2000	R149	1563			
07/19/2000	R149	1564			
09/13/1999	R142	387			
09/13/1999	R142	389			

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary **Owners** **Appraisals**
Market Land Info **Dwellings** **Other Bldgs/Improvements** **Commercial**

Party #1

Default Information:	ADKINS MIKE PO BOX 32 PRAY, MT 59065-0032
Ownership %:	100.000
Primary Owner:	Yes
Interest Type:	Conversion
Last Modified:	11/16/2007 3:10:25 AM

Other Names

Name	Type
No Other Names	

Other Addresses

No Other Addresses

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals
Market Land Info Dwellings Other Bldgs/Improvements Commercial

Appraisal History

Tax Year	Land Value	Building Value	Total Value	Method
2011	366,598	384,700	751,298	COST
2010	366,598	384,700	751,298	COST
2009	366,598	384,700	751,298	COST

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals

Market Land Info Dwellings Other Bldgs/Improvements Commercial

Market Land Item #1

Method:	Acre	**Type:**	1 - Primary Site
Width:		**Depth:**	
Square Feet:		**Acres:**	9.792
Valuation			
Class Code:	2107	**Value:**	179,218

Market Land Item #2

Method:	Acre	**Type:**	1 - Primary Site
Width:		**Depth:**	
Square Feet:		**Acres:**	3.000
Valuation			
Class Code:	2101	**Value:**	187,380

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals
Market Land Info **Dwellings** Other Bldgs/Improvements Commercial

Existing Dwellings

Dwelling Type	Style	YearBuilt	
SFR	**03 - Ranch**	**2003**	**Select**
SFR	03 - Ranch	2006	**Select**

Dwelling Information

Residential Type:	SFR	**Style:**	03 - Ranch		
Year Built:	2003	**Roof Material:**	10 - Asphalt Shingle		
Effective Year:		**Roof Type:**	3 - Gable		
Story Height:	1.0	**Attic Type:**	0 - None		
Grade:	5	**Exterior Walls:**	1 - Frame		
Class Code:	3301	**Exterior Wall Finish:**	5 - Maintenance Free Aluminum/Vinyl/Steel		
Year Remodeled:		**Degree Remodeled:**			

Mobile Home Details

Manufacturer:		**Serial #:**		**Width:**	0
Model:				**Length:**	0

Basement Information

Foundation:	2 - Concrete	**Finished Area:**	0	**Daylight:**	
Basement Type:	0 - None	**Quality:**			

Heating/Cooling Information

Type:	Central	**System Type:**	5 - Forced Air		
Fuel Type:	3 - Gas	**Heated Area:**	0		

Living Accomodations

Bedrooms:	2	**Full Baths:**	2	**Addl Fixtures:**	3
Family Rooms:	0	**Half Baths:**	0		

Additional Information

Fireplaces:		**Stacks:**	0	**Stories:**	0
		Openings:	0	**Prefab/Stove:**	0
Garage Capacity:	0	**Cost & Design:**	0	**Flat Add:**	0
% Complete:	0	**Description:**		**Description:**	

Dwelling Amenities

View:			**Access:**		
Area Used In Cost					
Basement:	0	**Additional Floors:**	0	**Attic:**	0
First Floor:	936	**Half Story:**	0	**Unfinished Area:**	0
Second Floor:	0			**SFLA:**	936
Depreciation Information					
CDU:	Fair (6)	**Physical Condition:**		**Utility:**	
Desirability:		**Property:**			
		Location:			
Depreciation Calculation					
Age:	5.00	**Pct Good:**	0.88	**RCNLD:**	78,520

Additions / Other Features

Additions

Lower	First	Second	Third	Area	Year	Cost
	11 - Porch, Frame, Open			24		457
	33 - Deck, Wood			40		400

Other Features

No other features exist for this dwelling

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/12/2011

Summary Owners Appraisals
Market Land Info **Dwellings** Other Bldgs/Improvements Commercial

Existing Dwellings

Dwelling Type	Style	YearBuilt	
SFR	03 - Ranch	2003	Select
SFR	**03 - Ranch**	**2006**	Select

Dwelling Information

Residential Type:	SFR	**Style:**	03 - Ranch		
Year Built:	2006	**Roof Material:**	10 - Asphalt Shingle		
Effective Year:		**Roof Type:**	3 - Gable		
Story Height:	1.0	**Attic Type:**	0 - None		
Grade:	5	**Exterior Walls:**	1 - Frame		
Class Code:	3301	**Exterior Wall Finish:**	6 - Wood Siding or Sheathing		
Year Remodeled:		**Degree Remodeled:**			

Mobile Home Details

Manufacturer:		**Serial #:**		**Width:**	0
Model:				**Length:**	0

Basement Information

Foundation:	2 - Concrete	**Finished Area:**	0	**Daylight:**	
Basement Type:	0 - None	**Quality:**			

Heating/Cooling Information

Type:	Non-Central	**System Type:**	7 - Electric Baseboard/Electric Radiant		
Fuel Type:	4 - Electricity	**Heated Area:**	0		

Living Accomodations

Bedrooms:	2	**Full Baths:**	1	**Addl Fixtures:**	3
Family Rooms:	0	**Half Baths:**	0		

Additional Information

Fireplaces:		**Stacks:**	0	**Stories:**	0
		Openings:	0	**Prefab/Stove:**	0

Garage Capacity:	0	**Cost & Design:**	0	**Flat Add:**	0
% Complete:	85	**Description:**		**Description:**	

Dwelling Amenities

View: **Access:**

Area Used In Cost

Basement:	0	**Additional Floors:**	0	**Attic:**	0
First Floor:	816	**Half Story:**	0	**Unfinished Area:**	0
Second Floor:	0			**SFLA:**	816

Depreciation Information

CDU:	Average (7)	**Physical Condition:**		**Utility:**	
Desirability:		**Property:**			
		Location:			

Depreciation Calculation

Age:	2.00	**Pct Good:**	0.97	**RCNLD:**	63,860

Additions / Other Features

Additions

Lower	First	Second	Third	Area	Year	Cost
	33 - Deck, Wood			20		200
	33 - Deck, Wood			36		360

Other Features

No other features exist for this dwelling

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals
Market Land Info Dwellings **Other Bldgs/Improvements** Commercial

Outbuilding/Yard Improvement #1

Type:	Commercial	**Description:**	CPA2 - Paving, concrete, 4"		
Quantity:	2	**Year Built:**	2000	**Grade:**	
Condition:	Com 5 Excellent	**Functional:**	4-Good	**Class Code:**	3307
Dimensions					
Width/Diameter:	7	**Length:**	12	**Size/Area:**	84
Height:		**Bushels:**		**Circumference:**	

Outbuilding/Yard Improvement #2

Type:	Commercial	**Description:**	CRS2 - Utility Building, metal		
Quantity:	1	**Year Built:**	2000	**Grade:**	
Condition:	Com 3 Normal	**Functional:**	3-Normal	**Class Code:**	3307
Dimensions					
Width/Diameter:	8	**Length:**	10	**Size/Area:**	80
Height:		**Bushels:**		**Circumference:**	

Outbuilding/Yard Improvement #3

Type:	Residential	**Description:**	RRG1 - Garage, frame, detached, finished		
Quantity:	1	**Year Built:**	1995	**Grade:**	5
Condition:	Res Good	**Functional:**		**Class Code:**	3301
Dimensions					
Width/Diameter:		**Length:**		**Size/Area:**	782
Height:		**Bushels:**		**Circumference:**	

Outbuilding/Yard Improvement #4

Type:	Residential	**Description:**	RRT7 - Deck, covered patio		
Quantity:	1	**Year Built:**	2005	**Grade:**	A
Condition:	Res Good	**Functional:**		**Class Code:**	3301
Dimensions					
Width/Diameter:	8	**Length:**	22	**Size/Area:**	176
Height:		**Bushels:**		**Circumference:**	

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/13/2011

Summary Owners Appraisals
Market Land Info Dwellings Other Bldgs/Improvements Commercial

Existing Commercial Buildings

Building Number	Building Name	Structure Type	Units/Bldg	YearBuilt	
1		**705 - Truck/Heavy Equipment Service**	**1**	**2000**	**Select**
1		396 - Mini Warehouse	10	2003	**Select**

General Building Information

Building Number:	1	**Building Name:**		**Structure Type:**	
Units/Building:	1	**Identical Units:**	1	705 - Truck/Heavy Equipment Service	
Grade:	A	**Year Built:**	2000	**Year Remodeled:**	0
Class Code:	3307	**Effective Year:**	0	**Percent Complete:**	0.00

Interior/Exterior Data Section #1

Level From:	01	**Level To:**	01	**Use Type:**	070 - Service Station with Bays
Dimensions					
Area:	2,160			**Use SK Area:**	N
Perimeter:	186			**Wall Height:**	14
Features					
Exterior Wall Description:		**Construction:**		**Economic Life:**	
02 - Frame		1-Wood Frame/Joist/Beam		30 Years	
% Interior Finished:	100	**Partitions:**	2-Normal	**Heat Type:**	3-Unit or Space Heaters
AC Type:	0-None			**Plumbing:**	2-Normal
Physical Condition:	4-Good			**Functional Utility:**	3-Normal

Building Other Features

No other features exist for this interior/exterior detail

Elevators and Escalators

Show Definitions

Property Record Card **Tax Year:** 2011 Data last updated on 07/12/2011

Summary Owners Appraisals
Market Land Info Dwellings Other Bldgs/Improvements Commercial

Existing Commercial Buildings

Building Number	Building Name	Structure Type	Units/Bldg	YearBuilt	
1		705 - Truck/Heavy Equipment Service	1	2000	Select
1		**396 - Mini Warehouse**	**10**	**2003**	**Select**

General Building Information

Building Number:	1	**Building Name:**		**Structure Type:**	
Units/Building:	10	**Identical Units:**	1	396 - Mini Warehouse	
Grade:	F	**Year Built:**	2003	**Year Remodeled:**	0
Class Code:	3307	**Effective Year:**	0	**Percent Complete:**	0.00

Interior/Exterior Data Section #1

Level From:	01	**Level To:**	01	**Use Type:**	041 - Mini Warehouse

Dimensions

Area:	960	**Use SK Area:**	N
Perimeter:	184	**Wall Height:**	10

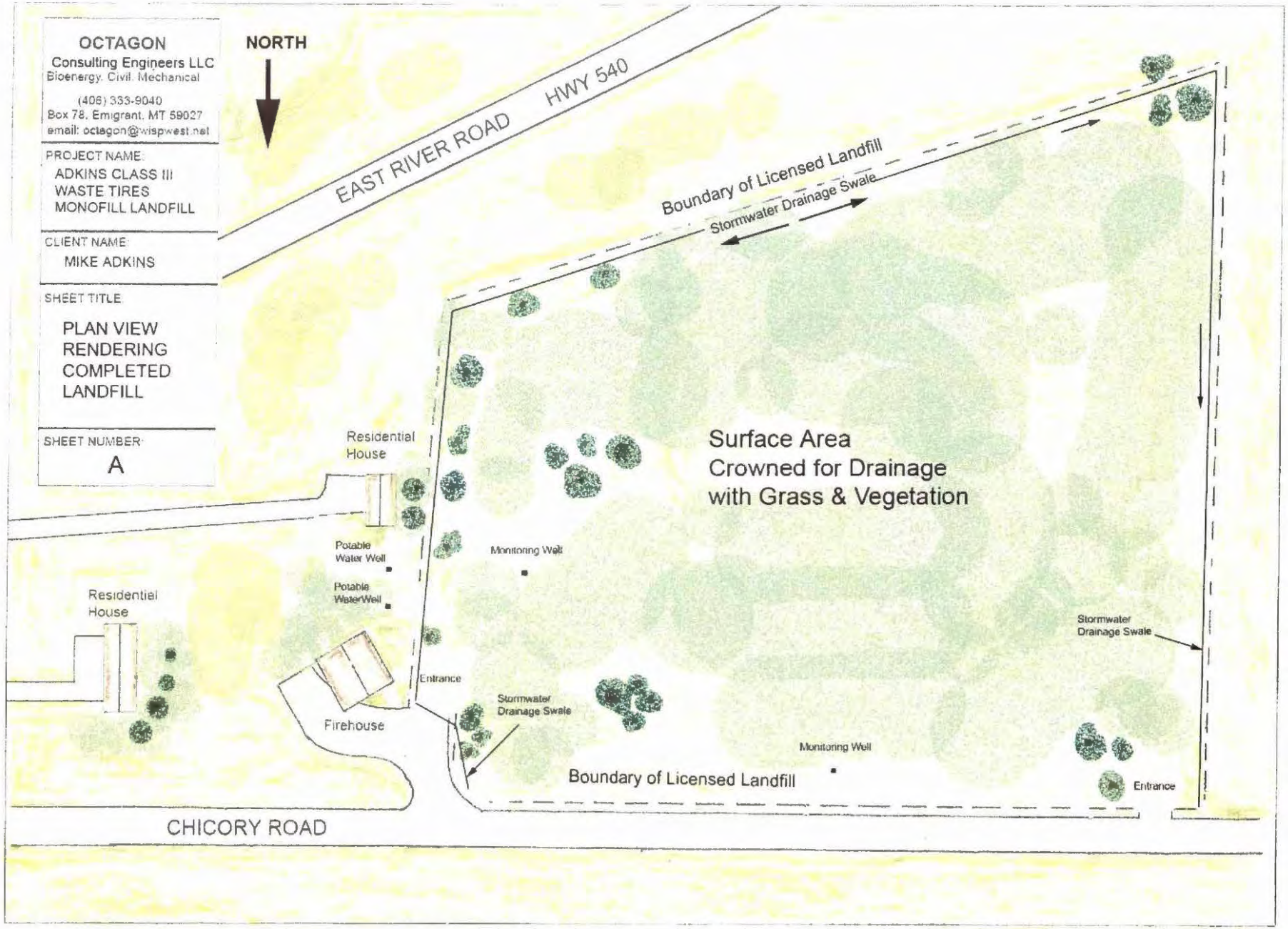
Features

Exterior Wall Description:		**Construction:**		**Economic Life:**	
02 - Frame		1-Wood Frame/Joist/Beam		35 Years	
% Interior Finished:	100	**Partitions:**	2-Normal	**Heat Type:**	0-None
AC Type:	0-None			**Plumbing:**	0-None
Physical Condition:	4-Good			**Functional Utility:**	3-Normal

Building Other Features

No other features exist for this interior/exterior detail

Elevators and Escalators


OCTAGON
Consulting Engineers LLC
Bioenergy. Civil. Mechanical
(406) 333-9040
Box 78, Emigrant, MT 59027
email: octagon@wispwest.net
PROJECT NAME:
ADKINS CLASS III
WASTE TIRES
MONOFILL LANDFILL
CLIENT NAME:
MIKE ADKINS
SHEET TITLE:
PLAN VIEW
RENDERING
COMPLETED
LANDFILL
SHEET NUMBER:
A
NORTH
EAST RIVER ROAD
HWY 540
Boundary of Licensed Landfill
Stormwater Drainage Swale
Surface Area
Crowned for Drainage
with Grass & Vegetation
Residential
House
Potable
Water Well
Potable
WaterWell
Monitoring Well
Residential
House
Stormwater
Drainage Swale
Entrance
Stormwater
Drainage Swale
Firehouse
Monitoring Well
Boundary of Licensed Landfill
Entrance
CHICORY ROAD

OCTAGON
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Box 78, Belgrant, MT 59027
email: octagon@wispwest.net

MONTANA
WILLIAM E SMITH 9021 E
REG. ELEC.
PROFESSIONAL ENGINEER

PROJECT NAME:
Adkins Class III Waste Tires Monofill Landfill

CLIENT NAME:
Mike Adkins

DRAWN BY	ENGINEERING APPROVAL	CLIENT APPROVAL	CIVIL APPROVAL	DATE	REV. NUMBER

REVISION SCHEDULE

SHEET TITLE
Site Layout

Notes:
* No burning will occur
* Location of on-site roads will change as work in Pit progresses

SHEET NUMBER
3 OF 4

Secondary Access

Boundary Line of Licensed landfill

CHICORY ROAD (County R/W)

828.00'

Existing Driveway (Primary Access)

Storage Building

Boundary Fencing (In Phase 2, Typical)

Monitoring Well

Boundary Fencing 4-ft High

Processing Facility

Shop

OFFICE

DF

Gate

PHASE 2
3.00 Acres
130,680 sf

Buildings to be removed

O/H Power Line

Power Pole

100-ft R

Well

Park County Rural 1 Fire Station # 3

Boundary Fencing 4-ft High

Total Acreage of Landfill Site: 11.70 Acres
Total Acreage of Pit:
Phase 1 & Phase 2: 11.00 Acres, 479,160 sf
Total Approximate Volume of Pit:
Phase 1 & Phase 2: 700,000 cubic yards

752.71'

398.32'

Office Building (to be removed in Phase 2)

DF

Boundary Line of Licensed Landfill

100.00'

PHASE 1
8.70 Acres
378,972 sf

O/H Power Line

Boundary Fencing 4-ft High

Boundary Fencing (In Phase 2, Typical)

End of Boundary Fence in Phase 1

862.09'

Note: 12' Set Back from Property Boundary Line of Licensed Landfill Site to top edge of Pit (Typical all around)

Typical Cut Slope provided from Edge of Pit to Ensure Ground Stability

EAST RIVER ROAD
State Highway 514

NORTH

Scale: 1-inch = 150-ft
(8/1/2 X 11 Sheet)

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email: octagon@wispwest.net

MONTANA
WILLIAM E SMITH 8021 E REG. STERED PROFESSIONAL ENGINEER

PROJECT NAME:
Adkins Class III Waste Tires Monofill Landfill

CLIENT NAME:
Mike Adkins

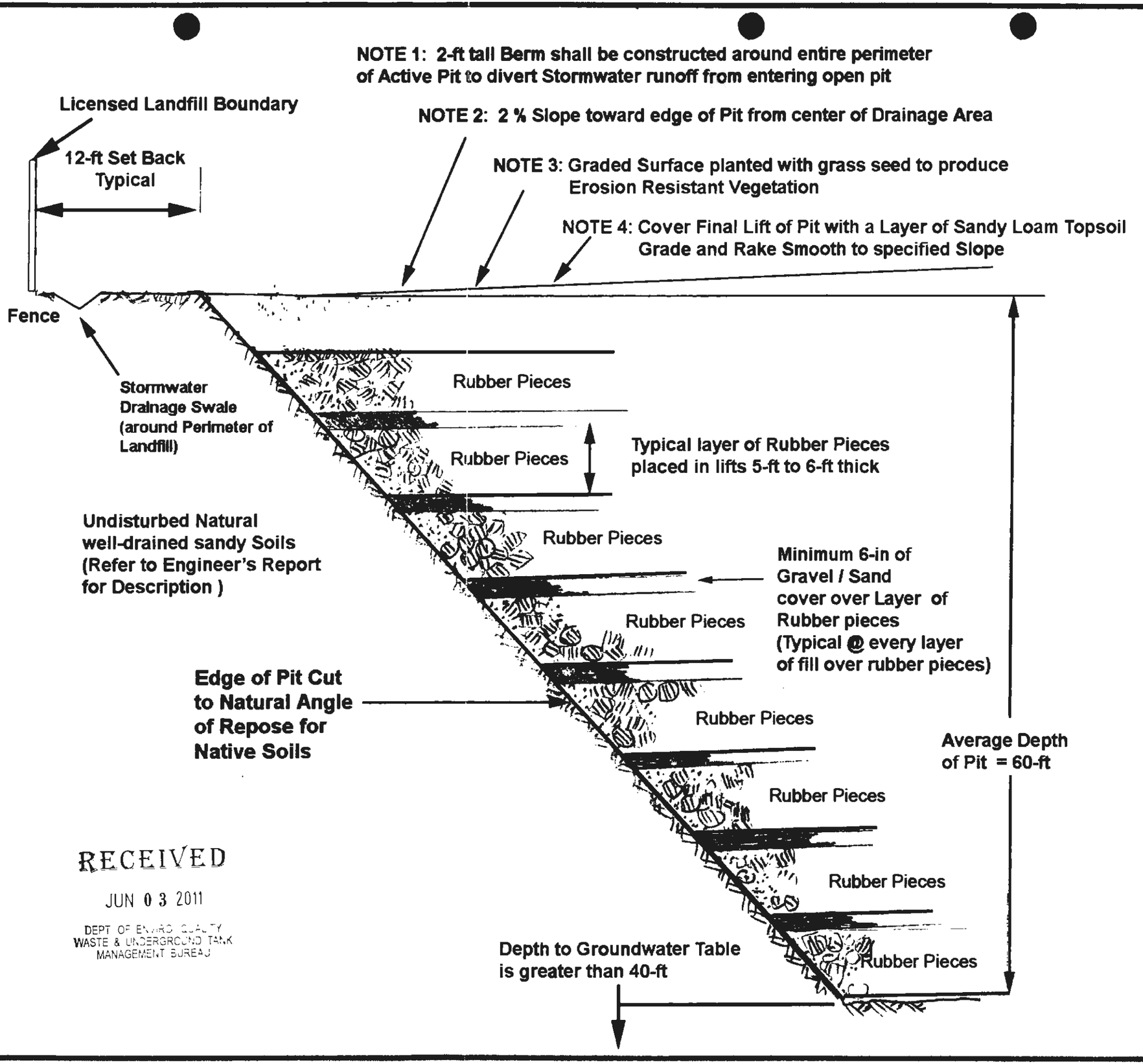
DRAWN BY	ENGINEERING APPROVAL	CLIENT APPROVAL	CIVIL APPROVAL	DATE	REV. NUMBER

REVISION SCHEDULE

SHEET TITLE

Typical Section at Landfill Boundary

SHEET NUMBER
4 of 4



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email: octagon@wispwest.net

MONTANA
WILLIAM
E SMITH
8021 E
REG. & TERED
PROFESSIONAL ENGINEER

PROJECT NAME:
Adkins Class III
Waste Tires
Monofill Landfill

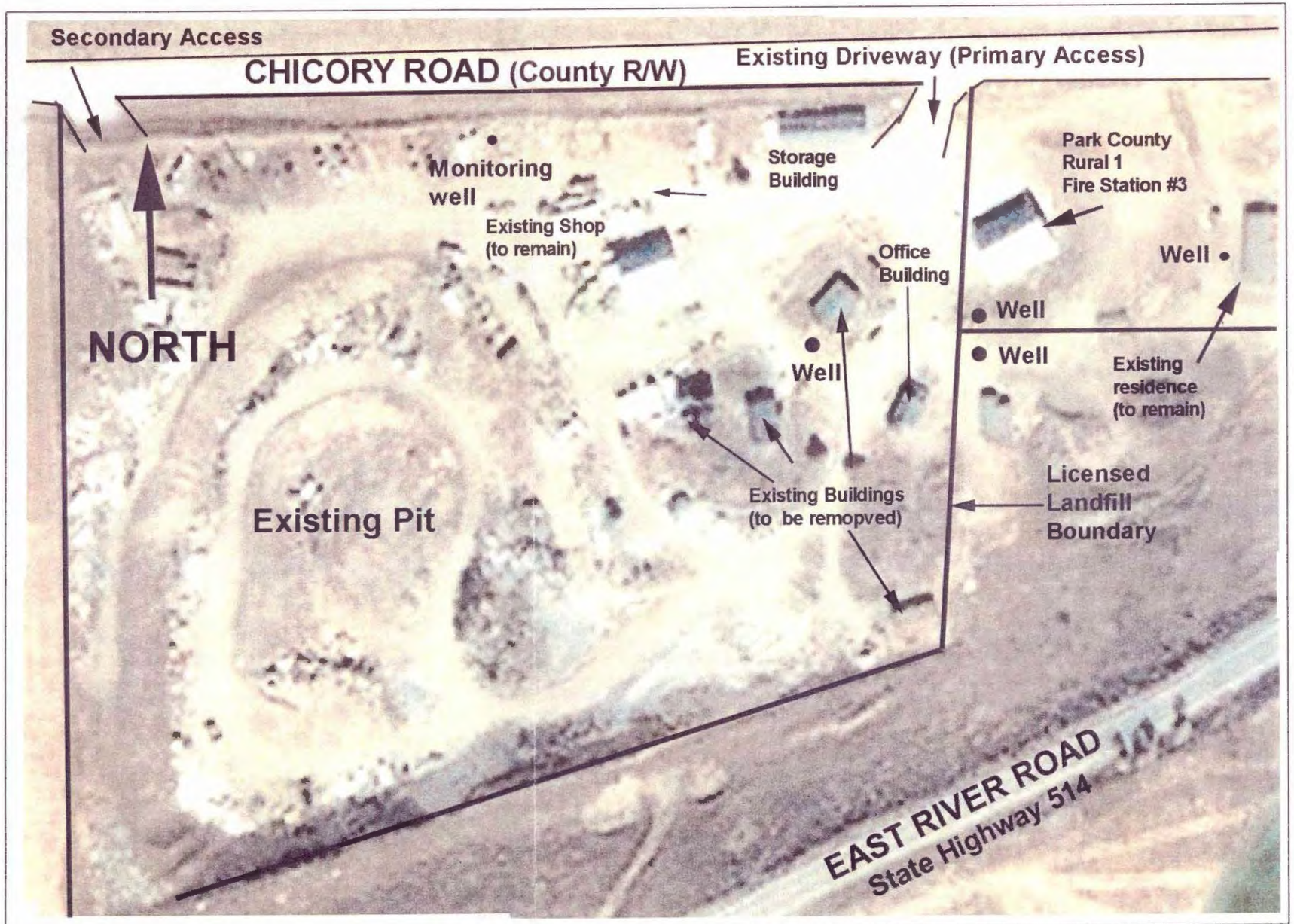
CLIENT NAME:
Mike Adkins

DRAWN BY	ENGINEERING APPROVAL	CLIENT APPROVAL	CIVIL APPROVAL	DATE	REV. NUMBER

REVISION SCHEDULE

SHEET TITLE
EXISTING CONDITIONS
Aerial Photograph showing Existing Development & Activities

SHEET NUMBER
2 OF 4



OCTAGON
Consulting Engineers LLC
BioEnergy, Civil, Mechanical

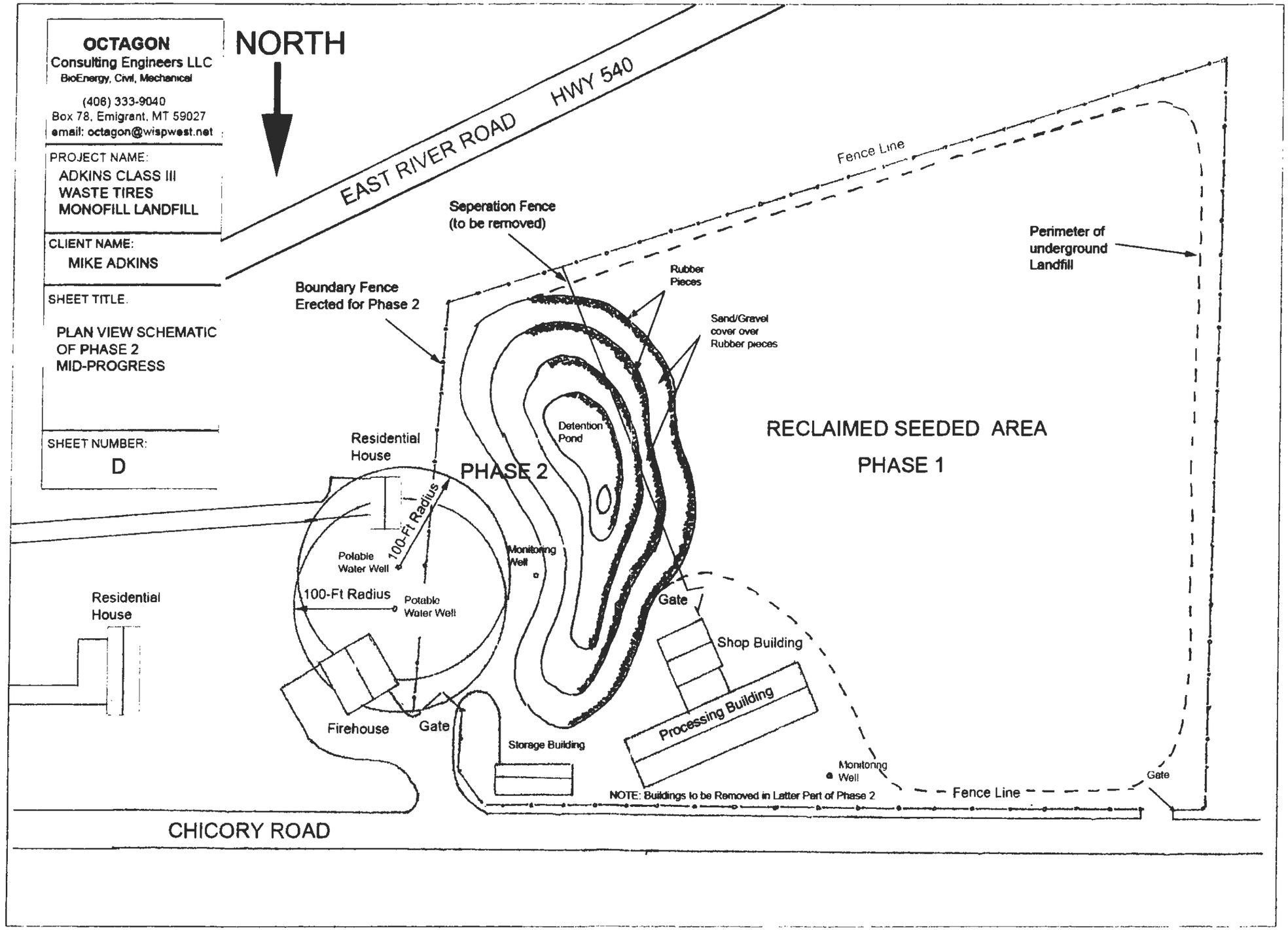
(406) 333-9040
Box 78, Emigrant, MT 59027
email: octagon@wispwest.net

PROJECT NAME:
ADKINS CLASS III
WASTE TIRES
MONOFILL LANDFILL

CLIENT NAME:
MIKE ADKINS

SHEET TITLE:
PLAN VIEW SCHEMATIC
OF PHASE 2
MID-PROGRESS

SHEET NUMBER:
D



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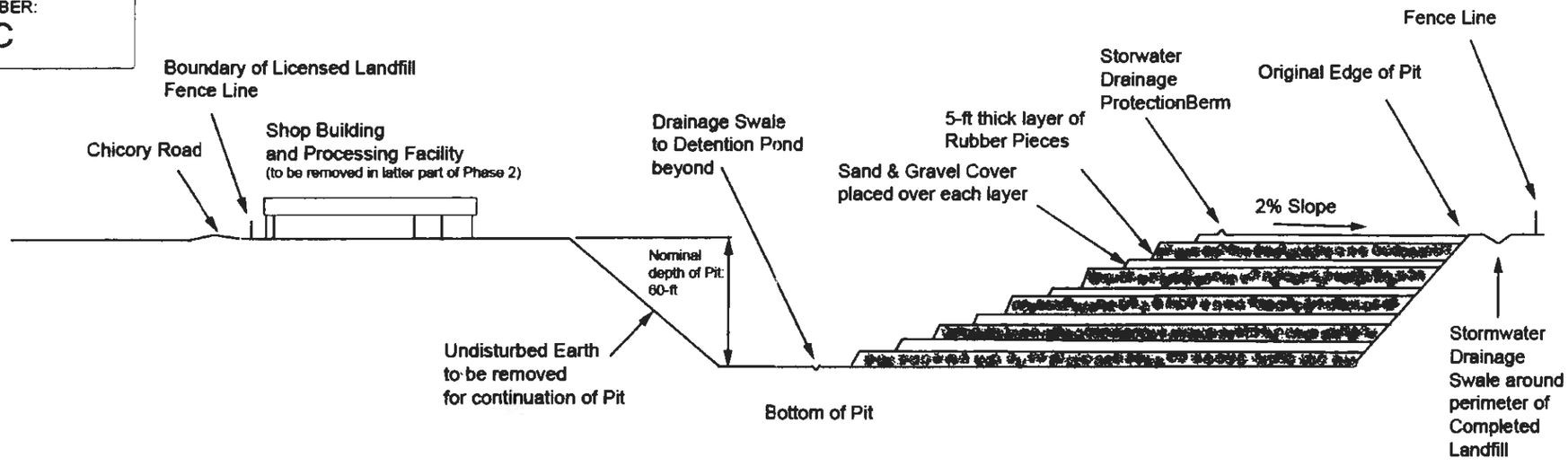
PROJECT NAME:
ADKINS CLASS III
WASTE TIRES
MONOFILL LANDFILL

CLIENT NAME:
MIKE ADKINS

SHEET TITLE:
SECTION A-A
SCHEMATIC
Through Full Width
of Working Landfill
PHASE 1

SHEET NUMBER:
C



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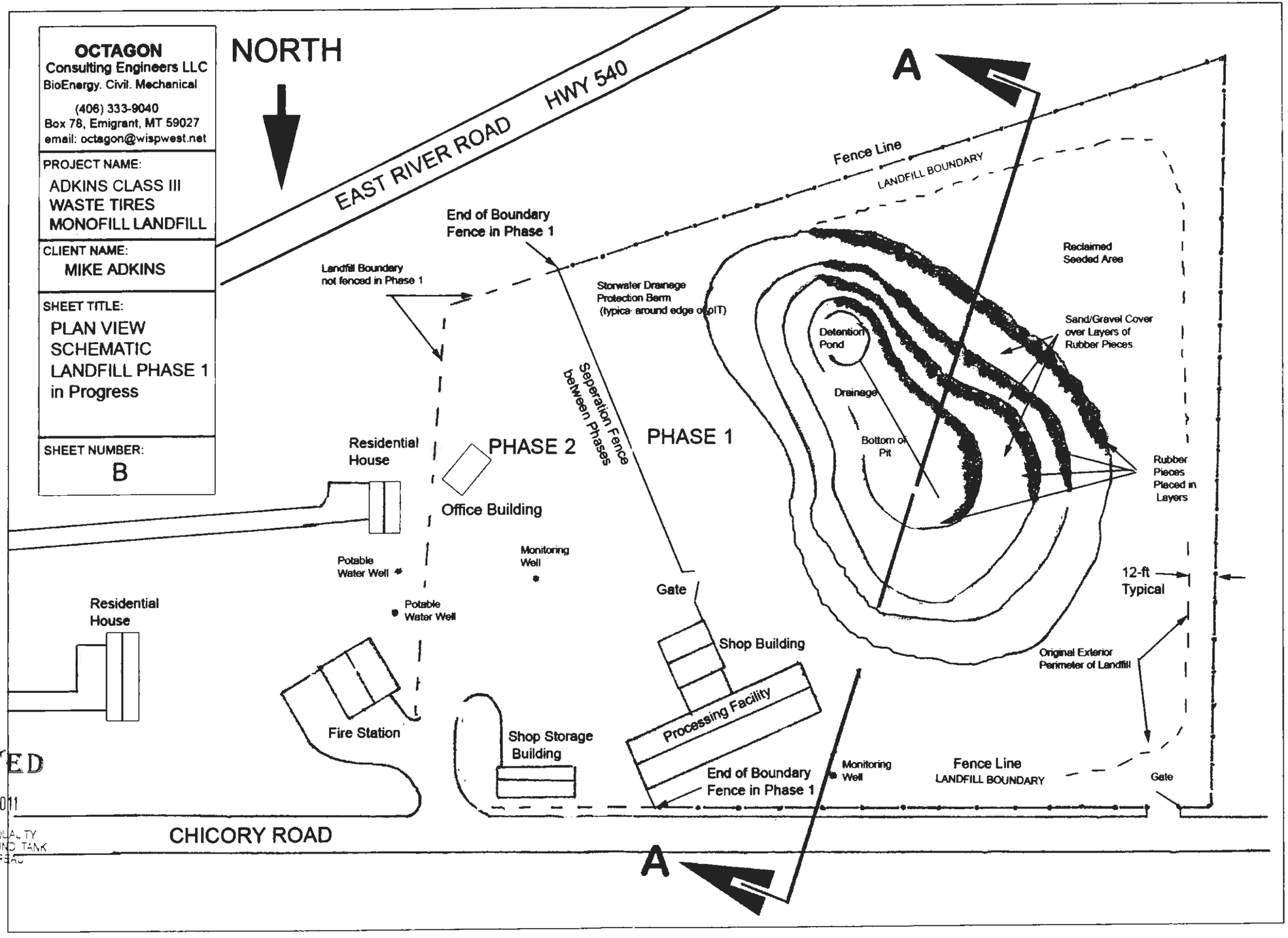
email: octagon@wispwest.net

PROJECT NAME:
ADKINS CLASS III
WASTE TIRES
MONOFILL LANDFILL

CLIENT NAME:
MIKE ADKINS

SHEET TITLE:
PLAN VIEW
SCHEMATIC
LANDFILL PHASE 1
in Progress

SHEET NUMBER:
B



OCTAGON

Consulting Engineers LLC
BioEnergy, Civil, Mechanical

MONTANA
WILLIAM
PROFESSIONAL ENGINEER

PROJECT NAME:
Adkins Class III
Waste Tires
Monofill L:andfill

CLIENT NAME:
Mike Adkins

DRAWN BY | ENGINEERING APPROVAL | CLIENT APPROVAL | CIVIL APPROVAL | DATE | REV. NUMBER

REVISION SCHEDULE

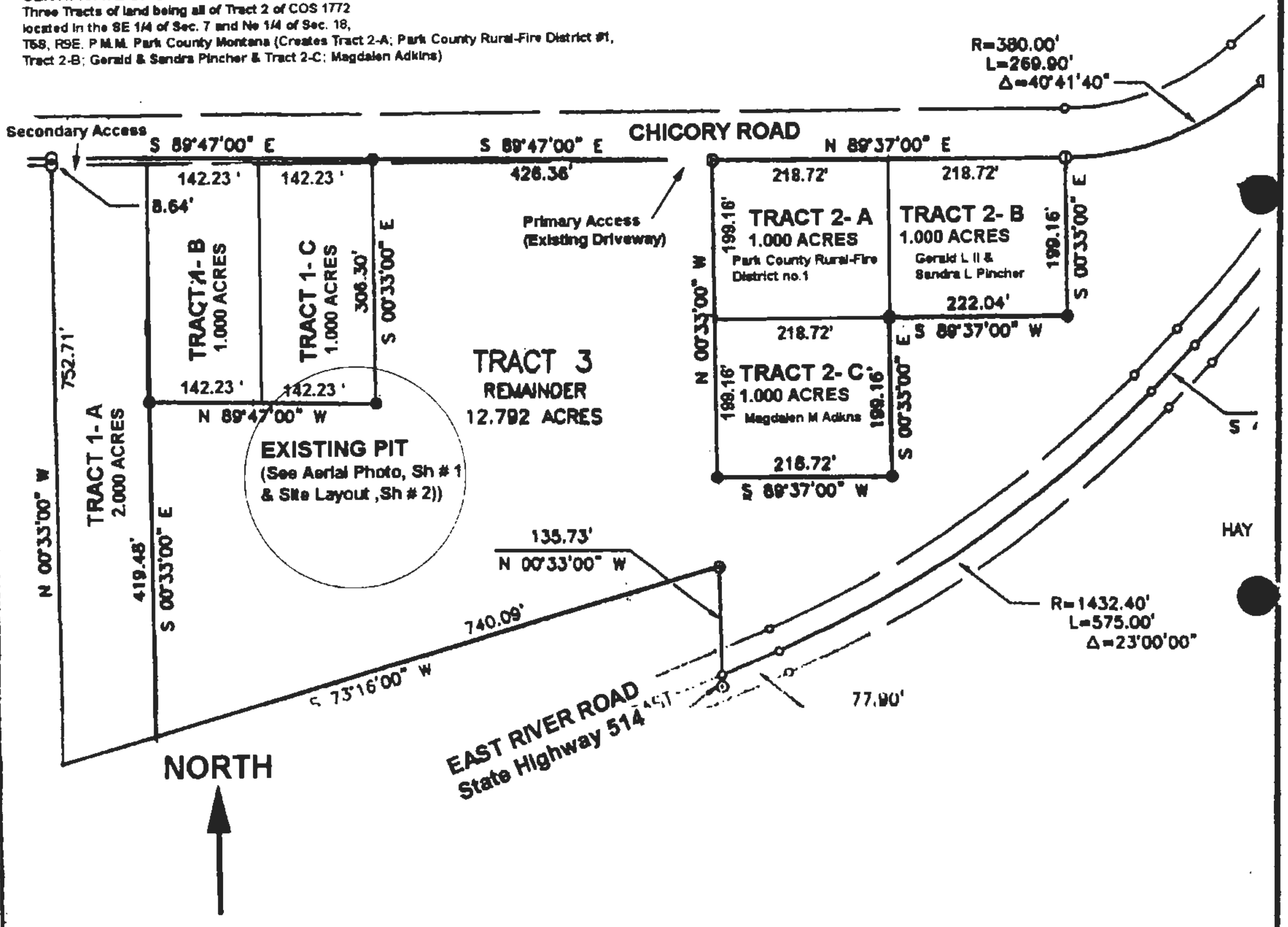
SHEET TITLE
Property Boundaries In accordance with; COS 1906 FE, 1810 FE & 1772 FE of TRACT A of COS 1699

SHEET NUMBER
1 OF 4

CERTIFICATE OF SURVEY: 1772FE
Three Tracts of land being all of Tract A of COS 1699
located in the SE 1/4 of Sec. 7 and NE 1/4 of Sec. 18,
T5S, R9E, P.M.M. Park County Montana (Creates Tract 1;Magdelen Adkins, Tract 2; Heather Michelle Adkins & Tract 3; Remainder)

CERTIFICATE OF SURVEY: 1906FE
Three Tracts of land being all of Tract 1 of COS 1772
located in the NE 1/4 of Sec. 18, T5S, R9E, P.M.M. Park County Montana (Creates Tract 1- A; Michael Adkins, Tract 1-B; Margrit Fehlman & Tract 1-C; Remainder)

CERTIFICATE OF SURVEY: 1810FE
Three Tracts of land being all of Tract 2 of COS 1772
located in the SE 1/4 of Sec. 7 and Ne 1/4 of Sec. 18,
T5S, R9E, P.M.M. Park County Montana (Creates Tract 2-A; Park County Rural-Fire District #1,
Tract 2-B; Gerald & Sandra Pincher & Tract 2-C; Magdalen Adkins)



SCALE: 1-IN = 200-FT

PARK COUNTY COMMUNITY DEVELOPMENT DEPARTMENT

City/County Building
414 East Callender Street
Livingston, MT 59047

Phone 406-222-4102
Fax 406-222-4109
pfletcher *a* parkcounty.org

MEMORANDUM

DATE: Friday, March 11, 2011

FROM: Philip Fletcher, Director

TO: William E. Smith, P.E.

RE: Request for "Zoning Certification" on Application for Proposed Landfill Located within NE 1/4 Section 18 T5S R9E MPM, Park County.

SUBJECT: CLASS III SOLID WASTE MANAGEMENT SYSTEM LICENSE APPLICATION: ZONING CERTIFICATION

Dear William:

Attached is a signed copy of your Class III Solid Waste Management System License Application with a qualification as noted below:

We have deleted the language of the Zoning Certification section that states "*I hereby certify that the site of the planned solid waste management system is in accordance with local government zoning and ordinances . . .*" as this language is inapplicable to Park County as the site proposed for the "planned solid waste management system" is not in any zoned area --- it is neither "in accord with our local zoning ordinance and ordinances" or not in "accordance." We simply have no zoning jurisdiction at all by which we can measure the proposal's accordance.

I believe, however, that this clarification should suffice for your immediate purpose(s).

Finally, please note that by signing this Certification we are not necessarily agreeing with, or accepting, the factual background or other information stated in your letter addressed to be and dated March 3, 2011.

Please let us know if this office can be of any further assistance to you in this matter.

Printed Name: PHILIP FLETCHER

Signature: _____ Title: DIRECTOR

Representing: PARK COUNTY COMM. DEV. Date: 11-MAR-2011

SECTION V - CERTIFICATIONS

LANDOWNER CERTIFICATION

I am the: *(check one)*

Property Owner ☐ Designated Representative of the Property Owner ☐
(Provide verification of status as representative)

By signing this form, I hereby certify that I am aware of the proposed solid waste management system. The applicant has my permission to use the site in accordance with the laws and rules of Montana governing solid waste management and any conditions or provisions imposed by the licensing agency. If the owner/operator of the solid waste management system fails to perform in accordance with any provision or provisions of the license issued pursuant to this application, as the landowner, I will be responsible for executing facility closure and post-closure activities pursuant to the requirements of the license and the solid waste laws and rules.

Property Owner Signature: _____ Date: _____
(attach a copy of the deed or other document that verifies the site owner)

ZONING CERTIFICATION

~~I hereby certify that the site of the planned solid waste management system is in accordance with local government zoning and ordinances (to be signed by appropriate local government official having knowledge of local zoning ordinances).~~ See attachment

Printed Name: PHILIP FLETCHER

Signature: _____ Title: DIRECTOR

Representing: PARK COUNTY COMM. DEV. Date: 11-MAR-2011

APPLICANT CERTIFICATION

I am the party responsible for operation of this proposed facility. I certify that the above-described solid waste management system will be constructed and operated in accordance with Sections 75-10-201 through
75-10-233, Montana Code Annotated (MCA), the rules adopted pursuant thereto, and in accordance with conditions which have or may be imposed in the license.

Applicant Printed Name: _____

Applicant Signature: _____

Title: _____ Date: _____

OCTAGON
Consulting Engineers, LLC
BIOENERGY • CIVIL • MECHANICAL

March 3, 2011

Philip Fletcher, Director
Park County Planning and Development
414 East Callender
Livingston, MT 59047

Re: Request "Zoning Certification" on Application form for Proposed Landfill
Located within NE¼ Section 18 T5S R9E MPM, Park County

Dear Philip:

The ~14 acre property southwest of the intersection and between Chicory Road and East River Road with rural address 19 Chicory Road is occupied by an old gravel pit which dates back to the late 1940's, and serves as the base of operations for Adkins Construction Company. There is a proposal in the making to seek approval from the State of Montana Solid Waste Program to license this property as a Class III mono-fill waste tire landfill. This proposal calls for the entire property to be excavated over the life of the landfill to the depth of the existing old gravel pit and backfilled with rubber pieces from shredded tires.

This property has encountered significant disturbance since the gravel pit started. Plans call for the surface of the pit to be progressively reclaimed, seeded and replanted with bushes, shrubs and trees as the pit is filled to ground level. Copy of map showing the layout of property boundaries and the location of this property is attached.

I am requesting that you fill out the "Zoning Certification" section on the attached License Application page 4 of 4 to certify that the planned solid waste management system is in accordance with local government zoning and ordinances. I will be happy to pick up the completed page bearing your original signature at your earliest convenience. Thank you for your cooperation and assistance in this matter.

Sincerely,
OCTAGON CONSULTING ENGINEERS, LLC

William E. Smith, P.E.
Consulting Engineer

WES:
Attachments
Cc: Mike Adkins, Property Owner

P.O. Box 78 • Emigrant, MT 59027 • (406) 333-9040 • octagon@wispwest.net

Adkins Class III Waste Tire Mono-Fill Landfill

Operation and Preventative Maintenance Plan

1. This landfill will receive only waste tires at an operational maximum rate of 5000 carcasses per day from three sources: 1) cut, chopped and shredded waste tire pieces that have been processed by company trucks at source locations and hauled to landfill; 2) whole carcasses delivered to the landfill by hired trucks from maintenance shops and retail businesses that generate waste tires; and 3) whole carcasses dropped off at landfill one to four-at-a-time by private individuals. Upon arriving at the landfill, waste tire pieces processed off-site will be conveyed directly into the pit. Whole tire carcasses delivered to the landfill will be off-loaded into the processing building located within the licensed landfill boundary, chopped, cut or shredded and then conveyed into the pit.
2. Tire carcasses will be cut, chopped and shredded to significantly reduce void volume and increase the number of carcasses that can be placed into each cubic yard of pit volume. It is estimated that the chopped rubber pieces produced from between 33 and 62 average size car tires can be disposed per cubic.
3. Landfill hours of operation are expected to be 7:30 am to 5:00 pm Monday through Friday, except legal holidays. Additional hours could include 8:00 am to noon on Saturday depending upon potential level of business on that day. The Owners expect the facility to be staffed by 4 to 6 full time and 2 part time employees. A front desk clerk will be available to check-in and document loads of tires, collect money, give receipts, etc. during business hours.
4. This site is accessed directly off of Chicory Road, a paved county road. The main entrance into the proposed landfill property is approximately 1000 ft from the Chicory Road intersection with East River Road, state highway 540. The facility will be accessed through double gates to provide clearance for larger trucks. A secondary access into the pit side of the property will be controlled by a pair of locked gates. The public access area and the pit operation will be separated by fence and gates, and vehicles entering into the property will be greeted by a person at the front desk who has visual oversight of the public area.
   Less than 1 mile to the northeast, East River Road intersects with Mill Creek Road (a paved county road). In this distance between Chicory Road and Mill Creek Road, East River Road crosses over Mill Creek. Although the bridge is slightly narrower than the two driving lanes of ERR, the bridge is structurally sound for trucks running at legal highway loads, and is maintained by MDT. Mill Creek crosses over Yellowstone River on a late model full highway width and load bridge and intersects with US Highway 89 South in a distance of approximately 0.8 mile to the north.
5. An old gravel pit occupies an area equal to approximately 40% of the licensed landfill property. The maximum depth of this pit is 60 feet but the pit bottom

slopes up in all directions. As part of routine landfill operation, the landfill will be excavated to a nominal depth of 60 ft below natural ground surface, and perimeter excavation into native soils will be laid back to maintain stable soil conditions in the surrounding terrain.

6. Landfilling will not encroach upon the east boundary of Gary Dolsman's Tract 1-A until the purchase of this tract can be transacted between him and Mike Adkins. Mike presently holds a right of first refusal for purchasing this property from Gary.

7. At the outset of pit operations, consideration will also be paid to future retrieval of these rubber pieces, when technology enables economically viable processes for their use.

8. Chopped rubber pieces will be placed into the pit in lifts approximately 5 ft thick; backfilled with native sand and gravel excavated from the pit; and mechanically compacted to fill voids and stabilize each lift. The compacted lift will then be covered with a 6" layer of sand/gravel.
   The lift will grow in surface area at the rate of approximately 3000 sq. ft per week. Lifts will be routinely backfilled, compacted and covered every 2 to 3 weeks as the fill operation proceeds across the open pit, so that no more than 6 to 9 thousand sq. ft of rubber pieces remain exposed at any one time. When the eleventh lift finally reaches ground surface, an 18" thick finish layer of sand/gravel excavated from the pit and a 6" cover of loamy topsoil retrieved from on-site stockpiles will be placed to cap the pit. This finished layer will be contoured to an average slope of 2% toward the perimeter of the pit to enhance stormwater runoff.
   A stormwater control berm approximately 2 ft high will be constructed within not more than 10 ft of the edge of the open pit (as shown in schematic Section A-A on the attached drawing sheet C) to protect from stormwater running into the pit.

9. All processed rubber pieces will be placed into the pit as carcasses are chopped, cut, shredded. Carcasses will be processed at a rate that will control and minimize the number of waste tires stockpiled and the time they remain in standby. Hydraulic cutters / shredders installed in the building on site will be used to cut carcasses. In addition, heavy excavation equipment, such as rubber tired front loader, track excavator, track bulldozer, vibratory sheep-foot compactor, and material handling conveyors adequately sized to efficiently handle the volume of rubber pieces and earthen backfill material will be operated within the designated perimeter of the landfill.

10. The west area is designated as Phase 1. Phase 1area is shown on the attached aerial photo labeled "Existing Conditions" (sheet 2 of 4), Site Layout (sheet 3 of 4) and Plan Schematic (sheet B). Additional activities also conducted within Phase 1 area will include: staging and processing whole tire carcasses in the processing building to be constructed immediately to the north of the existing shop building; and maintaining equipment in the existing shop building.

11. As the surface area of the pit is enlarged, topsoil on the natural ground surface shall be stripped and stockpiled on-site for use in future reclamation of landfill surface. In addition, erosion control measures shall be implemented to mitigate

effects of stormwater runoff and wind. Silt fences shall be erected and maintained to minimize erosion and sediment transport due to stormwater. Growth of vegetation from the stockpiled topsoil will be encouraged to protect against wind erosion. The existing stockpiles of topsoil show heavy volunteer growth of vegetation showing the soil to be laden with plant seeds ready to germinate in favorable conditions.

Soil excavated from the pit will be screened on-site as required and used to provide sand, gravel and cobble material adequate for backfilling lifts of rubber pieces. Dust abatement measures, which may include use of water sprinklers in the screening equipment, shall be implemented as required. Larger dimension reject cobbles, rocks and boulders will be hauled off site.

12. The line separating Phase 1 from Phase 2 will be fenced with a durable steel fencing material at least 4 ft in height, and maintained as long as landfill operations are limited to the Phase 1 area. The location of this fenced line with access gates between Phase 1 and Phase 2 is shown on the attached Site Layout.

13. As the pit fills up with waste tire pieces from the southwest corner of the property in Phase 1, and the surface is reclaimed to form natural ground, excavation and landfill will proceed to the north and east. As the pit encroaches upon the gravel screening operation, this operation will be relocated from the northern area to the southern area of Phase 1 made available by reclaiming the pit. Landfill operations will continue uninterrupted throughout Phase 1. As the pit in Phase 1 nears completion, excavation will continue east along the south boundary of the licensed landfill property into the south portion of Phase 2 area. Then pit excavation will continue north until the processing building, maintenance shop and storage building are encroached upon. These buildings may then be temporarily relocated onto the reclaimed Phase 1 area or removed from site. Because this scenario is at least 15 years off into the future, exact details of this transition are not clear at this writing.

14. The number of tires used per unit volume, the rate at which a lift of compacted rubber pieces will grow, and area of each lift required to be covered in each 2 to 3 week interval is discussed as follows:

    Completed lifts will be backfilled and covered with native pit run and screened earthen material consisting of sand and gravel with varying content of loam and fines at intervals not to exceed 13 weeks. This is the maximum interval set by the laws and rules of the State of Montana. In general, the operational standard will be to keep the lifts covered within four weeks of placement in order to reduce the visual impact and the danger from fire. A total of eleven lifts of compacted rubber pieces will be placed in the full depth of the pit.

15. Density of rubber shreds averages between 24 and 33 lb/cu. ft (pcf) for loose material and between 40 and 52 lb/cu. ft once compacted into place. (Refer to NEWMOA Fact Sheet, "Beneficial Use of Tire Shreds As Lightweight Fill", dated April 6, 2001 prepared by Northeast Waste Management Officials' Association, and "Source Users Guidelines for Waste and By-Product Materials in Pavement Construction" Federal Highway Administration, FHWA-RD-97-148, April 1998.)

Rubber pieces will be placed and compacted into the landfill at a nominal rate of 110 cu. yds per day. Each lift will be nominal 5 ft in depth and will be backfilled and compacted in several passes to ensure stability as the lift is brought up. Each lift will grow at a rate of 3000 sq. ft per week, and each completed lift measuring 9,000 sq. ft in area will be covered with 6 inches of sand and gravel soil at least every 3 weeks.

16. When the final lift of waste rubber pieces brings a portion of the landfill's surface at least 6000 sq. ft in area to within +/-1 ft of surrounding ground level, an 18" thick layer of sand/gravel covered by a 6" minimum thick layer of loam and clayey loam topsoil shall be placed over top of the lift. The final topsoil layer spread over the sand/gravel layer shall be capable of sustaining a healthy stand of surface vegetation. Prior to placing the topsoil layer, the final layer of sand/gravel spread over the finished lift shall be contoured to a gentle crown across the finished surface of the landfill pit and slightly compacted. Weather permitting, the topsoil shall be planted with a mix of grass seeds. If hot summer weather is present, seeded areas should be gently irrigated to establish a durable, erosion resistant stand of surface vegetation.

17. As each lift is brought to ground surface, covered with the required layer of sand/gravel, contoured to finish shape and planted, measures shall be taken to prevent stormwater runoff from flowing into the open pit and causing erosion and transport of sediment into the pit. The edges of the open pit shall be protected with a small berm of compacted topsoil or silt fence and the surface crowned toward the perimeter of the pit to cause stormwater collected on the finished surface to be drained toward the outside edges.

18. During the growing season, application of irrigation water to the freshly reclaimed and seeded areas should be a consideration. Water can be diverted from the Mill Creek Irrigation Pipeline, pumped from the existing monitoring well located near the north boundary of Phase I area, or the well located within Phase 2 for use in irrigating the reclaimed and seeded areas of finished pit surface. Irrigation water should be applied at a rate of 1 inch to 1.5 inches per week during the growing season for at least two consecutive growing seasons to establish and maintain a durable stand of grass and surface vegetation.

19. Reclamation will be completed on areas of the pit approximately 7000 to 9000 sq. ft in size (approximately every two to three weeks) as they are brought to ground level. Finish topsoil will be spread to the required thickness, graded to a gentle slope toward the property boundary and planted with a mix of native and drought resistant grass seeds. Stormwater received on the finished surface during a rainfall event will drain toward the perimeter of the landfill but most will soak in to the root zone of the plants. The exterior perimeter between the edge of the pit and the licensed boundary of the landfill shall be protected with an earth swale approximately 2 ft deep by 5 ft wide contoured into the natural ground surface and planted with grass. The swale is dimensioned to provide adequate capacity to convey flows generated by the 100 year storm event without over topping it banks, thereby ensuring that stormwater is not received on the reclaimed pit surface.

This swale fits into the natural topography of the ground and serves as the path of least resistance to convey stormwater runoff around the landfill. Stormwater runoff from the surface of the landfill, and from surrounding land will be intercepted by the swale and channeled around the perimeter of the licensed landfill and off the property.

20. Stormwater landing inside the open pit shall be channeled into a lined stormwater detention basin from which it can be pumped. The lined basin should be excavated into the bottom of the pit at its lowest point. A pumping sump must be provided in the lowest end of the lined basin to accommodate a pump intake. A basin 10 ft wide x 15 ft long x 2 ft average depth will contain the total volume of runoff generated by design storm event. Water discharged from the pump outlet must be spread and dispersed onto ground surface outside pit in such a manner to prevent soil scour and erosion.

21. Routine maintenance and preventive maintenance must be conducted on all equipment on a periodic basis. Maintenance schedules shall be established and implemented for each machine and piece of equipment in order to ensure the reliable operation.

22. The waste tire mono-fill landfill is not expected to attract a significant amount of litter. However, maintaining a slightly appearance throughout the facility will be emphasized to the employees. They will be encouraged to keep their work areas in tidy and orderly condition. In the same manner, rodents, insects and other nuisance creatures are not expected to be attracted to this facility.

TRACT 3
Remainder

BK 167 PG 117

DePuy Law Firm, P.C

LIMITED WARRANTY DEED

FOR VALUE RECEIVED, **NELSON APPLEGATE, AS TRUSTEE OF THE NELSON APPLEGATE INTER VIVOS TRUST AGREEMENT, DATED FEBRUARY 23, 1998**, of P. O. Box 336, Emigrant, Montana 59027 and **GLORIA J. APPLEGATE, AS TRUSTEE OF THE GLORIA J. APPLEGATE INTER VIVOS TRUST AGREEMENT, DATED FEBRUARY 23, 1998**, of P. O. Box 336, Emigrant, Montana 59027, the Grantors, do hereby grant, bargain, sell, convey and confirm unto **MIKE ADKINS**, of P. O. Box 465, Livingston, Montana 59047, the following described real property in Park County, Montana, to-wit:

TRACT A OF CERTIFICATE OF SURVEY NO. 1699, BEING ALL OF THE OLAF EGGAR AND JACK G. EGGAR TRACT AS SHOWN ON PLAT NO.529 AND THAT LAND BETWEEN EAST RIVER ROAD AND CHICORY ROAD AS SHOWN ON PLAT 689 AND LOCATED IN THE SOUTHEAST ONE- QUARTER OF SECTION 7 AND NORTHEAST ONE-QUARTER OF SECTION 18, TOWNSHIP 5 SOUTH, RANGE 9 EAST, PRINCIPAL MERIDIAN MONTANA, PARK COUNTY, MONTANA, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS

COMMENCING AT THE NORTHWEST CORNER OF SECTION 18, T5S, R9E, P.M M., PARK COUNTY, MONTANA; THENCE S 89°- 47'-00" E ALONG THE LINE COMMON TO SAID SECTIONS 7 AND 18, A DISTANCE OF 3109.54 FEET TO THE POINT OF BEGINNING; THENCE CONTINUING S 89°-47'-00" E ALONG SAID LINE COMMON TO SECTIONS 7 AND 18, A DISTANCE OF 828.00 FEET TO A POINT; THENCE S 89°-37'-00" W, A DISTANCE OF 440.76 FEET TO A POINT; THENCE NORTHEASTERLY ALONG A 380.00 FOOT RADIUS TANGENT CURVE TO THE LEFT, WITH A CENTRAL ANGLE OF 40°-41'-40", AND A CURVE LENGTH OF 269.90 FEET TO A POINT; THENCE N 48°-55'-20" E, A DISTANCE OF 203.78 FEET TO A POINT; THENCE S 00°-00'- 00" E, A DISTANCE OF 95.29 FEET TO A POINT; THENCE SOUTHWESTERLY ALONG THE CENTERLINE OF EAST RIVER ROAD AND A 1145.90 FOOT RADIUS TANGENT CURVE TO THE RIGHT, WITH A CENTRAL ANGLE OF 22°-02'-43", A CURVE LENGTH OF 440.90 FEET TO A POINT; THENCE S 43°-47'-00" W ALONG SAID CENTERLINE OF EAST RIVER ROAD, A DISTANCE OF 79.00 TO A POINT; THENCE SOUTHWESTERLY ALONG SAID CENTERLINE OF EAST RIVER ROAD AND A 1432.40 FOOT RADIUS TANGENT CURVE TO THE RIGHT, WITH A CENTRAL ANGLE OF 23°-00'-00", A CURVE LENGTH OF 575.00 FEET TO A POINT; THENCE S 66°-47'-00" W ALONG SAID CENTERLINE OF EAST RIVER ROAD; A DISTANCE OF 77.90 FEET TO A POINT; THENCE N 00°-33'-00" W, A DISTANCE OF 135.73 FEET TO A POINT; THENCE S 73°-16'-00" W, A DISTANCE OF 862.09 FEET TO A POINT; THENCE N 00°-33'-00" W, A DISTANCE OF 752.71 FEET TO A POINT; THENCE CONTINUING N 00°-33'-00" W, A DISTANCE OF 8.64 FEET TO THE POINT OF BEGINNING. SAID TRACT A CONTAINS 18.310 ACRES.

Together with all appurtenances, hereditaments, and tenements, including all water rights, gas, oil, other hydrocarbons, minerals and geothermal rights now held by the Grantors.

SUBJECT TO:

Easements and right-of-ways of record, easements as delineated on recorded plats or certificates of survey and easements apparent by visual inspection.

Rights of way for ditches, streams, creeks, rivers or canals, roads, streets or highways as the same may be located over, along, and across the property.

County road rights-of-way not recorded and indexed as a conveyance in the office of the clerk and recorder pursuant to Title 70, Chapter 21, M.C.A.

Deed Restrictions that apply only to that portion of the property described as the Sand Pit Tract in Plat No. 689.

1. No mining of sand, gravel, or minerals while the grantee owns the property or whenever either or both Nelson Applegate or Gloria J. Applegate cease to live on the property, (whichever occurs first) described in a deed recorded in Roll 130, pages 580-581, in the office of the Clerk and Recorder of Park County, Montana.

2. No buildings mobile homes or structures shall be built or placed on the property while the grantee owns property, or whenever either or both Nelson Applegate or Gloria J. Applegate cease to live on the property, (whichever occurs first), as described in a deed recorded in Roll 130, pages 580-581, in the office of the Clerk and Recorder, in the office of the Clerk and Recorder of Park County, Montana.

Exceptions and reservations contained in any patent and prior statutory grants not disclosed by patent.

Minerals, gas, coal, oil or other hydrocarbons reserved by the grantors' predecessors in interest.

TO HAVE AND TO HOLD with their appurtenances unto the said grantee, and his heirs and assigns forever, and the trustees do hereby covenant to and with the said grantee that the trustees are the owners in fee simple and that the property is free from all encumbrances and that the trustees will warrant and defend the title from all lawful claims whatsoever, as to that part of Tract A of Certificate of Survey No. _____, which was formerly a part of Plat No. 689 and quit claims all its interest in the remainder of Tract A of Certificate of Survey No. _____ to the grantee.

Dated this 14th day of December, 2001.

Nelson Applegate Trustee

NELSON APPLEGATE, AS TRUSTEE OF THE NELSON APPLEGATE INTER VIVOS TRUST AGREEMENT, DATED FEBRUARY 23, 1998

Gloria J. Applegate, Trustee

GLORIA J. APPLEGATE APPLEGATE, AS TRUSTEE OF THE GLORIA J. APPLEGATE INTER VIVOS TRUST AGREEMENT, DATED FEBRUARY 23, 1998

STATE OF MONTANA)
: ss.
County of Park)

This instrument was acknowledged to before me this 14th day of December, 2001, by **NELSON APPLEGATE, AS TRUSTEE OF THE NELSON APPLEGATE INTER VIVOS TRUST, DATED FEBRUARY 23, 1998 and GLORIA J. APPLEGATE APPLEGATE, AS TRUSTEE OF THE GLORIA J. APPLEGATE INTER VIVOS TRUST AGREEMENT, DATED FEBRUARY 23, 1998.**

Notary Public for the State of Montana
Residing at Livingston, Montana
My commission expires 2/24/2005

State of Montana } ss
County of Park }
Filed for record this 14 day of December, A.D. 20 01, at 10:40 o'clock A. M. Recorded in Book 167, Pages 117-119

Elaine Nelson
County Clerk & Recorder

By _____ Deputy

Recording Fee $ 8.00 Document No. 295375 Return to GUARDIAN TITLE CO 304 E CALLENDER STREET LIVINGSTON MT 59047

CIS 1699 REALTY TRANSFER RECEIVED

BOOK 201 PAGE 766

DePuy Law Firm, P.C.

TRACT 1-B
Remainder

QUIT CLAIM DEED

FOR VALUE RECEIVED, I, **MIKE ADKINS**, of P. O. Box 465, Livingston, Montana 59047, the Grantor, do hereby grant, bargain, sell, convey and confirm unto my wife, **MAGDALEN M. ADKINS**, of P. O. Box 465, Livingston, Montana 59047, the Grantee, the following described real property in Park County, Montana, to-wit:

Tract 1 of Certificate of Survey No. 1772, located in NE¼ of Section 18, Township 5 South, Range 9 East, of the Montana Principal Meridian in the County of Park, State of Montana, according to the Certificate of Survey on file and of record in the office of the Clerk and Recorder of Park County, Montana.

Together with appurtenances, hereditaments and tenements, including but not limited to water rights, mineral rights, gas rights and geothermal rights now held by the grantor.

TO HAVE AND TO HOLD the said premises, with their appurtenances, hereditaments and tenements unto the said grantee, and her heirs and assigns forever.

Dated this 12th day of February, 2004.

Mike Adkins
MIKE ADKINS

STATE OF MONTANA)
: ss.
County of Park)

This instrument was acknowledged to before me this 12th day of February, 2004, by **MIKE ADKINS.**

NOTARIAL SEAL STATE OF MONTANA

David W. DePuy
David W. DePuy (Printed Name)
Notary Public for the State of Montana
Residing at Livingston, Montana
My commission expires 6-7-2006

314900 Fee: $ 6.00 Roll 201 Pg 766
PARK COUNTY Recorded 03/16/2004 At 02:37 PM
Denise Nelson, Clk & Rodr By
Return to: DEPUY LAW P.O. BOX 487
LIVINGSTON, MT 59047

REALTY TRANSFER RECEIVED
C/S 1772

TRACT 1-C
C/S 1906

Return To
Guardian Title, Inc
504 E Callender
Livingston, MT 59047

353699 Fee: $7.00 Roll: R 281 Page(s): 1
Park County Recorded 2/13/2009 At 10 27 AM
Denise Nelson, Clk & Rcdr By: MR
GUARDIAN TITLE, INC. 504 EAST CALLENDER
LIVINGSTON, MT 59047

Return To:

QUIT CLAIM DEED

FOR A VALUABLE CONSIDERATION, the receipt and sufficiency of which is hereby acknowledged, **Margrit Fehlmann of 419 South 7th Street, Livingston, Montana 59047**, the Grantor, does hereby remise, release, and quitclaim unto **Magdalen M. Adkins and Michael D. Adkins of PO Box 32, ~~Livingston, Montana, 59047~~** the Grantees as joint tenants and not as tenants in common, all right, title and interest of Grantor in and to the following described premises in Park County, Montana, to-wit:

* Pray, MT 59065 me

Tract 1-C of Certificate of Survey No. 1906, located in the NE¼ of Section 18, Township 5 South, Range 9 East, MPM, Park County, Montana, according to the official plat thereof on file and of record in the office of the Clerk and Recorder of Park County, Montana.

Together with all the tenements, hereditaments, and appurtenances thereto belonging, and the reversion and reversions, remainder and remainders, rents, issues and profits thereof; and also all the estate, right, title and interest in and to said property, possession, claim and demand whatsoever as well in law as in equity, of the said Grantor, of, in or to the said premises and every part and parcel thereof.

Dated this 12 day of Feb, 2009.

Margrit Fehlmann
Margrit Fehlmann

STATE OF Montana)
: ss.
County of Park)

On this 12 day of Feb in the year 2009, before me Katie N Peel, a Notary Public for the State of Montana, personally **Margrit Fehlmann**, known to me to be the person whose names is subscribed to the within instrument acknowledged to me that he executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year in this certificate above written..

KATIE N PEEL NOTARIAL SEAL STATE OF MONTANA

Notary Public for the State of Montana
Residing at: Livingston
My Commission expires: 12/20/2009

REALTY TRANSFER RECEIVED
C/S 1906

Return To
Guardian Title, Inc
504 E Callender
Livingston, MT 59047

Tract 1-A
C/S 1906

356092 Fee: $7.00 Roll: R 287 Page(s): 1
Park County Recorded 7/8/2009 At 2:14 PM
Denise Nelson, Clk & Rcdr By ... Return To:
GUARDIAN TITLE, INC. 504 EAST CALLENDER
LIVINGSTON, MT 59047

QUIT CLAIM DEED

FOR A VALUABLE CONSIDERATION, the receipt and sufficiency of which is hereby acknowledged, **Michael Adkins of PO Box 465, Livingston, Montana 59047,** the Grantors, do hereby remise, release, and quitclaim unto **Gary A. Dolsman of PO Box 491, Gardiner, Montana 59030,** the Grantees as joint tenants with rights of survivorship, all right, title and interest of Grantors in and to the following described premises in Park County, Montana, to-wit:

Tract 1-A of Certificate of Survey No. 1906, according to the Certificate of Survey on file and of record in the office of the Clerk and Recorder of Park County, Montana.

Dated this 6 day of July, 2009 MA

Michael Adkins
Michael Adkins

STATE OF Montana)
: ss.
County of Park)

On this 6th day of July in the year ~~2008~~ 2009, before me Colene Sachanowski, a Notary Public for the State of Montana, personally appeared **Michael Adkins,** known to me to be the persons whose names are subscribed to the within instrument acknowledged to me that he executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year in this certificate above written.

COLENE SACHANOWSKI
NOTARY PUBLIC for the
State of Montana
Residing at Emigrant, Montana
My Commission Expires
March 15, 2011

Colene Sachanowski
Notary Public for the State of Montana
Residing at: Emigrant
My Commission expires: 03-15-2011

REALTY TRANSFER RECEIVED
C/S 1906 FE

Big Sky. Big Land. Big History.
Montana
Historical Society

Historic Preservation
Museum
Outreach & Interpretation
Publications
Research Center

March 8, 2011

William Smith
Octagon Consulting Engineers
PO Box 78
Emigrant MT 59027

RE: PROPOSED CLASS III MONO-FILL WASTE TIRE LANDFILL, PARK CO. SHPO Project #: 2011030705

Dear Mr. Smith:

I have conducted a cultural resource file search for the above-cited project located in Section 18, T5S R9E. According to our records there have been no previously recorded sites within the designated search locale. The absence of cultural properties in the area does not mean that they do not exist but rather may reflect the absence of any previous cultural resource inventory in the area, as our records indicated none.

Because this project will be occurring within a previously disturbed gravel pit we feel that there is a low likelihood cultural properties will be impacted. We, therefore, feel that a recommendation for a cultural resource inventory is unwarranted at this time. However, should cultural materials be inadvertently discovered during this project we would ask that our office be contacted and the site investigated.

If you have any further questions or comments you may contact me at (406) 444-7767 or by e-mail at dmurdo@mt.gov. I have attached an invoice for the file search. Thank you for consulting with us.

Sincerely,

Damon Murdo
Cultural Records Manager
State Historic Preservation Office

File: DEQ/AIR&WATER WASTE MNG/2011

225 North Roberts Street
P.O. Box 201201
Helena, MT 59620-1201
(406) 444-2694
(406) 444-2696 FAX
montanahistoricalsociety.org

OCTAGON
Consulting Engineers, LLC
BIOENERGY • CIVIL • MECHANICAL

February 28, 2011

Montana Historical Society
P.O. Box 210202
Helena, MT 59620-1800

Re: Request for Response to Predicted Impact from Proposed Landfill
Located within NE¼ Section 18T5S R9E MPM, Park County

Dear Mr. Murdo:

The ~14 acre property southwest of the intersection and between Chicory Road and East River Road with rural address 19 Chicory Road is occupied by an old gravel pit which dates back to the late 1940's, and serves as the base of operations for Adkins Construction Company. There is a proposal in the making to seek approval from the State of Montana to license this property as a Class III mono-fill waste tire landfill. This proposal calls for the entire property to be excavated over the life of the landfill to the depth of the existing old gravel pit and backfilled with rubber pieces from shredded tires.

This property has encountered significant disturbance since the gravel pit started. Plans call for the surface of the pit to be progressively reclaimed, seeded and replanted with bushes, shrubs and trees as the pit is filled to ground level. Copy of map showing the layout of property boundaries and the location of this property is attached.

Please return your response to me in the enclosed addressed and stamped envelope at your earliest convenience. Thank you for your cooperation and assistance in this matter.

Sincerely,
OCTAGON CONSULTING ENGINEERS, LLC

William Smith

William E. Smith, P.E.
Consulting Engineer

WES:
Cc: Mike Adkins, Property Owner

PARK COUNTY RURAL FIRE DISTRICT #1

DATE: 05-23-11

TO: William Smith - Octagon Consulting Engineers, LLC

FROM: Dann T. Babcox – Fire Chief

RE: Fire protection for Proposed Waste Tire Landfill

Dear William Smith,

Park County Rural Fire District #1 will provide fire protection for the proposed Waste Tire Landfill. That exact location is located in Paradise Valley Fire Service Area. However, we have an automatic aid agreement with that agency for both structural and wild fires. PCRFD#1 currently has three fire stations with the third located just a few hundred yards from the proposed site.

Our resources are as follows:

26 Firefighters
3 Structural Engines
1 CAFS unit
3 Water Tenders
2 Support Units
8 Wild land Units

The District feels confident we can provide adequate fire fighting resources with the combined efforts of the Authority Having Jurisdiction, Paradise Valley Fire Service Area.

Yours Very Truly,

Dann T. Babcox
Fire Chief- Park County Rural Fire District #1
304 East Park Street, Livingston, Montana 59047
406-222-0562

OCTAGON
Consulting Engineers
CIVIL • LAND DEVELOPMENT
STRUCTURAL • MECHANICAL

May 16, 2011

Dan Babcock, Chief
Park County Rural Fire District #1
304 East Park Street
Livingston, MT 59047

Re: Request Confirmation of Fire Coverage for Proposed Waste Tire Landfill
Located within NE¼ Section 18 T5S R9E MPM, Park County

Dear Dan:

The ~14 acre property southwest of the intersection and between Chicory Road and East River Road with rural address 19 Chicory Road is occupied by an old gravel pit which dates back to the late 1940's, and serves as the base of operations for Adkins Construction Company. We are preparing a proposal to seek approval from the State of Montana Solid Waste Program to license this property as a Class III mono-fill waste tire landfill. This proposal calls for the entire property to be excavated over the life of the landfill to the depth of the existing old gravel pit and backfilled with rubber pieces from shredded tires. Plans call for the surface of the pit to be progressively reclaimed, seeded and replanted with bushes, shrubs and trees as the pit is filled to ground level. Copy of map showing the location of this property is attached.

Fire protection is an important consideration to the licensing and operation of a facility of this nature. As you know, a Rural #1 fire station shares a common boundary with this proposed landfill. In addition, the Paradise Valley Volunteer Fire Department station is within 5 miles of this property located on East River Road toward the southwest from this site.

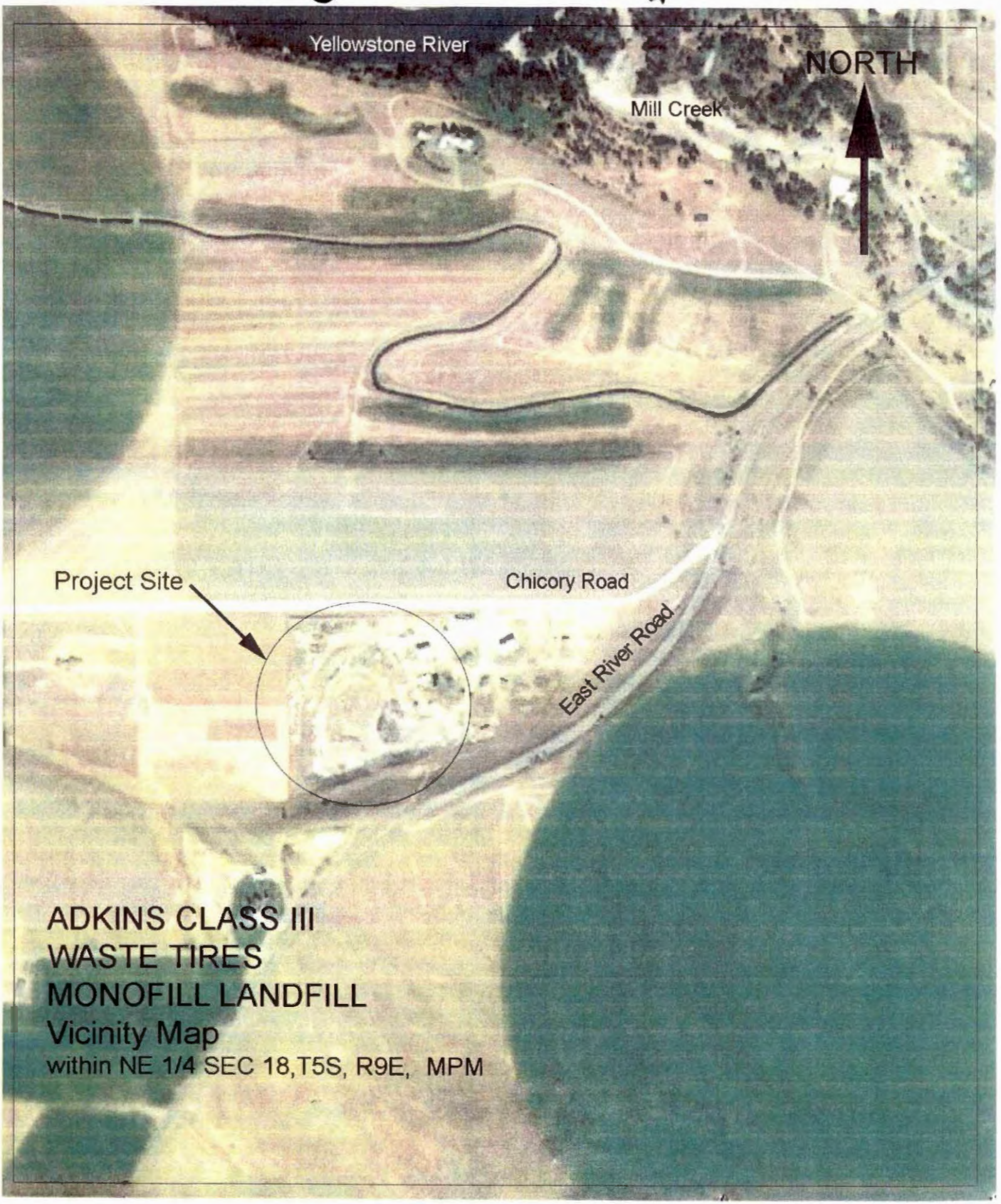
I am requesting that you address in a return letter to me your department's ability to provide fire protection to this proposed waste tire landfill. I will be happy to stop by the station to pick up your response letter at your earliest convenience. Thank you for your cooperation and assistance in this matter.

Sincerely,
OCTAGON CONSULTING ENGINEERS, LLC

William E. Smith, P.E.
Consulting Engineer

WES:
Attachments
Cc: Mike Adkins, Property Owner

P.O. Box 78 Emigrant, MT 59027 (406) 333-9040 email: octagon@[illegible].net
wispwest



ADKINS CLASS III WASTE TIRES MONOFILL LANDFILL

Vicinity Map

within NE 1/4 SEC 18,T5S, R9E, MPM

Engineer's Report

Adkins Class III Waste Tire Mono-fill Landfill
Licensing Application

May 20, 2011

Location of Property:
Within the $N^1/_2$ $NE^1/_4$ of Section 18
T. 5S, R. 9E, P.M.M.
Park County, Montana

Prepared for:

Michael D. Adkins
P. O. Box 34
Pray, Montana 59065

Prepared by:

Octagon Consulting Engineers, LLC
P. O. Box 78
Emigrant, MT 59027-0078
(406) 333-9040
(406) 223-9040

1. Legal Description and Ownership of Tracts of Record

1.1. The property on which Mike Adkins intends to operate a Class III waste tire mono-fill landfill is located within the NE¼ Section 18 T. 5 South, R. 9 East near Pray in Park County. The individual tracts of record comprising this 11.7 acres are more accurately described as: Tracts 1-A, 1-B and 1-C of COS 1906 FE; and that portion of Tract 3 Remainder of COS 1772 FE located west of the north-south line formed by the west boundary of Tracts 2-A and 2-C of COS 1810 FE and extending south to the boundary corner pin of Tract A defined on COS 1699.

1.2. The perimeter boundary of the property proposed to be used for this mono-fill landfill is as follows: north boundary being Chicory Road, a County road easement; east boundary runs from the northwest corner pin of Tract 2-A of COS 1810 FE south bearing S 00° 33' 00" E to the boundary corner pin of Tract A defined on COS 1699; south boundary is the original south boundary of Tract A of COS 1699; and west boundary is the original west boundary of Tract A of COS 1699. The total area is 11.7 acres (+/-) in size.

1.3. Mike Adkins is the owner of Tract 3 Remainder. Magdalen Adkins is the Owner of Tracts 1-B and 1-C. Tract 1-A is owned by Gary Dolsman (Mike Adkins' cousin), but Mike Adkins holds a right of first refusal executed between him and Gary Dolsman (copy attached). This tract will eventually become part of the landfill property.

1.4. Tracts 2-A, 2-B and 2-C were created by COS 1810 FE out of Tract 2 of COS 1772 FE. These three tracts are under the ownership of Park County Rural Fire District #1; Gerald and Sandra Pincherand; and Magdalen Adkins, Mike Adkins' wife, respectively. Tracts 2-A and 2-C share a common boundary with the proposed landfill property. Refer to attached map sheet number 1 of 4.

2. General Description of Landfill Operation

2.1. Mike and Maggie Adkins intend to operate a Class III landfill on this property. Material deposited into this landfill will consist solely of waste tires. No burning will take place on this site. Therefore, the landfill meets the criteria for a Class III mono-fill waste tire disposal site without burning.

2.2. The property proposed to be used for this mono-fill landfill is presently used for a diverse variety of purposes. A portion of this property is used by Adkins Construction Company as a construction materials yard and equipment maintenance shop. An old gravel pit, from which sand and gravel products were commercially mined beginning approximately 1948 and continuing through approximately 1965, occupies fully the west half of the property. The bottom of this pit is presently 60 ft below surrounding ground surface and perimeter side slopes are stable at 1:1 (V: H) or steeper.

2.3. Four small residential dwellings presently occupy the southeast quadrant of the property designated to be the licensed landfill. The owner intends to move these cabins to other home sites prior to commencing landfill operations.

2.4. The large assortment of scrap iron, steel and other metals; junk and antique cars and trucks; inoperable construction equipment; steel tanks; and new and

salvaged construction materials that once occupied a significant area of the pit has been completely removed, salvaged and cleaned up. In January 2010, the Owner began a unilateral self-imposed and self-funded cleanup effort to cut-up, disassemble and haul away the existing assortment for salvage. The Owner, his crew, equipment and contractors were actively engaged in this process for half the year when in July 2010 a formal complaint was made to DEQ Enforcement Division by an employee of the Montana Solid Waste Program. A schedule of compliance was agreed upon, and several inspections were conducted by DEQ Enforcement Division personnel. In January 2011, the cleanup of the pit was completed and inspected. The attached copy of Enforcement Division's letter dated January 28, 2011, states "ENFD is closing this complaint."

However, after receipt of this letter, another issue surfaced regarding the disposition of tires which were acquired by Adkins Construction through the demolition of a building of which these tires were a part. The tires, seen by us as salvaged building material, had been hauled from the pit to a neighbor's property for use in constructing slope retaining walls. Pursuant to the objection of the Solid Waste Licensing Program, the tires were retrieved from the neighbor's property and hauled to the Park County landfill at Mike Adkins' expense. A Copy of the receipt for payment to the Park County landfill by Mike Adkins was sent via email to the Solid Waste Licensing Program to document compliance with the State's rules.

The land at ground surface to the east of the pit on Tract 3 is presently occupied by construction related materials associated with Adkins Construction operations. The scrap metal and miscellaneous materials on Tract 1-A presently owned by Gary Dolsman is Gary's property and is expected to remain while Gary owns this tract. Upon transfer of possession to Mike Adkins, this tract will be cleaned up and made a part of the landfill operation.

2.5. It is estimated by the Owner and Engineer that 6 full-time jobs will be created by this landfill.

2.6. A sufficient amount of land is available to satisfy the design, operation and capacity of this solid waste tire mono-fill management system.

2.7. The specifications and information provided herein are a result of the Engineer's evaluation of the conditions on the site which may affect the placement of rubber pieces from chopped waste tires into this landfill, and considerations for control of stormwater runoff during operation, closure and control of surface stormwater and erosion, and post closure care. This report documents the justification for approval of the Class III mono-fill waste tire landfill by DEQ's Solid Waste Program.

3. Site Evaluation

3.1. The property lies in a sparsely developed area of gently sloping pastures and prairie. The terrain on this property and surrounding area is uniformly <1% to 2% with a steep slope (30% +) separating this property from East River Road (state highway 540). This surrounding terrain serves to isolate the subject property from stormwater run-on from neighboring properties.

3.2. This location provided adequate separation of waste from underlying ground water and adjacent surface water as described in this section (Site Evaluation) and the next section entitled "Evaluation of Groundwater and Surrounding Wells" of this Engineer's Report in accordance with ARM 17.50.1009(a).

3.3. This site is accessed directly off of Chicory Road, a paved county road. The main entrance into the proposed landfill property is approximately 500 ft from the Chicory Road intersection with East River Road, state highway 540. Approximately 1 mile to the northeast, East River Road intersects with Mill Creek Road (a paved county road). In this distance between Chicory Road and Mill Creek Road, East River Road crosses over Mill Creek. Although the bridge is slightly narrower than the two driving lanes of ERR, the bridge is structurally sound for trucks running at legal highway loads. Mill Creek crosses over Yellowstone River on a late model full highway width and load bridge and intersects with US Highway 89 South in a distance of approximately 0.8 mile to the north.

Trucks hauling loads of waste tires into this landfill are not limited by sub-highway standard or poorly maintained roads or bridges. In addition, the route described above provides primary access into this part of Park County from the north and is well maintained during winter by MDT snow plow trucks. Therefore, local roads are capable of providing access in all weather conditions and local bridges are capable of supporting vehicles with maximum rated loads in accordance with ARM 17.50.1009(b).

3.4. Due to the long history of industrial and commercial activities on this property resulting in significant surface and subsurface disturbances, the possibility of there being endangered or threatened species of plants or wildlife on this property is negligible. The facility or solid waste management activity does not result in the destruction or adverse modification of the critical habitat of endangered or threatened species, as identified in 50 CFR Part 17 in accordance with ARM 17.50.1009(i). In addition, a letter has been written to Montana Historical Society, and their reply states that no historically significant sites appear in their records. (Copies attached.)

3.5. Shortest horizontal distance measured on the USGS topo quad map between this site and the closest point on the Yellowstone River is 2250 ft (0.43 mile), and the site's vertical elevation is approximately 70 ft above the river at this location. Mill Creek runs toward the northwest at a distance of 2000 ft with a vertical separation of approximately 35 ft. Distances measured along the calculated groundwater flow direction (as shown on the attached 11x17 copy of a portion of the Pray USGS quad topo map) increase these line-of-sight distances slightly but not significantly.

The property boundary is well beyond the 100 year flood plains of the Yellowstone River and Mill Creek, and the two small well-defined dry drainage courses in the area (one to the east at a distance of 1000 ft and one to the west at a distance of 2000 ft) present no threat of flooding or channeling surface stormwater runoff to this proposed landfill site.
No water courses or streams exist within the property that would pose a significant threat of flooding, and East River Road protects the site from

stormwater run-on from neighboring property on the uphill side by diverting and channeling water downhill along the south side of the highway. In the mid 1990's, the well-maintained Mill Creek irrigation pipeline system replaced small irrigation ditches that once ran through the area, and over the ~15 years since the pipeline became operational, most of these ditches have been filled in through lack of use and maintenance. The attached Google Map aerial photo and copy of a portion of the USGS Pray, Montana 7.5 minute series topographic map show the location of the property and surrounding vicinity.

3.6. Neighboring properties to the west and southwest are primarily rural residential with single family residences on 5+ and 20 acre lots. Four twenty-acre tracts located immediately to the west and southwest are subdivided into 5 acre lots which are or will be served by DEQ-approved potable water wells and septic systems. Yellowstone Trails Ranch subdivision, located immediately beyond the 5 acre lots and mostly undeveloped at this time, provides 20+ acre tracts with designated building area for one single family residence and one guest house on each tract. Beyond YTR, at least 4000 ft to the southwest from the proposed landfill site, is Arrowhead Acres, a subdivision consisting of 18-two acre lots, which are largely undeveloped at present. Near the south end of Arrowhead Acres, Arrowhead School's well and drainfield are beyond one-mile radius from the proposed landfill site.

Lands to the east and south of East River Road and north of Chicory Road are undeveloped pasture lands for distances of at least 2200 ft and 1500 ft, respectively. Beyond these distances are more low density rural residential properties.

3.7. Three small-size lots which were created out of the east end of the pit property, as described in Section 1.4 above, are developed. Tract 2-A is under the ownership of Park County Rural Fire District #1 and the rural fire district station #3 is located on this tract. This fire station, like most volunteer fire stations in Montana, is not manned. However, it is outfitted with trucks and equipment, and the volunteer firefighters assigned to this station live within approximately 10 minutes. This improvement provides substantial fire protection for the landfill pit. A letter was written to Dan Babcock, Chief, to inform the district of the proposed development of this landfill, and Dan has written a supportive letter in return. Copies of these letters are attached.

Tracts 2-B and 2-C are each developed with a single family residence. Each tract is served by individual potable water well and drainfield located on the tract.

4. Evaluation of Groundwater and Surrounding Wells

4.1. An evaluation of groundwater underlying this site was undertaken in accordance with landfill application requirements to identify potential impacts on groundwater from this landfill. Leachate from mono-fill waste tire landfill is not considered to be a significant treat to groundwater, thereby the Class III designation for this type of landfill.

4.2. On the attached copy of a portion of the Pray USGS quad topography map, a one mile radius circle was plotted, and wells in the GWIC database were plotted. Results of a previous determination of groundwater flow direction and gradient using measured depths to SWL in wells located within 2 miles of this site are also shown. Well head elevations were surveyed into a common datum. The calculated flow direction is shown on the topo map. Greater consideration is given to existing wells located immediately around and down gradient of the proposed landfill site by plotting approximate location of each on the attached copy of the topo quad map.

4.3. The proposed landfill site is located within the N1/2 NE1/4 Section 18 T. 5 south, R. 9 east. The area of a one-mile radius circle plotted around this site covers most of Section 18, most of west half of Section 17, north edge of Section 19 T. 5 south, R. 9 east, and part of east half Section 13 T. 5 south, R. 8 east. Most of this area is up gradient of the site. The circle also covers Section 7 south of Yellowstone River and most of west half of Section 8 T. 5 south, R. 9 east, and part of SW1/4 Section12 T. 5 south, R. 8 east which are predominantly down gradient from the site.
The following table presents the number of existing wells potentially within the one-mile radius circle per section according to location description found in the GWIC database. In addition, well locations are plotted on the USGS topo map with identifying numbers which correlate to the attached well logs.

Section	Township south	Range east	Potential # Existing wells	Well's ID # on Map Correlated to Well Log
12	5	8	16	Not plotted on Map
13	5	8	6	Not plotted on Map
7	5	9	7	1, 2, 3, 4, 5, 6, 7
8	5	9	13	8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20
17	5	9	9	Not plotted on Map
18	5	9	34	21, 22, 23, 24, 25, 26, 27 Remainder located up gradient not plotted
19	5	9	6	Not plotted on Map

4.4. The closest neighboring existing wells serve the residences and fire station on properties immediately adjacent to the east boundary of the proposed landfill property. Wells planned to serve two residential lots approved by DEQ and Park County but not yet developed lie immediately to the west of the proposed landfill. Due to the rural character of this area where small residential developments occur in expanses of pastures and agricultural activities, a total of six potable water wells exist or are planned within a distance of 500 ft beyond the proposed landfill boundaries, and 13 wells occur within a distance of 1000 ft. On the proposed landfill property there is two monitoring wells. The one well close to the east boundary presently supplies water to residential housing, the use of which will be discontinued when the residential housing is phased out and moved from this site prior to putting this landfill into operation.

The zone of protection surrounding the neighboring well which serves the fire station will not be encroached upon by the pit of the new landfill being proposed. According to the calculated groundwater flow direction (see "Pray Area, Paradise Valley, Groundwater Gradient and Flow direction" calculation sheet and the flow direction arrow on the USGS topo map), only the three neighboring wells located to the east are down gradient of the proposed landfill. The existing and proposed wells serving each adjacent lot are located such that the landfill pit does not overlap any of the 100 ft radius zones of protection surrounding the wells.

4.5. Depths to groundwater SWL below top of well casing (TOC) were measured in the monitoring well located on the property (refer to well log number 25) on April 21, 2010 at 101.16 ft, on June 2, 2010 at 100.47 ft and on May 24, 2011 at 100.47 ft. TOC is 1.67 ft above surrounding ground level. SWLs reported on the well logs for the five wells drilled on this property (refer to attached well logs numbered 21 – 25) are: 95 ft on 2/18/04; 94 ft on 2/10/06; 91 ft on 1/06/03; 98 ft on 5/22/02; and (monitoring well) 104 ft on 4/09/07. The nominal depth of the pit will be excavated to 60 ft below surrounding ground surface. That leaves a vertical separation of 35+ ft between bottom of landfill pit and groundwater SWL.

4.6. The hydraulic gradient (i) and flow direction of the groundwater table under laying the Pray area were determined to be 0.00394 ft/ft to the north northeast by using the three point solution for wells located as shown on the attached copy of the USGS Pray quadrangle map. The three wells used are identified as the Paradise Found well, a vacant well in the Pray area and the Souza well. Their locations were surveyed by GPS, and the SWLs were measured between 10:00 A.M. and 4:00 P.M. on May 29, 2004. The distances between these wells are approximately 3950 ft, 3050 ft and 1600 ft (see "Pray Area, Paradise Valley, Groundwater Gradient and Flow direction" calculation sheet).

4.7. The facility has been located in a manner that does not allow the discharge of pollutants in excess of state standards for the protection of state waters, public water supply systems, or private water supply systems in accordance with ARM 17.50.1009(c). No adverse affects on groundwater quality are anticipated due to the operation of this proposed landfill.

5. Design Standards and References

Design, operation, closure, post closure care and financial security of the Class III mono-fill landfill shall conform to the following standards:

5.1. ARM 17.50.503, Closure Requirements for Landfills
5.2. ARM 17.50.540, Financial Assurance Requirements for Class III Landfill Units
5.3. Preliminary Version of New Solid Waste Rules (unofficial)
5.4. ARM 17.50.1009, Location Restrictions
5.5. ARM 17.50.1101, General Provisions, 17.50.1102, Definitions
5.6. ARM 17.50.1113, Deed Notation
5.7. ARM 17.50.1117, Operating Criteria for Class III Landfill Units
5.8. ARM 17.50.1401, Closure and Post-Closure Care Requirements for Class III Landfill Units

6. Description of Soils in Area from NRCS Documentation and Geologic Log Encountered in Selected Well Logs

6.1. NRCS Soil Survey descriptions and summaries of characteristics are provided. Soils in this area are generally well-drained sandy, gravelly and cobbly loam with depth to restrictive layer greater than 200 cm (~6.5 ft). An evaluation of "Disposal of Wastewater by Rapid Infiltration" included from the Soil Survey website shows "somewhat limited" to "very limited" for the soils in this area. The detailed description included with this evaluation defines "somewhat limited indicates that the soil has features that are moderately favorable for the specified use...Very limited indicates that the soil has one or more features that are unfavorable for the specified use." The specified use evaluated is the percolation through the soil of municipal wastewater applied in a level basin at a rate of 4 to 120 inches per week. This is included to confirm the well drained characteristics of the soil in this area.

6.2. Lythology recorded on the well logs for the five wells drilled on this property (refer to attached well logs numbered 21 – 25) is described as follows: sand, gravel, sandy gravels and cobbles between ground surface and approximately 80 ft; slightly to tight clay bound sand and gravels lie between 75 ft and 160 ft.

6.3. The perimeter cut slopes of the pit will be excavated to a stable shape as soil conditions allow (approximately 1 horizontal to 1 vertical). The existing cut slopes, which have been standing for decades, were observed by this Engineer at approximately 1 horizontal and 1 vertical.

6.4. Observations and conclusions:
Soils underlying the area proposed for the mono-fill tire pit are not being evaluated on the basis of permeability. Pieces of rubber from waste tires deposited into this pit are not expected to produce significant leachate or pose a significant risk of contamination to the groundwater. On the other hand, control of stormwater is a significant consideration. Stormwater running onto this landfill area from neighboring properties and running off this area onto neighboring areas is strictly prohibited. Surface soil conditions being well-drained increase the volume of stormwater that soaks in.

Therefore, native and in-situ soils excavated from this pit can be used in the on-going backfill and covering lifts of rubber pieces. Topsoil stripped from the natural ground surface and stockpiled on-site is available for use in reclamation of the landfill surface to be placed as the final earthen cover. Additional quantity of loam and clayey loam topsoil can be imported as required if on-site quantities run short. The finished surface will be graded to a ~2% crown over the top of the pit and then planted with grass seeds and small shrubs progressively as the pit is filled to surrounding ground level. The finished level of the pit will be approximately 2 ft above surrounding ground surface.

7. Landfill Operations Plan

7.1. This landfill will receive waste tires at an operational maximum rate of 5000 carcasses per day from three sources: 1) cut, chopped and shredded waste tire pieces that have been processed by company trucks at source locations

and hauled to landfill; 2) whole carcasses delivered to the landfill by hired trucks from maintenance shops and retail businesses that generate waste tires; and 3) whole carcasses dropped off at landfill one to four-at-a-time by private individuals. Upon arriving at the landfill, waste tire pieces processed off-site will be conveyed directly into the pit. Whole tire carcasses delivered to the landfill will be off-loaded into the processing building located within the licensed landfill boundary, chopped, cut or shredded and then conveyed into the pit.

7.2. The upper edge of the excavated pit will set approximately 12 ft inside the property boundary on all sides, and occupy an area of approximately 11 acres at full build-out. As a part of routine landfill operation, the pit will be excavated to a nominal depth of 60 ft below natural ground surface, and perimeter excavation into native soils will be laid back to maintain stable soil conditions in the surrounding terrain. The total volume of the landfill will be approximately 700,000 cubic yards. Tire carcasses will be cut, chopped and shredded to significantly reduce void volume and increase the number of carcasses that can be placed into each cubic yard of pit volume. At the outset of pit operations, consideration will also be paid to future retrieval of these rubber pieces, when technology enables economically viable processes for their use. It is estimated that the chopped rubber pieces produced from between 33 and 62 average size car tires can be disposed per cubic. A total of at least 25 million tires can be disposed over the life of this landfill. At the estimated rate of 5000 tires per day, this landfill will have a useful life of at least 20 years.

7.3. Chopped rubber pieces will be placed into the pit in lifts approximately 5 ft thick; backfilled with native sand and gravel excavated from the pit; and mechanically compacted to fill voids and stabilize each lift. The compacted lift will then be covered with a 6" layer of sand/gravel. The lift will grow in surface area at the rate of approximately 3000 sq. ft per week. Lifts will be routinely backfilled, compacted and covered every 2 to 3 weeks as the fill operation proceeds across the open pit, so that no more than 6 to 9 thousand sq. ft of rubber pieces remain exposed at any one time. When the eleventh lift finally reaches ground surface, an 18" thick finish layer of sand/gravel excavated from the pit and a 6" cover of loamy topsoil retrieved from on-site stockpiles will be placed to cap the pit. This finished layer will be contoured to an average slope of 2% toward the perimeter of the pit to enhance stormwater runoff. A stormwater control berm approximately 2 ft high will be constructed within not more than 10 ft of the edge of the open pit (as shown in schematic Section A-A on the attached drawing sheet C) to protect from stormwater running into the pit.

7.4. All processed rubber pieces will be placed into the pit as carcasses are shredded. Carcasses will be processed at a rate that will control and minimize the number of waste tires stockpiled and the time they remain in standby. Hydraulic shredders and cutters installed in the building on site will be used to cut carcasses. In addition, heavy excavation equipment, such as rubber tired front loader, track excavator, track bulldozer, vibratory sheep-foot compactor, and material handling conveyors adequately sized to efficiently handle the volume of rubber pieces and earthen backfill material will be operated within

designated perimeter of the landfill. Tire pieces will be compacted into lifts as described in Section 7.12 of this report.

7.5. One adequately sized building will be constructed on-site to provide for indoor staging and processing of waste tire carcasses. Processing activities will occur inside the buildings and not be visible to surrounding neighbors and passersby.

7.6. The licensed area of the proposed landfill is approximately 11.7 acres. A large pit already exists on the property from previous commercial mining of gravel and sand. This pit has set a gauge for depth of excavation at a nominal dimension of 60 ft below surrounding ground surface. The pit will be excavated, expanded and shaped in order to landfill waste tire pieces. The pit has established the west area of the licensed landfill as where the excavation and landfilling operations will commence. Landfilling will not encroach upon the east boundary of Gary Dolsman's Tract 1-A until the purchase of this tract can be transacted between him and Mike Adkins.

7.7. The west area is designated as Phase 1. Phase 1area is shown on the attached aerial photo labeled "Existing Conditions" (sheet 2 of 4), Site Layout (sheet 3 of 4) and Plan Schematic (sheet B). Additional activities also conducted within Phase 1 area will include: staging and processing whole tire carcasses in the processing building to be constructed immediately to the north of the existing shop building; and maintaining equipment in the existing shop building.

7.8. As the surface area of the pit is enlarged, topsoil on the natural ground surface shall be stripped and stockpiled on-site for use in future reclamation of landfill surface. In addition, erosion control measures shall be implemented in accordance with Section 11 of this Engineer's report. Excavated soil will be screened on-site as required and used to provide sand, gravel and cobble material adequate for backfilling lifts of rubber pieces. Dust abatement measures, which may include use of water sprinklers in the screening equipment, shall be implemented as required. Larger dimension reject cobbles, rocks and boulders will be hauled off site.

7.9. The line separating Phase 1 from Phase 2 will be fenced with a durable steel fencing material at least 4 ft in height, and maintained as long as landfill operations are limited to the Phase 1 area. The location of this fenced line between Phase 1 and Phase 2 is shown on the attached Site Layout.

7.10. The landfill area designated as Phase 2 is presently occupied by: a small storage building; one small vacant house; four small residential dwellings; one well; and two active drainfield septic systems. The storage building will remain for use by landfill operations, the vacant house is intended to be used as an office until excavation of the pit encroaches upon it, and the residential buildings will be removed to locations off-site prior to commencing landfill operations. Without the residences, the existing water supply well will be used for monitoring groundwater and supplying water for irrigation of the reclaimed and seeded finished surface of the pit. The drainfields will be removed as the pit is excavated for the landfill.

7.11. As the pit fills up with waste tire pieces from the southwest corner of the property in Phase 1, and the surface is reclaimed to form natural ground, excavation and landfill will proceed to the north and east. As the pit encroaches upon the gravel screening operation, this operation will be relocated from the northern area to the southern area of Phase 1 made available by reclaiming the pit. Landfill operations will continue uninterrupted throughout Phase 1. As the pit in Phase 1 nears completion, excavation will continue east along the south boundary of the licensed landfill property into the south portion of Phase 2 area. Then pit excavation will continue north until the processing building, maintenance shop and storage building are encroached upon. These buildings may then be temporarily relocated onto the reclaimed Phase 1 area or removed from site. Because this scenario is at least 15 years off into the future, exact details of this transition are not clear at this writing.

7.12. The number of tires used per unit volume, the rate at which a lift of compacted rubber pieces will grow, and area of each lift required to be covered in each 2 to 3 week interval is discussed as follows:

Completed lifts will be backfilled and covered with native pit run and screened earthen material consisting of sand and gravel with varying content of loam and fines at intervals not to exceed 13 weeks. This is the maximum interval set by the laws and rules of the State of Montana. However, the operational standard will be to keep the lifts covered within three weeks of placement in order to reduce the visual impact and the danger from fire. A total of eleven lifts of compacted rubber pieces will be placed in the full depth of the pit.

According to the Operation Plan, waste tires will be received at a maximum rate of 5000 carcasses per day. Carcasses will be chopped, cut and shredded prior to being placed into the landfill. Density of rubber shreds averages between 24 and 33 lb/cu. ft (pcf) for loose material and between 40 and 52 lb/cu. ft once compacted into place. (Refer to NEWMOA Fact Sheet, "Beneficial Use of Tire Shreds As Lightweight Fill", dated April 6, 2001 prepared by Northeast Waste Management Officials' Association, and "Source Users Guidelines for Waste and By-Product Materials in Pavement Construction" Federal Highway Administration, FHWA-RD-97-148, April 1998.) At 25 pcf each cubic yard (cy) averages 675 lbs, and at 46 pcf each cubic yard weighs 1242 lbs. Given that an average tire weights 20 lbs, each cubic yard of loose rubber shreds contains 34 tires and each compacted cubic yard contains 62 tires. Since many tires received may be larger than average and the vibratory sheep-foot compactor is expected to deliver near maximum compaction, we will assume 45 to 50 tires per cy. Rubber pieces will be placed and compacted into the landfill at a nominal rate of 110 cu. yds per day. Each lift will be nominal 5 ft in depth and will be backfilled and compacted in several passes to ensure stability as the lift is brought up. Each lift will grow at a rate of 3000 sq. ft per week, and a completed open face of lift measuring 9,000 sq. ft in area will be covered with 6 inches of sand and gravel soil at least every 3 weeks.

7.13. The relationship between the: 1) total volume of the landfill; 2) volume of soil excavated to form the existing pit; and 3) volume of soil backfill required to fill and cover each lift and provide a soil cap (not including topsoil which has been and will be stripped and stockpiled on-site) is calculated as follows:

1) Estimated volume of existing pit = 40% of total landfill
   Therefore, volume of soil remaining to be excavated = 60% of total landfill
2) Fill voids in waste rubber: compacted rubber density @ 46 pcf = 1242 pcy
   assumed density of rubber @ 70 pcf = 1900 pcy
   Therefore, void ratio = 1.0 – (1242/1900)*100% = 35.0%
3) 6" soil cover over each lift of rubber pieces to lift thickness = 10%
   18" soil cover over top of pit compared to total depth of pit = 2.5%
4) Total volume to backfill required = 47.5%
   Round total soil backfill required to 50%

Conclusion: The difference between remaining soil volume of landfill to be excavated and calculated volume of soil backfill is 10%. This 10% represents a reasonable estimate in volume of oversize cobbles and rocks that could be rejected and hauled from site. Therefore, the presence of the existing pit results in a balanced cut and fill over the life of the landfill. Due to the soil volume that must be excavated in order to shape the existing pit to begin to receive waste rubber shreds, the balanced cut and fill will take effect immediately.

7.14. When the final lift of waste rubber pieces brings a portion of the landfill's surface at least 6000 sq. ft in area to within +/-1 ft of surrounding ground level, an 18" thick layer of sand/gravel covered by a 6" minimum thick layer of loam and clayey loam topsoil shall be placed over top of the lift. The final topsoil layer spread over the sand/gravel layer shall be capable of sustaining a healthy stand of surface vegetation. Prior to placing the topsoil layer, the final layer of sand/gravel spread over the finished lift shall be contoured to a gentle crown across the finished surface of the landfill pit and slightly compacted. Weather permitting, the topsoil shall be planted with a mix of grass seeds. If hot summer weather is present, seeded areas should be gently irrigated to establish a durable, erosion resistant stand of surface vegetation.

As each lift is brought to ground surface, covered with the required layer of sand/gravel, contoured to finish shape and planted, measures shall be taken to prevent stormwater runoff from flowing into the open pit and causing erosion and transport of sediment into the pit. The edges of the open pit shall be protected with a small berm of compacted topsoil or silt fence and the surface crowned toward the perimeter of the pit to cause stormwater collected on the finished surface to be drained toward the outside edges.

During the growing season, application of irrigation water to the freshly reclaimed and seeded areas should be a consideration. Water can be diverted from the Mill Creek Irrigation Pipeline, pumped from the existing monitoring well located near the north boundary of Phase I area, or the well located within Phase 2 for use in irrigating the reclaimed and seeded areas of finished pit surface. Irrigation water should be applied at a rate of 1 inch to 1.5 inches per week during the growing season for at least two consecutive

growing seasons to establish and maintain a durable stand of grass and surface vegetation.

7.15. Reclamation will be completed on areas of the pit surface approximately 7000 to 9000 sq. ft in size (approximately every two to three weeks) as top lift is brought to ground level. Finish topsoil will be spread to the required thickness, graded to a gentle slope toward the property boundary and planted with a mix of native and drought resistant grass seeds. Stormwater received on the finished surface during a rainfall event will drain toward the perimeter of the landfill but most will soak in to the root zone of the plants. The exterior perimeter between the edge of the pit and the licensed boundary of the landfill shall be protected with an earth swale approximately 2 ft deep by 5 ft wide contoured into the natural ground surface and planted with grass. The swale is dimensioned to provide adequate capacity to convey flows generated by the 100 year storm event without over topping it banks, thereby ensuring that stormwater is not diverted onto the reclaimed pit surface. This swale fits into the natural topography of the ground and serves as the path of least resistance to convey stormwater runoff around the landfill. Stormwater runoff from the surface of the landfill, and from surrounding land will be intercepted by the swale and channeled around the perimeter of the licensed landfill and off the property.

Steps must be taken to contact neighboring land owners to remind them that trespass irrigation water from Mill Creek pipeline and/or other sources must not cross the boundary onto this landfill property. Allowing trespass water to flow off your property and onto the neighbor without permission is a violation of state law and will not be tolerated.

7.16. Stormwater landing inside the open pit shall be channeled into a lined stormwater detention basin from which it can be pumped. The lined basin should be excavated into the bottom of the pit at its lowest point. A pumping sump must be provided in the lowest end of the lined basin to accommodate a pump intake. A basin 10 ft wide x 15 ft long x 2 ft average depth will contain the total volume of runoff generated by design storm event. Water discharged from the pump outlet must be spread and dispersed onto ground surface outside pit in such a manner to prevent soil scour and erosion.

7.17. The Owner's business plan estimates receiving, processing and landfilling 1.26 million tires per year at full operation. This is a rate of 105,000 per month or 5,000 tires per business day (assuming 21 business days per month). The processing and landfilling of tire carcasses would occur eight hours per day with business hours assumed to be between 7:30 am to 4:00 pm Monday through Friday.

An average 40 ft long tractor trailer load of whole tires could bring 800 carcasses to the landfill staging area, however the labor to properly stack waste tires into the van may increase costs excessively. An open bobtail truck can bring at least 170 average size carcasses per load if stacked properly in a laced pattern. The same bobtail truck could bring 400 carcasses after those carcasses had been chopped into pieces. A 30 cu yd side dump trailer could deliver approximately 150 whole carcasses loaded randomly. On an average

business day, this landfill is expected to receive approximately 20 truckloads of whole waste tire carcasses and processed pieces. Because this pit will encourage local residents, businesses, Park County government and Yellowstone National Park to bring waste tires for disposal, approximately 10 additional deliveries per day by individual cars and small trucks are expected during regular business hours. At this rate, the pit would fill up at the rate of less than 200 cu yds per business day, and have a usable life of over 20 years.

7.18. The Owner's business plan also contemplates the possibility of unearthing and retrieving the rubber pieces at some future date, provided there becomes viable economic value based on future developments in technology and regulations. In this scenario, the landfilled rubber pieces would be excavated from the pit and removed from the sand and gravel backfill by screening. The salvaged rubber would be hauled from the site in truck loads that meet DOT highway requirements. Sand and gravel soil material rejected from the screened tire pieces would be returned and compacted into the pit along with adequate volume of imported pit run sand and gravel soil to replace salvaged rubber pieces. As the pit would be emptied of rubber pieces and backfilled the new surface could be lower than surrounding ground level, the surface shall be reclaimed with topsoil, planted with grass seed mix and protected from stormwater erosion in accordance with the closure plan for this licensed landfill.

8. Closure and Post-Closure Plan

In accordance with ARM 17.50.1405, Closure and Post-Closure Care Requirements for Class III Landfill Units

8.1. The facility must be located to allow for closure, post-closure care, and planned uses of the land after the post-closure period in accordance with ARM 17.50.1009(e), Location Restrictions.

8.2. The Owners and operator of this class III mono-fill waste tire landfill solid waste management system are responsible to operate this facility according to the applicable MCA and ARM, and the Landfill Operations Plan described in Section 7 of this report. Based on the parameters set forth in Section 7, including a schedule of backfilling, compacting and covering exposed portion of the lift in progress routinely every 2 to 3 weeks, the surface area of exposed rubber pieces is expected to average 7,000 sq. ft, (a nominal area 100 ft long by 70 ft wide).

8.3. The landfill unit's closure plan must include, at a minimum: a) procedures for construction of two feet of final cover including placement of six inches of top soil; b) procedures for grading and seeding to prevent erosion; and c) the deed notations called out in Section 9 for this report. The attached sheet entitled, "Scope of Work and Estimated Costs to Perform Closure of Landfill" summarizes requirements and costs for closure.

8.4. A minimum of 2 ft of earthen backfill material shall be placed as the cover over the pit at ground level with 6 inches of that thickness being loam to clay loam topsoil placed as the final layer. Reclamation areas shall be protected from erosion and sediment transport in accordance with Section 11 of this

Engineer's report. After surface vegetation begins to get established, measures to control the growth of noxious weeds shall be implemented in accordance with Section 11.

8.5. The final pit surface shall be graded smooth with a gentle slope of approximately 2% toward the landfill boundary, and planted with a seed mix consisting of starter species, native and drought resistant grasses. Consideration should be made of seeding reclaimed areas in spring before May 15 or in fall after September 15 so plants can take advantage of natural rainfall to establish surface vegetation to resist erosion from wind and stormwater runoff on the surface.

8.6. Deed notations addressed in Section 9 of this report shall be added to deeds, unless all wastes are removed from the landfill unit and the Owners or operator receive approval from the DEQ Solid Waste Program to remove these notations from the deed.

8.7. Post-closure care must include at minimum:

8.7.1. Maintain the integrity of the final cover;

8.7.2. Maintain adequate vegetative cover; and

8.7.3. Maintain erosion control as described in the Operations Plan (Section 7 and Section 11 of this Engineer's Report).

8.8. As described in Section 10, paragraph .2.4, Mike and Maggie Adkins, Owners of this property and business, operate an excavation construction company, have a long experience in construction, own and maintain substantial earth moving and excavation equipment, and have knowledgeable employees. In addition, Mike and Maggie plan to own this tire disposal business and the land on which it is sited through its life. Also, with emerging technologies in gasification with an emphasis on producing energy with bio-fuels, there are increasing possibilities that these rubber pieces would be unearthed and burned as a beneficial source of energy. Based on these considerations, post-closure care will be maintained by the Owners as an on-going part of their other operations with no addition budget required. Therefore, no additional money needs to be set aside for post-closure care.

8.9. The owner or operator shall give notice of intent to close the landfill as required in ARM 17.50.1405(4), and shall close the landfill and conduct post-closure care in compliance with the closure and post-closure plans.

9. Deed Notations

In accordance with ARM 17.50.1113(1)(a) and (b)

9.1. Before the initial receipt of waste at the facility, the owner of the land where a facility is located shall submit for DEQ approval a notation to the deed to that land, or to some other instrument that is normally examined during title search. The notation must be submitted to the department on a form provided by the department and, if the notation covers less than all the land in the deed, must be accompanied by a certified exhibit of the waste boundary that references the certificate of survey for the tract that encloses the facility.

If the notation covers all of the land in the deed, then the notation must reference the certificate of survey for that land. The notation must, in perpetuity, notify any potential purchaser of the land that:

9.1.1. The land has been used as a solid waste management system; and

9.1.2. Its use is restricted under ARM 17.50.1405(2).

9.2. If the department {DEQ} approves the notation and exhibit, it shall notify the owner by mail.

10. Insurance and Financial Assurance Requirements
In accordance with ARM 17.50.1114 and ARM 17.50.504

10.1. General Liability Insurance: Before the initial receipt of waste at a solid waste management facility, the owner or operator shall submit for department {DEQ} approval, and maintain in force during the active life of the facility, a policy of general liability insurance to cover bodily injury or property damage to third persons caused by sudden accidental occurrences at the facility in the minimum amount of $1 million per occurrence with a minimum annual aggregate of $2 million. The owner or operator shall place a copy of the approved policy in the facility operating record.

10.2. Financial Assurance for closure of landfill pit:

10.2.1. Owner or operator must have a detailed written estimate, in current dollars, of the cost of hiring a third party to close the area of the landfill pit that the department {DEQ} determines to be the largest active portion in the facility requiring a final cover as required under ARM 17.50.503, Waste Groups, (b)Group III wastes, during the active life of the facility in accordance with the closure plan. The owner or operator must submit a copy to the department and place the estimate in the operating record. The cost estimate must equal the cost of closing the largest active portion during the active life when the extent and manner of its operation would make closure the most expensive, as indicated by its closure plan. During the active life of the landfill, the cost estimate for closure shall be updated and adjusted annually.

10.2.2. The owner or operator must have a detailed written estimate, in current dollars, of the cost of hiring a third party to conduct post-closure care for the landfill unit in compliance with the post-closure plan. The post-closure cost estimate used to demonstrate financial assurance must account for the total costs of conducting post-closure care, including annual and periodic costs incurred over the entire post-closure care period. Cost estimates must be based on the most expensive costs. Refer to Section 8, paragraph .8 of this Engineer's report for justification as to why additional costs are not needed.

10.2.3. The owner or operator is not responsible to undertake corrective action.

10.2.4. Cost estimates for pit closure is provided on attached sheet. The total worst-case cost estimate for a third party contractor to perform pit

closure is $6,000, and total for post-closure care by a third party contractor is estimated at $00. (This scope will be the responsibility of the land and business owners, and a third party contractor is not required to protect the State's or public's interests in this pit.) A total cash value of $6,000 is provided for closure activities to be performed by third-party contractor.

As described in the cost estimate and closure plan, this estimate is considered by this Engineer (who from his background as a construction estimator developed these estimates) to be generous based on the costs encountered in the present economy. The business of this landfill Owner for over 25 years is excavation, road building, earthwork and reclamation, and he has available assets in the form of excavation machinery, trained and experienced employees, and stockpile of grass seed laden topsoil staged on the landfill property. In addition, adequate volume of native sand/gravel soil exists on-site to ensure a balanced cut and fill as described in Section 7.13 of this Engineer's report, which includes soil to backfill and cover exposed lifts in accordance with the Closure Plan. These factors lend credibility to the Owner's intentions to keep the backfilling of shredded rubber pieces and final reclamation of pit at ground surface within less than 9,000 sq. ft behind the pit landfilling operations.

10.2.5. The financial mechanisms which appear to make the most sense for the Owner of this pit are: 1) establishing a trust fund which conforms to the requirements of this rule, 2) posting a payment or performance surety bond, or 3) obtaining an irrevocable letter of credit which conforms to the requirements of the ARM. If the trust fund option was chosen, payments into the trust account would be made annually over the established pay-in period, with initial payment amount based on the cumulative total for closure plus post-closure care. The design-life of this pit is said to be 20 years, which becomes the pay-in period based on ARM. The initial annual payment amount would be $6,000 ÷ 20 years = $300 per year. Subsequent payments would be computed in accordance with applicable ARM.

11. Erosion Control, Reclamation and Control of Noxious Weeds

11.1. Reclamation activities shall be conducted in accordance with these specifications.

11.2. Adequate measures shall be implemented to control erosion from disturbed areas and topsoil stockpiles, reclaim disturbed areas of the site with topsoil and grass, and control the growth and spread of noxious and unsightly weeds. These measures shall include: stripping and stock piling topsoil from areas to be disturbed by cutting and filling operations for future use in reclamation; placing barriers along the lower perimeter of any soil stockpiles and disturbed area, as required by site conditions to reduce sediment transport; preparing the surface with topsoil over disturbed areas; and seeding disturbed areas with the correct blend of grass seeds.

11.3. Existing trees and other vegetation shall be preserved during pit excavation and landfill operations until excavation of the pit must encroach upon their locations. Disturbance of the natural ground cover due to construction activities should be confined to the areas immediately associated with that construction in order to prevent unnecessary disturbance outside these areas until excavation of the pit reaches those areas of the licensed landfill.

12. Stormwater Runoff Control Provisions

12.1. The stormwater drainage and potential for stormwater runoff have been evaluated in accordance with landfill licensing requirements ARM 17.36.310 (2), Storm Drainage and Circular DEQ 8.

12.1.1. The attached 2 spread sheets entitled "Stormwater calculations: Adkins Class III Mono-fill Waste Tire Landfill" document the results of a stormwater analysis for a typical 100-yr 24-hour storm event. The calculations predict a total of 3.2 inches of stormwater could be collected from this event.

12.1.2. The finished surface of the landfill shall be graded to slope and drain toward the perimeter of the landfill. With a drainage swale constructed around the pit to convey stormwater runoff around the pit/landfill and into the borrow pit running along the south edge of Chicory Road, the landfill is protected from runoff originating on the finished surface and on surrounding property.

12.1.3. A compacted earthen berm shall be constructed within ten feet of the edge of the open pit to protect from stormwater collected on the finished surface. The berm shall be a nominal 2 ft high and blended into the finish contours of the ground. A berm of this configuration is estimated to detain stormwater delivered by the 100-yr 24-hour storm event at a depth not to exceed 4 inches.

12.1.4. Stormwater landing inside the open pit shall be channeled into a lined stormwater detention basin from which it can be pumped. The lined basin should be excavated into the bottom of the pit at its lowest point. A pumping sump must be dug and lined into the lowest end of the basin to accommodate a pump intake. A basin 10 ft wide x 15 ft long x 2 ft average depth will contain the total volume of runoff generated by design storm event. Water discharged from the pump outlet must be spread and dispersed onto ground surface outside pit in such a manner as to prevent soil scour and erosion.

12.1.5. The potential for surface water run-on the finished surface of the landfill or erosion and sediment transport by stormwater surface run-on and runoff within the proposed licensed landfill boundary are low. These conclusions are based on several distinct factors: 1) the substantial surface vegetation that will be planted over this property progressively as the pit is completed; 2) finished surface set above surrounding ground surface; 3) finished surface is contoured and sloping toward perimeter; 4) swales that enhance existing contours to divert surface

water around the perimeter of the landfill site; 5) the ground surface is stable; 6) no active drainage courses cross this property; and 7) no signs of erosion exist. After the stormwater detention measures described herein, and specified on the Site Layout Maps are in place, all disturbed areas are reclaimed in accordance with Section 11.0, and the surface vegetation is reestablished, surface stormwater runoff from the landfill area and run-on from neighboring property onto this landfill will not be significant in accordance with ARM 17.50.1009(d).

12.1.6. The landfill location and proposed layout of operations will not alter pre-development stormwater flow patterns. In addition, specific steps will be taken to install drainage structures, which include grassed swales and compacted earth berms, to control surface water run-off from waste management areas and prevent surface water run-on into waste management areas in accordance with ARM 17.50.1009(d).

12.1.7. Enclosed with this Engineer's Report is a copy of a portion of the Pray quadrangle USGS topo map of this area with contour intervals of 20 ft and a Google aerial photo of the area with arrows drawn to depict existing surface water drainage / flow patterns and confirm that the landfill operation does not restrict the flow of the 100-yr flood, reduce the temporary water storage capacity of the floodplain (no floodplain is within 2000 ft of this property), or result in washout of solid waste so as to pose a hazard to human health and the environment in accordance with ARM 17.50.1009(h).

Closure of Adkins Class III Waste Tire Mono-Fill Landfill

Scope of Work and Estimated Costs to Reclaim Exposed and Disturbed Areas within Landfill Pit

Work shall be performed in accordance with Section 8 of the Engineer's Report for this Project, ARM 17.50.1405, Closure and Post-Closure Care Requirements, and MCA 75.10.216.

1. Anticipated Maximum Area of Exposed Waste Tire Pieces to be covered with sand and gravel soil in lower lift of landfill; or — 9,000 sq. ft

2. Anticipated Maximum Area of Landfill Surface to be Capped with sand/gravel and topsoil — 9,000 sq. ft

Note that only one of these areas will reasonably be open at any time due to the landfill operations plan presented in the Engineer's report and the distinctly separate areas in which they occur. Therefore, worst case scenario would be to cap landfill surface.

3. Tire carcasses disposal costs: 3 employees x 8 hrs x $20.00/hr each x 2.5 (payroll multiplication factor) — $1200

Explanation of quantity of tire carcasses to be disposed and estimated cost of disposal: This facility is designed and will be equipped and staffed to receive, process and dispose of 5000 tires per day in landfill. There is no scenario, short of a catastrophic natural disaster or equal, which could reasonably be expected to permanently and completely halt landfill operations on such short notice as to prevent the cleanup of accumulated carcasses received by the regular employees in the course of their day. The quantity of carcasses could total at most one full day's receipts. Seeing even a couple days in advance the circumstances which would force permanent landfill shut down would allow employees to decline to accept additional tires. Therefore, processing and disposal costs associated with this estimate are limited to one day's wages for a crew of 3 experienced employees.

4. Cover exposed lift at ground surface with 1.5 ft of sand/gravel excavated on-site — 500 cy @$3.20/cy = — $ 1600

5. Cap sand/gravel layer with min. 0.5 ft thick layer of topsoil hauled from pile on-site — 170 cy @ $3.20/cy = — $ 550

6. Use grader to shape and contour surface of sand/gravel — 5 hrs @ $125/hr = — $ 625

7. Seed and stabilize exposed area:
   - Grass seed material — $ 150
   - labor hand broadcast seed — $ 200
   - Labor to stabilize surface — $ 375

8. Maintain erosion control measures already in place — $ 500

9. Contingency to cover miscellaneous items not listed here — $ 800

10. Total to complete closure — $6000

Area of Interest Interactive Map

View Extent Contiguous U.S. Scale (not to scale)

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Properties and Qualities Ratings

Open All | Close All

- Soil Chemical Properties
- Soil Erosion Factors
- Soil Physical Properties
- **Soil Qualities and Features**
  - AASHTO Group Classification (Surface)
  - Depth to a Selected Soil Restrictive Layer
  - Depth to Any Soil Restrictive Layer
  - Drainage Class
  - Frost Action
  - Frost-Free Days
  - Hydrologic Soil Group
  - Map Unit Name
  - Parent Material Name
  - Representative Slope
  - **Unified Soil Classification (Surface)**

View Description | View Rating

View Options

Map

Table

Description of Rating

Rating Options —

Detailed Description

Advanced Options

Aggregation Method: Dominant Condition

Component Percent Cutoff

Tie-break Rule: Lower / Higher

Layer Options: Surface Layer

Depth Range

Top Depth

Tables — Unified Soil Classification (Surface) — Summary By Map Unit

Summary by Map Unit — Park County Area, Montana

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
25B	Cozdome-Cozberg complex, 0 to 4 percent slopes	SC-SM	68.5	34.9%
202C	Vendome-Cozdome complex, 2 to 8 percent slopes	SC-SM	21.3	10.9%
220F	Sixbeacon, cobbly-Vendome complex, 35 to 60 percent slopes	SC	18.7	9.5%
421A	Beaverell cobbly loam, 0 to 2 percent slopes	CL	37.4	19.1%
444A	Cetrack-Vendome-Binna complex, 0 to 2 percent slopes	CL	5.7	2.9%
845A	Vendome-Cetrack complex, 0 to 2 percent slopes	CL	37.7	19.2%
1303	Nirling, occasionally flooded-Clunton, frequently flooded complex, 0 to 8 percent slopes	SC-SM	6.8	3.4%
Totals for Area of Interest			**196.1**	**100.0%**

Description — Unified Soil Classification (Surface)

The Unified soil classification system classifies mineral and organic mineral soils for engineering purposes on the basis of particle-size characteristics, liquid limit, and plasticity index. It identifies three major soil divisions: (i) coarse-grained soils having less than 50 percent, by weight, particles smaller than 0.074 mm in diameter; (ii) fine-grained soils having 50 percent or more, by weight, particles smaller than 0.074 mm in diameter; and (iii) highly organic soils that demonstrate certain organic characteristics. These divisions are further subdivided into a total of 15 basic soil groups. The major soil divisions and basic soil groups are determined on the basis of estimated or measured values for grain-size distribution and Atterberg limits. ASTM D 2487 shows the criteria chart used for classifying soil in the Unified system and the 15 basic soil groups of the system and the plasticity chart for the Unified system.

The various groupings of this classification correlate in a general way with the engineering behavior of soils. This correlation provides a useful first step in any field or laboratory investigation for engineering purposes. It can serve to make some general interpretations relating to probable performance of the soil for engineering uses.

For each soil horizon in the database one or more Unified soil classifications may be listed. One is marked as the representative or most commonly occurring. The representative classification is shown here for the surface layer of the soil.

Rating Options — Unified Soil Classification (Surface)

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

Layer Options: Surface Layer

Natural Resources Conservation Service

Web Soil Survey

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A A A

Area of Interest (AOI) | Soil Map | Soil Data Explorer | Shopping Cart (Free)

View Soil Information By Use: All Uses

Printable Version | Add to Shopping Cart

Intro to Soils | Suitabilities and Limitations for Use | Soil Properties and Qualities | Ecological Site Assessment | Soil Reports

Map — Disposal of Wastewater by Rapid Infiltration

Scale (not to scale)

Warning: Soil Ratings Map may not be valid at this scale.

Search

Suitabilities and Limitations Ratings

Open All | Close All

- Building Site Development
- Construction Materials
- Disaster Recovery Planning
- Land Classifications
- Land Management
- Military Operations
- Recreational Development
- Sanitary Facilities
- Vegetative Productivity
- **Waste Management**
  - Disposal of Wastewater by Irrigation
  - **Disposal of Wastewater by Rapid Infiltration**

View Description | View Rating

View Options

Map

Table

Component Breakdown and Rating Reasons

Numeric Values

Description of Rating

Rating Options

Detailed Description

Advanced Options

View Description | View Rating

- Land Application of Municipal Sewage Sludge
- Manure and Food-Processing Waste
- Overland Flow Treatment of Wastewater
- Slow Rate Treatment of Wastewater
- Water Management

Tables — Disposal of Wastewater by Rapid Infiltration — Summary By Map Unit

Summary by Map Unit — Park County Area, Montana

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
25B	Cozdome-Cozberg complex, 0 to 4 percent slopes	Somewhat limited	Cozdome (55%)	Slow water movement (0.32)	68.5	34.9%
			Cozberg (28%)	Slow water movement (0.32)		
202C	Vendome-Cozdome complex, 2 to 8 percent slopes	Somewhat limited	Vendome (30%)	Cobble content (0.95)	21.3	10.9%
				Slow water movement (0.62)		
				Slope (0.13)		
			Cozdome (30%)	Slow water movement (0.32)		
				Slope (0.13)		
220F	Sixbeacon, cobbly-Vendome complex, 35 to 60 percent slopes	Very limited	Sixbeacon (55%)	Slope (1.00)	18.7	9.5%
				Slow water movement (0.99)		
				Cobble content (0.80)		
			Vendome (28%)	Slope (1.00)		
				Cobble content (0.67)		
				Slow water movement (0.32)		
421A	Beaverell cobbly loam, 0 to 2 percent slopes	Very limited	Beaverell (85%)	Slow water movement (1.00)	37.4	19.1%
444A	Cetrack-Vendome-Binna complex, 0 to 2 percent slopes	Very limited	Cetrack (35%)	Slow water movement (1.00)	5.7	2.9%
				Cobble content (0.64)		
			Vendome (30%)	Slow water movement (1.00)		
Totals for Area of Interest					**196.1**	**100.0%**

Summary by Map Unit — Park County Area, Montana

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Cobble content (0.80)		
			Binna (15%)	Slow water movement (1.00)		
845A	Vendome-Cetrack complex, 0 to 2 percent slopes	Very limited	Vendome (55%)	Slow water movement (1.00)	37.7	19.2%
				Cobble content (0.99)		
			Cetrack (30%)	Slow water movement (1.00)		
1303	Nirling, occasionally flooded-Clunton, frequently flooded complex, 0 to 8 percent slopes	Very limited	Nirling (60%)	Depth to saturated zone (1.00)	6.8	3.4%
				Flooding (0.60)		
				Slow water movement (0.32)		
				Slope (0.13)		
				Cobble content (0.03)		
			Clunton (20%)	Ponding (1.00)		
				Slow water movement (1.00)		
				Depth to saturated zone (1.00)		
				Flooding (0.60)		
Totals for Area of Interest					**196.1**	**100.0%**

Tables — Disposal of Wastewater by Rapid Infiltration — Summary by Rating Value

Summary by Rating Value

Rating	Acres in AOI	Percent of AOI
Very limited	106.3	54.2%
Somewhat limited	89.8	45.8%
Totals for Area of Interest	**196.1**	**100.0%**

Description — Disposal of Wastewater by Rapid Infiltration

Rapid infiltration of wastewater is a process in which wastewater applied in a level basin at a rate of 4 to 120 inches per week percolates through the soil. The wastewater may eventually reach the ground water. The application rate commonly exceeds the rate needed for irrigation of cropland. Vegetation is not a necessary part of the treatment; thus, the basins may or may not be vegetated. The thickness of the soil material needed for proper treatment of the wastewater is more than 72 inches. As a result, geologic and hydrologic investigation is needed to ensure proper design and performance and to determine the risk of ground-water pollution.

Soil properties are important considerations in areas where soils are used as sites for the treatment and disposal of organic waste and wastewater. Selection of soils with properties that favor waste management can help to prevent environmental damage.

Municipal wastewater is the waste stream from a municipality. It contains domestic waste and may contain industrial waste. It may have received primary or secondary treatment. It is rarely untreated sewage. Food-processing wastewater results from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In places it is high in content of sodium and chloride. The effluent in lagoons and storage ponds is from facilities used to treat or store food-processing wastewater or domestic or animal waste. Domestic and food-processing wastewater is very dilute, and the effluent from the facilities that treat or store it commonly is very low in content of carbonaceous and nitrogenous material; the content of nitrogen commonly ranges from 10 to 30 milligrams per liter. The wastewater from animal waste treatment lagoons or storage ponds, however, has much higher concentrations of these materials, mainly because the manure has not been diluted as much as the domestic waste. The content of nitrogen in this wastewater generally ranges from 50 to 2,000 milligrams per liter. When wastewater is applied, checks should be made to ensure that nitrogen, heavy metals, and salts are not added in excessive amounts.

The ratings are based on the soil properties that affect the risk of pollution and the design, construction, and performance of the system. Depth to a water table, ponding, flooding, and depth to bedrock or a cemented pan affect the risk of pollution and the design and construction of the system. Slope, stones, and cobbles also affect design and construction. Saturated hydraulic conductivity (Ksat) and reaction affect performance. Permanently frozen soils are unsuitable for waste treatment.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Search

Properties and Qualities Ratings

Open All | Close All

- Soil Chemical Properties
- Soil Erosion Factors
- Soil Physical Properties
- **Soil Qualities and Features**
  - AASHTO Group Classification (Surface)
  - Depth to a Selected Soil Restrictive Layer
  - Depth to Any Soil Restrictive Layer
  - **Drainage Class**

View Description | View Rating

View Options

Map

Table

Description of Rating

Rating Options

Detailed Description

Advanced Options

Aggregation Method: Dominant Condition

Component Percent Cut...

Tie-break Rule: Lower / Higher

View Description | View Rating

- Frost Action
- Frost-Free Days
- Hydrologic Soil Group
- Map Unit Name
- Parent Material Name
- Representative Slope
- Unified Soil Classification (Surface)
- Water Features

Tables — Drainage Class — Summary By Map Unit

Summary by Map Unit — Park County Area, Montana

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
25B	Cozdome-Cozberg complex, 0 to 4 percent slopes	Well drained	68.5	34.9%
202C	Vendome-Cozdome complex, 2 to 8 percent slopes	Well drained	21.3	10.9%
220F	Sixbeacon, cobbly-Vendome complex, 35 to 60 percent slopes	Well drained	18.7	9.5%
421A	Beaverell cobbly loam, 0 to 2 percent slopes	Well drained	37.4	19.1%
444A	Cetrack-Vendome-Binna complex, 0 to 2 percent slopes	Well drained	5.7	2.9%
845A	Vendome-Cetrack complex, 0 to 2 percent slopes	Well drained	37.7	19.2%
1303	Nirling, occasionally flooded-Clunton, frequently flooded complex, 0 to 8 percent slopes	Somewhat poorly drained	6.8	3.4%
Totals for Area of Interest			**196.1**	**100.0%**

Description — Drainage Class

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Rating Options — Drainage Class

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Search

Properties and Qualities Ratings

Open All | Close All

- Soil Chemical Properties
- Soil Erosion Factors
- Soil Physical Properties
- **Soil Qualities and Features**
  - AASHTO Group Classification (Surface)
  - Depth to a Selected Soil Restrictive Layer
  - **Depth to Any Soil Restrictive Layer**

View Description | View Rating

View Options

Map ☑
Table ☑
Description of Rating ☑
Rating Options ☑
Detailed Description ☐

Advanced Options

View Description | View Rating

- Drainage Class
- Frost Action
- Frost-Free Days
- Hydrologic Soil Group
- Map Unit Name
- Parent Material Name
- Representative Slope
- Unified Soil Classification (Surface)

- Water Features

Tables — Depth to Any Soil Restrictive Layer — Summary By Map Unit

Summary by Map Unit — Park County Area, Montana

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
25B	Cozdome-Cozberg complex, 0 to 4 percent slopes	>200	68.5	34.9%
202C	Vendome-Cozdome complex, 2 to 8 percent slopes	>200	21.3	10.9%
220F	Sixbeacon, cobbly-Vendome complex, 35 to 60 percent slopes	>200	18.7	9.5%
421A	Beaverell cobbly loam, 0 to 2 percent slopes	>200	37.4	19.1%
444A	Cetrack-Vendome-Binna complex, 0 to 2 percent slopes	>200	5.7	2.9%
845A	Vendome-Cetrack complex, 0 to 2 percent slopes	>200	37.7	19.2%
1303	Nirling, occasionally flooded-Clunton, frequently flooded complex, 0 to 8 percent slopes	>200	6.8	3.4%
Totals for Area of Interest			**196.1**	**100.0%**

Description — Depth to Any Soil Restrictive Layer

A "restrictive layer" is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers.

This theme presents the depth to any type of restrictive layer that is described for each map unit. If more than one type of restrictive layer is described for an individual soil type, the depth to the shallowest one is presented. If no restrictive layer is described in a map unit, it is represented by the "> 200" depth class.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options — Depth to Any Soil Restrictive Layer

Units of Measure: centimeters

Aggregation Method: Dominant Component

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Component" returns the attribute value associated with the component with the highest percent composition in the map unit. If more than one component shares the highest percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher attribute value should be returned in the case of a percent composition tie.

The result returned by this aggregation method may or may not represent the dominant condition throughout the map unit.

Component Percent Cutoff: *None Specified*

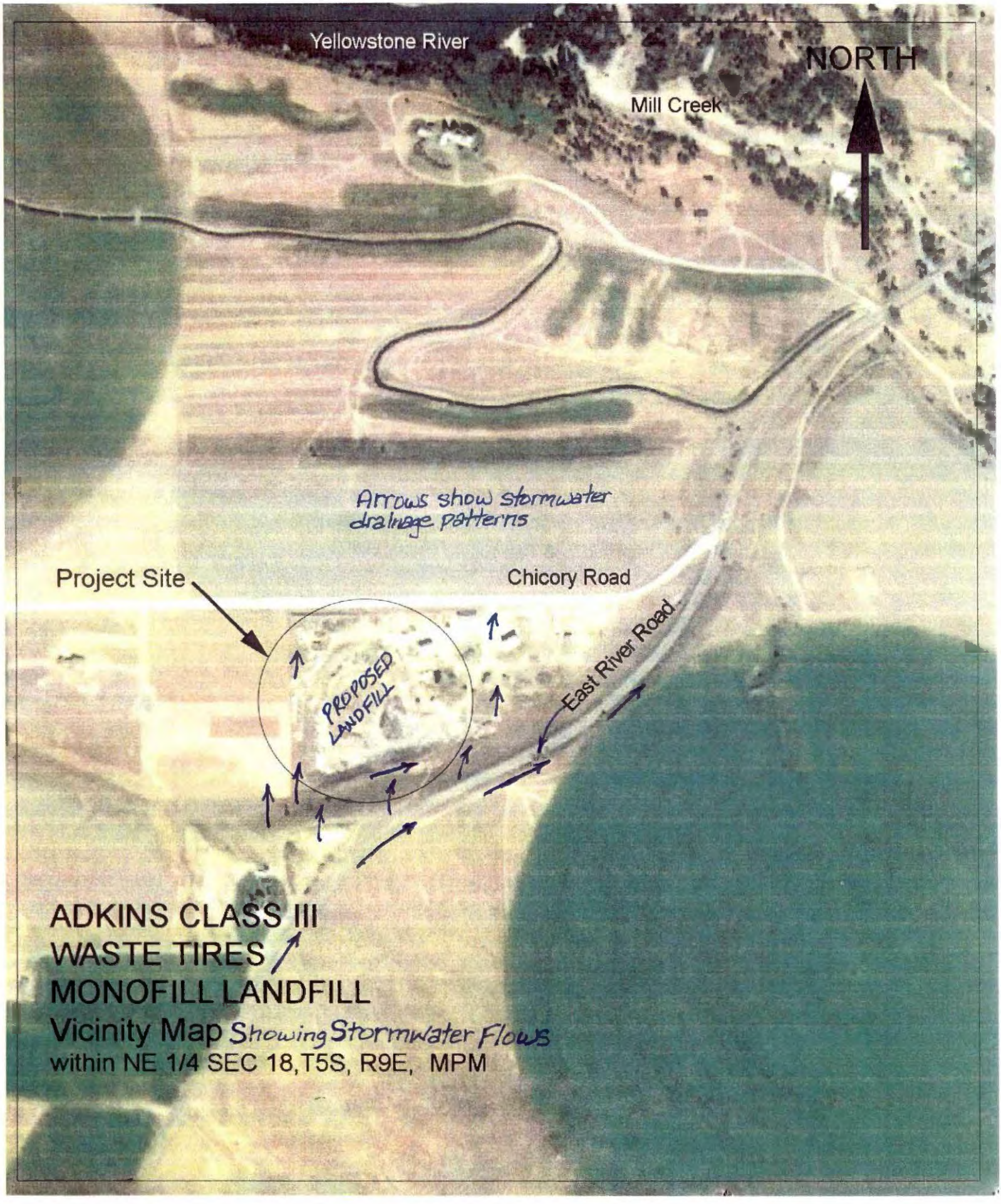
Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Lower

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Interpret Nulls as Zero: No

This option indicates if a null value for a component should be converted to zero before aggregation occurs. This will be done only if a map unit has at least one component where this value is not null.



ADKINS CLASS III
WASTE TIRES
MONOFILL LANDFILL
Vicinity Map Showing Stormwater Flows
within NE 1/4 SEC 18, T5S, R9E, MPM

Adkins Class III Monofill Waste Tire Landfill

Pray Area Site: Licensed Pit Area 13.75 acres
Volume Detained On-Site from Design 10 yr-6 hour Storm
REQUIRED STORMWATER DETENTION VOLUME:

RELATIVE IMPERVIOUSNESS FACTORS:		**(C Range)**	**(C Used)**
PAVED AREAS/STRUCTURES	=	(0.8-0.9)	0.9
GRAVELED AREAS	=	(0.35-0.8)	0.8
UNIMPROVED RANGELAND	=	(0.15-0.4)	0.3
LANDSCAPED (lawn, shurbs,trees)	=	(0.1-0.3)	0.1

10 YEAR -6HOUR STORM EVENT: i **1.20** in. per 6 hrs **(Input Site Rainfall Intensity 10-yr 6-hr)**
T 3600 sec/hr

		NEW SITE LAYOUT		**EXISTING SITE LAYOUT**	
AREAS:		**AREA (Ft2)**		**AREA (Ft2)**	
TOTAL AREA OF WATERSHED	=	**598,950** sq. ft.	13.75 acres		
		Input Only		**Input Only**	
PAVED AREAS/STRUCTURES	=	**8000.00** sq. ft.	0.18 acres	**0.00** sq. ft.	0.00 acres
GRAVELED AREAS	=	**87120.00** sq. ft.	2.00 acres	**0.00** sq. ft.	0.00 acres
UNIMPROVED	=	**299475.00** sq. ft.	6.87 acres	**0** sq. ft.	0.00 acres
LANDSCAPED	=	**204355.00** sq. ft.	4.69 acres	**0.00** sq. ft.	0.00 acres
TOTAL	=	**598,950** sq. ft.	13.75 acres	**0** sq. ft.	0.00 acres

VOLUMES REQUIRED: Volume of runoff = (C*I*A)*(43560/12)
Total Volume Difference = New Volume - Existing Volume

PAVED AREAS/STRUCTURES	=	720.00 C.F.	26.67 C.Y.	0.00 C.F.	0.00 C.Y.
GRAVELED AREAS	=	6969.60 C.F.	258.13 C.Y.	0.00 C.F.	0.00 C.Y.
UNIMPROVED	=	8984.25 C.F.	332.75 C.Y.	0.00 C.F.	0.00 C.Y.
LANDSCAPED	=	2043.55 C.F.	75.69 C.Y.	0.00 C.F.	0.00 C.Y.
TOTAL VOLUME	=	18717.40 C.F.	693.24 C.Y.	0.00 C.F.	0.00 C.Y.
FLOW IN C.F.S.	=	0.87 C.F.S.		0.00 C.F.S.	

TOTAL VOLUME DIFFERENCE	=	**18717 C.F.**	**693 C.Y.**
TOTAL FLOW IN C.F.S.	=	0.87 C.F.S.	

Adkins Class III Monofill Waste Tire Landfill

Pray Area Site: Licensed Pit Area 13.75 acres
Volume Detained On-Site from Design 100 yr-24 hour Storm
REQUIRED STORMWATER DETENTION VOLUME:

RELATIVE IMPERVIOUSNESS FACTORS:		**(C Range)**	**(C Used)**
PAVED AREAS/STRUCTURES	=	(0.8-0.9)	0.9
GRAVELED AREAS	=	(0.35-0.8)	0.8
UNIMPROVED RANGELAND	=	(0.15-0.4)	0.3
LANDSCAPED (lawn, shurbs,trees)	=	(0.1-0.3)	0.1

10 YEAR -6HOUR STORM EVENT: **i** **3.20** in. per 24 hr **(Input Site Rainfall Intensity 100-yr 24-hr)**
T 3600 sec/hr

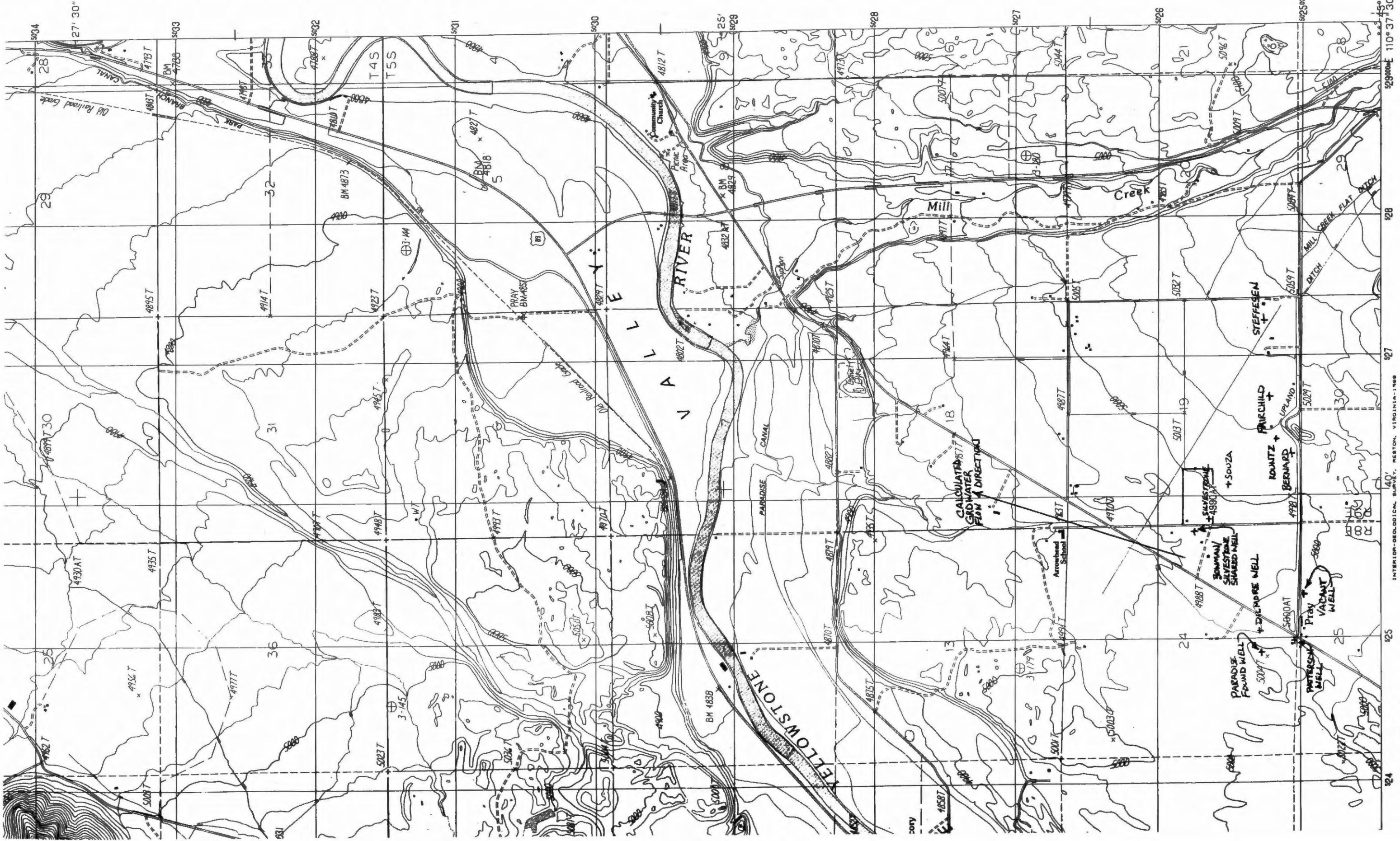
		NEW SITE LAYOUT		**EXISTING SITE LAYOUT**	
AREAS:		**AREA (Ft2)**		**AREA (Ft2)**	
TOTAL AREA OF WATERSHED	=	**598,950** sq. ft.	13.75 acres		
		Input Only		**Input Only**	
PAVED AREAS/STRUCTURES	=	**8000.00** sq. ft.	0.18 acres	**0.00** sq. ft.	0.00 acres
GRAVELED AREAS	=	**87120.00** sq. ft.	2.00 acres	**0.00** sq. ft.	0.00 acres
UNIMPROVED	=	**299475.00** sq. ft.	6.87 acres	**0** sq. ft.	0.00 acres
LANDSCAPED	=	**204355.00** sq. ft.	4.69 acres	**0.00** sq. ft.	0.00 acres
TOTAL	=	**598,950** sq. ft.	13.75 acres	**0** sq. ft.	0.00 acres

VOLUMES REQUIRED: Volume of runoff = (C*I*A)*(43560/12)
Total Volume Difference = New Volume - Existing Volume

PAVED AREAS/STRUCTURES	=	1920.00 C.F.	71.11 C.Y.	0.00 C.F.	0.00 C.Y.
GRAVELED AREAS	=	18585.60 C.F.	688.36 C.Y.	0.00 C.F.	0.00 C.Y.
UNIMPROVED	=	23958.00 C.F.	887.33 C.Y.	0.00 C.F.	0.00 C.Y.
LANDSCAPED	=	5449.47 C.F.	201.83 C.Y.	0.00 C.F.	0.00 C.Y.
TOTAL VOLUME	=	49913.07 C.F.	1848.63 C.Y.	0.00 C.F.	0.00 C.Y.
FLOW IN C.F.S.	=	2.31 C.F.S.		0.00 C.F.S.	

TOTAL VOLUME DIFFERENCE	=	**49913 C.F.**	**1849 C.Y.**
TOTAL FLOW IN C.F.S.	=	0.58 C.F.S.	

DETERMINATION OF GROUNDWATER FLOW DIRECTION AND WATER TABLE GRADIENT



PRAY AREA, PARADISE VALLEY
CALCULATE GROUNDWATER GRADIENT AND FLOW DIRECTION

HSWL = 4771.14 (VACANT WELL)
ISWL = 4769.20 (Tr B-2 TEST WELL)
LSWL = 4761.81 (SOUZA WELL)

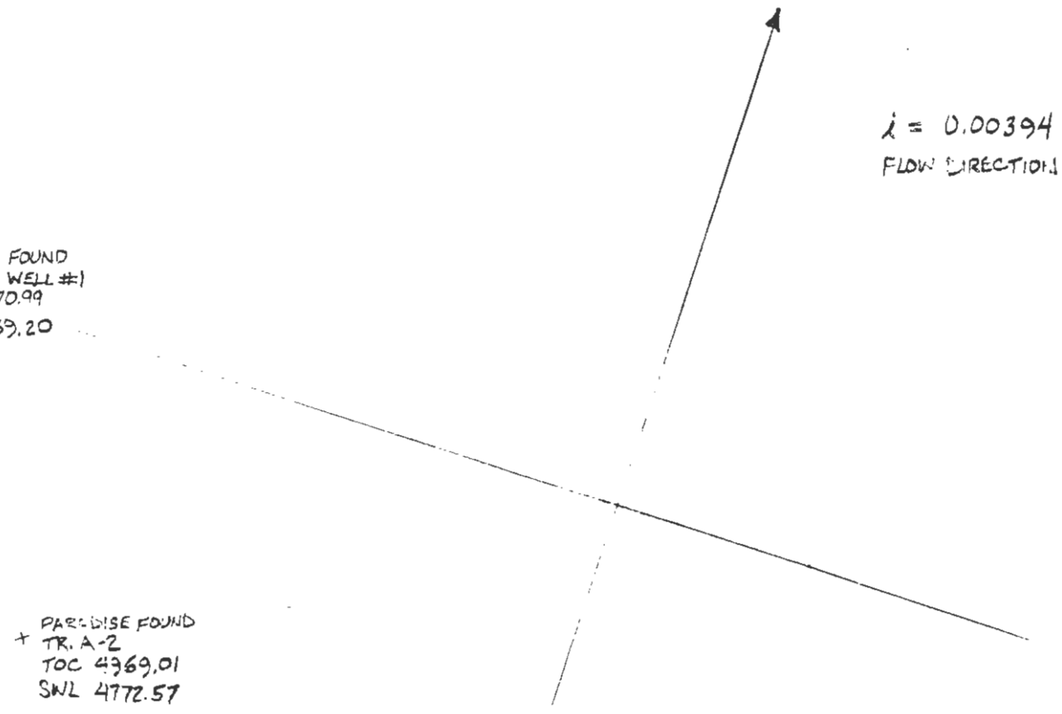
$$\frac{3065 \text{ (DIST. BTWN H \& L)}}{4771.14 - 4761.81} = 328.51' / \text{ft drop}$$

$$(4771.14 - 4769.20) \times 328.51' = 637.31'$$

Dist from HSWL well to ISWL contour = 492'
(measured along line ⊥ to ISWL contour)

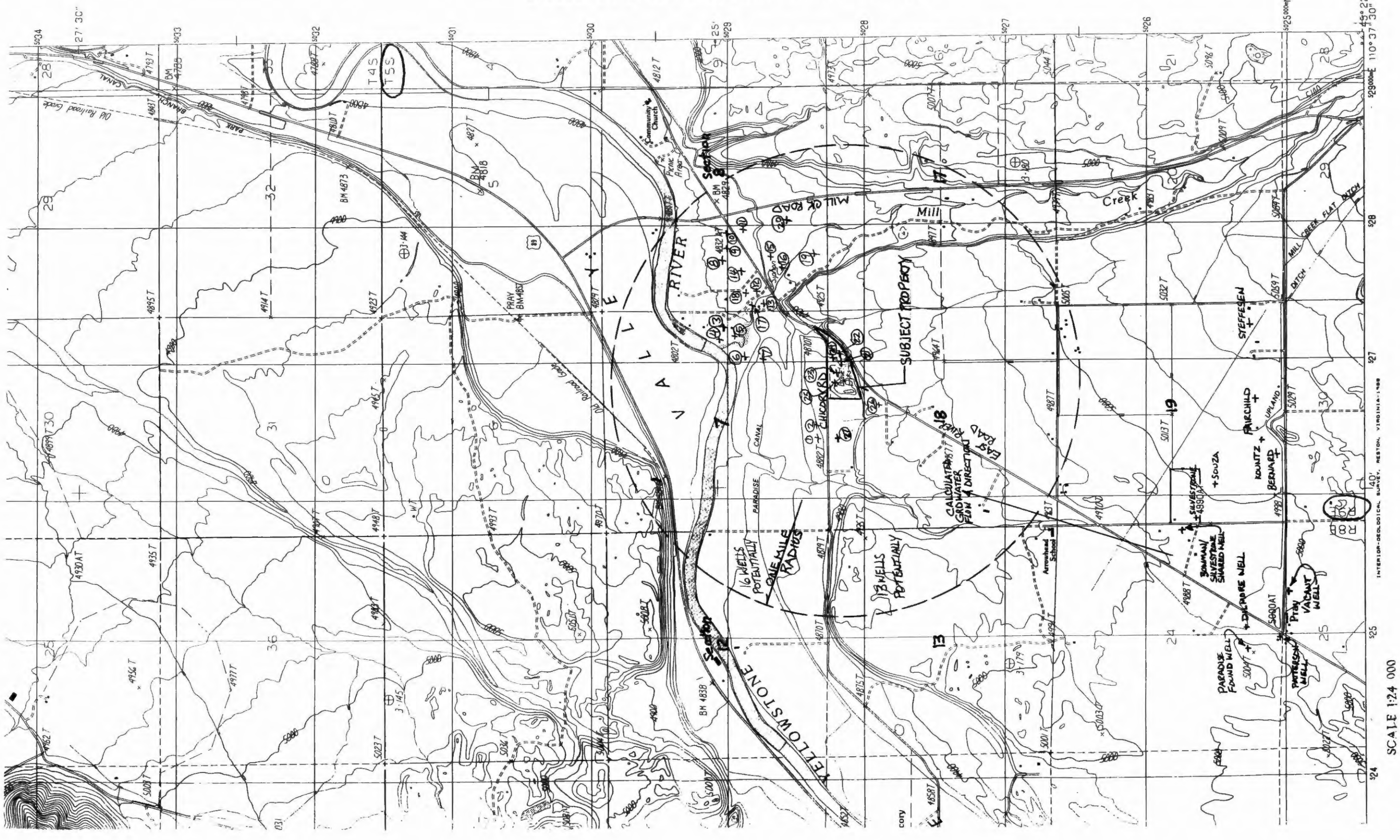
Hydraulic Gradient = (4771.14 − 4769.20) ÷ 492'
= 0.00394

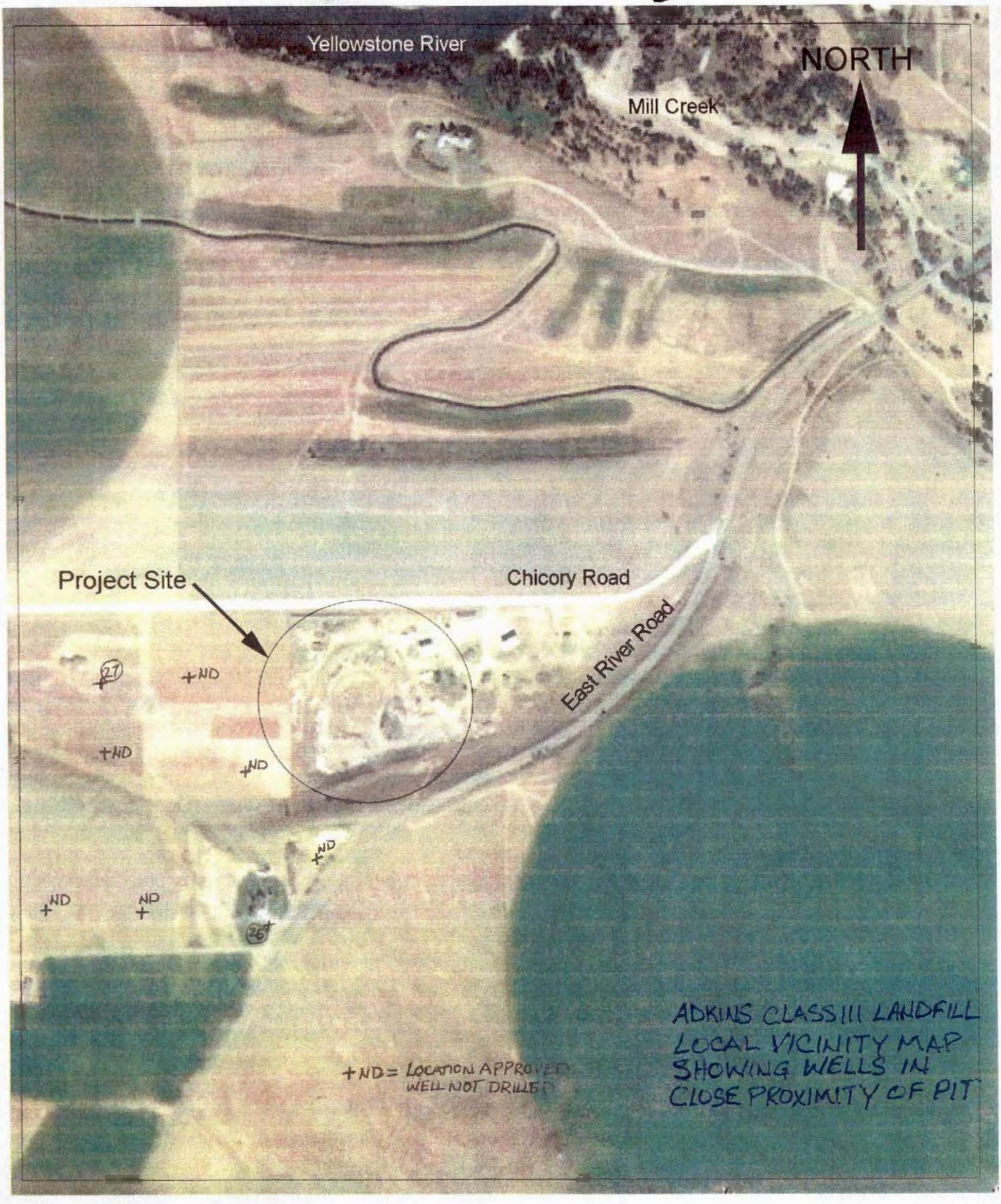
GROUNDWATER GRADIENT AND FLOW DIRECTION
FOR PRAY AREA
CALCULATED BY THREE POINT SOLUTION



SCALE:
1" = 300'

ADKINS CLASS III LANDFILL
LOCATIONS OF WELLS IN 2 MILE RADIUS
REFER TO INDIVIDUAL WELL LOGS IN SUBMITTAL




Yellowstone River
NORTH
Mill Creek
Project Site
Chicory Road
East River Road
+ND
+ND
+ND
+ND
+ND
+ND
27
26
+ND = LOCATION APPROVED WELL NOT DRILLED
ADKINS CLASS III LANDFILL
LOCAL VICINITY MAP
SHOWING WELLS IN
CLOSE PROXIMITY OF PIT

LISTS OF WELLS IN AREA

Groundwater Information Center
Montana Bureau of Mines and Geology
Montana Tech of The University of Montana
1300 West Park Street - Natural Resources Building Room 329
Butte Montana 59701-8997

GWIC Data > Well Construction Data > Township: 05S Range: 08E Sec: 12, 13

The following data were returned from the GWIC databases for the area you requested. For a more detailed description of the data view the GWIC Metadata report. If you notice data entry errors or have questions please let us know by clicking here to leave us a message. If you wish to view a one page report for a particular site, click the hyperlinked **Gwic Id** for that well. Scroll to the right of your screen to view all the data. All data displayed on the screen may not show up when printed.

Retrieval Statistics*

Field	Max	Min	Avg
Total Depth (ft)	260.00	33.00	121.37
Static Water Level (ft)	195.00	15.00	79.66
Yield (gpm)	500.00	10.00	56.70

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

Did you know about

Other GWIC data

GWIC has 5 field visit(s) for this request area.
GWIC has 9 water level(s) for this request area.

Thanks, Just take me back to the menu.

Other MBMG data

MBMG has 405 publications available for PARK county.
MBMG has 1 abandoned mine record(s) for this request area.

Gwic Id	PDF	DNRC WR	Site Name	Twn	Rng	Sec	Q Sec	Ver?	Type	Td	Swl	Pwl	Rwl	Yield	Test	Date	Use
102466			MORELAND MRS MARION	05S	08E	12		No	WELL	33.00	15.00	33.0		30.00	PUMP	6/19/1972	DOMESTIC
213424			GOLDBERG MD SHELDON	05S	08E	12	ACC	No	WELL	62.00	41.00		41.00	30.00	AIR	2/2/2004	DOMESTIC
149333		C101906-00	HUDSON JOHN	05S	08E	12	ACD	No	WELL	58.50	38.00			25.00	AIR	3/14/1995	DOMESTIC
236349			HARKINS ED	05S	08E	12	ADAD	No	WELL	79.00	50.00		50.00	60.00	AIR	5/25/2007	DOMESTIC
239722			MCCRUM BLISS	05S	08E	12	ADDD	No	WELL	100.00	38.00		38.00	80.00	AIR	9/19/2007	DOMESTIC
183452		C113327-00	CLUTE BRETT	05S	08E	12	BA	No	WELL	179.00	131.00		131.00	30.00	AIR	6/21/2000	DOMESTIC
213657			MILLER JIM	05S	08E	12	BACD	No	WELL	180.00	125.00		125.00	40.00	AIR	5/25/2004	DOMESTIC
203145			JEDD SUSAN	05S	08E	12	BBAC	No	WELL	179.00	124.00		124.00	25.00	AIR	4/30/2003	DOMESTIC
152240		C095510-00	YOUNG SR JAMES D	05S	08E	12	BCC	No	WELL	158.00	107.00	150.00		50.00	AIR	6/13/1995	DOMESTIC
220249			WILSON TIM	05S	08E	12	BCD	No	WELL	80.00	48.00			40.00	AIR	6/21/2005	DOMESTIC
102467			BOSSART KEN	05S	08E	12	BD	No	WELL	52.50	20.00	30.00		30.00	BAILER	10/19/1981	DOMESTIC
183946			BROOKE CARL AND HART PENNY	05S	08E	12	BDBB	No	WELL	159.00	104.00		104.00	40.00	AIR	7/28/2000	DOMESTIC
227720			KING JOE	05S	08E	12	BDBC	No	WELL	101.00	57.00		57.00	60.00	AIR	5/24/2006	DOMESTIC
136261		C084784-00	LIBBEY CHAN	05S	08E	12	BDC	No	WELL	98.60	45.00	45.00		90.00	AIR	4/27/1993	TEST WELL
220250			WILSON KERRY	05S	08E	12	BDC	No	WELL	80.00	45.00			40.00	AIR	6/21/2005	DOMESTIC
142859		C084784-00	YELLOWSTONES EDGE RV PARK	05S	08E	12	CABB	No	WELL	92.00	35.90	49.60		120.00	PUMP	8/24/1993	PUBLIC WATER SUPPLY
192470			VAILLANCOURT MARK	05S	08E	12	CBBB	No	WELL	79.00	48.00		48.00	80.00	AIR	11/6/2001	DOMESTIC
102468			SMITH RUSSELL	05S	08E	12	D	No	WELL	108.00	51.00	71.00		40.00	BAILER	2/7/1983	DOMESTIC
102469		C014421-00	HOBBS HARRY	05S	08E	12	DA	No	WELL	50.00	30.00	40.00		26.00	BAILER	8/21/1975	DOMESTIC
149090			HUDSON JOHN	05S	08E	12	DA	No	WELL	78.50	56.00			25.00	AIR	3/14/1995	DOMESTIC
181687			FORSETH EIVIND	05S	08E	12	DAAA	No	WELL	78.00	52.00		52.00	35.00	AIR	4/19/1994	DOMESTIC
243961			GREZLOUSKI STOJAN AND JEAN	05S	08E	12	DABC	No	WELL	100.00	65.00		65.00	60.00	AIR	3/21/2008	DOMESTIC
189111		C116426-00	PETERSEN JAMES	05S	08E	12	DADA	No	WELL	100.00	68.00		68.00	70.00	AIR	4/20/2001	DOMESTIC
243959		C30043289	FORSETH, EIVIND B AND JUDITH	05S	08E	12	DBAB	No	WELL	101.00	68.00		68.00	50.00	AIR	4/2/2008	DOMESTIC
212314			SEIBERT STEVE AND MARLENE	05S	08E	12	DBB	No	WELL	100.00	61.00		61.00	50.00	AIR	4/29/2004	DOMESTIC
196564			GERTH JEFFREY AND APRIL	05S	08E	12	DBCB	No	WELL	119.00	71.00		71.00	55.00	AIR	5/24/2002	DOMESTIC

16 Wells Potentially in Sec 12 w/in 1 mile of Pit

225588			ALVERSON DENNIS	05S	08E	12	DCCD	No	WELL	140.00	83.00		83.00	60.00	AIR	4/21/2006	DOMESTIC
147733			LAMMELA MIKE	05S	08E	12	DCDDDA	No	WELL	77.00	62.00	63.50		10.00	PUMP	6/10/1994	DOMESTIC
151258		C100720-00	KNOLL PAT & AMY	05S	08E	12	DDBD	Yes	WELL	111.00	79.00			20.00	AIR	5/15/1995	DOMESTIC
189114		C30002446	HELMS BRIAN	05S	08E	12	DDCA	No	WELL	119.00	76.00		76.00	50.00	AIR	3/10/2001	DOMESTIC
130001			GILLMAN J WAYNE	05S	08E	12	DDD	No	WELL	60.00	45.00	55.00		15.00	AIR	2/14/1992	DOMESTIC
130002		C082648-00	HODGKINSON DUANE	05S	08E	12	DDD	No	WELL	58.50	37.00	55.00		50.00	AIR	4/14/1992	DOMESTIC
169851		C106125-00	LIBSACK GARY AND CONNIE	05S	08E	12	DDD	No	WELL	98.00	74.00			30.00	AIR	10/13/1994	DOMESTIC
206318			YELLOWSTONE TRAILS RANCH TEST WELL # 1	05S	08E	13		No	WELL								
206319			YELLOWSTONE TRAILS RANCH TEST WELL # 2	05S	08E	13		No	WELL								
206316			YELLOWSTONE TRAILS RANCH TEST WELL #4	05S	08E	13		No	WELL								
102470			HOBBS HARRY B	05S	08E	13	A	No	WELL	180.00	160.00			500.00	OTHER	1/1/1900	STOCKWATER
221801			IBES GALEN	05S	08E	13	AADC	No	WELL	240.00	161.00		161.00	40.00	AIR	5/5/2005	DOMESTIC
205557			AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL 2	05S	08E	13	ABAD	Yes	WELL	239.00	168.00		168.00	40.00	AIR	6/25/2003	DOMESTIC
205595		C30012962	AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL 1	05S	08E	13	ABDA	Yes	WELL	239.00	174.00		174.00	40.00	OTHER	6/24/2003	DOMESTIC
245654			LAMM JOE & DEBRA	05S	08E	13	BDDB	No	WELL	260.00	195.00		195.00	30.00	AIR	5/29/2008	DOMESTIC
212142			DENNY GARY	05S	08E	13	CBB	No	WELL	160.00	120.00		120.00	30.00	AIR	6/21/2004	DOMESTIC
162941		P100729-00	ARROWHEAD SCHOOL DISTRICT 75	05S	08E	13	DDDD	Yes	WELL	248.00	158.30	182.30		72.00	PUMP	8/19/1996	PUBLIC WATER SUPPLY

Sec 12

Sec 1:

6 well
Potentia
in Sec 1
w/in] mi
of Pit

End of Report
43 record(s) listed

Items of Note:

[1]This report is restricted to site types of **WELL, BOREHOLE, SPRING, COAL BED METHANE WELL, PETWELL, PIEZOMETER**

[2]A single well record (a distinct GWIC Id) may be represented by more than one line in this report if more than one performance test was conducted on the well at the time of drilling

Explanation of Columns:

GWIC Id = Key field for the GWIC database. Links to one page reports
PDF = Are scanned documents available through the Document Manager?

- = Yes, click on the icon to download the PDF file
- = No, well was submitted electronically. No paper record exists
- = No, record does have a known well log but it is not scanned yet
- = No, record may or may not have a document to scan. Metadata is unclear.
- = No, record was created from a source other than a well log. No paper record exists.

DNRC WR = Water right number assigned to this site by Department of Natural Resources and Conservation
Site Name = Current owner name assigned to GWIC record
Location = Location of site in Montana township, range, section, and quarter-section coordinates.
Ver? = Has this location been verified by field staff?
Type = Type of site assigned to GWIC record
Td = Total depth of well in feet below ground
Swl = Static water level in feet above/below ground - Negative values are reported for water levels that are above land surface
Pwl = Pumping water level in feet below ground
Rwl = Recovery water level in feet below ground
Yield = Yield in gallons per minute.
Test = Type of performance test reported
Date = Completion date of well/borehole
Use = Reported use of water.

Disclaimer:

Groundwater Information Center
Montana Bureau of Mines and Geology
Montana Tech of The University of Montana
1300 West Park Street - Natural Resources Building Room 329
Butte Montana 59701-8997

You are currently signed in. | 5/7/2010
Sign Out

GWIC Data > Well Construction Data > Township: 05S Range: 09E Sec: 7, 8, 18, 17, 19

The following data were returned from the GWIC databases for the area you requested. For a more detailed description of the data view the GWIC Metadata report. If you notice data entry errors or have questions please let us know by clicking here to leave us a message. If you wish to view a one page report for a particular site, click the hyperlinked Gwic Id for that well. Scroll to the right of your screen to view all the data. All data displayed on the screen may not show up when printed.

Retrieval Statistics*

Field	Max	Min	Avg
Total Depth (ft)	344.00	29.00	159.44
Static Water Level (ft)	249.00	0.00	110.55
Yield (gpm)	140.00	4.00	40.37

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

Did you know about...

Other GWIC data

GWIC has 1 water quality sample(s) for this area.
GWIC has 14 field visit(s) for this request area.
GWIC has 28 water level(s) for this request area.

Thanks, Just take me back to the menu.

Other MBMG data

MBMG has 405 publications available for PARK county.
MBMG has 0 abandoned mine record(s) for this request area.

Gwic Id	PDF	DNRC WR	Site Name	Twn	Rng	Sec	Q Sec	Ver?	Type	Td	Swl	Pwl	Rwl	Yield	Test	Date	Use
160129			AXELSON PETER	05S	09E	7		No	WELL	98.50	61.00	95.00		60.00	AIR	10/10/1996	DOMESTIC
102593			BURNS ERNESTINE	05S	09E	7		No	WELL	29.00	14.00	14.00		20.00	BAILER	6/15/1977	DOMESTIC
102594		C012014-00	SCALISE BILL	05S	09E	7		No	WELL	32.00	11.00	17.00		45.00	BAILER	7/24/1975	DOMESTIC
102595			SHEPHERD L J	05S	09E	7		No	WELL	33.00	16.00	16.00		50.00	BAILER	7/3/1975	DOMESTIC
132597			SHEPHERD LAVOY	05S	09E	7		No	WELL	32.00	10.00	15.00		30.00	BAILER	3/4/1977	IRRIGATION
185342			HULL TONY & GAIL	05S	09E	7	AAA	No	WELL	80.00	62.00			7.00	AIR	8/16/2000	DOMESTIC
213432			KROGSTAD CHAD OR ELAINE	05S	09E	7	AAA	No	WELL	102.00	58.00		58.00	30.00	AIR	2/6/2004	DOMESTIC
196505		C30007799	SITES STEWART AND MARTHA	05S	09E	7	AAA	No	WELL	99.00	61.00		61.00	60.00	AIR	5/28/2002	DOMESTIC
160131			SKAGGS JOSEPH	05S	09E	7	AAA	No	WELL	78.50	46.00	77.00		60.00	AIR	10/11/1996	DOMESTIC
102596		C073662-00	SKAGGS JOSEPH	05S	09E	7	AAA	No	WELL	85.00	22.00			50.00	AIR	10/31/1989	DOMESTIC
130007			LEWIS DR ROGER	05S	09E	7	AAD	No	WELL	60.00	28.00	55.00		40.00	AIR	9/13/1991	DOMESTIC
160133			LEWIS DR. ROGER & ELIZABETH	05S	09E	7	AB	No	WELL	98.00	44.00	48.00		100.00	PUMP	10/30/1996	DOMESTIC
196506			SAHNOW RON	05S	09E	7	ACDD	No	WELL	79.00	45.00		45.00	60.00	AIR	5/24/2002	DOMESTIC
134423		C012014-00	SCALISE BILL	05S	09E	7	AD	No	WELL	58.00	26.00	31.00		75.00	AIR	4/9/1992	DOMESTIC
207279			GREENWOOD DAVE AND PAT	05S	09E	7	ADAB	No	WELL	99.00	43.00		43.00	50.00	AIR	8/5/2003	DOMESTIC
175614		C108895-00	INGLIS MIKE & JULIE	05S	09E	7	B	No	WELL	88.00	41.00		41.00	25.00	AIR	5/5/1999	
102597		C074387-00	HODGKINSON DUANE #1	05S	09E	7	BAB	No	WELL	154.00	84.00			37.00	AIR	2/19/1990	DOMESTIC
213661			HARKINS ED	05S	09E	7	BCBD	No	WELL	81.00	44.00		44.00	80.00	AIR	5/21/2004	DOMESTIC
236350			HARKINS ED	05S	09E	7	BCBD	No	WELL	79.00	48.00		48.00	60.00	AIR	5/24/2007	DOMESTIC
143115		C088119-00	ANDERSON CARL	05S	09E	7	BD	No	WELL	80.00	31.00			30.00	AIR	9/14/1993	DOMESTIC
148812		C092589-00	FORD TOM	05S	09E	7	BD	No	WELL	83.00	37.00	78.00		30.00	AIR	7/14/1994	DOMESTIC

146543		C091482-00	DEMAREE GARY	05S	09E	7	BDB	No	WELL	88.00		83.00		35.00	AIR	12/1/1993	DOMESTIC
179813			ANDERSON CARL	05S	09E	7	BDCA	No	WELL	84.00	24.00			120.00	AIR	9/22/1999	
207280		C30009185	BOWMAN DAVID	05S	09E	7	CDCD	No	WELL	139.00	88.00		88.00	50.00	AIR	10/27/2003	STOCKWATER
147748			MCLAUGHLIN BOB	05S	09E	7	CDD	No	WELL	100.00	74.00	95.00		20.00	AIR	10/13/1994	DOMESTIC
102598			LEWIS JESSE & LAVINA	05S	09E	7	D	No	WELL	40.00	10.00				OTHER	1/1/1961	DOMESTIC
164268			TALIAFERRO JOHN	05S	09E	7	DAA	No	WELL	59.00	35.00	55.00		50.00	AIR	5/8/1997	DOMESTIC
149526		C092450-00	APPLEGATE NELSON	05S	09E	7	DAC	No	WELL	43.00	20.00	33.00		40.00	AIR	7/16/1994	DOMESTIC
225589			MCCRUM BLISS	05S	09E	7	DACB	No	WELL	81.00	38.00		38.00	60.00	AIR	4/20/2006	DOMESTIC
234843		C30028001	BLISS MCCRUM	05S	09E	7	DDBB	No	WELL	119.00	60.00		60.00	80.00	AIR	1/25/2007	OTHER
245974			MDOT * S-273 (01) * 1	05S	09E	8		No	BOREHOLE	29.20	0.00					9/18/1959	GEOTECH
245975			MDOT * S-273 (01) * 2	05S	09E	8		No	BOREHOLE	38.80	13.00					9/15/1959	GEOTECH
247690			PARADISE VALLEY COMMUNITY CHURCH	05S	09E	8	AADD	No	WELL	101.00	32.00		32.00	80.00	AIR	10/1/2008	DOMESTIC
245655			PAUL FINGERSH & BRENDA ALTHOUSE	05S	09E	8	ABAC	No	WELL	61.00	32.00		32.00	80.00	AIR	6/26/2008	DOMESTIC
140259		C088058-00	SHERWOOD DAVID	05S	09E	8	ABB	No	WELL	40.00	20.00	35.00		35.00	AIR	7/12/1993	DOMESTIC
195468		C30002242	PARADISE VALLEY COMMUNITY CHURCH	05S	09E	8	ADBB	No	WELL	93.00	50.00		50.00	50.00	AIR	2/13/2002	DOMESTIC
215805			MORGAN RICHARD M & MARI ANNE K	05S	09E	8	ADC	No	WELL	240.00	164.00		164.00	50.00	AIR	11/24/2004	DOMESTIC
189122			SWAINSON WANDA	05S	09E	8	BACD	No	WELL	60.00	34.00		34.00	60.00	AIR	4/3/2001	DOMESTIC
102599			MCLAUGHLIN BOB	05S	09E	8	C	No	WELL	37.00	14.00	18.00		30.00	BAILER	3/8/1974	DOMESTIC
102600		C024714-00	RUSSELL R L	05S	09E	8	C	No	WELL	40.00	15.00	15.00		30.00	BAILER	8/14/1978	DOMESTIC
102602			WARFIELD WILLIAM #1	05S	09E	8	C	No	WELL					10.00	OTHER	1/1/1937	DOMESTIC
102601			WARFIELD WILLIAM #2	05S	09E	8	C	No	WELL					10.00	OTHER	1/1/1937	DOMESTIC
146555		C091526-00	KERNS KASEY	05S	09E	8	CBC	No	WELL	65.00	44.00	64.00		30.00	AIR	5/26/1994	DOMESTIC
239721			MCCRUM BLISS	05S	09E	8	CBCC	No	WELL	120.00	44.00		44.00	65.00	AIR	9/18/2007	IRRIGATION
221516			CAHOON LARRY & DONNA	05S	09E	8	CBDB	No	WELL	101.00	45.00		45.00	60.00	AIR	8/15/2005	DOMESTIC
158360		C098018-00	COLEMAN STU	05S	09E	8	CCA	No	WELL	78.00	41.00	75.00		20.00	AIR	5/14/1996	DOMESTIC
148813		C093657-00	WARFIELD WILLIAM S	05S	09E	8	CCAC	Yes	WELL	69.00	43.00	63.00		25.00	AIR	2/22/1995	DOMESTIC
148814			MCLAUGHLIN BOB	05S	09E	8	CCB	No	WELL	60.00	25.00	55.00		30.00	AIR	4/20/1994	DOMESTIC
147750			MCLAUGHLIN BOB	05S	09E	8	CCB	No	WELL	60.00	37.00	55.00		25.00	AIR	4/21/1994	DOMESTIC
239708			EATON TONY & LAUREN	05S	09E	8	CCDD	No	WELL	120.00	65.00		65.00	60.00	AIR	7/17/2007	DOMESTIC
175612		C106180-00	WARFIELD WILLIAM	05S	09E	8	CDBD	Yes	WELL	93.00	43.00		43.00	50.00	AIR	9/7/1998	DOMESTIC
215804			MORGAN RICHARD M & MARI ANNE K	05S	09E	8	DBA	No	WELL	280.00	163.00		163.00	100.00	AIR	11/16/2004	DOMESTIC
102603		C072000-00	HAWKINS PAUL	05S	09E	8	DC	No	WELL	60.00	35.00	60.00		30.00	AIR	6/6/1989	DOMESTIC
236702		C30042792	COCHRANE KEN	05S	09E	17	AAC	No	WELL	322.00	196.00		196.00	30.00	AIR	6/29/2007	DOMESTIC

245476			ECKHARDT BRUCE	05S	09E	17	ACA	No	WELL	285.00	192.00		192.00	75.00	AIR	7/31/2008	DOMESTIC
175609		C108868-00	MORGAN DON	05S	09E	17	ACB	No	WELL	299.00	215.00	224.00	215.00	12.00	AIR	5/13/1999	DOMESTIC
212416			MORGAN RICHARD M AND MARI ANNE K	05S	09E	17	ADA	No	WELL	264.00	216.00		216.00	20.50	AIR	5/6/2004	DOMESTIC
211709			MILL CREEK RIDGE TEST WELL #2	05S	09E	17	ADAB	Yes	WELL	264.00					OTHER		
212418			MORGAN RICHARD M AND MARI ANNE K	05S	09E	17	ADD	No	WELL	344.00	236.00		236.00	60.00	AIR	5/3/2004	DOMESTIC
211706			MILL CREEK RIDGE TEST WELL #1	05S	09E	17	ADDC	Yes	WELL	344.00	290.00	249.56		140.00	PUMP	5/25/2004	
102606			WALKER TAVNER	05S	09E	17	C	No	WELL	200.00	150.00				OTHER	1/1/1940	DOMESTIC
102607		C004839-00	COWAN LEE	05S	09E	17	CA	No	WELL	103.00	85.00	85.00		12.00	BAILER	1/7/1975	DOMESTIC
165319		C103213-00	LEE JERRY AND VANGIE	05S	09E	17	CAA	No	WELL	160.00	118.00		118.00	20.00	AIR	9/2/1997	DOMESTIC
206250		43B-300082	NORDBLOM HANS	05S	09E	17	CAA	No	WELL	158.00	104.00		104.00	20.00	AIR	7/30/2003	DOMESTIC
102608			HANS NORDBLOM	05S	09E	17	CAAA	Yes	WELL	127.00	100.00	124.00		15.00	OTHER	4/24/1980	UNKNOWN
183455			WALTER NICK	05S	09E	17	CACD	No	WELL	159.00	110.00		110.00	30.00	AIR	6/12/2000	DOMESTIC
102609			COWAN LEE	05S	09E	17	CD	No	WELL	97.00	72.00	86.00		14.00	BAILER	10/15/1969	DOMESTIC
209613			PLACEK DAVID	05S	09E	17	CDA	No	WELL	138.00	118.00		118.00	18.00	AIR	10/30/2003	DOMESTIC
220251			PLACEK DAVID	05S	09E	17	CDB	No	WELL	200.00	145.00			50.00	AIR	6/6/2005	DOMESTIC
210236			RADTKE PHILIP K DDS	05S	09E	17	DAAC	No	WELL	299.00	228.00		228.00	30.00	AIR	3/19/2004	DOMESTIC
164269		C30009888	SPANGLER CHARLES AND BRENDA	05S	09E	17	DB	No	WELL	260.00	195.00	255.00		18.00	AIR	6/9/1997	DOMESTIC
251922			MELIN JOHN	05S	09E	17	DDBA	No	WELL	300.00	210.00					7/21/2009	DOMESTIC
145491		C30030143	ADKINS MICHAEL & MAGDALEN	05S	09E	18		No	WELL	106.00	84.00	85.00		10.00	PUMP	8/13/1994	DOMESTIC
102610		C30030144	ADKINS MIKE	05S	09E	18		No	WELL	100.00		100.00		25.00	AIR	10/27/1984	DOMESTIC
133379			DAY DANIEL	05S	09E	18		No	WELL	120.00		80.00		20.00	AIR	3/23/1989	DOMESTIC
102631			GENTRY BURT	05S	09E	18		No	WELL	200.00	160.00	200.00		20.00	AIR	8/29/1978	DOMESTIC
210235			ADKINS MIKE	05S	09E	18	AABB	No	WELL	161.00	95.00		95.00	60.00	AIR	2/18/2004	DOMESTIC
225593			ADKINS MIKE	05S	09E	18	AABB	No	WELL	160.00	94.00		94.00	60.00	AIR	2/10/2006	DOMESTIC
102611			EGGAR CONSTRUCTION S	05S	09E	18	AB	No	WELL	101.00	45.00	48.00		100.00	AIR	8/19/1971	INDUSTRIAL
201775			ADKINS MIKE	05S	09E	18	ABAA	No	WELL	139.00	91.00		91.00	40.00	AIR	1/6/2003	DOMESTIC
199471			RURAL 1 FIRE DISTRICT	05S	09E	18	ABAA	No	WELL	159.00	98.00		98.00	70.00	AIR	5/22/2002	DOMESTIC
238365			ADKINS MIKE	05S	09E	18	ABAB	No	WELL	159.00	104.00		104.00	60.00	AIR	4/9/2007	DOMESTIC
225594			TIDWELL MARVIN AND JOSIE	05S	09E	18	ABBC	No	WELL	161.00	110.00		110.00	40.00	AIR	4/24/2006	DOMESTIC
102612		C025632-00	HAKE KEN	05S	09E	18	ABC	No	WELL	214.00		210.00		20.00	AIR	9/5/1978	DOMESTIC
218742			DUFFY GARY	05S	09E	18	ABCD	No	WELL	220.00	151.00		151.00	45.00	AIR	1/28/2005	DOMESTIC
231199			SAUNDERS JAMES AND HEIDI	05S	09E	18	ABCD	No	WELL	220.00	148.00		148.00	60.00	AIR	10/13/2006	DOMESTIC
164270			ROGERS DAVID	05S	09E	18	AC	No	WELL	198.50	159.00	193.00		20.00	AIR	6/20/1997	DOMESTIC
221587			ALVERSON DENNIS	05S	09E	18	BAAA	No	WELL	160.00	103.00		103.00	40.00	AIR	5/9/2005	DOMESTIC

225595			TIDWELL MARVIN AND JOSIE	05S	09E	18	BAAD	No	WELL	161.00	105.00		105.00	40.00	AIR	4/25/2006	DOMESTIC
151570		C095369-00	HOWE KATHERINE	05S	09E	18	BB	No	WELL	160.00	110.00	150.00		60.00	AIR	6/7/1995	DOMESTIC
102613			PEAKE FRED	05S	09E	18	BB	No	WELL	126.00	110.00	110.00			OTHER	2/7/1943	DOMESTIC
201776		C30030145	ADKINS MIKE	05S	09E	18	BBBA	Yes	WELL	159.00	101.00		101.00	30.00	AIR	2/20/2003	DOMESTIC
253321			LIL ANDERSON AND ALAN STRANGE	05S	09E	18	BBBC	No	WELL	208.00	158.00		158.00	40.00	AIR	10/15/2009	DOMESTIC
242986			BARNES DREW	05S	09E	18	BBD	No	WELL	220.00	164.00			35.00	AIR	5/5/2008	DOMESTIC
236341			DUFFY CHARLES G	05S	09E	18	BCCC	No	WELL	230.00	180.00		180.00	50.00	AIR	9/21/2007	DOMESTIC
102614			WETZEL ROBERT H	05S	09E	18	BDB	No	WELL	180.00	110.00	180.00		30.00	AIR	9/15/1981	UNKNOWN
182637			BRYANT ROSEMARRY	05S	09E	18	BDBA	Yes	WELL	180.00	138.30	138.60			OTHER		DOMESTIC
184343			BRYANT ROSEMARY	05S	09E	18	BDBA	No	WELL								
102615			LECKNER TED	05S	09E	18	CAB	No	WELL	185.00	133.00	180.00		42.00	AIR	8/13/1981	UNKNOWN
247681			BENNIN BERT AND ANGELA	05S	09E	18	CABB	No	WELL	240.00	162.00		162.00	50.00	AIR	8/28/2008	DOMESTIC
231201			CHARLES G DUFFY/ WESLEY KREMER TIC	05S	09E	18	CCAB	No	WELL	260.00	169.00		169.00	70.00	AIR	10/10/2006	DOMESTIC
231202			CHARLES G DUFF / WESLEY KREMER TIC	05S	09E	18	CCAC	No	WELL	240.00	172.00		172.00	40.00	AIR	10/6/2006	DOMESTIC
243958			DUFFY, CHARLES G / WESLEY KREMER TIC	05S	09E	18	CCDB	No	WELL	240.00	185.00		185.00	50.00	AIR	4/9/2008	DOMESTIC
192475		C117219-00	SHIMMIN RILEY	05S	09E	18	CDDC	Yes	WELL	218.00	175.00		175.00	20.00	AIR	9/20/2001	DOMESTIC
102616			PIHL RON	05S	09E	18	D	No	WELL	237.00	189.00	210.00		10.00	PUMP	4/26/1982	UNKNOWN
152241		C058381-00	ADKINS MICHAEL & MAGDALEN	05S	09E	18	DDD	No	WELL	144.00	98.00	99.00		10.00	PUMP	8/13/1995	DOMESTIC
102617			KEYSTONE RANCH	05S	09E	19	A	No	WELL	223.00	202.00	212.00		10.00	BAILER	7/19/1946	DOMESTIC
102618			PELTZ HUGH	05S	09E	19	A	No	WELL		200.00			10.00	OTHER	1/1/1890	DOMESTIC
189123		C115559-00	GRAY JOHN	05S	09E	19	AAB	No	WELL	279.00	210.00		210.00	28.00	AIR	4/2/2001	DOMESTIC
244051			PLACEK DAVID	05S	09E	19	AAB	No	WELL	304.00	218.00		218.00	40.00	AIR	5/30/2008	DOMESTIC
102619			LANNEN EARL	05S	09E	19	B	No	WELL	205.00	180.00			4.00	OTHER	1/1/1916	DOMESTIC
153944		C096684-00	SHIMMIN BRUCE & ELMA M	05S	09E	19	BBA	No	WELL	218.00	173.00	213.00		20.00	AIR	7/27/1995	DOMESTIC
203163		C30006208	DEFANDORF CHARLES	05S	09E	19	C	No	WELL	238.00	190.00		190.00	12.00	AIR	1/29/2003	DOMESTIC
226375			MARCHINGTON LAURNA	05S	09E	19	CAB	No	WELL	300.00	231.00		231.00	40.00	AIR	3/29/2006	DOMESTIC
160135			SILVESTRONE ROBERT	05S	09E	19	CBB	No	WELL	218.00	176.00	215.00		20.00	AIR	10/17/1996	DOMESTIC
221520			JACOBS RICHARDS	05S	09E	19	CBCC	No	WELL	265.00	196.00		196.00	35.00	AIR	8/18/2005	DOMESTIC
165426			SOUZA TOM & HELENA	05S	09E	19	CBD	No	WELL	259.00	194.00	255.00		20.00	AIR	7/29/1997	DOMESTIC
169475			BERNARD BILL	05S	09E	19	CC	No	WELL	258.50	196.00	253.00		25.00	AIR	6/4/1998	DOMESTIC
102620		C005140-00	KOUNTZ STEVE	05S	09E	19	D	No	WELL	235.00	205.00	210.00		35.00	BAILER	1/24/1974	DOMESTIC
102621			BAR J J RANCH	05S	09E	19	DC	No	WELL	230.00	213.00	223.00			AIR	4/1/1976	DOMESTIC
102622			FAIRCHILD ALAN	05S	09E	19	DCC	No	WELL	250.00	230.00	250.00		10.00	BAILER	6/2/1982	DOMESTIC
157339			SCHRUM GUY	05S	09E	19	DDA	No	WELL	298.00	249.00	295.00		18.00	AIR	5/7/1996	DOMESTIC
165320			STEFFESEN	05S	09E	19	DDA	No	WELL	318.00	236.00	315.00		30.00	AIR	8/26/1997	DOMESTIC

			DORCEAN													
102623		C073689-00	NEIL & STEFFESEN	05S	09E	19	DDBC	Yes	WELL	300 00	237 00	40 00	AIR	4/27/1989	DOMESTIC	
159032			PARADISE VALLEY ASSOC	05S	09E	19	DDD	No	WELL	320 00	236 00	30.00	AIR	9/26/1997	DOMESTIC	

End of Report
125 record(s) listed

Items of Note:
[1]This report is restricted to site types of WELL, BOREHOLE, SPRING, COAL BED METHANE WELL, PETWELL, PIEZOMETER
[2]A single well record (a distinct GWIC Id) may be represented by more than one line in this report if more than one performance test was conducted on the well at the time of drilling

Explanation of Columns:
GWIC Id = Key field for the GWIC database. Links to one page reports
PDF = Are scanned documents available through the Document Manager?

- = Yes, click on the icon to download the PDF file
- = No, well was submitted electronically. No paper record exists.
- = No, record does have a known well log but it is not scanned yet.
- = No, record may or may not have a document to scan. Metadata is unclear
- = No, record was created from a source other than a well log. No paper record exists

DNRC WR = Water right number assigned to this site by Department of Natural Resources and Conservation
Site Name = Current owner name assigned to GWIC record
Location = Location of site in Montana township, range, section, and quarter-section coordinates
Ver? = Has this location been verified by field staff?
Type = Type of site assigned to GWIC record
Td = Total depth of well in feet below ground
Swl = Static water level in feet above/below ground - Negative values are reported for water levels that are above land surface
Pwl = Pumping water level in feet below ground
Rwl = Recovery water level in feet below ground
Yield = Yield in gallons per minute
Test = Type of performance test reported
Date = Completion date of well/borehole
Use = Reported use of water

Disclaimer:
The preceding materials represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user at the time and date of the retrieval. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted. There may be wells in the request area that are not recorded at the Information Center.

Refer to 11x17 Topo map for location of each well #

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 2:24:54 PM)

Site Name: BOWMAN DAVID
GWIC Id: 207280
DNRC Water Right: C30009185

Section 1: Well Owner

Owner Name
BOWMAN DAVID
Mailing Address
PO BOX 87

City	State	Zip Code
PRAY	MT	59065

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	7	SE¼ SW¼ SE¼ SW¼

County	Geocode
PARK	

Latitude	Longitude	Geomethod	Datum
45.409242	110.664466	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
STOCKWATER (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Monday, October 27, 2003

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	141	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	139	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
139	141	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 139
Static Water Level: 88
Water Temperature:

Air Test *

50 gpm with drill stem set at 135 feet for 1 hours.
Time of recovery 0.5 hours.
Recovery water level 88 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	18	SAND GRAVEL AND SMALL BOULDERS
18	35	LARGE BOULDERS
35	100	SAND GRAVEL AND COBBLES
100	140	LIGHTLY CLAYBOUND SAND GRAVEL FEW BOULDERS

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 10/27/2003

MONTANA WELL LOG REPORT

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Other Options

Plot this site on a topographic map
View scanned well log (7/16/2008 1:27:03 PM)

Site Name: MCLAUGHLIN BOB
GWIC Id: 147748

Section 1: Well Owner

Owner Name
MCLAUGHLIN BOB
Mailing Address
315 W BUTTE

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	7	SE¼ SE¼ SW¼

County: PARK
Geocode

Latitude	Longitude	Geomethod	Datum
45.409714	110.662513	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Thursday, October 13, 1994

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	100	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	99	6				STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 100
Static Water Level: 74
Water Temperature:

Air Test *

20 gpm with drill stem set at _ feet for 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 95 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	1	TOPSOIL
1	100	SAND & GRAVEL

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HILLMAN DRILLING
License No: WWC-436
Date Completed: 10/13/1994

MONTANA WELL LOG REPORT

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Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 1:53:59 PM)

Site Name: LEWIS JESSE & LAVINA
GWIC Id: 102598

Section 1: Well Owner

Owner Name
LEWIS JESSE AND LAVINA
Mailing Address
126 NO 8TH ST

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	7	SE¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.412543	110.656003	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method:

Section 5: Well Completion Date
Date well completed: Sunday, January 01, 1961

Section 6: Well Construction Details
There are no borehole dimensions assigned to this well.
There are no casing strings assigned to this well.
There are no completion records assigned to this well.
Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 40
Static Water Level: 10
Water Temperature:

Unknown Test Method *

Yield _ gpm.
Pumping water level _ feet.
Time of recovery _ hours.
Recovery water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
111ALVM - ALLUVIUM (HOLOCENE)

From	To	Description
0	2	TOPSOIL
2	24	COARSE GRAVEL
24	36	FINE GRAVEL
36	39	SAND
39	40	FINE SAND AND GRAVEL

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:	
Company:	
License No:	-
Date Completed:	1/1/1961

MONTANA WELL LOG REPORT

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Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 1:54:31 PM)

Site Name: TALIAFERRO JOHN
GWIC Id: 164268

Section 1: Well Owner

Owner Name
TALIFERRO JOHN
Mailing Address
BOX B

City	State	Zip Code
PRAY	MT	59065

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	7	NE¼ NE¼ SE¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.415373	110.652097	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition **Block** **Lot**

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Thursday, May 08, 1997

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	60	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.7	59	6				STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
59	59	6			OPEN BOTTOM *

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 59
Static Water Level: 35
Water Temperature:

Air Test *

50 gpm with drill stem set at _ feet for 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 55 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	18	BOULDERS AND GRAVEL
18	53	CLAYBOUND GRAVEL AND COBBLES VERY TIGHT VERY LITTLE WATER
53	59	CLEAN GRAVELS AND SAND SOME CLAY WATER
59	65	CLAYBOUND GRAVELS AND SAND VERY LITTLE WATER

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 5/8/1997

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MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 1:55:06 PM)

Site Name: APPLEGATE NELSON
GWIC Id: 149526
DNRC Water Right: C092450-00

Section 1: Well Owner

Owner Name
APPLEGATE NELSON
Mailing Address

City	State	Zip Code
EMIGRANT	MT	59027

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	7	SW¼ NE¼ SE¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.413486	110.654701	TRS-SEC	NAD83

Altitude **Method** **Datum** **Date**

Addition **Block** **Lot** 8

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Wednesday, March 16, 1994

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	43	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	38.5	6				STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 43
Static Water Level: 20
Water Temperature:

Air Test *

40 gpm with drill stem set at _ feet for 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 33 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	1	TOPSOIL
1	43	BOULDERS GRAVEL & SAND

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: VAN DYKEN DRILLING INC
License No: WWC-380
Date Completed: 3/16/1994

MONTANA WELL LOG REPORT

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Other Options

Plot this site on a topographic map
View scanned well log (5/23/2006 7:53:28 AM)

Site Name: MCCRUM BLISS
GWIC Id: 225589

Section 1: Well Owner

Owner Name
MCCRUM BLISS
Mailing Address
P.O. BOX 2169

City	State	Zip Code
LIVINGSTON	MT	69047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	7	NW¼ SW¼ NE¼ SE¼

County	Geocode
PARK	

Latitude	Longitude	Geomethod	Datum
45.4149	110.6539	NAV-GPS	NAD27

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Thursday, April 20, 2006

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	80	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	79	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
79	80	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 81
Static Water Level: 38
Water Temperature:

Air Test *

60 gpm with drill stem set at 75 feet for 1 hours.
Time of recovery 0.5 hours.
Recovery water level 38 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	16	SAND GRAVEL AND COBBLES
16	38	BOULDERS SAND AND GRAVEL
38	81	SLIGHTLY CLAYBOUND GRAVELS SAND AND A FEW BOULDERS

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 4/20/2006

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (4/4/2007 5:17:25 PM)

Site Name: BLISS MCCRUM
GWIC Id: 234843
DNRC Water Right: C30028001

Section 1: Well Owner

Owner Name
BLISS, MCCRUM
Mailing Address
PO BOX 2169

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	7	NW¼ NW¼ SE¼ SE¼

County PARK
Geocode

Latitude	Longitude	Geomethod	Datum
45.412072	110.655352	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
OTHER (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Thursday, January 25, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	120	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	119	6	0.25		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
119	120	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 119
Static Water Level: 60
Water Temperature:

Air Test *

80 gpm with drill stem set at 115 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 60 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	2	TOP SOIL AND COBBLES
2	14	SAND
14	35	SAND GRAVEL AND COBBLES
35	90	SAME CLAYBOUND FEW BOULDERS FEW SAND BARS
90	108	HEAVY CLAYBOUND GRAVELS NO WATER
108	120	SANDS, GRAVEL SOME CLAY

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: WILLIAM HAYES
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 1/25/2007

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 1:30:19 PM)

Site Name: MCLAUGHLIN BOB
GWIC Id: 102599

Section 1: Well Owner

Owner Name
MCLAUGHLIN BOB
Mailing Address
111 S 11TH
City **State** **Zip Code**

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	SW¼

County **Geocode**
PARK

Latitude	Longitude	Geomethod	Datum
45.412863	110 645713	TRS-SEC	NAD83

Altitude **Method** **Datum** **Date**

Addition **Block** **Lot**

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: CABLE

Section 5: Well Completion Date
Date well completed: Friday, March 08, 1974

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	37	6

There are no casing strings assigned to this well.
There are no completion records assigned to this well.
Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 37
Static Water Level: 14
Water Temperature:

Bailer Test *

30 gpm with _ feet of drawdown after 2 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 18 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
110TRRC - TERRACE DEPOSITS (QUATERNARY)

From	To	Description
0	37	GRAVEL LIGHT

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HILLMAN DRILLING
License No: WWC-258
Date Completed: 3/8/1974

(9)

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report

Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 1:58:19 PM)

Site Name: RUSSELL R L
GWIC Id: 102600
DNRC Water Right: C024714-00

Section 1: Well Owner

Owner Name
RUSSELL R L
Mailing Address
2147 MONAD ROAD

City	State	Zip Code
BILLINGS	MT	

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	SW¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.412863	110.645713	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition **Block** **Lot**

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method:

Section 5: Well Completion Date
Date well completed: Monday, August 14, 1978

Section 6: Well Construction Details
There are no borehole dimensions assigned to this well.
Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1	39.5	6				STEEL

There are no completion records assigned to this well.
Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 40
Static Water Level: 15
Water Temperature:

Bailer Test *

30 gpm with _ feet of drawdown after 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 15 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
110TRRC - TERRACE DEPOSITS (QUATERNARY)

From	To	Description
0	1	TOPSOIL
1	14	COURSE OVERBURDEN
14	28	CLAY SAND AND GRAVEL
28	40	SAND AND GRAVEL

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: POTTS DRILLING INC
License No: -
Date Completed: 8/14/1978

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 1:58:49 PM)

Site Name: WARFIELD WILLIAM #1
GWIC Id: 102602

Section 1: Well Owner

Owner Name
WARFIELD WILLIAM
Mailing Address
HOFFMAN RT

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	SW¼

County
PARK
Geocode

Latitude	Longitude	Geomethod	Datum
45.412863	110.645713	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition **Block** **Lot**

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method:

Section 5: Well Completion Date
Date well completed: Friday, January 01, 1937

Section 6: Well Construction Details
There are no borehole dimensions assigned to this well.
Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	0	12				

There are no completion records assigned to this well.
Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth:
Static Water Level:
Water Temperature:

Unknown Test Method *

Yield 10 gpm.
Pumping water level _ feet.
Time of recovery _ hours.
Recovery water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
110TRRC - TERRACE DEPOSITS (QUATERNARY)
Lithology Data

There are no lithologic details assigned to this well.

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:	
Company:	
License No:	-
Date Completed:	1/1/1937

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 1:59:27 PM)

Site Name: WARFIELD WILLIAM #2
GWIC Id: 102601

Section 1: Well Owner

Owner Name
WARFIELD WILLIAM
Mailing Address
HOFFMAN RT

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	SW¼

County: PARK
Geocode:

Latitude	Longitude	Geomethod	Datum
45.412863	110.645713	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method:

Section 5: Well Completion Date
Date well completed: Friday, January 01, 1937

Section 6: Well Construction Details
There are no borehole dimensions assigned to this well.
Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	0	4				

There are no completion records assigned to this well.
Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth:
Static Water Level:
Water Temperature:

Unknown Test Method *

Yield 10 gpm.
Pumping water level _ feet.
Time of recovery _ hours.
Recovery water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
110TRRC - TERRACE DEPOSITS (QUATERNARY)
Lithology Data

There are no lithologic details assigned to this well.

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:	
Company:	
License No:	-
Date Completed:	1/1/1937

(12)

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 2:00:02 PM)

Site Name: KERNS KASEY
GWIC Id: 146555
DNRC Water Right: C091526-00

Section 1: Well Owner

Owner Name
KERNS KASEY
Mailing Address
BOX 753

City	State	Zip Code
GARDINER	MT	59030

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	SW¼ NW¼ SW¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.413781	110.649626	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot
ELBEM MOUNTAIN		1

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Thursday, May 26, 1994

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	20	9
20	65	7

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	64	6				STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 65
Static Water Level. 44
Water Temperature:

Air Test *

30 gpm with drill stem set at _ feet for 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 64 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	2	TOPSOIL
2	65	CLEAN SMALL GRAVEL

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: AAQUA DRILLING INC
License No: WWC-542
Date Completed: 5/26/1994

(12)

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report

Other Options

Plot this site on a topographic map
View scanned well log (11/14/2007 1:37:12 PM)
View scanned well log (2/23/2010 1:30:56 PM)

Site Name: MCCRUM BLISS
GWIC Id: 239721

Section 1: Well Owner

Owner Name
MCCRUM, BLISS
Mailing Address
P.O. BOX 2169

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	SW¼ SW¼ NW¼ SW¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.413083	110.6495	NAV-GPS	NAD27

Altitude	Method	Datum	Date

Addition **Block** **Lot**

Section 3: Proposed Use of Water
IRRIGATION (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Tuesday, September 18, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	120	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	118.5	6	0.25		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
118.5	120	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 120
Static Water Level: 44
Water Temperature:

Air Test *

65 gpm with drill stem set at 115 feet for 1 hours.
Time of recovery 0.5 hours.
Recovery water level 44 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks
IR DRIVE SHOE USED

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	70	SAND, GRAVEL & BOULDERS
70	86	CLAYBOUND GRAVELS - NO FLOW
82	118	CLAYBOUND GRAVELS
86	92	SAND & GRAVEL - WATER
118	120	SAND, GRAVEL & COBBLES, SOME CLAY

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: WILLIAM HAYES
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 9/18/2007

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (12/5/2005 3:53:00 PM)
View scanned well log (2/23/2010 1:31:30 PM)

Site Name: CAHOON LARRY & DONNA
GWIC Id: 221516

Section 1: Well Owner

Owner Name
CAHOON LARRY & DONNA
Mailing Address
8141 BARRINGTON DRIVE

City	State	Zip Code
LAMIRADA	CA	90638

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	NW¼ SE¼ NW¼ SW¼

County: PARK
Geocode:

Latitude	Longitude	Geomethod	Datum
45.414241	110.64767	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition: Block: Lot:

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Monday, August 15, 2005

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	101	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	99	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
99	101	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 101
Static Water Level: 45
Water Temperature:

Air Test *

60 gpm with drill stem set at 95 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 45 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	26	SAND GRAVEL & BOULDERS
26	101	SAME SMALLER BOULDERS & COBBLES

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 8/15/2005

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MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 2:00:55 PM)

Site Name: COLEMAN STU
GWIC Id: 158360
DNRC Water Right: C098018-00

Section 1: Well Owner

Owner Name
COLEMAN STU
Mailing Address
13 CEDAR LN

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	NE¼ SW¼ SW¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.411944	110.647017	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Tuesday, May 14, 1996

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	80	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1	78	6				STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
78	78	6			OPEN BOTTOM *

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 78
Static Water Level: 41
Water Temperature:

Air Test *

20 gpm with drill stem set at _ feet for 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 75 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	3	TOPSOIL
3	80	SAND GRAVEL & CLAY

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HILLMAN DRILLING
License No: WWC-436
Date Completed: 5/14/1996

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View hydrograph for this site
View scanned well log (2/23/2010 2:02:00 PM)

Site Name: WARFIELD WILLIAM S
GWIC Id: 148813
DNRC Water Right: C093657-00

Section 1: Well Owner

Owner Name
WARFIELD WILLIAM S
Mailing Address
1668 E RIVER RD

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	SW¼ NE¼ SW¼ SW¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.4116	110.6467	NAV-GPS	NAD27

Altitude	Method	Datum	Date
4840			10/7/2000

Addition **Block** **Lot**

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Wednesday, February 22, 1995

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	69	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	68	6				STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 69
Static Water Level: 43
Water Temperature:

Air Test *

25 gpm with drill stem set at _ feet for 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 63 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	1	TOPSOIL
1	35	COARSE GRAVEL-SAND-WATER
35	67	CLAYBOUND GRAVEL AND SAND
67	69	CLEAN GRAVEL AND SAND

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: VAN DYKEN DRILLING INC
License No: WWC-380
Date Completed: 2/22/1995

17

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 2:03:00 PM)

Site Name: MCLAUGHLIN BOB
GWIC Id: 148814

Section 1: Well Owner

Owner Name
MCLAUGHLIN BOB
Mailing Address
315 W BUTTE ST

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	NW¼ SW¼ SW¼

County: PARK
Geocode:

Latitude	Longitude	Geomethod	Datum
45.411944	110.649626	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Wednesday, April 20, 1994

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
40	60	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	58	6				STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 60
Static Water Level: 25
Water Temperature:

Air Test *

30 gpm with drill stem set at _ feet for 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 55 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
40	60	GRAVEL CLAY AND BOULDERS

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HILLMAN DRILLING
License No: WWC-436
Date Completed: 4/20/1994

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/23/2010 2:03:36 PM)

Site Name: MCLAUGHLIN BOB
GWIC Id: 147750

Section 1: Well Owner

Owner Name
MCLAUGHLIN BOB
Mailing Address
315 W BUTTE ST

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	NW¼ SW¼ SW¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.411944	110.649626	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Thursday, April 21, 1994

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	60	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	58	6				STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 60
Static Water Level: 37
Water Temperature:

Air Test *

25 gpm with drill stem set at _ feet for 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 55 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	1	TOPSOIL
1	60	GRAVEL CLAY & BOULDERS

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HILLMAN DRILLING
License No: WWC-436
Date Completed: 4/21/1994

(19)

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (11/14/2007 1:35:15 PM)

Site Name: EATON TONY & LAUREN
GWIC Id: 239708

Section 1: Well Owner

Owner Name
EATON, TONY & LAUREN
Mailing Address
300 LOMA METISSE

City	State	Zip Code
MALIBU	CA	90265

Well Address
1668 E. RIVER ROAD

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	SE¼ SE¼ SW¼ SW¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.409647	110.646365	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition **Block** **Lot**

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Tuesday, July 17, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	120	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	119	6	0.25		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
119	120	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 120
Static Water Level: 65
Water Temperature:

Air Test *

60 gpm with drill stem set at 115 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 65 feet.
Pumping water level _ feet.

* *During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks
IR DRIVE SHOE USED

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	3	TOPSOIL & SOME GRAVELS
3	25	SAND, GRAVEL & BOULDERS
25	120	CLAYBOUND GRAVELS & COBBLES

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: WILLIAM HAYES
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 7/17/2007

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View hydrograph for this site
View scanned well log (2/23/2010 2:04:07 PM)

Site Name: WARFIELD WILLIAM
GWIC Id: 175612
DNRC Water Right: C106180-00

Section 1: Well Owner

Owner Name
WARFIELD WILLIAM
Mailing Address
116 MILL CREEK RD

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	8	SE¼ NW¼ SE¼ SW¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.4123	110.6433	NAV-GPS	NAD27

Altitude	Method	Datum	Date
4850			10/7/2000

Addition **Block** **Lot**

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Monday, September 07, 1998

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	100	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	93	6				STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
93	93	6			OPEN BOTTOM *

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 93
Static Water Level: 43
Water Temperature:

Air Test *

50 gpm with drill stem set at _ feet for 1 hours.
Time of recovery 0.25 hours.
Recovery water level 43 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	18	COARSE GRAVEL & ROCKS
18	46	COARSE GRAVEL & CLAY
46	51	ROCKS BOULDERS
51	93	GRAVEL CLAY MIX
93	100	CEMENTED GRAVEL

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: BRIDGER DRILLING INC
License No: WWC-475
Date Completed: 9/7/1998

21

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/26/2010 10:29:22 AM)

Site Name: ADKINS MIKE
GWIC Id: 210235

Section 1: Well Owner

Owner Name
ADKINS MIKE
Mailing Address
CHICORY RD

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	18	NW¼ NW¼ NE¼ NE¼

County: PARK
Geocode:

Latitude	Longitude	Geomethod	Datum
45.408725	110.65517	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition: Block: Lot:

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Wednesday, February 18, 2004

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	160	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	159	6	.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
159	160	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 161
Static Water Level: 95
Water Temperature:

Air Test *

60 gpm with drill stem set at 155 feet for 1.5 hours.
Time of recovery 30 hours.
Recovery water level 95 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	18	SAND
18	80	SAND GRAVEL COBBLES AND SMALL BOULDERS
80	161	SAND GRAVEL AND COBBLES AND SLIGHTLY

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 2/18/2004

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (5/23/2006 8:04:31 AM)

Site Name: ADKINS MIKE
GWIC Id: 225593

Section 1: Well Owner

Owner Name
ADKINS MIKE
Mailing Address
P.O. BOX 465

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	18	NW¼ NW¼ NE¼ NE¼

County / **Geocode**
PARK

Latitude	Longitude	Geomethod	Datum
45.4089	110.6544	NAV-GPS	NAD27

Altitude	Method	Datum	Date

Addition **Block** **Lot**

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Friday, February 10, 2006

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	160	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	159	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
159	160	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 160
Static Water Level: 94
Water Temperature:

Air Test *

60 gpm with drill stem set at 155 feet for 1 hours.
Time of recovery 0.5 hours.
Recovery water level 94 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	3	SAND AND GRAVEL
3	40	SAND AND SOME GRAVEL
40	104	SAND GRAVELS COBBLES AND SMALL BOULDERS
104	112	BOULDER PATCH
112	160	SAND GRAVEL COBBLES SOME CLAY

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 2/10/2006

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/26/2010 10:30:56 AM)

Site Name: ADKINS MIKE
GWIC Id: 201775

Section 1: Well Owner

Owner Name
ADKINS MIKE
Mailing Address
PO BOX 465

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	18	NE¼ NE¼ NW¼ NE¼

County: PARK
Geocode:

Latitude	Longitude	Geomethod	Datum
45.408725	110.656478	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Monday, January 06, 2003

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	141	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	139	6	0.250			STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
139	141	6			OPEN HOLE

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONIE	

Section 7: Well Test Data

Total Depth: 139
Static Water Level: 91
Water Temperature:

Air Test *

40 gpm with drill stem set at 135 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 91 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	4	GRAVEL AND SAND
4	18	SAND LITTLE GRAVEL
18	75	SAND AND GRAVEL
75	130	TIGHT CLAYBOUND GRAVELS AND BOULDERS
130	141	SAND GRAVEL AND COBBLES

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 1/6/2003

(24)

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (2/26/2010 10:31:32 AM)

Site Name: RURAL 1 FIRE DISTRICT
GWIC Id: 199471
DNRC Water Right:

Section 1: Well Owner

Owner Name
RURAL 1 FIRE DISTRICT
Mailing Address
15 CHICORY RD

City	State	Zip Code
PRAY	MT	59065

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	18	NE¼ NE¼ NW¼ NE¼

County	Geocode
PARK	

Latitude	Longitude	Geomethod	Datum
45.408725	110.656478	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Wednesday, May 22, 2002

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	160	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	159	6	0.250			STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
159	160	6			OPEN HOLE

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	CONT FED BENTONITE	

Section 7: Well Test Data

Total Depth: 159
Static Water Level: 98
Water Temperature:

Air Test *

70 gpm with drill stem set at 155 feet for 1.5 hours.
Time of recovery 0.5 hours.
Recovery water level 98 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	25	SAND SOME GRAVEL
25	115	SAND GRAVEL AND COBBLES
115	136	CLAYBOUND SAND AND GRAVEL LOTS OF LARGE BOULDERS
136	160	SAND GRAVEL AND COBBLES

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 5/22/2002

PIT MONITORING WELL

25

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (7/31/2007 1:45:13 PM)

Site Name: ADKINS MIKE
GWIC Id: 236365

Section 1: Well Owner

Owner Name
ADKINS, MIKE
Mailing Address
P.O. BOX 465

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	18	NW¼ NE¼ NW¼ NE¼

County
PARK

Geocode

Latitude	Longitude	Geomethod	Datum
45.408725	110.657786	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Monday, April 09, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	160	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	159	6	0.25		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
159	159	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 159
Static Water Level: 104
Water Temperature:

Air Test *

60 gpm with drill stem set at 155 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 104 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks
I.R. DRIVE SHOE

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	18	SAND
18	110	SANDY GRAVELS AND COBBLES
110	160	SILIGHTLY CLAYBOUND GRAVELS, COBBLES, SMALL BOULDERS AND SAND

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: WILLIAM HAYES
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 4/9/2007

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report

Other Options

Plot this site on a topographic map
View scanned well log (2/26/2010 10:32:50 AM)

Site Name: DUFFY GARY
GWIC Id: 218742

Section 1: Well Owner

Owner Name
DUFFY GARY
Mailing Address
21 SHOOTING STAR TRAIL

City	State	Zip Code
GARDINER	MT	59030

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	18	SE¼ SW¼ NW¼ NE¼

County / **Geocode**
PARK

Latitude	Longitude	Geomethod	Datum
45.405948	110.659094	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition **Block** **Lot**

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Friday, January 28, 2005

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	220	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	219	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
219	220	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	Y

Section 7: Well Test Data

Total Depth 220
Static Water Level: 151
Water Temperature:

Air Test *

45 gpm with drill stem set at 215 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 151 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	90	SAND, GRAVEL AND COBBLES
90	132	BOULDERS AND GRAVEL
132	142	SAND ANS CLAY
142	220	SAND, GRAVEL AND SMALL BOULDERS

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 1/28/2005

(27)

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report

Other Options

Plot this site on a topographic map
View scanned well log (5/23/2006 8:04:56 AM)

Site Name: TIDWELL MARVIN AND JOSIE
GWIC Id: 225595

Section 1: Well Owner

Owner Name
TIDWELL MARVIN AND JOSIE
Mailing Address
5 SHOSHONE WAY

City	State	Zip Code
LIVINGSTON	MT	59047

Section 2: Location

Township	Range	Section	Quarter Sections
05S	09E	18	SE¼ NE¼ NE¼ NW¼

County PARK **Geocode**

Latitude	Longitude	Geomethod	Datum
45.4078	110.661	NAV-GPS	NAD27

Altitude	Method	Datum	Date

Addition **Block** **Lot**

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Tuesday, April 25, 2006

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	161	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
1.5	159	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
159	161	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth 161
Static Water Level. 105
Water Temperature:

Air Test *

40 gpm with drill stem set at 155 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 105 feet.
Pumping water level _ feet.

* *During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	3	TOP SOIL AND CLAY
3	18	SAND AND GRAVEL
18	30	SAND VERY LITTLE GRAVEL
30	80	SANDY GRAVELS AND COBBLES
80	110	SAND GRAVEL AND BOULDERS
110	151	SAND GRAVEL COBBLES AND CLAY
151	161	SLIGHTLY CLAYBOUND GRAVELS AND SAND

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: HAYES DRILLING
License No: WWC-361
Date Completed: 4/25/2006

Yellowstone River Ranch Estates
Environmental Assessment

Appendix E

Well Pump Test Reports

for Three Pump Tests Conducted on Neighboring Properties

February 18, 2004

William Smith
PO Box 78
Emigrant MT 59027

Mr Smith

**The following is a revision of a report submitted to Ellen Woodbury on July 16, 2003. The revisions reflect additional analyses of background water-level trends and a revised interpretation of aquifer saturated thicknesses.

The following are the results of two aquifer tests conducted at the proposed Yellowstone Trails Ranch Subdivision between July 8th and July 11th 2003. Wells for the test, the pump and pump operation were provided by contractors through the developer. Test supervision, data collection, and data analyses were provided by the MBMG funded through an existing ground-water study in the Paradise Valley. The MBMG neither supports nor opposes the Yellowstone Trails Ranch Subdivision and all data collected will be made publicly available through our GWIC database or published reports. Copies of the raw data and type curve analyses are attached.

The aquifer tests were conducted at two sites. Site 1 is located on a high bench of glacial till sediments Eight-Mile glacial advance (Lopez and Reiten, 2003). These sediments typically consist of unsorted and unstratified gravel, clay fragments, and boulders. The well penetrated 180 feet of these deposits and was completed in course sand and gravel outwash deposits underlying the till. Two test wells (well #1 and well #2; Figure 1) at this site were drilled to a depth of 240 feet. The depth to water in these wells is approximately 170 feet. Based on available stratigraphic and geophysical data the saturated thickness under this site is estimated to be 350 feet.

Site 2 (Figure 1) is located on a low terrace of the Yellowstone River. Sediments under this site typically consist of cobbles and pebbles with minor amounts of sand and silt. Two test wells (well #3 and well #4; Figure 1) at this site were drilled to depths of 102 feet and the depth to ground water in the wells is approximately 52 feet. Based on available stratigraphic and geophysical data the saturated thickness under this site is estimated to be 300 feet.

All four test-wells were completed as open cased wells, which is the typical construction method in the area. Consequently the pumping wells are open to a very small portion (6-inches) of the aquifer's total thickness (the are partially penetrating wells). Additionally, available ground-water level data in the area has indicated vertical hydraulic gradients

An aquifer test at site #1 was conducted on July 8th and 9th 2003 by pumping test well #1. Prior to the test ground-water levels were measured in all test wells and in two off site residences (Adkins and Sackett; Figure 1). A step drawdown test was conducted to select a flow rate for the longer-term aquifer test. The step test consisted of measuring pumping water levels at increasing flow rates per step. The step drawdown test indicated the well had a specific capacity (pumping rate per foot of drawdown) of between 5.5

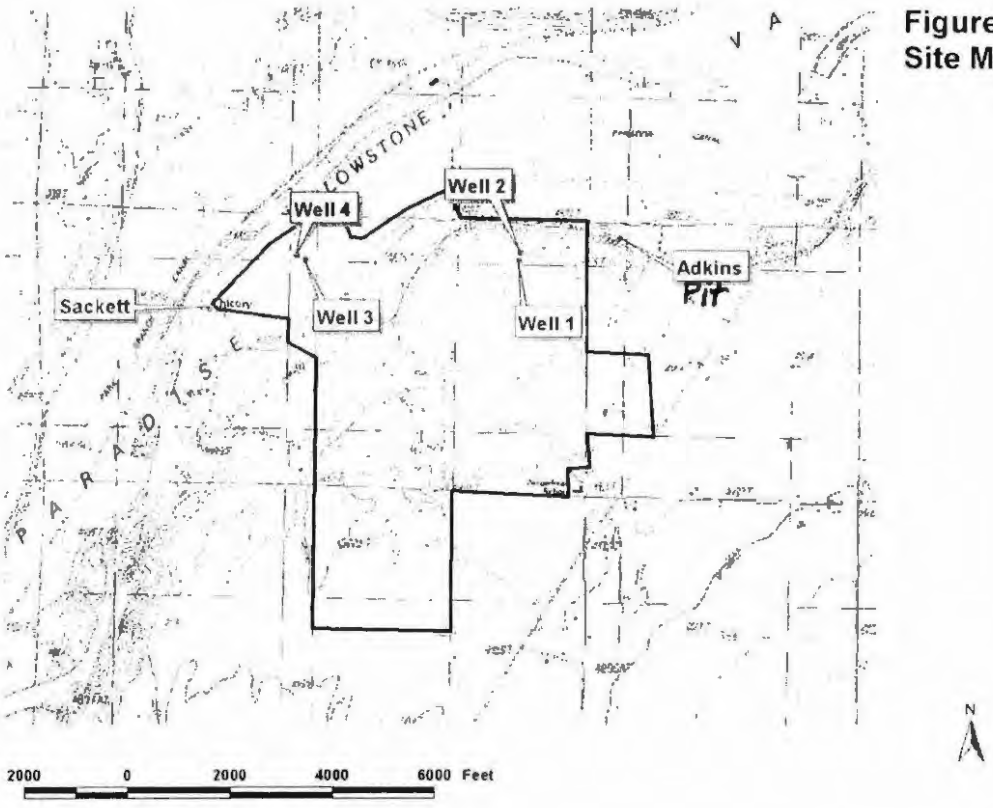


Figure 1
Site Map

gallons per minute (gpm) per foot at 35 gpm to 2.2 gpm/ft at 95 gpm. Specific capacity typically decreases at higher pumping rates due to increase friction loss and turbulence. The estimated maximum pumping rate for the well is 95 gpm. On the basis of the step test a pumping rate of 93 gpm was selected for the aquifer test. At this sustained pumping rate the ground-water level in the pumping well dropped 46 feet, but only dropped 0.14 feet in the observation well (well #2) which is located 177 feet from the pumping well. The test was conducted for 24 hours after which the pump was shut off and the ground-water level recovery was measured in well #2 for another 24 hours.

Test #2 was conducted on July 10th and 11th 2003 by pumping test well #3. As in the case of the previous test baseline water levels were measured at the test wells and offsite residences and a step drawdown test was performed. The step drawdown test indicated a well specific capacity of between 45.8 gpm/ft at 60 gpm to 27.3 gpm/ft at 180 gpm. Based on this data (and projected specific capacities), the maximum theoretical pumping

rate for the well would be about 300 gpm. The pump test was conducted at a rate of 180 gpm, which was the maximum rate for the pump available. At this sustained pumping rate the pumping well drawdown was 6.6 feet, but was only 0.06 feet at the observation well (well #4) which was located 195 feet from the pumping well. The test was conducted for 22 hours and recovery ground-water levels were measured for 2 hours.

Aquifer test analyses were performed using the Moench method (Moench, 1993). Based on available information about the well constructions and aquifer properties this was the most appropriate method. The Moench method is a modification of the more commonly used Newman method and allows for analyses in unconfined ground water in an anisotropic aquifer and partially penetrating wells. The test analyses provided values of aquifer transmissivity, lateral and vertical hydraulic conductivity, and specific yield. The analyses were constrained by setting vertical conductance of approximately 20 feet per day which is consistent with stream and river loss rates throughout the valley.

	Transmisivity	**Lateral hydraulic conductivity**	**Vertical hydraulic conductivity**	**Specific yield**
	(ft^2/day)	(ft/day)	(ft/day)	(ft^3/ft^3)
Site 1 Pumping	64,000	180	18	0.14
Site 2 Pumping	760,000	2,500	25	0.12

The test results indicate that the aquifer under both sites, particularly at site 2, is a highly productive water source. Considering the limited radial influence at high yields, drawdown cones from normal household use will be negligible.

If you have any questions or require additional information please contact me at 406-657-2929 or at Jolson@mtech.edu

Sincerely

John L. Olson
Hydrogeologist
Montana Bureau of Mines and Geology

Well Data

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL 1

Plot this site on a topographic map

Location Information

GWIC Id:	205595	Source of Data:	LOG
Location (TRS):	05S 08E 13 ABDA	Latitude (dd):	45.4075
County (MT):	PARK	Longitude (dd):	-110.6766
DNRC Water Right:		Geomethod:	TRS-TWN
PWS Id:		Datum:	NAD27
Block:		Certificate of Survey:	
Lot:		Type of Site:	WELL
Addition:	YELLOWSTONE TRAILS RANCH SUBDIVISION		

Well Construction and Performance Data

Total Depth (ft):	239.00	How Drilled:	ROTARY
Static Water Level (ft):	174.00	Driller's Name:	HAYES
Pumping Water Level (ft):		Driller License:	WWC361
Yield (gpm):	40.00	Completion Date (m/d/y):	6/24/2003
Test Type:		Special Conditions:	
Test Duration:	2.00	Is Well Flowing?:	
Drill Stem Setting (ft):	235.00	Shut-In Pressure:	
Recovery Water Level (ft):	174.00	Geology/Aquifer:	Not Reported
Recovery Time (hrs):	1.00	Well/Water Use:	DOMESTIC OTHER
Well Notes:			

Hole Diameter Information

From	To	Diameter
0.0	240.0	6.0

Casing Information[1]

From	To	Dia	Description
-2.0	239.0	6.0	STEEL

Annular Seal Information

From	To	Description
0.0	20.0	BENTONITE

Completion Information[1]

From	To	Dia	Description
239.0	240.0	6.0	OPEN BOTTOM

Lithology Information

From	To	Description
0.0	20.0	LARGE BOULDERS 1 TO 3FT COBBLES AND GRAVEL
20.0	125.0	SAND GRAVEL AND COBBLES OCCASIONAL BOULDER 1 TO 2FT
125.0	180.0	LARGE BOULDERS 2 TO 5FT AND GRAVEL
180.0	240.0	COARSE GRAVELS AND SAND OCCASIONAL SMALL BOULDER

[1] - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL 2

Plot this site on a topographic map

Location Information

GWIC Id:	205557	Source of Data:	LOG
Location (TRS):	05S 08E 13 ABAD	Latitude (dd):	45.4084
County (MT):	PARK	Longitude (dd):	-110.6766
DNRC Water Right:		Geomethod:	TRS-TWN
PWS Id:		Datum:	NAD27
Block:		Certificate of Survey:	
Lot:		Type of Site:	WELL
Addition:			

Well Construction and Performance Data

Total Depth (ft):	239.00	How Drilled:	ROTARY
Static Water Level (ft):	168.00	Driller's Name:	HAYES
Pumping Water Level (ft):		Driller License:	WWC361
Yield (gpm):	40.00	Completion Date (m/d/y):	6/25/2003
Test Type:	AIR	Special Conditions:	
Test Duration:	1.00	Is Well Flowing?:	
Drill Stem Setting (ft):	235.00	Shut-In Pressure:	
Recovery Water Level (ft):	168.00	Geology/Aquifer:	Not Reported
Recovery Time (hrs):	1.00	Well/Water Use:	DOMESTIC
Well Notes:			

Hole Diameter Information

From	To	Diameter
0.0	240.0	6.0

Annular Seal Information

From	To	Description
0.0	20.0	BENTONITE

Casing Information[1]

From	To	Dia	Description
-2.0	239.0	6.0	STEEL

Completion Information[1]

From	To	Dia	Description
239.0	240.0	6.0	OPEN BOTTOM

Lithology Information

From	To	Description
0.0	10.0	SOFT SANDY CLAYS WITH SOME GRAVEL
10.0	150.0	SAND GRAVEL AND COBBLES
150.0	180.0	GRAVELS AND BOULDERS 1 TO 2FT
180.0	220.0	COARSE GRAVELS AND SAND
220.0	240.0	BOULDERS 1 TO 3FT AND GRAVEL COARSE

[1] - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL 3

Plot this site on a topographic map
View Hydrograph for this Site

Location Information

GWIC Id:	205551	Source of Data:	LOG
Location (TRS):	05S 08E 14 AADB	Latitude (dd):	45.4075
County (MT):	PARK	Longitude (dd):	-110.6932
DNRC Water Right:		Geomethod:	TRS-TWN
PWS Id:		Datum:	NAD27
Block:		Altitude (feet):	4852.00
Lot:		Certificate of Survey:	
Addition:		Type of Site:	WELL

Well Construction and Performance Data

Total Depth (ft):	98.50	How Drilled:	ROTARY
Static Water Level (ft):	52.00	Driller's Name:	HAYES
Pumping Water Level (ft):		Driller License:	WCC361
Yield (gpm):	80.00	Completion Date (m/d/y):	7/1/2003
Test Type:	AIR	Special Conditions:	
Test Duration:	1.00	Is Well Flowing?:	
Drill Stem Setting (ft):	95.00	Shut-In Pressure:	
Recovery Water Level (ft):	52.00	Geology/Aquifer:	Not Reported
Recovery Time (hrs):	0.50	Well/Water Use:	DOMESTIC
Well Notes:			

Hole Diameter Information

From	To	Diameter
0.0	100.0	6.0

Annular Seal Information

From	To	Description
0.0	25.0	BENTONITE

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-2.0	98.5	6.0	0.250		WELDED	STEEL

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
98.5	102.0	6.0			OPEN BOTTOM

Lithology Information

From	To	Description
0.0	28.0	BOULDERS GRAVEL AND SAND
28.0	41.0	SAND AND GRAVEL
41.0	62.0	SOFT CLAY AND GRAVEL
62.0	67.0	SMALL GRAVELS VERY SAND
67.0	94.0	BOULDERS AND GRAVELS
94.0	102.0	GRAVELS AND SAND SOME CLAY

[1] - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE TEST WELL 4

Plot this site on a topographic map
View Hydrograph for this Site

Location Information

GWIC Id: 205550
Location (TRS): 05S 08E 14 AADA
County (MT): PARK
DNRC Water Right:
PWS Id:
Block:
Lot:
Addition:

Source of Data: LOG
Latitude (dd): 45.4075
Longitude (dd): -110.6919
Geomethod: TRS-TWN
Datum: NAD27
Altitude (feet): 4852.00
Certificate of Survey:
Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 98.50
Static Water Level (ft): 53.00
Pumping Water Level (ft):
Yield (gpm): 80.00
Test Type: AIR
Test Duration: 2.00
Drill Stem Setting (ft): 95.00
Recovery Water Level (ft): 53.00
Recovery Time (hrs): 0.50
Well Notes:

How Drilled: ROTARY
Driller's Name: HAYES
Driller License: WCC361
Completion Date (m/d/y): 7/3/2003
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: Not Reported
Well/Water Use: DOMESTIC

Hole Diameter Information

From	To	Diameter
0.0	102.0	6.0

Annular Seal Information

From	To	Description
0.0	20.0	BENTONITE

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-2.0	98.5	6.0	0.250		WELDED	STEEL

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
98.5	102.0	6.0			OPEN BOTTOM

Lithology Information

From	To	Description
0.0	18.0	SAND GRAVEL AND COBBLES
18.0	55.0	SAND AND SANDY CLAYS VERY LITTLE GRAVEL
55.0	80.0	SANDY GRAVELS
80.0	102.0	GRAVELS SAND AND COBBLES TIGHT SMALL BOULDERS SOME SILTY CLAY

[1] - All diameters reported are **inside** diameter of the casing.

Type Curve Analyses

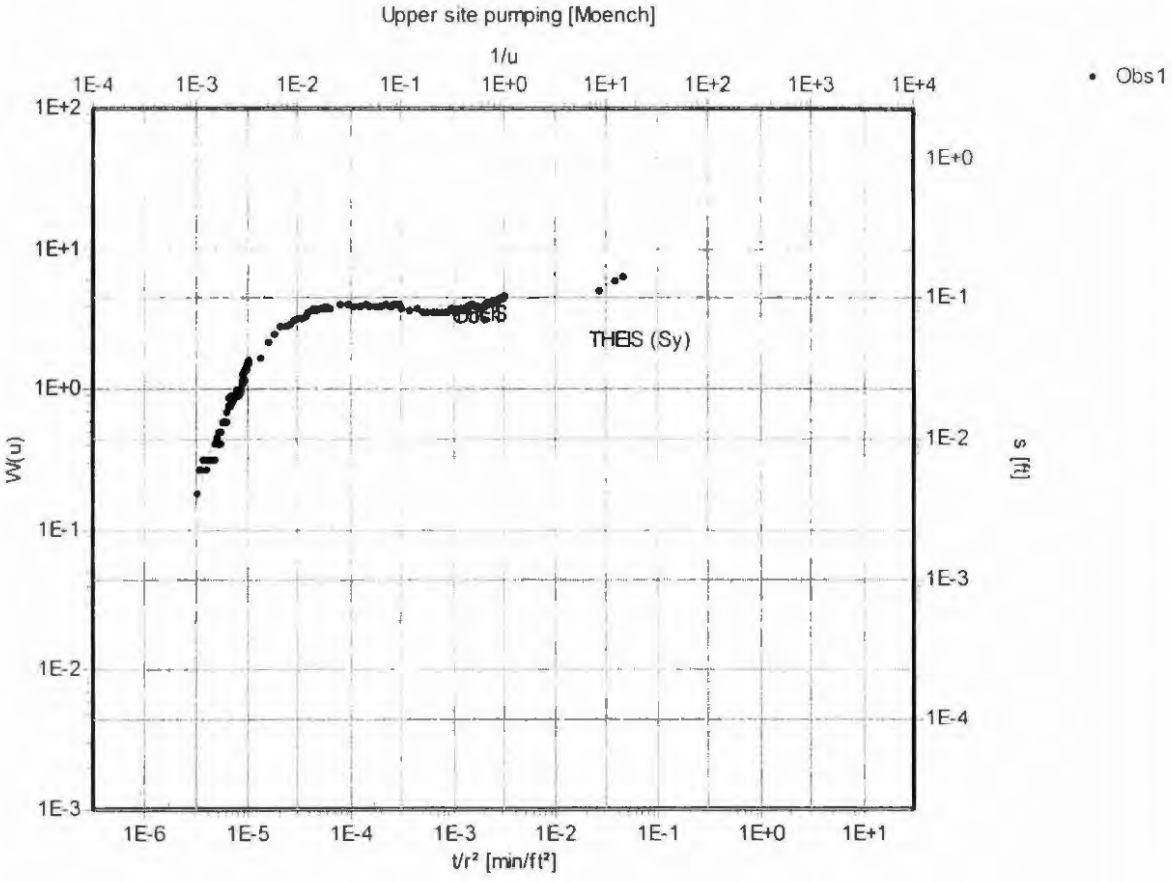
MBMG
1300 N 27th St
Billings, Montana 59101
Phone: 406-657-2929

Pumping Test Analysis Report

Project: Yellostone Trail Ranch

Number:

Client:



Pumping Test: **Upper site pumping**

Analysis Method: **Moench**

Analysis Results:	Transmissivity:	6.36E+4 [ft²/d]	Conductivity:	1.82E+2 [ft/d]
	Storativity:	1.37E-1	Conductivity (vertical):	1.82E+1 [ft/d]
Test parameters:	Pumping Well:	PW	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Unconfined Aquifer	
	Screen length:	0.25 [ft]	S/Sy:	0.01
	Boring radius:	0.25 [ft]	Kv/Kh:	0.1
	Discharge Rate:	93 [U.S. gal/min]	Gamma:	1E9
	b:	70 [ft]		

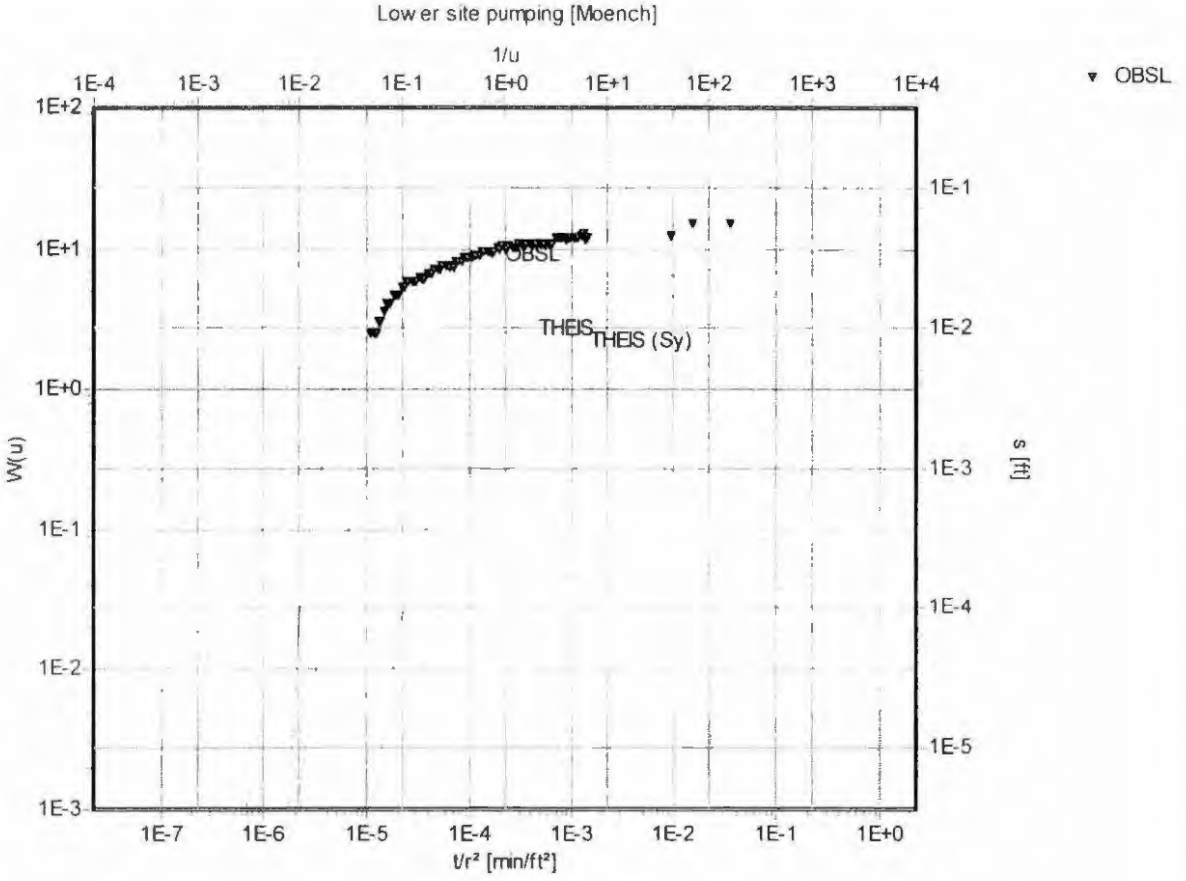
Comments:

Evaluated by:

Evaluation Date: 2/27/2004

MBMG
1300 N 27th St
Billings, Montana 59101
Phone: 406-657-2929

Pumping Test Analysis Report
Project: Yellostone Trail Ranch
Number:
Client:



Pumping Test: **Lower site pumping**

Analysis Method: **Moench**

Analysis Results:	Transmissivity:	7.59E+5 [ft²/d]	Conductivity:	2.53E+3 [ft/d]
	Storativity:	1.18E-1	Conductivity (vertical):	2.53E+1 [ft/d]
Test parameters:	Pumping Well:	PWL	Aquifer Thickness:	300 [ft]
	Casing radius:	0.25 [ft]	Unconfined Aquifer	
	Screen length:	0.25 [ft]	S/Sy:	0.18
	Boring radius:	0.25 [ft]	Kv/Kh:	0.01
	Discharge Rate:	180 [U.S. gal/min]	Gamma:	1E9
	b:	50 [ft]		

Comments:

Evaluated by:

Evaluation Date: 2/27/2004

Test Data

MBMG
1300 N 27th St
Billings, Montana 59101
Phone: 406-657-2929

Pumping Test Data Report
Project: Yellostone Trail Ranch
Number:
Client:

Data observed at:	**Obs1**	**Pumping Test:**	**Upper site pumping**
Distance from PW:	177 [ft]	Pumping Well:	PW
Depth to Static WL:	170.07 [ft]	Casing radius:	0.25 [ft]
Location:	Near Pray, Montan	Boring radius:	0.25 [ft]
Recorded by:		Screen length:	0.25 [ft]
Date:	7/8/2003	Aquifer Thickness:	350 [ft]

	Time [min]	Depth to WL [ft]	Drawdown [ft]
1	0.044	170.07	0.00
2	0.048	170.07	0.00
3	0.052	170.07	0.00
4	0.056	170.07	0.00
5	0.06	170.07	0.00
6	0.065	170.07	0.00
7	0.069	170.07	0.00
8	0.073	170.08	0.01
9	0.077	170.07	0.00
10	0.081	170.08	0.01
11	0.085	170.07	0.00
12	0.09	170.07	0.00
13	0.094	170.07	0.00
14	0.098	170.07	0.00
15	0.102	170.07	0.00
16	0.106	170.08	0.01
17	0.11	170.08	0.01
18	0.115	170.08	0.01
19	0.119	170.08	0.01
20	0.123	170.08	0.01
21	0.127	170.08	0.01
22	0.131	170.08	0.01
23	0.135	170.08	0.01
24	0.14	170.08	0.01
25	0.144	170.08	0.01
26	0.148	170.08	0.01
27	0.152	170.08	0.01
28	0.156	170.08	0.01
29	0.16	170.08	0.01
30	0.165	170.08	0.01
31	0.169	170.08	0.01

MBMG
1300 N 27th St
Billings, Montana 59101
Phone: 406-657-2029

Pumping Test Data Report
Project: Yellostone Trail Ranch
Number:
Client:

Data observed at:	**Obs1**	**Pumping Test:**	**Upper site pumping**
Distance from PW:	177 [ft]	Pumping Well:	PW
Depth to Static WL:	170.07 [ft]	Casing radius:	0.25 [ft]
Location:	Near Pray, Montan	Boring radius:	0.25 [ft]
Recorded by:		Screen length:	0.25 [ft]
Date:	7/8/2003	Aquifer Thickness:	350 [ft]

	Time [min]	Depth to WL [ft]	Drawdown [ft]
32	0.173	170.08	0.01
33	0.177	170.08	0.01
34	0.181	170.08	0.01
35	0.185	170.08	0.01
36	0.19	170.08	0.01
37	0.194	170.08	0.01
38	0.198	170.08	0.01
39	0.202	170.09	0.02
40	0.206	170.09	0.02
41	0.21	170.09	0.02
42	0.215	170.09	0.02
43	0.219	170.09	0.02
44	0.223	170.09	0.02
45	0.227	170.09	0.02
46	0.231	170.09	0.02
47	0.235	170.09	0.02
48	0.24	170.09	0.02
49	0.244	170.09	0.02
50	0.248	170.09	0.02
51	0.252	170.09	0.02
52	0.256	170.09	0.02
53	0.26	170.09	0.02
54	0.265	170.09	0.02
55	0.269	170.09	0.02
56	0.273	170.09	0.02
57	0.277	170.09	0.02
58	0.281	170.10	0.03
59	0.285	170.09	0.02
60	0.29	170.10	0.03
61	0.294	170.10	0.03
62	0.298	170.10	0.03

MBMG
1300 N 27th St
Billings, Montana 59101
Phone: 406-657-2929

Pumping Test Data Report
Project: Yellostone Trail Ranch
Number:
Client:

Data observed at:	**Obs1**	**Pumping Test:**	**Upper site pumping**
Distance from PW:	177 [ft]	Pumping Well:	PW
Depth to Static WL:	170.07 [ft]	Casing radius:	0.25 [ft]
Location:	Near Pray, Montan	Boring radius:	0.25 [ft]
Recorded by:		Screen length:	0.25 [ft]
Date:	7/8/2003	Aquifer Thickness:	350 [ft]

	Time [min]	Depth to WL [ft]	Drawdown [ft]
63	0.302	170.10	0.03
64	0.306	170.10	0.03
65	0.31	170.10	0.03
66	0.315	170.10	0.03
67	0.319	170.10	0.03
68	0.323	170.10	0.03
69	0.327	170.10	0.03
70	0.331	170.10	0.03
71	0.419	170.11	0.04
72	0.502	170.12	0.05
73	0.585	170.12	0.05
74	0.669	170.13	0.06
75	0.752	170.13	0.06
76	0.835	170.13	0.06
77	0.919	170.14	0.07
78	1.002	170.14	0.07
79	1.085	170.14	0.07
80	1.169	170.14	0.07
81	1.252	170.15	0.08
82	1.335	170.15	0.08
83	1.419	170.15	0.08
84	1.502	170.15	0.08
85	1.585	170.15	0.08
86	1.669	170.15	0.08
87	1.752	170.15	0.08
88	1.835	170.16	0.09
89	1.919	170.15	0.08
90	2.002	170.15	0.08
91	2.502	170.16	0.09
92	3.002	170.16	0.09
93	3.502	170.16	0.09

MBMG
1300 N 27th St
Billings, Montana 59101
Phone: 406-657-2929

Pumping Test Data Report
Project: Yellostone Trail Ranch
Number:
Client:

Data observed at:	**Obs1**	**Pumping Test:**	**Upper site pumping**
Distance from PW:	177 [ft]	Pumping Well:	PW
Depth to Static WL:	170.07 [ft]	Casing radius:	0.25 [ft]
Location:	Near Pray, Montan	Boring radius:	0.25 [ft]
Recorded by:		Screen length:	0.25 [ft]
Date:	7/8/2003	Aquifer Thickness:	350 [ft]

	Time [min]	Depth to WL [ft]	Drawdown [ft]
94	4.002	170.16	0.09
95	4.502	170.16	0.09
96	5.002	170.16	0.09
97	5.502	170.16	0.09
98	6.002	170.16	0.09
99	6.502	170.16	0.09
100	7	170.16	0.09
101	7.5	170.16	0.09
102	8	170.16	0.09
103	8.5	170.16	0.09
104	9	170.16	0.09
105	9.5	170.16	0.09
106	10	170.15	0.08
107	12	170.15	0.08
108	14	170.15	0.08
109	16	170.15	0.08
110	18	170.15	0.08
111	20	170.15	0.08
112	22	170.15	0.08
113	24	170.15	0.08
114	26	170.15	0.08
115	28	170.15	0.08
116	30	170.15	0.08
117	32	170.15	0.08
118	34	170.15	0.08
119	36	170.15	0.08
120	38	170.15	0.08
121	40	170.15	0.08
122	42	170.15	0.08
123	44	170.16	0.09
124	46	170.16	0.09

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Pumping Test Data Report
Project: Yellostone Trail Ranch
Number:
Client:

Data observed at:	**Obs1**	**Pumping Test:**	**Upper site pumping**
Distance from PW:	177 [ft]	Pumping Well:	PW
Depth to Static WL:	170.07 [ft]	Casing radius:	0.25 [ft]
Location:	Near Pray, Montan	Boring radius:	0.25 [ft]
Recorded by:		Screen length:	0.25 [ft]
Date:	7/8/2003	Aquifer Thickness:	350 [ft]

	Time [min]	Depth to WL [ft]	Drawdown [ft]
125	48	170.16	0.09
126	50	170.16	0.09
127	52	170.16	0.09
128	54	170.16	0.09
129	56	170.16	0.09
130	58	170.15	0.08
131	60	170.15	0.08
132	62	170.16	0.09
133	64	170.16	0.09
134	66	170.16	0.09
135	68	170.16	0.09
136	70	170.16	0.09
137	72	170.16	0.09
138	74	170.16	0.09
139	76	170.16	0.09
140	78	170.16	0.09
141	80	170.16	0.09
142	82	170.16	0.09
143	84	170.17	0.10
144	86	170.17	0.10
145	88	170.16	0.09
146	90	170.17	0.10
147	92	170.17	0.10
148	94	170.17	0.10
149	96	170.17	0.10
150	98	170.17	0.10
151	100	170.17	0.10
152	842	170.18	0.11
153	1205	170.20	0.13
154	1440	170.21	0.14

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Pumping Test Data Report
Project: Yellostone Trail Ranch
Number:
Client:

Data observed at:	**OBSL**	**Pumping Test:**	**Lower site pumping**
Distance from PW:	195 [ft]	Pumping Well:	PWL
Depth to Static WL:	52.155 [ft]	Casing radius:	0.25 [ft]
Location:	Near Pray, Montan	Boring radius:	0.25 [ft]
Recorded by:		Screen length:	0.25 [ft]
Date:	7/14/2003	Aquifer Thickness:	300 [ft]

	Time [min]	Depth to WL [ft]	Drawdown [ft]
1	0.04	52.13	-0.03
2	0.045	52.13	-0.03
3	0.05	52.13	-0.03
4	0.055	52.13	-0.03
5	0.06	52.13	-0.03
6	0.065	52.13	-0.03
7	0.07	52.13	-0.03
8	0.075	52.13	-0.03
9	0.08	52.13	-0.03
10	0.085	52.13	-0.03
11	0.09	52.13	-0.03
12	0.095	52.13	-0.02
13	0.1	52.13	-0.03
14	0.106	52.13	-0.02
15	0.112	52.13	-0.02
16	0.118	52.13	-0.02
17	0.126	52.13	-0.02
18	0.133	52.13	-0.02
19	0.141	52.13	-0.02
20	0.149	52.13	-0.02
21	0.158	52.13	-0.02
22	0.167	52.14	-0.02
23	0.177	52.14	-0.01
24	0.188	52.15	-0.01
25	0.199	52.15	-0.01
26	0.21	52.15	-0.01
27	0.223	52.15	-0.01
28	0.236	52.15	0.00
29	0.25	52.15	0.00
30	0.265	52.15	0.00
31	0.28	52.16	0.00

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Pumping Test Data Report
Project: Yellostone Trail Ranch
Number:
Client:

Data observed at:	**OBSL**	**Pumping Test:**	**Lower site pumping**
Distance from PW:	195 [ft]	Pumping Well:	PWL
Depth to Static WL:	52.155 [ft]	Casing radius:	0.25 [ft]
Location:	Near Pray, Montan	Boring radius:	0.25 [ft]
Recorded by:		Screen length:	0.25 [ft]
Date:	7/14/2003	Aquifer Thickness:	300 [ft]

	Time [min]	Depth to WL [ft]	Drawdown [ft]
32	0.297	52.16	0.00
33	0.315	52.16	0.00
34	0.333	52.16	0.00
35	0.353	52.16	0.00
36	0.374	52.16	0.01
37	0.396	52.16	0.01
38	0.42	52.16	0.01
39	0.445	52.16	0.01
40	0.47	52.16	0.01
41	0.496	52.17	0.01
42	0.525	52.17	0.01
43	0.555	52.17	0.01
44	0.586	52.17	0.02
45	0.621	52.17	0.02
46	0.658	52.17	0.02
47	0.696	52.17	0.02
48	0.738	52.17	0.02
49	0.781	52.17	0.02
50	0.828	52.17	0.02
51	0.876	52.17	0.02
52	0.928	52.18	0.02
53	0.983	52.18	0.02
54	1.041	52.18	0.02
55	1.103	52.18	0.02
56	1.168	52.18	0.02
57	1.238	52.18	0.02
58	1.311	52.18	0.02
59	1.39	52.18	0.02
60	1.473	52.18	0.02
61	1.561	52.18	0.02
62	1.655	52.18	0.02

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Pumping Test Data Report
Project: Yellostone Trail Ranch
Number:
Client:

Data observed at:	**OBSL**	**Pumping Test:**	**Lower site pumping**
Distance from PW:	195 [ft]	Pumping Well:	PWL
Depth to Static WL:	52.155 [ft]	Casing radius:	0.25 [ft]
Location:	Near Pray, Montan	Boring radius:	0.25 [ft]
Recorded by:		Screen length:	0.25 [ft]
Date:	7/14/2003	Aquifer Thickness:	300 [ft]

	Time [min]	Depth to WL [ft]	Drawdown [ft]
63	1.753	52.18	0.03
64	1.858	52.18	0.03
65	1.968	52.18	0.03
66	2.085	52.18	0.03
67	2.21	52.18	0.03
68	2.341	52.18	0.03
69	2.481	52.18	0.03
70	2.63	52.18	0.03
71	2.786	52.18	0.03
72	2.953	52.18	0.03
73	3.13	52.18	0.03
74	3.316	52.19	0.03
75	3.515	52.19	0.03
76	3.725	52.19	0.03
77	3.946	52.19	0.03
78	4.181	52.19	0.03
79	4.429	52.19	0.03
80	4.693	52.19	0.03
81	4.973	52.19	0.03
82	5.27	52.19	0.03
83	5.583	52.19	0.03
84	5.915	52.19	0.03
85	6.266	52.19	0.03
86	6.64	52.19	0.03
87	7.035	52.19	0.04
88	7.453	52.19	0.04
89	7.896	52.19	0.04
90	8.366	52.19	0.04
91	8.865	52.19	0.04
92	9.391	52.19	0.04
93	9.95	52.19	0.04

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Pumping Test Data Report
Project: Yellostone Trail Ranch
Number:
Client:

Data observed at:	**OBSL**	**Pumping Test:**	**Lower site pumping**
Distance from PW:	195 [ft]	Pumping Well:	PWL
Depth to Static WL:	52.155 [ft]	Casing radius:	0.25 [ft]
Location:	Near Pray, Montan	Boring radius:	0.25 [ft]
Recorded by:		Screen length:	0.25 [ft]
Date:	7/14/2003	Aquifer Thickness:	300 [ft]

	Time [min]	Depth to WL [ft]	Drawdown [ft]
94	10.541	52.19	0.04
95	11.168	52.19	0.04
96	11.831	52.19	0.04
97	12.535	52.19	0.04
98	13.28	52.19	0.04
99	14.07	52.20	0.04
100	14.906	52.20	0.04
101	15.791	52.20	0.04
102	16.73	52.20	0.04
103	17.723	52.19	0.04
104	18.776	52.19	0.04
105	19.891	52.19	0.04
106	21.073	52.19	0.04
107	22.325	52.20	0.04
108	23.65	52.20	0.04
109	25.055	52.20	0.04
110	26.543	52.20	0.04
111	28.118	52.20	0.04
112	29.786	52.20	0.04
113	31.555	52.20	0.04
114	33.428	52.20	0.04
115	35.411	52.20	0.04
116	37.513	52.20	0.04
117	39.74	52.20	0.04
118	42.098	52.20	0.04
119	44.596	52.20	0.04
120	47.243	52.20	0.05
121	50.046	52.20	0.05
122	53.015	52.20	0.04
123	56.16	52.20	0.04
124	356	52.20	0.05

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Pumping Test Data Report
Project: Yellostone Trail Ranch
Number:
Client:

Data observed at:	**OBSL**	**Pumping Test:**	**Lower site pumping**
Distance from PW:	195 [ft]	Pumping Well:	PWL
Depth to Static WL	52.155 [ft]	Casing radius	0.25 [ft]
Location:	Near Pray, Montan	Boring radius:	0.25 [ft]
Recorded by		Screen length:	0.25 [ft]
Date:	7/14/2003	Aquifer Thickness:	300 [ft]

	Time [min]	Depth to WL [ft]	Drawdown [ft]
125	577	52.21	0.05
126	1342	52.21	0.05

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
B. NEAL AINSWORTH / LLOYD MANDEVILLE OPEN SPACE 2

Plot this site on a topographic map

Location Information

GWIC Id: 213660
Location (TRS): 05S 08E 24 BCAA
County (MT): PARK
DNRC Water Right:
PWS Id:
Block:
Lot:
Addition:

Source of Data: LOG
Latitude (dd): 45.3910
Longitude (dd): -110.6873
Geomethod: TRS-TWN
Datum: NAD27
Altitude (feet):
Certificate of Survey:
Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 259.00
Static Water Level (ft): 191.00
Pumping Water Level (ft):
Yield (gpm): 40.00
Test Type: AIR
Test Duration: 1.00
Drill Stem Setting (ft): 255.00
Recovery Water Level (ft): 191.00
Recovery Time (hrs): 0.50
Well Notes:

How Drilled: ROTARY
Driller's Name: HAYES
Driller License: WWC361
Completion Date (m/d/y): 5/20/2004
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: Not Reported
Well/Water Use: OTHER

Hole Diameter Information

From	To	Diameter
0.0	259.0	6.0

Annular Seal Information

From	To	Description
0.0	20.0	BENTONITE

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-2.0	258.0	6.0	0.250		WELDED	STEEL

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
258.0	259.0	6.0			OPEN BOTTOM

Lithology Information

From	To	Description
0.0	1.0	TOPSOIL
1.0	170.0	SAND, GRAVEL, COBBLES & FEW BOULDERS
170.0	259.0	SAME WITH NUMEROUS LARGE BOULDERS & SOME CLAY

[1] - All diameters reported are **Inside** diameter of the casing.

Ground-Water Information Center
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Montana Tech of The University of Montana
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Ground Water Information Center
Wells Report

The following data were returned from the GWIC databases for the area you requested. For a more detailed description of the data view the **GWIC Metadata report**. If you notice data entry errors or have questions please let us know by clicking here to leave us a message. If you wish to view a one page report for a particular site, click the hyperlinked **Gwic Id** for that well. Scroll to the right of your screen to view all the data.

Retrieval Statistics *

Field	Max	Min	Count	Avg
Total Depth	248.00	160.00	5	213.20
Pumping Water Level	162.30	162.30	1	162.30
Static Water Level	174.00	120.00	5	156.06
Yield (gpm)	500.00	30.00	5	136.40

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

Filter Options

Td >=

filter report

Gwic Id	DNRC WR	Site Name	Location	Ver?	Type	Td	Pwl	Swl	Yield	Date	Use
102470		HOBBS HARRY B.	05S08E13A	NO	WELL	180.00		160.00	500.00	1/1/1900	STOCKWATER
205557		AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL 2	05S08E13ABAD	YES	WELL	239.00		168.00	40.00	6/25/2003	DOMESTIC
205595		AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL 1	05S08E13ABDA	YES	WELL	239.00		174.00	40.00	6/24/2003	DOMESTIC OTHER
212142		DENNY GARY	05S08E13CBB	NO	WELL	160.00		120.00	30.00	6/21/2004	DOMESTIC
162941	P100729-00	ARROWHEAD SCHOOL DISTRICT 75	05S08E13DDDD	YES	WELL	248.00	162.30	158.30	72.00	8/19/1996	PUBLIC WATER SUPPLY

End of Report.
5 record(s) listed.

This report is restricted to site types of **WELL**, **BOREHOLE**, **SPRING**, and **COAL BED METHANE WELL**.

Explanation of Columns:
Td = Total depth of well in feet below ground
Pwl = Pumping water level in feet below ground
Swl = Static water level in feet above/below ground - Negative values are reported for water levels that are above land surface.
Yield = Yield in gallons per minute
Date = Completion date of well/borehole
Use = Reported use of water
Ver? = Was location verified?

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Ground Water Information Center
Wells Report

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Retrieval Statistics *

Field	Max	Min	Count	Avg
Total Depth	284.00	175.00	11	225.36
Pumping Water Level	197.00	157.00	3	183.00
Static Water Level	200.00	47.00	11	165.91
Yield (gpm)	600.00	10.00	11	122.09

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

Filter Options

Td >=

filter report

Gwic Id	DNRC WR	Site Name	Location	Ver?	Type	Td	Pwl	Swl	Yield	Date	Use
102481		BUSBY LESLIE	05S08E24A	NO	WELL	207.00		47.00	600.00	2/1/1949	DOMESTIC STOCKWATER
102482		ANDERSON ARNOLD J	05S08E24AD	NO	WELL	200.00	197.00	170.00	25.00	2/27/1979	DOMESTIC
102483		HOBBS HARRY H.	05S08E24B	NO	WELL	180.00		160.00	500.00	1/1/1900	STOCKWATER
213660		B. NEAL AINSWORTH / LLOYD MANDEVILLE	05S08E24BCAA	NO	WELL	259.00		191.00	40.00	5/20/2004	OTHER
215806		HARDIN DORTHY L. OR W. EDWARD	05S08E24CCD	NO	WELL	260.00		184.00	42.00	12/7/2004	DOMESTIC
212415		GOULD TOM	05S08E24CD	NO	WELL	284.00		200.00	58.00	5/28/2004	DOMESTIC
102484	C015198-00	BALAVAGE JERRY	05S08E24D	NO	WELL	175.00	157.00	140.00	15.00	10/13/1976	DOMESTIC
102485		QUESENBERRY MARVIN	05S08E24D	NO	WELL	195.00	195.00	165.00	10.00	12/11/1986	DOMESTIC
196500	C30005478	BIG SKY HOLDINGS LLC	05S08E24DBAD	NO	WELL	239.00		191.00	18.00	5/31/2002	DOMESTIC
183947		HALL NORMAN	05S08E24DBCA	NO	WELL	239.00		187.00	15.00	7/25/2000	DOMESTIC
212476		DILMORE VINCE AND TARA	05S08E24DC	NO	WELL	241.00		190.00	20.00	6/28/2001	DOMESTIC

End of Report.
11 record(s) listed.

This report is restricted to site types of **WELL**, **BOREHOLE**, **SPRING**, and **COAL BED METHANE WELL**.

Explanation of Columns:
Td = Total depth of well in feet below ground
Pwl = Pumping water level in feet below ground
Swl = Static water level in feet above/below ground - Negative values are reported for water levels that are above land surface.
Yield = Yield in gallons per minute
Date = Completion date of well/borehole
Use = Reported use of water
Ver? = Was location verified?

The preceding materials represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user at the time and date of the retrieval. Retransmission of the data

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Montana Bureau of Mines and Geology
Montana Tech of The University of Montana
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Butte Montana 59701-8997

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Ground Water Information Center
Wells Report

The following data were returned from the GWIC databases for the area you requested. For a more detailed description of the data view the **GWIC Metadata report**. If you notice data entry errors or have questions please let us know by clicking **here** to leave us a message. If you wish to view a one page report for a particular site, click the hyperlinked **Gwic Id** for that well. Scroll to the right of your screen to view all the data.

Retrieval Statistics *

Field	Max	Min	Count	Avg
Total Depth	219.00	28.00	49	128.63
Pumping Water Level	205.00	30.00	36	92.51
Static Water Level	173.00	10.00	48	65.60
Yield (gpm)	100.00	8.00	47	26.38

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

Filter Options

Td >=

filter report

Gwic Id	DNRC WR	Site Name	Location	Ver?	Type	Td	Pwl	Swl	Yield	Date	Use
167776		BURGFECHTEL STEVE	05S08E14	NO	WELL	134.00	120 00	38.50	12 00	4/18/1998	DOMESTIC
153651		HART EDWARD N AND ENSTROM AND EILEEN	05S08E14	NO	WELL	173.50	102.50	97.50	10.00	9/7/1995	DOMESTIC
102472		JERLA RALPH	05S08E14	NO	WELL	205.00	205.00	66.00	30.00	5/24/1982	DOMESTIC
102473		MCCARTHY VESTA #1	05S08E14	NO	WELL	28.00		28.00		1/1/1900	DOMESTIC STOCKWATER
102474		MCCARTY VESTA *WELL #2	05S08E14	NO	WELL	28.00		28.00		1/1/1900	DOMESTIC STOCKWATER
155018		STOUFFER MARSHALL	05S08E14	NO	WELL	139.50	41.50	38.00	15.00	10/15/1995	DOMESTIC
102471		VANCE DUANE	05S08E14	NO	WELL	86.00	80.00	34.00	25.00	4/16/1984	DOMESTIC
155015		BIGENHO ED & CARYL	05S08E14	NO	WELL	109.50	41.50	39.00	15.00	9/17/1995	DOMESTIC
205550		AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE	05S08E14AADA	YES	WELL	98.50		53.00	80.00	7/3/2003	DOMESTIC
205551		AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL 3	05S08E14AADB	YES	WELL	98.50		52.00	80.00	7/1/2003	DOMESTIC
102475	C095458-00	DELOREY BRUCE	05S08E14ABD	NO	WELL	175.00	170.00	135.00	8.00	7/27/1979	DOMESTIC
147735	C089711-00	REINHARDT CARL	05S08E14ACB	NO	WELL	93.00	90.00	10.00	35.00	11/10/1993	FIRE PROTECTION
159750	C097936-00	SACKETT GARY AND SHANNON	05S08E14ACBD	YES	WELL	43.50	30.00	26.00	15.00	4/15/1996	DOMESTIC
134019		HENNESSEY MIKE	05S08E14ACC	NO	WELL	74.00	70.00	14.00	35.00	8/6/1992	DOMESTIC
133368		LAY BRUCE	05S08E14ACC	NO	WELL	86.00	83.00	33.00	35.00	8/8/1992	DOMESTIC
169348		DEYOUNG BRET	05S08E14ACD	NO	WELL	139.00	47.00	44.00	12.00	6/13/1998	DOMESTIC
169349		EDDINGTON TERESA D.	05S08E14ACD	NO	WELL	139.00	55.00	48.00	12.00	5/31/1998	DOMESTIC
169350	C104672-00	BURGFECHTEL	05S08E14BBD	NO	WELL	134.00	46.00	38.50	12.00	4/18/1998	DOMESTIC

		STEVE									
102477	C007666-00	ANGLE BOB	05S08E14D	NO	WELL	162.00	157.00	149.00	12.00	8/13/1975	DOMESTIC
155016		BIGENHO ED & CARYL	05S08E14D	NO	WELL	121 50	39 00	38 00	15 00	10/1/1995	DOMESTIC
102478		D'ANGELO RON	05S08E14D	NO	WELL	148.50		110.00	25 00	4/4/1990	DOMESTIC
175956		DEWALT FREDERIC G & PATRICA G	05S08E14D	NO	WELL	162 00	66 00	39 00	15 00	10/24/1999	DOMESTIC
170790	C106158-00	DEYOUNG BRET	05S08E14D	NO	WELL	139 00	47 00	44 00	12 00	6/13/1998	DOMESTIC
183230	C30009393	MACKAY GREG & TERESA	05S08E14D	NO	WELL	118 50		63 00	30 00	5/18/2000	DOMESTIC
102476	C061505-00	NAGEL WALTER	05S08E14D	NO	WELL	202 00	190 00	164 00	18 00	4/28/1986	DOMESTIC
147736		O'BRIEN JAMES R	05S08E14D	NO	WELL	149.00	39 50	34.00	13.00	7/2/1994	DOMESTIC
143113	C088952-00	GRINDINGER LEE & RUTH	05S08E14DA	NO	WELL	118.00	115.00	90.00	20.00	5/24/1993	DOMESTIC
160118	C099513-00	QUESENBERRY NELSON	05S08E14DA	NO	WELL	118.00	115.00	91 00	20.00	6/25/1996	DOMESTIC
143112	C091506-00	BUSBY MIKE AND SUSAN	05S08E14DAA	NO	WELL	67.00	60.00	45.00	15.00	5/25/1993	DOMESTIC
200132		BIGENHO ED CARYL AND CHRISTOPHER	05S08E14DAC	NO	WELL	131.50	91 00	87 00	14 00	9/22/2002	DOMESTIC
155017		PHILLIPS MATT	05S08E14DAC	NO	WELL	127 50	81 00	76 00	12 00	10/12/1995	DOMESTIC
213658		SPANNRING BOB	05S08E14DACC	NO	WELL	181 00		98 00	80 00	5/26/2004	DOMESTIC
200141		BIGENHO ED CARYL AND CHRISTOPHER	05S08E14DBA	NO	WELL	113 50	48 50	45 50	14 00	10/10/2002	DOMESTIC
142905	C089621-00	KNOLL AMY	05S08E14DBC	NO	WELL	95.00	90.00	34.00	35 00	11/2/1993	DOMESTIC
147211	C092490-00	JURACK ROGER OR CAROLYN	05S08E14DBD	NO	WELL	109 00	45.00	40 00	13 00	7/17/1994	DOMESTIC
181688		FATAUROS JOSH	05S08E14DBDD	NO	WELL	158 00		41 00	100 00	9/11/1997	DOMESTIC
134021	C093756-00	HENNESSEY MIKE	05S08E14DC	NO	WELL	63.00	60.00	15.00	35.00	8/7/1992	DOMESTIC
159751		TATUM JEANNIE	05S08E14DC	NO	WELL	149.00	144 00	80 00	25 00	4/1/1996	DOMESTIC
169852		HANLON KEVIN	05S08E14DCA	NO	WELL	155.00			100 00	9/16/1998	DOMESTIC
133369	C083301-00	ROBEY PATRICIA	05S08E14DCAD	YES	WELL	135.00	117 00	81 00	10.00	4/21/1992	DOMESTIC
192471		DAVIS DAN AND VIVIAN	05S08E14DCB	NO	WELL	99 00		67 00	15 00	6/14/2001	DOMESTIC
147740	C089710-00	REINHARDT CARL	05S08E14DCB	NO	WELL	78.00	75.00	12.00	35 00	11/10/1993	DOMESTIC
144004	C092574-00	REINHART CARL	05S08E14DCB	NO	WELL	141 00	135.00	31 00	30.00	9/15/1993	DOMESTIC
147738	C095530-00	MOFFO LEONARD	05S08E14DCC	NO	WELL	177.00	161.00	162.00	10.00	5/20/1994	DOMESTIC
213595		BUSCHER CRAIG	05S08E14DD	NO	WELL	142.00		47 00	30.00	8/3/2004	DOMESTIC
210808	C30008681	CHADWICK KIRK	05S08E14DDA	NO	WELL	181.00		115 00	8.00	9/28/1997	DOMESTIC
166310	C30008681	CHADWICK KIRK	05S08E14DDA	NO	WELL	181.00	118.00	115 00	8 00	9/28/1997	DOMESTIC
204071		DELOREY ELMER	05S08E14DDAD	NO	WELL	219.00		173.00	20.00	5/21/2003	DOMESTIC
142906	C092444-00	KENNARD CHRIS	05S08E14DDB	NO	WELL	178.00	155.00	140.00	20.00	7/6/1993	DOMESTIC

End of Report.
49 record(s) listed.

This report is restricted to site types of WELL, BOREHOLE, SPRING, and COAL BED METHANE WELL

Explanation of Columns:
Td = Total depth of well in feet below ground
Pwl = Pumping water level in feet below ground
Swl = Static water level in feet above/below ground - Negative values are reported for water levels that are above land surface.
Yield = Yield in gallons per minute
Date = Completion date of well/borehole
Use = Reported use of water
Ver? = Was location verified?

The preceding materials represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user at the time and date of the retrieval. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted. There may be wells in the area

June 15, 2004

William Smith
Octagon Engineering
PO Box 78
Emigrant, MT 59027
Octagon@wispwest.net

Subject: Aquifer pump test results, Pray site, (T05S, R08E, Sec 24C)

Dear Mr. Smith

The following are results of the aquifer pump test conducted at the proposed subdivision near Pray Montana (Pray site) at Township 05S Range 08E Section 24C on May 27th and 28th 2004. The tests were done in cooperation with your firm and well completion, pump installation and operation tasks were contracted by the developer. Data collection by the Montana Bureau of Mines and Geology (MBMG) were conducted within the scope of our on-going Paradise Valley water resources study. The MBMG neither supports nor opposes the proposed development. The collected data and interpretation will be made publicly available through our soon to be published project report and our Ground Water Information Center (GWIC) database.

Site Setting

The aquifer test site is located approximately ¼ mile northwest of Pray Montana in the Paradise Valley. Observation wells are located approximately 600 (observations well #1) and 750 feet (observation well #2) from the pumping well. The pumping well is completed to a depth of 284 feet and the observation wells are completed to a depth of 230 feet. The pumping well is constructed with 6-inch steel casing with an open bottom. This is a common well design in the valley but is highly inefficient because of the very limited aquifer area exposed to the well.

Hydrogeologic Data

The proposed subdivision is located on a high terrace composed of glacial outwash deposits from the Eight Mile Creek advance. These deposits overlie older glacial and alluvial deposits. Aquifers form where sand, gravel, and cobble sediments become water-saturated, which in the site vicinity occur at depths greater than 196 to 201 feet. Data from a petroleum test well completed about ¼ mile to the north of the site (MPC 1984) indicate an aquifer saturated thickness of about 650 feet thick at that location.

Test Description

Depth to ground-water measurements were collected from the pumping well and from the observation well #1 using an *In-situ* MiniTroll and were barometrically corrected with an *In-situ* BaroTroll. Dawdown data were verified with periodic electronic water level tape measurements by Octagon. Water level and barometric data are provided in the attached spreadsheet.

Pumping started at 21:49 on May 27th 2004 at a rate of 150 gallons per minute (gpm) and a maximum pumping well drawdown of 36.46 feet. The test ran until approximately 17:10 on May 29th 2004. Automated measurements from the troll recorder indicated a 99 percent recovery in the pumping well in less than 15 minutes (less than the time increment of the probe). Measurements from the troll recorder in observation well #1 demonstrated background ground-water fluctuations of 0.03 foot above and below the original level, but no obvious drawdown.

Test Results

The data could not be matched directly to a type curve because drawdown in the observation well could not be resolved above the instrument accuracy and background fluctuations. However, evaluation of MBMG pump test data collected from the Yellowstone Trails Ranch (YTR) about 1.5 miles to the south indicates that at a distance of 600 feet a drawdown of 0.05 feet would be expected after 24 hours of pumping. Therefore, it seems reasonable to conclude that the aquifer at the Pray site is at least as productive as the YTR test. Consequently it is reasonable to assume the aquifer transmissivity (ground-water flow in a 1-foot cross sectional slice of aquifer under a 1 ft/ft gradient) is greater than 60,000 $feet^2$/day (the value from the YTR test).

The pump test demonstrates that the aquifer at this location is capable of sustaining high yields (100 to 200 gpm) without influencing ground-water levels appreciably beyond a few hundred feet of the pumping well. Much higher pumping rates are possible with a well constructed with a screen rather than the open bottom.

If you have questions regarding the data or interpretation of this test please call me at 657-2929.

Sincerely

John Olson

John L. Olson
Associate Research Hydrogeologist
Montana Bureau of Mines and Geology

TKE MAJOR PUMP TEST

Pump Test Data, Pumping Well, T5S R08E S 24 SW1/4

		Troll		Best fit line from Barotroll	
		Depth to ground water (feet)	Uncorection Drawdown	Barometric Correction (ft-water)**	Corrected Drawdown
5/27/04 21:48		201.79			
5/27/04 21:49	0				
5/27/04 21:50	1	219 31	17.52	-0 05	17 47
5/27/04 22:00	11	235.93	34.14	-0.05	34.09
5/27/04 22:10	21	238.49	36.70	-0.05	36.65
5/27/04 22:20	31	238.54	36.75	-0.04	36.71
5/27/04 22:30	41	238.65	36.86	-0.04	36.82
5/27/04 22:40	51	238.67	36.88	-0.04	36.84
5/27/04 22:50	61	238.72	36.93	-0.04	36.89
5/27/04 23:00	71	238.64	36.85	-0.03	36.82
5/27/04 23:10	81	238.75	36.96	-0.03	36.93
5/27/04 23:20	91	238.75	36.96	-0.03	36.93
5/27/04 23:30	101	238.70	36.91	-0.03	36.88
5/27/04 23:40	111	238 71	36.92	-0.03	36.89
5/27/04 23:50	121	238.73	36.94	-0.03	36.91
5/28/04 0:00	131	238.73	36.94	-0.02	36.92
5/28/04 0:10	141	238.72	36.93	-0.02	36.91
5/28/04 0:20	151	238.72	36.93	-0.02	36.91
5/28/04 0:30	161	238.70	36.91	-0.02	36.89
5/28/04 0:40	171	238.70	36.91	-0.02	36.89
5/28/04 0:50	181	238.66	36.87	-0.02	36.85
5/28/04 1:00	191	238.64	36.85	-0.02	36.83
5/28/04 1:10	201	238.70	36.91	-0.02	36.89
5/28/04 1:20	211	238.69	36.90	-0.02	36.88
5/28/04 1:30	221	238.73	36.94	-0.02	36.92
5/28/04 1:40	231	238.69	36.90	-0.02	36.88
5/28/04 1:50	241	238.70	36.91	-0.02	36.89
5/28/04 2:00	251	238.69	36.90	-0.02	36.88
5/28/04 2:10	261	238.71	36.92	-0.02	36.90
5/28/04 2:20	271	238.69	36.90	-0.02	36.88
5/28/04 2:30	281	238.70	36.91	-0.02	36.89
5/28/04 2:40	291	238.71	36.92	-0.02	36.90
5/28/04 2:50	301	238.73	36.94	-0.02	36.92
5/28/04 3:00	311	238.76	36.97	-0.02	36.95
5/28/04 3:10	321	238.77	36.98	-0.02	36.96
5/28/04 3:20	331	238.77	36.98	-0.02	36.96
5/28/04 3:30	341	238.77	36.98	-0.02	36.96
5/28/04 3:40	351	238.78	36.99	-0.02	36.97
5/28/04 3:50	361	238.81	37.02	-0.02	37.00
5/28/04 4:00	371	238.80	37.01	-0.02	36.99
5/28/04 4:10	381	238.78	36.99	-0.03	36.96
5/28/04 4:20	391	238.78	36.99	-0.03	36.96
5/28/04 4:30	401	238.75	36.96	-0.03	36.93
5/28/04 4:40	411	238.83	37.04	-0.03	37.01
5/28/04 4:50	421	238.73	36.94	-0.03	36.91

5/28/04 5:00	431	238.76	36.97	-0.03	36.94
5/28/04 5:10	441	238.79	37.00	-0.04	36.96
5/28/04 5:20	451	238.78	36.99	-0.04	36.95
5/28/04 5:30	461	238.78	36.99	-0.04	36.95
5/28/04 5:40	471	238.76	36.97	-0.04	36.93
5/28/04 5:50	481	238.78	36.99	-0.04	36.95
5/28/04 6:00	491	238.75	36.96	-0.05	36.91
5/28/04 6:10	501	238.80	37.01	-0.05	36.96
5/28/04 6:20	511	238.76	36.97	-0.05	36.92
5/28/04 6:30	521	238.73	36.94	-0.05	36.89
5/28/04 6:40	531	238.76	36.97	-0.06	36.91
5/28/04 6:50	541	238.74	36.95	-0.06	36.89
5/28/04 7:00	551	238.75	36.96	-0.06	36.90
5/28/04 7:10	561	238.71	36.92	-0.06	36.86
5/28/04 7:20	571	238.69	36.90	-0.07	36.83
5/28/04 7:30	581	238.70	36.91	-0.07	36.84
5/28/04 7:40	591	238.68	36.89	-0.07	36.82
5/28/04 7:50	601	238.66	36.87	-0.08	36.79
5/28/04 8:00	611	238.64	36.85	-0.08	36.77
5/28/04 8:10	621	238.62	36.83	-0.08	36.75
5/28/04 8:20	631	238.60	36.81	-0.08	36.73
5/28/04 8:30	641	238.63	36.84	-0.09	36.75
5/28/04 8:40	651	238.62	36.83	-0.09	36.74
5/28/04 8:50	661	238.59	36.80	-0.09	36.71
5/28/04 9:00	671	238.62	36.83	-0.10	36.73
5/28/04 9:10	681	238.58	36.79	-0.10	36.69
5/28/04 9:20	691	238.61	36.82	-0.10	36.72
5/28/04 9:30	701	238.58	36.79	-0.10	36.69
5/28/04 9:40	711	238.58	36.79	-0.11	36.68
5/28/04 9:50	721	238.50	36.71	-0.11	36.60
5/28/04 10:00	731	238.54	36.75	-0.11	36.64
5/28/04 10:10	741	238.56	36.77	-0.12	36.65
5/28/04 10:20	751	238.56	36.77	-0.12	36.65
5/28/04 10:30	761	238.57	36.78	-0.12	36.66
5/28/04 10:40	771	238.53	36.74	-0.12	36.62
5/28/04 10:50	781	238.49	36.70	-0.13	36.57
5/28/04 11:00	791	238.50	36.71	-0.13	36.58
5/28/04 11:10	801	238.52	36.73	-0.13	36.60
5/28/04 11:20	811	238.48	36.69	-0.14	36.55
5/28/04 11:30	821	238.53	36.74	-0.14	36.60
5/28/04 11:40	831	238.50	36.71	-0.14	36.57
5/28/04 11:50	841	238.51	36.72	-0.14	36.58
5/28/04 12:00	851	238.48	36.69	-0.15	36.54
5/28/04 12:10	861	238.45	36.66	-0.15	36.51
5/28/04 12:20	871	238.49	36.70	-0.15	36.55
5/28/04 12:30	881	238.47	36.68	-0.15	36.53
5/28/04 12:40	891	238.44	36.65	-0.16	36.49
5/28/04 12:50	901	238.46	36.67	-0.16	36.51
5/28/04 13:00	911	238.44	36.65	-0.16	36.49
5/28/04 13:10	921	238.47	36.68	-0.16	36.52
5/28/04 13:20	931	238.49	36.70	-0.16	36.54
5/28/04 13:30	941	238.49	36.70	-0.17	36.53

5/28/04 13:40	951	238.44	36.65	-0.17	36.48
5/28/04 13:50	961	238.41	36.62	-0.17	36.45
5/28/04 14:00	971	238.48	36.69	-0.17	36.52
5/28/04 14:10	981	238.46	36.67	-0.17	36.50
5/28/04 14:20	991	238.39	36.60	-0.18	36.42
5/28/04 14:30	1001	238.41	36.62	-0.18	36.44
5/28/04 14:40	1011	238.41	36.62	-0.18	36.44
5/28/04 14:50	1021	238.43	36.64	-0.18	36.46
5/28/04 15:00	1031	238.43	36.64	-0.18	36.46
5/28/04 15:10	1041	238.38	36.59	-0.18	36.41
5/28/04 15:20	1051	238.36	36.57	-0.19	36.38
5/28/04 15:30	1061	238.37	36.58	-0.19	36.39
5/28/04 15:40	1071	238.40	36.61	-0.19	36.42
5/28/04 15:50	1081	238.42	36.63	-0.19	36.44
5/28/04 16:00	1091	238.43	36.64	-0.19	36.45
5/28/04 16:10	1101	238.39	36.60	-0.19	36.41
5/28/04 16:20	1111	238.43	36.64	-0.19	36.45
5/28/04 16:30	1121	238.40	36.61	-0.19	36.42
5/28/04 16:40	1131	238.46	36.67	-0.19	36.48
5/28/04 16:50	1141	238.46	36.67	-0.19	36.48
5/28/04 17:00	1151	238.44	36.65	-0.20	36.45
5/28/04 17:10	1161	238.48	36.69	-0.20	36.49
5/28/04 17:20	1171	202.35	0.56	-0.20	0.36
5/28/04 17:30	1181	202.30	0.51	-0.20	0.31
5/28/04 17:40	1191	202.28	0.49	-0.20	0.29
5/28/04 17:50	1201	202.27	0.48	-0.20	0.28
5/28/04 18:00	1211	202.25	0.46	-0.20	0.26
5/28/04 18:10	1221	202.24	0.45	-0.20	0.25
5/28/04 18:20	1231	202.23	0.44	-0.20	0.24
5/28/04 18:30	1241	202.22	0.43	-0.20	0.23
5/28/04 18:40	1251	202.21	0.42	-0.20	0.22
5/28/04 18:50	1261	202.20	0.41	-0.20	0.21
5/28/04 19:00	1271	202.19	0.40	-0.20	0.20
5/28/04 19:10	1281	202.19	0.39	-0.20	0.19
5/28/04 19:20	1291	202.17	0.38	-0.20	0.18
5/28/04 19:30	1301	202.16	0.37	-0.20	0.17
5/28/04 19:40	1311	202.15	0.36	-0.20	0.16
5/28/04 19:50	1321	202.14	0.35	-0.20	0.15
5/28/04 20:00	1331	202.13	0.34	-0.20	0.14
5/28/04 20:10	1341	202.12	0.33	-0.20	0.13
5/28/04 20:20	1351	202.10	0.31	-0.20	0.11
5/28/04 20:30	1361	202.09	0.30	-0.19	0.11
5/28/04 20:40	1371	202.08	0.29	-0.19	0.10
5/28/04 20:50	1381	202.07	0.28	-0.19	0.09
5/28/04 21:00	1391	202.06	0.27	-0.19	0.08
5/28/04 21:10	1401	202.05	0.26	-0.19	0.07
5/28/04 21:20	1411	202.04	0.25	-0.19	0.06
5/28/04 21:30	1421	202.03	0.24	-0.19	0.05
5/28/04 21:40	1431	202.01	0.22	-0.19	0.03
5/28/04 21:50	1441	202.01	0.22	-0.19	0.03
5/28/04 22:00	1451	202.00	0.21	-0.19	0.02
5/28/04 22:10	1461	201.99	0.20	-0.19	0.01

5/28/04 22:20	1471	201.98	0.19	-0.19	0.00
5/28/04 22:30	1481	201.97	0.18	-0.19	-0.01
5/28/04 22:40	1491	201.96	0.17	-0.18	-0.01
5/28/04 22:50	1501	201.95	0.16	-0.18	-0.02
5/28/04 23:00	1511	201.94	0.15	-0.18	-0.03
5/28/04 23:10	1521	201.93	0.14	-0.18	-0.04
5/28/04 23:20	1531	201.92	0.13	-0.18	-0.05
5/28/04 23:30	1541	201.92	0.13	-0.18	-0.05
5/28/04 23:40	1551	201.91	0.12	-0.18	-0.06
5/28/04 23:50	1561	201.90	0.11	-0.18	-0.07
5/29/04 0:00	1571	201.89	0.10	-0.18	-0.08
5/29/04 0:10	1581	201.88	0.09	-0.18	-0.09
5/29/04 0:20	1591	201.87	0.08	-0.17	-0.09
5/29/04 0:30	1601	201.86	0.07	-0.17	-0.10
5/29/04 0:40	1611	201.85	0.06	-0.17	-0.11
5/29/04 0:50	1621	201.84	0.05	-0.17	-0.12
5/29/04 1:00	1631	201.83	0.04	-0.17	-0.13
5/29/04 1:10	1641	201.82	0.03	-0.17	-0.14
5/29/04 1:20	1651	201.82	0.03	-0.17	-0.14
5/29/04 1:30	1661	201.81	0.02	-0.17	-0.15
5/29/04 1:40	1671	201.80	0.01	-0.17	-0.16
5/29/04 1:50	1681	201.79	0.00	-0.17	-0.17
5/29/04 2:00	1691	201.78	-0.01	-0.16	-0.17
5/29/04 2:10	1701	201.77	-0.02	-0.16	-0.18
5/29/04 2:20	1711	201.76	-0.03	-0.16	-0.19
5/29/04 2:30	1721	201.75	-0.04	-0.16	-0.20
5/29/04 2:40	1731	201.74	-0.05	-0.16	-0.21
5/29/04 2:50	1741	201.73	-0.06	-0.16	-0.22
5/29/04 3:00	1751	201.73	-0.06	-0.16	-0.22
5/29/04 3:10	1761	201.72	-0.07	-0.16	-0.23
5/29/04 3:20	1771	201.71	-0.08	-0.16	-0.24
5/29/04 3:30	1781	201.70	-0.09	-0.16	-0.25
5/29/04 3:40	1791	201.70	-0.09	-0.16	-0.25
5/29/04 3:50	1801	201.69	-0.10	-0.16	-0.26
5/29/04 4:00	1811	201.68	-0.11	-0.16	-0.27
5/29/04 4:10	1821	201.68	-0.11	-0.16	-0.27
5/29/04 4:20	1831	201.67	-0.12	-0.16	-0.28
5/29/04 4:30	1841	201.66	-0.13	-0.15	-0.28
5/29/04 4:40	1851	201.65	-0.14	-0.15	-0.29
5/29/04 4:50	1861	201.64	-0.15	-0.15	-0.30
5/29/04 5:00	1871	201.64	-0.15	-0.15	-0.30
5/29/04 5:10	1881	201.63	-0.16	-0.15	-0.31
5/29/04 5:20	1891	201.62	-0.17	-0.15	-0.32
5/29/04 5:30	1901	201.61	-0.18	-0.15	-0.33
5/29/04 5:40	1911	201.60	-0.19	-0.15	-0.34
5/29/04 5:50	1921	201.59	-0.20	-0.15	-0.35
5/29/04 6:00	1931	201.59	-0.20	-0.15	-0.35
5/29/04 6:10	1941	201.58	-0.21	-0.15	-0.36
5/29/04 6:20	1951	201.57	-0.22	-0.15	-0.37
5/29/04 6:30	1961	201.56	-0.23	-0.15	-0.38
5/29/04 6:40	1971	201.55	-0.24	-0.15	-0.39
5/29/04 6:50	1981	201.54	-0.25	-0.15	-0.40

5/29/04 7:00	1991	201.53	-0.26	-0.15	-0.41
5/29/04 7:10	2001	201.52	-0.27	-0.15	-0.42
5/29/04 7:20	2011	201.52	-0.27	-0.15	-0.42
5/29/04 7:30	2021	201.50	-0.29	-0.15	-0.44
5/29/04 7:40	2031	201.50	-0.29	-0.15	-0.44
5/29/04 7:50	2041	201.49	-0.31	-0.15	-0.46
5/29/04 8:00	2051	201.48	-0.31	-0.15	-0.46
5/29/04 8:10	2061	201.47	-0.32	-0.15	-0.47
5/29/04 8:20	2071	201.46	-0.33	-0.15	-0.48
5/29/04 8:30	2081	201.45	-0.34	-0.15	-0.49
5/29/04 8:40	2091	201.44	-0.35	-0.15	-0.50
5/29/04 8:50	2101	201.43	-0.36	-0.15	-0.51
5/29/04 9:00	2111	201.42	-0.37	-0.15	-0.52
5/29/04 9:10	2121	201.41	-0.38	-0.15	-0.53
5/29/04 9:20	2131	201.40	-0.39	-0.15	-0.54
5/29/04 9:30	2141	202.17	0.38	-0.14	0.24
5/29/04 9:40	2151	202.16	0.37	-0.14	0.23
5/29/04 9:50	2161	202.15	0.36	-0.14	0.22
5/29/04 10:00	2171	202.14	0.35	-0.14	0.21
					0.21

9.58E-05

Pump test data, T08e, R24E, S24 C

OBSERVATION WELL

Date-time	Elapsed time (minutes)	Depth to ground water (feet uncorrected)	Uncorrected drawdown (feet)	Barometric Pressure (ft-H20)	Pressure Change (ft-H20)	Corrected drawdown	D		
								0	0
5/27/04 21:49	0	195.93					0	136	
5/27/04 23:50	121	195.97					0.014	151	
5/28/04 0:05	136	195.96	0.01	28.76	0.00	0.01	0.014	166	
5/28/04 0:20	151	195.96	0.01	28.75	-0.01	0.01	0.015	181	
5/28/04 0:35	166	195.96	0.01	28.75	-0.01	0.01	0.02	196	
5/28/04 0:50	181	195.96	0.02	28.75	-0.02	0.01	0.02	211	
5/28/04 1:05	196	195.96	0.02	28.74	-0.02	0.01	0.021	226	
5/28/04 1:20	211	195.96	0.02	28.74	-0.02	0.01	0.022	241	
5/28/04 1:35	226	195.96	0.02	28.74	-0.02	0.01	0.022	256	
5/28/04 1:50	241	195.96	0.02	28.74	-0.02	0.01	0.022	271	
5/28/04 2:05	256	195.96	0.02	28.74	-0.02	0.01	0.023	286	
5/28/04 2:20	271	195.97	0.02	28.74	-0.02	0.01	0.023	301	
5/28/04 2:35	286	195.97	0.02	28.74	-0.02	0.01	0.023	316	
5/28/04 2:50	301	195.97	0.02	28.74	-0.02	0.01	0.034	331	
5/28/04 3:05	316	195.97	0.02	28.74	-0.02	0.01	0.034	346	
5/28/04 3:20	331	195.97	0.03	28.73	-0.03	0.00	0.034	361	
5/28/04 3:35	346	195.97	0.03	28.73	-0.03	0.01	0.034	376	
5/28/04 3:50	361	195.97	0.03	28.73	-0.03	0.01	0.035	391	
5/28/04 4:05	376	195.98	0.03	28.73	-0.03	0.01	0.035	406	
5/28/04 4:20	391	195.98	0.04	28.73	-0.04	0.01	0.038	421	
5/28/04 4:35	406	195.98	0.04	28.73	-0.04	0.01	0.039	436	
5/28/04 4:50	421	195.98	0.04	28.72	-0.04	0.01	0.039	451	
5/28/04 5:05	436	195.98	0.04	28.72	-0.04	0.01	0.043	466	
5/28/04 5:20	451	195.99	0.04	28.72	-0.04	0.01	0.043	481	
5/28/04 5:35	466	195.99	0.04	28.72	-0.04	0.01	0.044	496	
5/28/04 5:50	481	195.99	0.04	28.72	-0.04	0.01	0.042	511	
5/28/04 6:05	496	195.99	0.04	28.72	-0.04	0.02	0.042	526	
5/28/04 6:20	511	196.00	0.04	28.72	-0.04	0.02	0.043	541	
5/28/04 6:35	526	196.00	0.04	28.72	-0.04	0.02	0.056	556	
5/28/04 6:50	541	196.00	0.04	28.72	-0.04	0.02	0.056	571	
5/28/04 7:05	556	196.00	0.06	28.70	-0.06	0.01	0.056	586	
5/28/04 7:20	571	196.00	0.06	28.70	-0.06	0.01	0.071	601	
5/28/04 7:35	586	196.00	0.06	28.70	-0.06	0.01	0.071	616	
5/28/04 7:50	601	196.00	0.07	28.69	-0.07	0.00	0.071	631	
5/28/04 8:05	616	196.00	0.07	28.69	-0.07	0.00	0.083	646	
5/28/04 8:20	631	196.01	0.07	28.69	-0.07	0.01	0.083	661	
5/28/04 8:35	646	196.01	0.08	28.68	-0.08	-0.01	0.083	676	
5/28/04 8:50	661	196.01	0.08	28.68	-0.08	0.00	0.087	691	
5/28/04 9:05	676	196.02	0.08	28.68	-0.08	0.00			
5/28/04 9:20	691	196.02	0.09	28.67	-0.09	0.00			

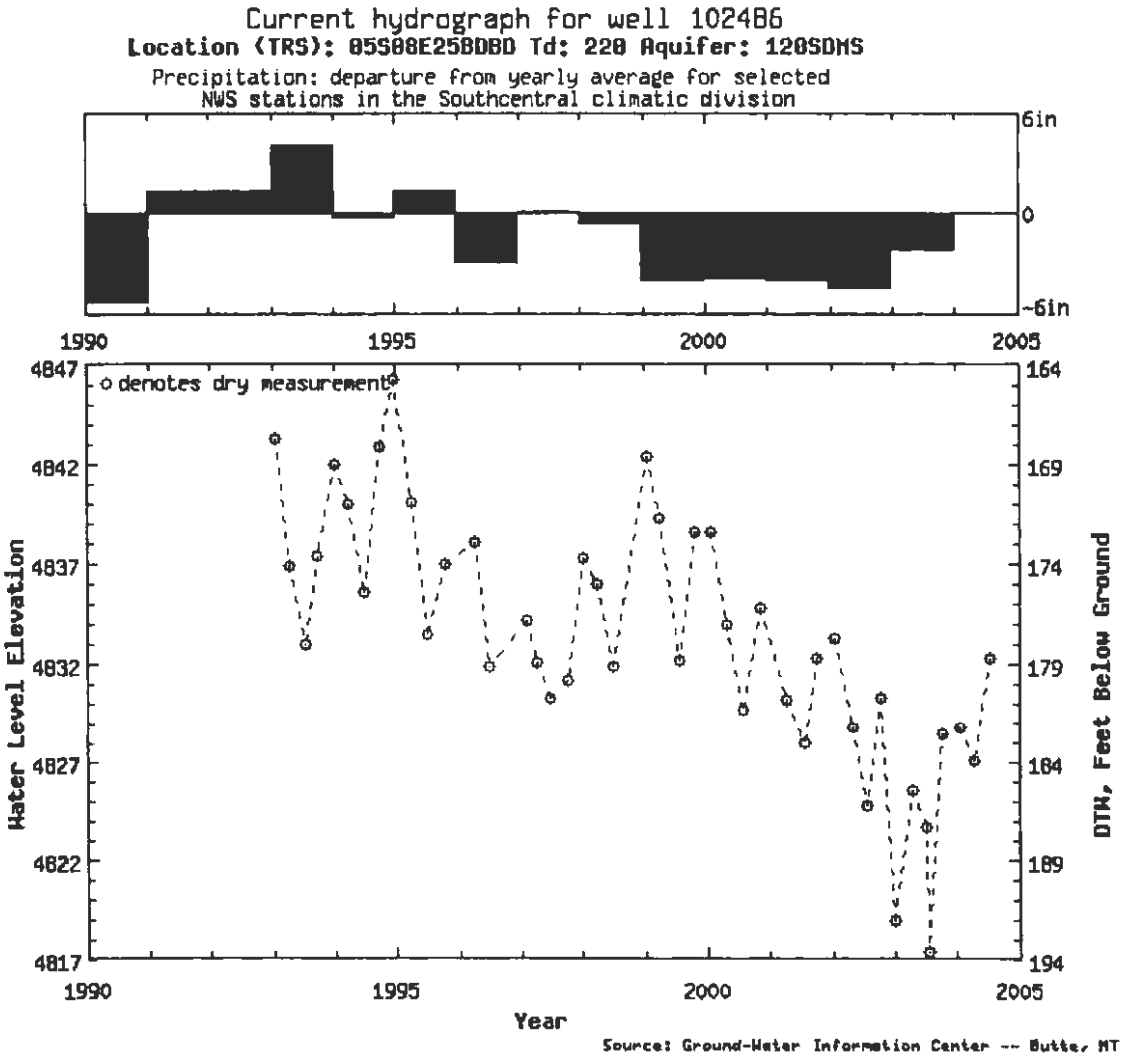
5/28/04 9:35	706	196.02	0.09	28.67	-0.09	0.00	0.088	706
5/28/0 0	721	196.03	0.09	28.	-0.09	0.00	0.088	72
5/28/04 10:05	736	196.03	0.11	28.65	-0.11	-0.01	0.11	736
5/28/04 10:20	751	196.04	0.11	28.65	-0.11	-0.01	0.111	751
5/28/04 10:35	766	196.04	0.11	28.65	-0.11	-0.01	0.111	766
5/28/04 10:50	781	196.04	0.12	28.64	-0.12	-0.02	0.122	781
5/28/04 11:05	796	196.05	0.12	28.64	-0.12	-0.01	0.123	796
5/28/04 11:20	811	196.05	0.12	28.64	-0.12	-0.01	0.123	811
5/28/04 11:35	826	196.06	0.15	28.61	-0.15	-0.03	0.148	826
5/28/04 11:50	841	196.06	0.15	28.61	-0.15	-0.02	0.148	841
5/28/04 12:05	856	196.07	0.15	28.61	-0.15	-0.02	0.149	856
5/28/04 12:20	871	196.07	0.17	28.59	-0.17	-0.03	0.167	871
5/28/04 12:35	886	196.07	0.17	28.59	-0.17	-0.03	0.167	886
5/28/04 12:50	901	196.08	0.17	28.59	-0.17	-0.03	0.168	901
5/28/04 13:05	916	196.08	0.18	28.58	-0.18	-0.03	0.182	916
5/28/04 13:20	931	196.09	0.18	28.58	-0.18	-0.03	0.182	931
5/28/04 13:35	946	196.09	0.18	28.58	-0.18	-0.02	0.182	946
5/28/04 13:50	961	196.10	0.19	28.57	-0.19	-0.03	0.189	961
5/28/04 14:05	976	196.10	0.19	28.57	-0.19	-0.02	0.189	976
5/28/04 14:20	991	196.11	0.19	28.57	-0.19	-0.01	0.189	991
5/28/04 14:35	1006	196.11	0.18	28.58	-0.18	0.00	0.179	1006
5/28/04 14:50	1021	196.12	0.18	28.58	-0.18	0.01	0.179	1021
5/28/04 15:05	1036	196.12	0.18	28.58	-0.18	0.01	0.179	1036
5/28/04 15:20	1051	196.13	0.19	28.57	-0.19	0.00	0.188	1051
5/28/04 15:35	1066	196.13	0.19	28.57	-0.19	0.00	0.189	1066
5/28/04 15:50	1081	196.13	0.19	28.57	-0.19	0.01	0.189	1081
5/28/04 16:05	1096	196.13	0.19	28.57	-0.19	0.00	0.193	1096
5/28/04 16:20	1111	196.13	0.19	28.57	-0.19	0.01	0.194	1111
5/28/04 16:35	1126	196.13	0.19	28.57	-0.19	0.01	0.194	1126
5/28/04 16:50	1141	196.14	0.20	28.56	-0.20	0.01	0.198	1141
5/28/04 17:05	1156	196.14	0.20	28.56	-0.20	0.01	0.198	1156
5/28/04 17:20	1171	196.14	0.20	28.56	-0.20	0.01	0.199	1171
5/28/04 17:35	1186	196.14	0.20	28.56	-0.20	0.01	0.2	1186
5/28/04 17:50	1201	196.17	0.20	28.56	-0.20	0.01	0.2	1201
5/28/04 18:05	1216	196.16	0.20	28.56	-0.20	0.01	0.201	1216
5/28/04 18:20	1231	196.16	0.19	28.57	-0.19	0.02	0.189	1231
5/28/04 18:35	1246	196.16	0.19	28.57	-0.19	0.02	0.189	1246
5/28/04 18:50	1261	196.16	0.19	28.57	-0.19	0.02	0.189	1261
5/28/04 19:05	1276	195.96	0.19	28.57	-0.19	0.02	0.19	1276
5/28/04 19:20	1291	196.16	0.19	28.57	-0.19	0.02	0.19	1291
5/28/04 19:35	1306	196.15	0.19	28.57	-0.19	0.01	0.19	1306
5/28/04 19:50	1321	196.15	0.17	28.59	-0.17	0.02	0.174	1321
5/28/04 20:05	1336	196.15	0.17	28.59	-0.17	0.02	0.174	1336
5/28/04 20:20	1351	196.14	0.17	28.59	-0.17	0.01	0.174	1351
5/28/04 20:35	1366	196.14	0.17	28.59	-0.17	0.02	0.166	1366
5/28/04 20:50	1381	196.14	0.17	28.59	-0.17	0.01	0.167	1381

5/28/04 21:05	1396	196.13	0.17	28.59	-0.17	0.01	0.167	1396
5/28/04 [illegible]0	1411	196.14	0.16	28	-0.16	0.02	0.159	141
5/28/04 21:35	1426	196.13	0.16	28.60	-0.16	0.01	0.16	1426
5/28/04 21:50	1441	196.13	0.16	28.60	-0.16	0.01	0.16	1441
5/28/04 22:05	1456	196.13	0.17	28.59	-0.17	-0.01	0.173	1456
5/28/04 22:20	1471	196.13	0.17	28.59	-0.17	-0.01	0.173	1471
5/28/04 22:35	1486	196.13	0.17	28.59	-0.17	-0.01	0.174	1486
5/28/04 22:50	1501	196.13	0.17	28.59	-0.17	0.00	0.168	1501
5/28/04 23:05	1516	196.13	0.17	28.59	-0.17	-0.01	0.168	1516
5/28/04 23:20	1531	196.14	0.17	28.59	-0.17	-0.01	0.169	1531
5/28/04 23:35	1546	196.14	0.16	28.60	-0.16	0.00	0.158	1546
5/28/04 23:50	1561	196.14	0.16	28.60	-0.16	0.00	0.158	1561
5/29/04 0:05	1576	196.14	0.16	28.60	-0.16	0.00	0.158	1576
5/29/04 0:20	1591	196.14	0.15	28.61	-0.15	0.01	0.149	1591
5/29/04 0:35	1606	196.14	0.15	28.61	-0.15	0.00	0.149	1606
5/29/04 0:50	1621	196.14	0.15	28.61	-0.15	0.00	0.149	1621
5/29/04 1:05	1636	196.14	0.14	28.62	-0.14	0.01	0.14	1636
5/29/04 1:20	1651	196.14	0.14	28.62	-0.14	0.01	0.14	1651
5/29/04 1:35	1666	196.14	0.14	28.62	-0.14	0.00	0.14	1666
5/29/04 1:50	1681	196.14	0.14	28.62	-0.14	0.00	0.14	1681
5/29/04 2:05	1696	196.14	0.14	28.62	-0.14	0.00	0.141	1696
5/29/04 2:20	1711	196.14	0.14	28.62	-0.14	0.00	0.141	1711
5/29/04 2:35	1726	196.14	0.15	28.61	-0.15	-0.01	0.152	1726
5/29/04 2:50	1741	196.14	0.15	28.61	-0.15	-0.02	0.153	1741
5/29/04 3:05	1756	196.15	0.15	28.61	-0.15	-0.02	0.153	1756
5/29/04 3:20	1771	196.15	0.16	28.60	-0.16	-0.03	0.162	1771
5/29/04 3:35	1786	196.15	0.16	28.60	-0.16	-0.02	0.162	1786
5/29/04 3:50	1801	196.15	0.16	28.60	-0.16	-0.03	0.163	1801
5/29/04 4:05	1816	196.16	0.15	28.61	-0.15	-0.01	0.153	1816
5/29/04 4:20	1831	196.16	0.15	28.61	-0.15	-0.01	0.153	1831
5/29/04 4:35	1846	196.16	0.15	28.61	-0.15	-0.02	0.154	1846
5/29/04 4:50	1861	196.17	0.13	28.63	-0.13	0.01	0.131	1861
5/29/04 5:05	1876	196.17	0.13	28.63	-0.13	0.01	0.131	1876
5/29/04 5:20	1891	196.18	0.13	28.63	-0.13	0.01	0.131	1891
5/29/04 5:35	1906	196.18	0.13	28.63	-0.13	0.01	0.129	1906
5/29/04 5:50	1921	196.18	0.13	28.63	-0.13	0.01	0.129	1921
5/29/04 6:05	1936	196.19	0.13	28.63	-0.13	0.00	0.129	1936
5/29/04 6:20	1951	196.19	0.12	28.64	-0.12	0.01	0.117	1951
5/29/04 6:35	1966	196.19	0.12	28.64	-0.12	0.01	0.117	1966
5/29/04 6:50	1981	196.19	0.12	28.64	-0.12	0.01	0.117	1981
5/29/04 7:05	1996	196.19	0.11	28.65	-0.11	0.02	0.106	1996
5/29/04 7:20	2011	196.20	0.11	28.65	-0.11	0.01	0.107	2011
5/29/04 7:35	2026	196.20	0.11	28.65	-0.11	0.01	0.107	2026
5/29/04 7:50	2041	196.20	0.09	28.67	-0.09	0.02	0.092	2041
5/29/04 8:05	2056	196.21	0.09	28.67	-0.09	0.02	0.093	2056
5/29/04 8:20	2071	196.21	0.09	28.67	-0.09	0.02	0.093	2071

5/29/04 8:35	2086	196.21	0.09	28.67	-0.09	0.02	0.086	2086
5/29/0 :50	2101	196.21	0.09	28	-0.09	0.02	0.086	210
5/29/04 :05	2116	196.21	0.09	28.67	-0.09	0.02	0.087	2116
5/29/04 9:20	2131	196.21	0.09	28.67	-0.09	0.01	0.09	2131
5/29/04 9:35	2146	196.21	0.09	28.67	-0.09	0.01	0.09	2146
5/29/04 9:50	2161	196.22	0.09	28.67	-0.09	0.01	0.091	2161
5/29/04 10:05	2176	196.21	0.09	28.67	-0.09	0.00	0.092	2176
5/29/04 10:20	2191	196.22	0.09	28.67	-0.09	0.00	0.092	2191
5/29/04 10:35	2206	196.21	0.09	28.67	-0.09	0.00	0.092	2206
5/29/04 10:50	2221	196.22	0.08	28.68	-0.08	0.01	0.078	2221
5/29/04 11:05	2236	196.22	0.08	28.68	-0.08	0.01	0.078	2236
5/29/04 11:20	2251	196.22	0.08	28.68	-0.08	0.01	0.078	2251
5/29/04 11:35	2266	196.22	0.07	28.69	-0.07	0.01	0.074	2266
5/29/04 11:50	2281	196.25	0.07	28.69	-0.07	0.02	0.074	2281
			0.00					
						-0.03		
						0.02		
						0.00		

Montana Bureau of Mines and Geology
Ground-Water Information Center SWL Report
All altitudes listed are in feet above Mean Sea Level

Hide precipitation data for this graph



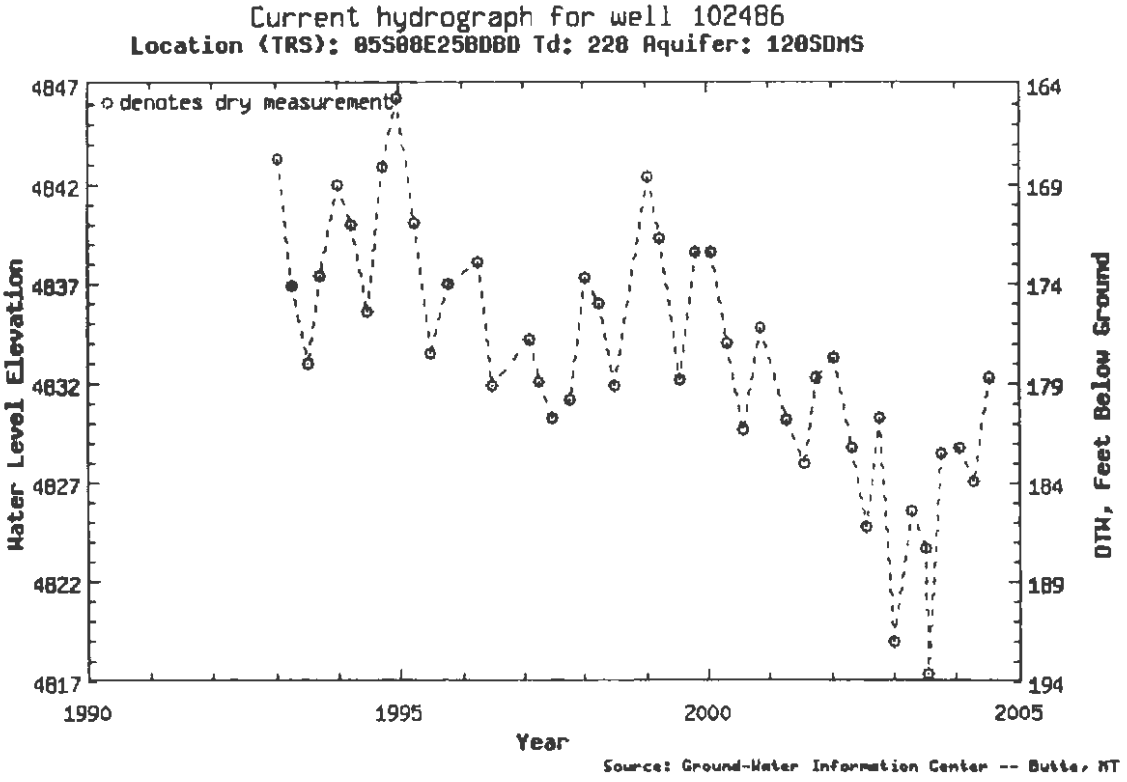
GWIC Id: **View The Well Log For 102486**
Site Name: STANDISH CHAD AND MORLEY PAT
Geologic Source(s): 120SDMS
Land Surface Altitude: 5011
Latitude/Longitude: 45.3752 , -110.6847
Location: 05S 08E 25 BDBD
County: PARK
Get the data used to make this graph

Total Depth (ft): 220
Period of Record: 1/19/1993 - 7/20/2004
Last Date: 7/20/2004 12:10:00
Last Altitude: 4832.10
Measurements: 45
Record Low Altitude: 4817.26 on 7/18/2003
Record High Altitude: 4846.11 on 12/23/1994
Average Altitude: 4833.06

GWICWEBDATA V9.1.0 1998-2003
Any questions or comments can be e-mailed to **GWIC WebMaster**
Report Created 08/18/2004

Montana Bureau of Mines and Geology
Ground-Water Information Center SWL Report
All altitudes listed are in feet above Mean Sea Level

View precipitation data for this graph



GWIC Id: **View The Well Log For 102486**
Site Name: STANDISH CHAD AND MORLEY PAT
Geologic Source(s): 120SDMS
Land Surface Altitude: 5011
Latitude/Longitude: 45.3752 , -110.6847
Location: 05S 08E 25 BDBD
County: PARK
Get the data used to make this graph

Total Depth (ft): 220
Period of Record: 1/19/1993 - 7/20/2004
Last Date: 7/20/2004 12:10:00
Last Altitude: 4832.10
Measurements: 45
Record Low Altitude: 4817.26 on 7/18/2003
Record High Altitude: 4846.11 on 12/23/1994
Average Altitude: 4833.06

GWICWEBDATA V9.1.0 1998-2003
Any questions or comments can be e-mailed to **GWIC WebMaster**
Report Created 08/18/2004

Ground-Water Information Center
Internet Data Services
Static Water Level Report

GWIC Id:	View The Well Log For 102486	Total Depth (ft):	220
Site Name:	STANDISH CHAD AND MORLEY PAT	Period of Record:	1/19/1993 - 7/20/2004
Geologic Source(s):	120SDMS	Last Date:	7/20/2004 12:10:00
Land Surface Altitude:	5011	Last Altitude:	4832.10
Latitude/Longitude:	45.3752 , -110.6847	Measurements:	45
Location:	05S 08E 25 BD8D	Record Low Altitude:	4817.26 on 7/18/2003
County:	PARK	Record High Altitude:	4846.11 on 12/23/1994
		Average Altitude:	4833.06

Date/Time	SWL Altitude	SWL Ground (ft)	Agency	Method	Remarks
1/19/1993 16:04	4843.10	167.90	MBMG	SOUNDER	INITIAL GWAA MEASUREMENT
4/14/1993 12:41	4836.75	174.25	MBMG	SOUNDER	
7/7/1993 16:46	4832.80	178.20	MBMG	SOUNDER	
9/21/1993 16:27	4837.24	173.76	MBMG	SOUNDER	
12/30/1993 09:36	4841.85	169.15	MBMG	SOUNDER	
3/29/1994 10:55	4839.80	171.20	MBMG	SOUNDER	
6/30/1994 20:44	4835.43	175.57	MBMG	SOUNDER	
9/30/1994 08:50	4842.74	168.26	MBMG	SOUNDER	
12/23/1994 09:28	4846.11	164.89	MBMG	SOUNDER	
3/31/1995 09:40	4839.99	171.01	MBMG	SOUNDER	
7/6/1995 06:20	4833.38	177.62	MBMG	SOUNDER	
10/16/1995 13:19	4836.88	174.12	MSU	SOUNDER	
4/12/1996 12:50	4837.97	173.03	MSU	SOUNDER	
7/6/1996 07:46	4831.76	179.24	MSU	SOUNDER	
2/1/1997 11:07	4834.02	176.98	MSU	SOUNDER	
4/4/1997 11:00	4831.93	179.07	MSU	SOUNDER	
7/1/1997 10:30	4830.13	180.87	MSU	SOUNDER	PUMPING
10/7/1997 12:19	4831.07	179.93	MSU	SOUNDER	
1/13/1998 10:50	4837.11	173.89	MSU	SOUNDER	
4/3/1998 11:30	4835.88	175.12	MSU	SOUNDER	
7/8/1998 12:28	4831.72	179.28	MSU	SOUNDER	
1/18/1999 00:00	4842.23	168.77	MSU	SOUNDER	
4/3/1999 10:55	4839.13	171.87	MSU	SOUNDER	
7/25/1999 12:00	4832.04	178.96	MSU	SOUNDER	
10/27/1999 12:27	4838.49	172.51	MSU	SOUNDER	
1/29/2000 12:08	4838.48	172.52	MSU	SOUNDER	
4/24/2000 13:15	4833.90	177.10	GCWQD	SOUNDER	
7/31/2000 10:20	4829.57	181.43	GCWQD	SOUNDER	
11/18/2000 13:46	4834.61	176.39	MSU	SOUNDER	
4/14/2001 12:20	4830.05	180.95	MSU	SOUNDER	
7/26/2001 14:15	4827.82	183.18	MSU	SOUNDER	
10/6/2001 11:35	4832.18	178.82	MSU	SOUNDER	
1/21/2002 12:36	4833.13	177.87	MBMG	SOUNDER	
4/29/2002 12:35	4828.64	182.36	MSU	SOUNDER	
7/23/2002 10:16	4824.68	186.32	MSU	SOUNDER	
10/17/2002 14:40	4830.17	180.83	MSU	SOUNDER	
1/7/2003 13:02	4818.89	192.11	MSU	STEEL TAPE	

4/19/2003 12:37	4825.49	185.51	MSU	STEEL TAPE
7/10/2003 00:00	4823.56	187.44	MBMG	SOUNDER
7/10/2003 12:45	4823.56	187.44	MBMG	SOUNDER
7/18/2003 12:05	4817.26	193.74	MSU	SOUNDER
10/11/2003 14:25	4828.35	182.65	MSU	STEEL TAPE
1/24/2004 13:45	4828.64	182.36	MSU	STEEL TAPE
4/17/2004 10:05	4826.93	184.07	MSU	SOUNDER
7/20/2004 12:10	4832.10	178.90	MSU	SOUNDER

Any questions or comments can be e-mailed to GWIC WebMaster
Page Created 08/18/2004

MONTANA WELL LOG REPORT

PARADISE FOUND — Test Well Tract B2

Form No. 603 R2-99

Well ID# _____

This log reports the activities of a licensed Montana well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered. This form is to be completed by the driller and filed with DNRC within 60 days of completion of the work. Acquiring Water Rights is the well owner's responsibility and is not accomplished by the filing of this report.

Well log information is stored in the Groundwater Information Center at the Montana Bureau of Mines and Geology (Butte) and water right information is stored in the Water Rights Bureau records (Helena).

For fields that are not applicable, enter NA. Optional fields have a grayed background. Record additional information in the REMARKS section.

1. WELL OWNER:

Name TOM COULD LLC

Mailing address 237 PINE CREEK RD

LIVINGSTON MT 59047

2. WELL LOCATION List ¼ from smallest to largest

____ ¼ ____ ¼ SE ¼ SW ¼, Section 24

Township 5 N/S Range 8 E/W County PARK

Lot ____, Tract/Blk ____ Subdivision Name

Well Address _____

GPS ☒ Yes ☐ No

Latitude N45° 22948 Longitude W110° 40966

Error as reported by GPS locator (± feet) 27

Horizontal datum ☐ NAD27 ☒ WGS84

3. PROPOSED USE: ☒ Domestic ☐ Stock ☐ Irrigation

☐ Public water supply ☐ Monitoring Well ☐ Other:

4. TYPE OF WORK:

☒ New well ☐ Deepen existing well ☐ Abandon existing well

Method: ☐ Cable ☒ Rotary ☐ Other: _____

5. WELL CONSTRUCTION DETAILS:

Borehole:

Dia. 7 7/8 in. from 0 ft. to 284 ft.

Dia. _____ in. from _____ ft. to _____ ft.

Dia. _____ in. from _____ ft. to _____ ft.

Casing:

Steel Wall thickness .250 ☐ Threaded ☒ Welded

Dia. 6 5/8 in. from +2 ft. to 284 ft.

Dia. _____ in. from _____ ft. to _____ ft

Plastic: Pressure Rating _____ lbs. ☐ Threaded ☐ Welded

Dia. _____ in. from _____ ft. to _____ ft.

Perforations/Slotted Pipe:

Type of perforator used _____

Size of perforations/slots _____ in. by _____ in.

_____ no. of perforations/slots from _____ ft. to _____ ft.

_____ no. of perforations/slots from _____ ft. to _____ ft.

Screens: ☐ Yes ☒ No

Material _____

Dia. _____ Slot size _____ from _____ ft. to _____ ft.

Dia. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel Packed: ☐ Yes ☒ No

Size of gravel _____

Gravel placed from _____ ft. to _____ ft.

Packer: ☐ Yes ☐ No

Type _____ Depth(s) _____

Grout: Material used ~~Casing Seal Bentonite~~

Depth from _____ ft. to _____ ft. OR ☒ Continuous feed

6. WELL TEST DATA:

A well test is required for all wells. (*See details on well log report cover.*)

☐ Static water level 200 ft. below top of casing or

☐ Closed-in artesian pressure _____ psi.

How was test flow measured:

bucket/stopwatch, weir, flume, flowmeter, etc _____

Yellowstone Controlled Groundwater Area - Water Temperature _____ °F

☐ AQUIFER TEST DATA FORM ATTACHED

Test - 1 hour minimum

Drawdown is the amount water level is lowered below static level

All depth measurements shall be from the top of the well casing.

Time of recovery is hours/minutes since pumping stopped.

Air test*

50 gpm with drill stem set at 280 ft. for 1 hours

Time of recovery 30 hrs/(min) Recovery water level 200 ft.

OR Bailer test*

_____ gpm with _____ ft. of drawdown after _____ hours

Time of recovery _____ hrs/min. Recovery water level _____ ft.

OR Pump test*

Depth pump set for test 278 ft.

150 gpm pump rate with 76.4 ft. of drawdown after 9 hrs pumping

Time of recovery 5 hrs/min. Recovery water level 200 ft.

OR Flowing Artesian*

_____ gpm for _____ hours

Flow controlled by _____

**During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing*

7. WELL LOG:

Depth, Feet From	Depth, Feet To	Material: color/rock and type/descriptor (example: blue/shale/hard, or brown/gravel/water, or brown/sand/heaving)
Top	1	Topsoil/Gravel
1	84	Pinesand/Gravel/Boulders
84	264	" " "
264	284	" " "

☐ ADDITIONAL SHEETS ATTACHED

8. DATE WELL COMPLETED: 5/17/04

9. REMARKS: _____

10. DRILLER/CONTRACTOR'S CERTIFICATION:

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name, firm, or corporation (print) RED TIGER DRILLING INC

Address ~~PO BOX 659 MANHATTAN MT 59741~~

Signature _____

Date 5/19/04 License no. 598

Montana DNRC P.O. BOX 201601 HELENA, MT 59620-1601 444-6610

MBMG ID#

_____

DEPARTMENT - BUREAU COPY

MONTANA WELL LOG REPORT

Observation Well for PARADISE FOUND

Form No. 603 R2-99

Well ID# _____

This log reports the activities of a licensed Montana well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered. This form is to be completed by the driller and filed with DNRC within 60 days of completion of the work. Acquiring Water Rights is the well owner's responsibility and is not accomplished by the filing of this report.

Well log information is stored in the Groundwater Information Center at the Montana Bureau of Mines and Geology (Butte) and water right information is stored in the Water Rights Bureau records (Helena).

For fields that are not applicable, enter NA. Optional fields have a grayed background. Record additional information in the REMARKS section.

1. WELL OWNER:

Name VINCE & TARA DILMORE

Mailing address 1409 E. RIVER RD

LIVINGSTON MT. 59047

2. WELL LOCATION List ¼ from smallest to largest

____ ¼ NW ¼ SW ¼ SE ¼, Section 24

Township 5 (N) S Range 8 (E) W County PARK

Lot 13, Tract/Blk ____ Subdivision Name

Well Address SAME

GPS ☐ Yes ☒ No

Latitude _____ Longitude _____

Error as reported by GPS locator (± feet) _____

Horizontal datum ☐ NAD27 ☐ WGS84

3. PROPOSED USE: ☒ Domestic ☐ Stock ☐ Irrigation

☐ Public water supply ☐ Monitoring Well ☐ Other:

4. TYPE OF WORK:

☒ New well ☒ Deepen existing well ☐ Abandon existing well

Method: ☐ Cable ☒ Rotary ☐ Other: _____

5. WELL CONSTRUCTION DETAILS:

Borehole:

Dia. 6 in. from 0 ft. to 241 ft.

Dia. _____ in. from _____ ft. to _____ ft.

Dia. _____ in. from _____ ft. to _____ ft.

Casing:

Steel: Wall thickness .250 ☐ Threaded ☒ Welded

Dia. 6 5/8 in. from +2 ft. to 241 ft.

Dia. _____ in. from _____ ft. to _____ ft.

Plastic: Pressure Rating _____ lbs. ☐ Threaded ☐ Welded

Dia. _____ in. from _____ ft. to _____ ft.

Perforations/Slotted Pipe:

Type of perforator used _____

Size of perforations/slots _____ in. by _____ in.

_____ no. of perforations/slots from _____ ft. to _____ ft.

_____ no. of perforations/slots from _____ ft. to _____ ft.

Screens: ☐ Yes ☒ No

Material _____

Dia. _____ Slot size _____ from _____ ft. to _____ ft.

Dia. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel Packed: ☐ Yes ☒ No

Size of gravel _____

Gravel placed from _____ ft. to _____ ft.

Packer: ☐ Yes ☒ No

Type _____ Depth(s) _____

Grout: Material used BENTONITE CASING SEAL

Depth from _____ ft. to _____ ft. OR ☒ Continuous feed

6. WELL TEST DATA:

A well test is required for all wells. (*See details on well log report cover.*)

☒ Static water level 190 ft. below top of casing or

☐ Closed-in artesian pressure _____ psi.

How was test flow measured:

bucket/stopwatch, weir, flume, flowmeter, etc _____

Yellowstone Controlled Groundwater Area - Water Temperature _____ °F

☐ AQUIFER TEST DATA FORM ATTACHED

Test - 1 hour minimum

Drawdown is the amount water level is lowered below static level.
All depth measurements shall be from the top of the well casing.
Time of recovery is hours/minutes since pumping stopped.

Air test*

20 gpm with drill stem set at 220 ft. for 1 hours

Time of recovery 1.5 (hrs)/min. Recovery water level 190 ft.

OR Bailer test*

_____ gpm with _____ ft. of drawdown after _____ hours

Time of recovery _____ hrs/min. Recovery water level _____ ft.

OR Pump test*

Depth pump set for test _____ ft.

___ gpm pump rate with ___ ft. of drawdown after ___ hrs pumping

Time of recovery _____ hrs/min. Recovery water level _____ ft.

OR Flowing Artesian*

_____ gpm for _____ hours

Flow controlled by _____

**During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

7. WELL LOG:

Depth, Feet From	Depth, Feet To	Material color/rock and type/descriptor (example: blue/shale/hard, or brown/gravel/water, or brown/sand/heaving)
0	3	TOP SOIL
3	19	FINE SAND/GRAVELS/COBBLES
19	49	FINE SAND/GRAVELS
49	63	CEMENTED GRAVELS
63	66	FINE SAND
66	83	CEMENTED GRAVELS
83	100	FINESANDS/GRAVELS
100	141	CEMENTED GRAVELS
141	241	FINE SAND/GRAVELS

☐ ADDITIONAL SHEETS ATTACHED

8. DATE WELL COMPLETED: 6-28-01

9. REMARKS: FILE LOST

10. DRILLER/CONTRACTOR'S CERTIFICATION:

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name, firm, or corporation (print) RED TIGER DRILLING INC.

Address BOX 659 MANHATTAN MT. 59741

Signature Gary A Hansen

Date 6-11-04 License no. 598

Observation Well Tract A2

MONTANA WELL LOG REPORT

Well ID# _____

Form No. 603 R2-99

This log reports the activities of a licensed Montana well driller and serves as the official record of work done within the borehole and casing and describe the amount of water encountered. **This form is to be completed by the driller and filed with DNRC within 60 days of completion of the work.** **Acquiring Water Rights is the well owner's responsibility and is not accomplished by the filing of this report.**

Well log information is stored in the Groundwater Information Center at the Montana Bureau of Mines and Geology (Butte) and water right information is stored in the Water Rights Bureau records (Helena).

For fields that are not applicable, enter NA. Optional fields have a grayed background. Record additional information in the REMARKS section.

1. WELL OWNER:
Name Jim Patterson
Mailing address P.O. Box 117
Pray MT. 59065

2. WELL LOCATION: List ¼ from smallest to largest
____ ¼ ____ ¼ SW ¼ SW ¼, Section 24
Township 5 N S Range 8 E W County PARK
Lot ____, Tract/Blk ____ Subdivision Name ____
Well Address ____
GPS ☐ Yes ☐ No
Latitude ____ Longitude ____
Error as reported by GPS locator (± feet) ____
Horizontal datum ☐ NAD27 ☐ WGS84

3. PROPOSED USE: ☒ Domestic ☐ Stock ☐ Irrigation
☐ Public water supply ☐ Monitoring Well ☐ Other: ____

4. TYPE OF WORK:
☒ New well ☐ Deepen existing well ☐ Abandon existing well
Method: ☐ Cable ☒ Rotary ☐ Other: ____

5. WELL CONSTRUCTION DETAILS:
Borehole:
Dia. 6 in. from 0 ft. to 260' ft.
Dia. ____ in. from ____ ft. to ____ ft.
Dia. ____ in. from ____ ft. to ____ ft.

Casing:
Steel: Wall thickness .250 ☐ Threaded ☒ Welded
Dia 6 5/8 O.D. in. from -2 ft. to 258 ft.
Dia ____ in. from ____ ft. to ____ ft.

Plastic. Pressure Rating N/A lbs. ☐ Threaded ☐ Welded
Dia. ____ in. from ____ ft. to ____ ft

Perforations/Slotted Pipe:
Type of perforator used N/A
Size of perforations/slots ____ in. by ____ in.
____ no. of perforations/slots from ____ ft. to ____ ft.
____ no. of perforations/slots from ____ ft. to ____ ft.

Screens: ☐ Yes ☒ No
Material ____
Dia. ____ Slot size ____ from ____ ft. to ____ ft.
Dia. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel Packed: ☐ Yes ☒ No
Size of gravel ____
Gravel placed from ____ ft. to ____ ft.

Packer: ☐ Yes ☒ No
Type ____ Depth(s) ____

Grout: Material used Bentonite Grout
Depth from ____ ft. to ____ ft. OR ☒ Continuous feed

6. WELL TEST DATA:
A well test is required for all wells. (*See details on well log report cover.*)
☒ Static water level 193' ft. below top of casing or
☐ Closed-in artesian pressure ____ psi.

How was test flow measured:
(bucket/stopwatch) weir, flume, flowmeter, etc ____

Yellowstone Controlled Groundwater Area - Water Temperature N/A °F
☐ AQUIFER TEST DATA FORM ATTACHED

Test - 1 hour minimum
Drawdown is the amount water level is lowered below static level.
All depth measurements shall be from the top of the well casing
Time of recovery is hours/minutes since pumping stopped

(Air test*)
30 gpm with drill stem set at 255' ft for 2 hours
Time of recovery 1 (hrs)/min. Recovery water level 193' ft.

OR Bailer test*
____ gpm with ____ ft. of drawdown after ____ hours
Time of recovery ____ hrs/min. Recovery water level ____ ft.

OR Pump test*
Depth pump set for test ____ ft.
____ gpm pump rate with ____ ft. of drawdown after ____ hrs pumping
Time of recovery ____ hrs/min Recovery water level ____ ft

OR Flowing Artesian*
____ gpm for ____ hours
Flow controlled by ____

**During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

7. WELL LOG:

Depth, Feet From	Depth, Feet To	Material color/rock and type/descriptor (example: blue/shale/hard or brown/gravel/water, or brown/sand/heaving)
0	1	Black - Topsoil
1	260	Gravel & Sand

☐ ADDITIONAL SHEETS ATTACHED

8. DATE WELL COMPLETED: 6-21-01

9. REMARKS: ____

10. DRILLER/CONTRACTOR'S CERTIFICATION:
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name, firm, or corporation (print) Bridger Drilling Inc.
Address P.O. Box 4287 Bozeman, MT. 59772
Signature ____
Date 7-2-01 License no. 425

Montana DNRC P.O. BOX 201601 HELENA, MT 59620-1601 444-6610
DEPARTMENT COPY
DRILLER: Please give this copy to the well owner to complete reverse side.

MBMG ID# ____

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
SOUZA TOM & HELENA

Plot this site on a topographic map

Location Information

GWIC Id:	165426	Source of Data:	LOG
Location (TRS):	05S 09E 19 CBD	Latitude (dd):	45.3849
County (MT):	PARK	Longitude (dd):	-110.6674
DNRC Water Right:		Geomethod:	TRS-TWN
PWS Id:		Datum:	NAD27
Block:		Altitude (feet):	
Lot:		Certificate of Survey:	
Addition:		Type of Site:	WELL

Well Construction and Performance Data

Total Depth (ft):	259.00	How Drilled:	ROTARY
Static Water Level (ft):	194.00	Driller's Name:	HAYES
Pumping Water Level (ft):	255.00	Driller License:	WWC361
Yield (gpm):	20.00	Completion Date (m/d/y):	7/29/1997
Test Type:	AIR LIFT	Special Conditions:	
Test Duration:	1.00	Is Well Flowing?:	
Drill Stem Setting (ft):		Shut-In Pressure:	
Recovery Water Level (ft):		Geology/Aquifer:	Not Reported
Recovery Time (hrs):		Well/Water Use:	DOMESTIC
Well Notes:			

Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-2.0	259.0	6.0				STEEL

Annular Seal Information

From	To	Description
0.0	20.0	BENTONITE

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
259.0	259.0	6.0			OPEN BOTTOM *

Lithology Information

From	To	Description
0.0	4.0	TOPSOILS GRAVEL & CLAY
4.0	48.0	LARGE COBBLES COULDERS GRAVEL & SOME CLAY
48.0	130.0	GRAVELS CLAY & FEW SMALL BOULDERS
130.0	185.0	LOOSE SAND & GRAVELS W/POOR CIRCULATION
185.0	220.0	CLAYBOUND GRAVELS & BOULDERS
220.0	261.0	SAME W/SOME VOLCANIC TYPE GRAVELS & ROCK

[1] - All diameters reported are **inside** diameter of the casing.

Yellowstone River Ranch Estates
Environmental Assessment

Appendix D

Water and Sanitation Information

and

Submittal to
Montana Department of
Environmental Quality

Yellowstone River Ranch Estates

Water and Sanitation Information

a. Vicinity Map: Refer to attached map (11" x 17") entitled "Water and Sanitation Vicinity Map, Yellowstone River Ranch Estates", and attached maps (11" x 17") entitled "Water and Sanitation Site Layout" and numbered sheets C-2a through C-2s (1 through 19 of 19).

i. Location within 100 ft outside exterior property boundary of proposed subdivision, and on proposed lots:

1. Flood plain: Shown on attached vicinity map.
2. Surface water features: Shown on attached vicinity map.
3. Springs: None known to exist on this property.
4. Irrigation ditches: Existing irrigation ditch and center pivot are shown on attached maps.
5. Existing, previously approved and proposed water wells and drainfields:
   Shown on attached Site Layout Maps.
6. Drainfield mixing zones: Shown on attached Site Layout Maps.
7. Representative drainfield: The location of a drainfield on each lot less than 20 acres is shown on attached Site Layout Maps.
8. Location, within 500 ft outside exterior boundary of proposed subdivision property, of public water and sewer facilities: N/A.
9. Locations of neighboring wells and drainfields within 100 ft of the exterior boundary of this subdivision property:
   Neighboring wells located on lots north of this property are shown on Site Layout Map, sheets 18 and 19 of 19. Although these wells are greater than 100 ft from the boundary, the potential impacts from proposed drainfields on this subdivision are considered. Drainfields located on these lots are greater than 100 ft beyond the common boundary and are not overlapped by new drainfields' mixing zones. No other wells or drainfields are known to exist on other surrounding properties within 100 ft of the common boundaries with this subdivision, and therefore are not shown on the attached Site Layout Map.

b. Description of proposed:
   Potable water supply systems: Private individual well to be drilled on each lot.
   Wastewater treatment and disposal systems: Private individual standard septic tank and drainfield to be constructed on each lot.
   Stormwater detention and control systems: Stormwater from gravel driving surfaces of access roads will be captured in drainage ditches

constructed along sides of roadways or allowed to sheet flow through well vegetated areas. Stormwater caught in drainage ditches will be detained behind dikes placed in ditches at specified intervals in order to detain volumes of stormwater greater than excess produced by new development on this property. Separate stormwater detention/settling areas will be constructed to capture and detain excess stormwater discharged from roadways but not detained in roadside drainage ditches. The YRRE Homeowners Association will be responsible to maintain and remove depositions of sediments from within these detention structures. In addition, as specified on sheet C-2f (number 6 of 19) in "Stormwater Runoff Control Requirements", lot owners are responsible to control stormwater runoff on their lot. This responsibility includes constructing a berm at least 12" high by 40 ft long along the lower edge of landscaped area of lot, and providing drainage ditched along driveways in order to collect and detain stormwater volumes greater than the excess stormwater produced by development on the lot. Stormwater runoff volumes produced from development to be constructed as part of this subdivision will be collected and detained on-site in drainage structures constructed as part of this subdivision. Other stormwater runoff will collect in depressions in the natural ground surface. Most of this retained stormwater, which accounts for a larger volume than the excess produced by this development, is expected to infiltrate into the generally porous soils. The remaining volume of stormwater runoff is expected to flow off the property through well-vegetated routes to the Yellowstone River and neighboring properties, as it has historically done.

Solid waste disposal system: Park County solid waste disposal system consisting of green box enclosures located through Park County. The closest green box enclosure is located at the intersection of East River Road and Chico Road.

c. Lot Layout: Refer to attached maps for layout of well and drainfield proposed for each lot. Due to the number of lots planned to be created by this subdivision and the lengths of drainfield mixing zones, one generic lot layout can not adequately predict cumulative impacts to groundwater. Therefore, a drainfield is shown on every lot.

d. Wastewater treatment: Evidence of suitability for new on-site wastewater treatment/disposal systems that, at a minimum, includes:

   1. Due to the size of this property, a total of 51 soil profile inspection pits were excavated and soil profiles were recorded in accordance with DEQ Circular 4. The pits were excavated to depths at least 10 ft deep. The locations of these soil inspection pits are shown on the attached Site Layout Maps. In addition, soil reports obtained from NRCS are provided in Appendix C of the Environmental Assessment.

   2. The observations of soil conditions made and recorded from these 51 pits verify that greater than 4 ft of vertical separation exists between bottom of the deepest drainfield trench and a limiting layer. Drainfield

trenches are generally constructed to a depth of 24", and the maximum depth in accordance with Circular DEQ 4 is 36".

3. In no case was evidence of limiting geological layer or high groundwater table found to be above the bottom of any soil inspection pit. This evidence clearly establishes that high groundwater table does not crest within 10 ft of ground surface, and therefore, will not encroach within 4 ft for bottom of drainfield trenches.

e. Water supply: For new water supply systems, evidence of adequate water availability:

1. Pump tests were conducted by the Engineer in 2005 from 2 of the 3 wells drilled on this property. These wells are identified as Test Well #3 and Test Well #1. During these tests, static water levels were monitored within 2 other wells located on the property. These well are identified as Well #2 and stone house well. Each pump test discharged water from the test well at a rate of over 100 gpm for at least 24 hours. An analysis of these two pump tests is presented in the Summary / Conclusions section of the pump test log for these tests provided in the DEQ submittal.
   The GWIC database reports over 75 well logs in Sections 13, 14, 23, 26, 24, 25 and 35 T. 5S R. 8E which produce adequate yields to exceed the minimum requirements set by DEQ (refer to attached GWIC summary sheets 1 through 5 of 5 in the attached DEQ submittal). In addition, a pump test was conducted by the Engineer in 2004 from a well drilled on Tract B-2 of Paradise Found. Two separate tests were conducted by MBMG and the developer of Yellowstone Trails Ranch is 2003. Both these subdivisions are contiguous to the east of this property. Continuous yields of greater than 100 gpm for periods greater than 19 hours were discharged during these five well tests. Copies of the test reports are provided with the DEQ submittal or in Environmental Assessment Appendix E. These results indicate that there is reasonable potential of drilling a well on each of these 99 lots near the locations indicated on the Site Layout Map which will yield adequate water to serve the single family residence, guest house and some landscape irrigation on each lot.
   As an extension of the analysis conducted from the pump tests data, 5 wells in the area on and beyond this property to the east were surveyed for horizontal location and vertical elevation using GPS survey grade equipment, and the static water levels were measured within a 4 hour period. These data were used to calculate groundwater gradient and flow direction for use in the nitrates sensitivity analysis (NSA). The NSA uses a mathematical model for predicting cumulative impacts on groundwater from the new drainfields proposed by this subdivision.

f. Water Quality:
Water samples collected from the 2 test wells (Wells #1 and #3) during the pump tests were analyzed for water quality at a state certified lab. The results show nitrates concentrations of 0.44 ppm and 0.15 ppm, respectively, from Wells #1 and #3, and specific conductance values and 283 umhos and 339 umhos, respectively, for Wells #1 and #3. These results show the underlying groundwater to be Class 1 as defined by EPA.

g. Groundwater Quality:
The attached calculation sheets document results from the nitrates sensitivity analysis performed to predict the impact on groundwater from proposed drainfield on each lot intended to serve one single family residence and an additional guest house on the same lot, where a guest house is allowed. Drainfields on Lots 2, 15, 16, 31, 32, 33, 61 and 63 result in one line in which 8 drainfields are assumed to be aligned along the calculated groundwater flow direction over a total distance of 3890 ft. This alignment is analyzed in spread sheets identified by page numbers 1 through 8 of 8. All 8 of these drainfields are analyzed to serve a residence and guest house. Another assumed alignment of five drainfields on Lots 78, 79, 81, 82 and 83 spans a distance of 1980 ft. This alignment is analyzed in spread sheets identified by page numbers 1 through 5 of 5. All 5 of these drainfields are analyzed to serve only a single family residence due to the area of the building envelope on these lots. These alignments produce nitrates concentrations in groundwater less than the maximum value of 5.0 ppm allowed by DEQ regulations. All other alignments of drainfields on this subdivision consist of fewer drainfields, over longer or the same distances, allow longer lengths of drainfield perpendicular to groundwater flow direction, and a regulation length mixing zone. Therefore, the analysis demonstrates that overall cumulative impacts on groundwater will be non-significant in accordance with DEQ regulations.
In addition, a generic stand alone drainfield 75 ft long perpendicular to groundwater flow serving residence and guest house was analyzed with three lengths of mixing zones: 1) typical 500 ft long mixing zone, 2) a mixing zone limited to 300 ft, and 3) a mixing zone limited to 200 ft long. The nitrates concentrations predicted are less than allowable maximum. The shorter mixing zones address situations where a mixing zone may overlap the zone of isolation surrounding a potable water well or extend unnecessarily onto neighboring property, as is the case on Lots 83, 84, 91, 93, 94 and 99 located along the north boundary of the subdivision. The 300 ft or 200 ft long mixing zone limits encroachment into neighboring property. Due to the size of each lot and general layout of improvements on the lot, drainfield mixing zones in general do not overlap the 100 ft radius zone of protection around a proposed well along the groundwater gradient for over 500 ft. Where they may overlap, nitrates concentrations would be less than allowable maximum. In addition, due to the sparseness and proximity of surrounding development, low density of

proposed development on this subdivision and direction of calculated flow direction, existing drainfields are located on neighboring properties such that their mixing zones do not overlap proposed drainfields or 100 ft radius zones of protection around proposed wells. Therefore, the NSA calculation sheets described above estimate the cumulative nitrates concentrations resulting from worst case alignments.

h. Exclusions:
No exclusions apply or have been requested for this project.

WATER AND SANITATION VICINITY MAP

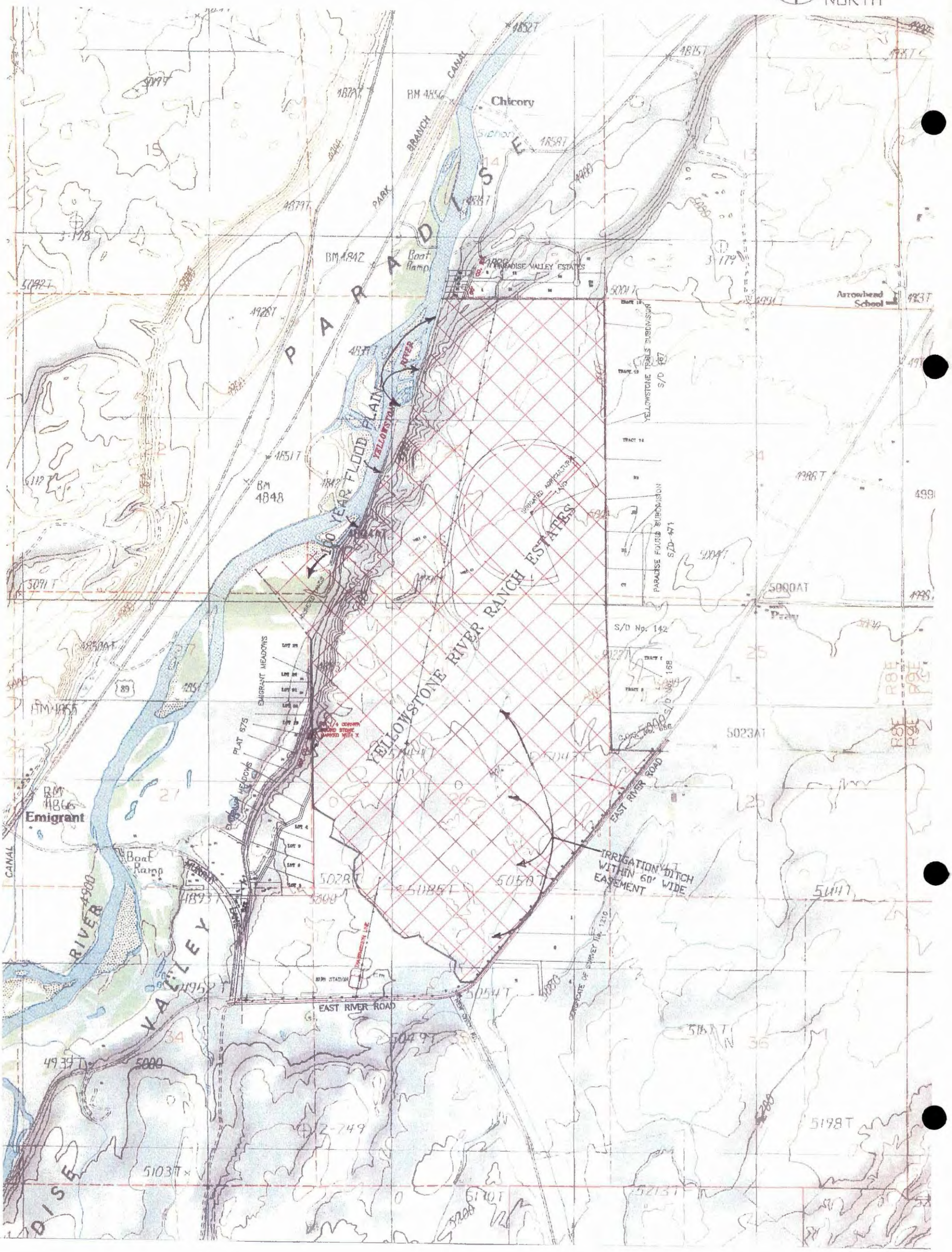
YELLOWSTONE RIVER RANCH ESTATES

A PROPOSED SUBDIVISION LOCATED IN THE SE 1/4 SEC. 22, SEC. 23, THE SW 1/4 SEC. 25, SEC. 26, THE NE 1/4 SEC. 27, AND THE N 1/2 OF SEC. 35, T. 5 S., R. 8 E., P.M.M., PARK COUNTY MONTANA

AUGUST 18, 2006

SCALE: 1" = 1600'

NORTH



NOTE:
REFER TO SITE LAYOUT MAP FOR WATER AND SANITATION FEATURES ON THIS AND NEIGHBORING PROPERTIES.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY/ LOCAL GOVERNMENT JOINT APPLICATION FORM

PART I. GENERAL DESCRIPTION AND INFORMATION

1. Name of proposed development Yellowstone River Ranch Estates

2. Location: City and/or county Near Pray Paradise Valley, Park County
   Legal description: _____ 1/4 SW 1/4 of Section 25 Township 5S Range 8E
   Sections 23 & 26 & N½ Sec 35 E

3. Is concurrent review by local governing body and DEQ requested? Yes _____ No ✓

4. Type of water supply system
   - ✓ Individual well
   - _____ Individual cistern
   - _____ Individual surface water supply or spring
   - _____ Shared well (2 connections)
   - _____ Multiple-user water supply system (3-14 connections and fewer than 25 people)
   - _____ Service connection to multiple-user system
   - _____ Service connection to public system
   - _____ Extension of public main
   - _____ New public system (15 or more connections or serving 25 or more people)

5. Type of wastewater treatment system
   - ✓ Individual wastewater treatment system
   - _____ Number of bedrooms (3 bedrooms will be used if unknown)
   - _____ Shared wastewater treatment system (2 connections)
   - _____ Multiple-user system (3-14 connections and fewer than 25 people)
   - _____ Service connection to multiple-user system
   - _____ Service connection to public system
   - _____ Extension of public main
   - _____ New public system (15 or more connections or serving 25 or more people)

6. Name of solid waste (garbage) disposal site Park County Solid Waste Disposal System

7. Nondegradation
   Yes ✓ No _____ Is information included which substantiates that there will be no degradation of state waters or that degradation will be nonsignificant?
   Yes _____ No _____ If not, have you enclosed an Application to Degrade?

8. Descriptive Data
   - 88 Number of lots or rental spaces 99 Total with 11 being >20 AC
   - _____ Total acreage in lots being reviewed
   - _____ Total acreage in streets or roads
   - _____ Total acreage in parks, open space, and/or common facilities
   - _____ Total gross acreage of subdivision
   - _____ Minimum size of lots or spaces
   - _____ Maximum size of lots or spaces

9. Indicate the proposed use(s) and number of lots or spaces in each.
   - ✓ Residential, single family With Guest House
   - _____ Residential, multiple family Number of units _____
   - _____ Type of multiple family structure (e.g. duplex)_____ Number of units _____
   - _____ Planned unit development Number of units _____
   - _____ Condominium Number of units _____
   - _____ Mobile home park Number of units _____
   - _____ Recreational vehicle park Number of units _____
   - _____ Commercial or industrial
   - _____ Other (please describe) _____

10. Provide the following information regarding the development.

Current land use Pasture

Depth to ground water at the time of year when water table is nearest to the natural ground surface within the drainfield area >10'

Depth to bedrock or other impervious material in the drainfield area >10'

Existing zoning or other regulations No Zoning / County Subdivision Regs apply

11. Include the following attachments, if applicable.

Yes ____ NA ✓ An overall development plan indicating the intent for the development of the remainder of the tract, if a tract of land is to be subdivided in phases.

Yes ✓ NA ____ Drafts of any covenants and restrictions to be included in deeds or contracts for sale.

Yes ✓ NA ____ Drafts of homeowners' association bylaws and articles of incorporation, if applicable.

(Submitting a draft copy of a homeowners' association bylaws and articles of incorporation is adequate for DEQ to initiate and complete its review of sanitary facilities, but a copy of the fully executed documents must be submitted before DEQ can issue final approval.)

I understand that a person may not dispose of any lot within a subdivision, erect any facility for the supply of water or disposal of sewage or solid waste, erect any building or shelter in a subdivision that requires facilities for the supply of water or disposal of sewage or solid waste, or occupy any permanent buildings in a subdivision until the reviewing authority under the Sanitation in Subdivisions Act has issued a certificate of subdivision approval indicating that the subdivision is not subject to sanitary restriction, unless the subdivision is exempt from the Sanitation in Subdivisions Act under 76-4-125, MCA. I understand that a person may not construct or use a facility that deviates from the certificate of subdivision approval until the reviewing authority has approved the deviation.

I designate William E. Smith, P.E. as my representative for purposes of this application.

Designated representative, if any (e.g., engineer, surveyor)

Name: William E. Smith, P.E. Phone: (406) 333-9040

Address: P.O. Box 78, Emigrant, MT 59027-0078
Company, Street or P.O. Box, City, State, Zip Code

Owner

Name: [signature] Managing Member Yellowstone River Ranch Estates, LLC
Signature of owner Print name of owner

Address: 104 W. Superior St. Duluth, MN. 55802
Street or P.O. Box, City, State, Zip Code

Date: 7/27/06 Phone: 218-722-3112

(The statement must be signed by the owner of the land proposed for subdivision or the responsible officer of the corporation offering the same for sale.)

Notice: The statutory time frame for each review is 60 days. Resubmittal of denied or incomplete applications restarts the time frame. The estimated time for the DEQ to act on a complete subdivision application is 10 days for subdivisions reviewed by a local department of health under contract to the DEQ. Local health departments review subdivisions within 50 days of receipt of a complete application. During non-peak times, a review may take 25 to 45 days. For peak times, the review may take 45 to 60 days.

Part IV SUBDIVISION CHECKLIST

Subdivision: Yellowstone River Ranch Estates County: Park

E.Q. Number (provided by DEQ): _____

Please complete the checklist with your initials or N/A.

WES			1. Have deviation or waiver requests been submitted with appropriate fees?	17.36.601	
WES			2. Is check included with correct fee?	17.36.103(1)(a)	
WES			3. Is application included with owner's signature/address/phone/date?	17.36.102(1)&(2)	
WES			4. Is legible copy of Preliminary Plat or COS included?	17.36.103(1)(m)	
WES			5. Is legal description included on the Preliminary Plat or COS?	17.36.103(1)(m)	
Yes			6. Are all lots described on survey being reviewed and any exclusions clearly stated on Preliminary Plat or COS?	17.36.103(1)(m), 17.36.605	
✓			7. Are lots at least 1 acre in size or otherwise meet minimum lot size requirements?	17.36.340, 17.36.322(4)	
To DEQ under Separate Cover			8. Is local health officer approval included?	17.36.102(3)&(6), 17.36.103(1)(n), 17.36.106(2)	
			9. Are Planning Board or County Commissioner comments included?	17.36.103(1)(n)	
WES			10. Is a clear copy of USGS or other topo map included to show ground slope of property?	17.36.103(1)(h), 17.36.310, 17.36.322	
✓			11. Are 4 copies of lot layout included with the subdivision name on each?	17.36.103(1)(d), 17.36.104	
✓			12. Is all required information (e.g., scale, legend, north arrow, etc.) included on the lot layout?	17.36.103(1)(d), 17.36.104	
N/A			13. Are locations of water and sewer mains shown?	17.36.103(1)(d), 17.36.104	
WES			14. Are on-site sewer systems designed in conformance with DEQ 4?	17.36.320	
✓			15. Is the slope given for drainfield areas?	17.36.103(1)(h), 17.36.322	
✓			16. Are drainfields orientated along land contours to meet depth requirements?	17.36.322, DEQ 4, Chap. 8	
✓			17. Are drainfield replacement areas shown?	17.36.104(2), Table 1	
✓			18. Are minimum setback requirements met?	17.36.323	
Waiver Requested			19. Is adequate test pit (8 ft. excavation) data provided?	17.36.103(1)(h), 17.36.325	
✓			20. Is SCS/NRCS soils data provided?	17.36.325(3)	
✓			21. Is information to verify depth to seasonal high ground water or bedrock provided?	17.36.103(1)(h), 17.36.106(2), 17.36.325(2)	
None Conducted			22. If conducted, does perc test value(s) correspond to soil type?	17.36.103(1)(h)	
WES			23. Are wells, 100 ft. well isolation zone, mixing zones, and ground water flow direction (verified by wells or other documentation) shown?	17.36.103(1)(e), 17.30.501-518	
WES			24. Is adequate water supply substantiated?	17.36.103(1)(f)	

WES			25. Are water quality analyses (nitrate, specific conductivity, and bac-T (for existing wells) provided, along with well log and well location?	17.36.103(1)(f), 17.36.330, 17.36.335	
WES			26. Is existing well over 25 ft. in depth?	17.36.335, 17.36.331(1)(e)	
N/A			27 Will surface water, spring or cistern system be disinfected and filtered?	17.36.336	
WES			28. Is nondegradation addressed and supporting data to determine background water quality, hydraulic conductivity and hydraulic gradient provided?	17.36.103(1)(i), 17.30.501-518, 17.30.715	
✓			29. Is nitrate level at end of mixing zone < 5 ppm (< 7.5 ppm, if level 2 provided), and phosphorous breakthrough > 50 years?	17.36.103(1)(i), 17.30.715	
N/A			30. Are shared users agreements included for shared well, drainfields and/or easements?	17.36.103(1)(o), 17.36.326(3)	
✓			31. Is a copy of the local septic permit (if issued) for an existing septic system provided?	17.36.327	
			32 Is a septic pumper's report stating an existing septic tank has been pumped within the last 3 years provided?	17.36 327	
✓			33. Is evidence demonstrating proper hydraulic functioning of an existing septic system provided?	17.36.327	
✓			34. Are wells, drainfields and/or mixing zones within 100 ft. perimeter outside of subdivision boundaries shown?	17.36.103(1)(e), 17.30.501-518, 17.30.706	
No			35. Is proposed subdivision within 500 feet of public water supply and/or sewer system?	17.36.328(1)	
N/A			36. Is authorized statement to connect to existing public water and/or sewer system and statement of adequate capacity provided?	17.36.103(1)(g), 17.36.328(2)(b)	
N/A			37. Is existing public water system approved by DEQ and PWS # provided?	17.36.328(2)(b) & (c)	
N/A			38. Do appropriate water rights exist for the public water connection?	17.36.328(2)(b)	
N/A			39. If needed, are easements for water and/or sewer systems/lines shown?	17.36.103(1)(m) & (o)	
N/A			40. Are plans and specs (3 copies) stamped and signed by PE?	17.36.103 (1)(b) & (c)	
WES			41. Are 100-year floodplain requirements met, and floodplains and drainages shown?	17.36.104, 17.36.106(2)(c), 17.36.324	
WES			42. Is solid waste disposal addressed?	17.36.103(1)(k), 17.36.309	
WES			43. Has storm water drainage been addressed?	17.36.103(j), 17.36.104(2), 17.36.310, DEQ 8	

Applicant/representative: Name William E. Smith Signature William E. Smith Date 7/18/2006

County reviewer: Name _____ Signature _____ Date / /

Revised 12/03

Engineer's Report

Yellowstone River Ranch Estates Major Subdivision

Release of Sanitary Restrictions for 99 Lots with
Individual On-Site Sewage Treatment Systems
and
Individual On-Site Potable Water Supply Wells

July 8, 2006

Location of Property:
Within Sections 23, 26, SW$^1/_4$ 25 and N$^1/_2$ 35 T. 5S, R. 8E., P.M.M.
Park County, Montana

Prepared for:

Yellowstone River Ranch Estates, LLC
$^c/_o$ Jerry Dodd
104 West Superior Street
Duluth, MN 55802

and

Mark Penfield
18141 Nalle Road
North Fort Myers, FL 33917

Prepared by:

William E. Smith, P.E.
Octagon Consulting Engineers
P.O. Box 78
Emigrant, MT 59027-0078
(406) 333-9040

1. Introduction

1.1. Jerry Dodd intends to subdivide his 1158 acre property which occupies all of Sections 23 and 26 east of Yellowstone River, within the NW¼ SW¼ Section 25 and a portion of the N½ Section 35 T.5 S, R. 8 E to create 99 lots ranging in size between 3.0 acres and 45.5 acres, as shown on the attached preliminary plat and Site Layout Map. The property is presently used as irrigated and dryland pasture and crop production. One old stone house ranch residence, served by individual water well and septic system is present. The boundary lines for Lot 13 have been located to place this house and associated development together on one lot. All of the proposed lots will be developed with one single family residence, and many of the larger lots are entitled to have one guest house. Each lot will be served by individual septic tank / drainfield system and individual well located on the lot.

1.2. The specifications and information provided herein are a result of the Engineer's evaluation of the conditions on the site which may affect the placement and use of on-site wastewater treatment, water supply wells and considerations for stormwater runoff. This report documents the justification for Department of Environmental Quality 's approval for the subdivision and the removal of sanitary restrictions from the newly created lots.

2. Site Evaluation

2.1. The property lies in a sparsely developed area of gently sloping pastures and prairie. The terrain over the majority of the property varies in slope between <1% and 8% with few steeper slopes. Steeper slopes between 12% and 40% occur overlooking the Yellowstone River and forming the bank. This subdivision has a boundary approximately 5000 ft long with the Yellowstone River, and an area of undevelopable common land over 20 acres in area lies within the 100-year flood plain. Due to the steepness and height of the river bank along the river front lots, the 100-year flood plain remains nearly vertical and does not extend into potential designated building sites on the lots. (Refer to the map of the pending flood plain in this reach of river.)

Along the northern boundary, the property is approximately 3000 ft wide, and near its middle where the river bends away to the west, the horizontal width increases to over one mile wide. The vertical elevation of most of this property is over 100 ft above the closest point on the Yellowstone River.

The property lies well beyond the 100 year flood plain of the Yellowstone River and no water courses or streams exist within the property that would pose a significant threat of flooding. The Mill Creek irrigation pipeline that supplies water to the operational center pivot replaces most of the small irrigation ditches that once ran on the property. This pivot is the last user on the end of the Mill Creek line and no transmission pipelines run through the property. The southern and central portions of the property receive irrigation water from Emigrant Creek through a series of private irrigation

ditches that end on this property. No down stream users receive water from this ditch.
A xerox copy of a portion of the USGS Pray, Montana 7.5 minute series topographic map is attached to show the location of the property.

2.2. Most of the neighboring property surrounding this subdivision is made up of subdivided lots that vary is area between approximately 2 acre rural residential lots to over 20 acre ranchettes. The owner of this proposed subdivision has created by C.O.S. a 160 acre tract of undeveloped land in the southern most part of this property for potential future development. The closest residences are located on Lot 23/24 and Lot 19 in Paradise Valley Estates to the north and lots in Emigrant Meadows to the west. The wells serving the residences in Emigrant Meadows appear by visual reconnoiter to all be located greater than 100 ft beyond the common boundary with this proposed subdivision. Wells along this boundary are not in a position to be overlapped by a mixing zone from a proposed drainfield. The locations of the wells serving the residences beyond the north boundary are shown on the site layout map, although they are greater than 100 ft beyond the boundary, due to the calculated flow direction of the groundwater and the potential impact that new drainfields on this subdivision could have on them. Drainfields serving these residences are not shown because they are greater than 100 ft beyond the property boundary, and more importantly, are not overlapped by new drainfield mixing zones which have been defined to be shorter along this north boundary so as not to extend significantly into neighboring property.

2.3. The wells located beyond the north boundary are the closest identified neighboring existing wells from the proposed drainfields in the subdivision. The zones of protection surrounding these wells are not overlapped by mixing zones of proposed drainfields as plotted according to the calculated groundwater flow direction. These wells should not be impacted by the proposed development.

2.4. Proposed wells and drainfields serving each subdivision lot are positioned on the lot such that drainfield mixing zones do not overlap the zone of isolation surrounding any well within over 500 ft. The location of each new well intended to serve the house and guest house (where applicable) on the lot will be greater than 100 ft horizontally from the new drainfield serving that lot. Consideration of the results of two 24 hour pump tests on wells on this property, three additional pump tests of wells located on Yellowstone Trails Ranch and Paradise Found (contiguous properties) and numerous wells drilled in the area (as documented in Section 7 of this report) strongly show the availability of groundwater for drilling domestic wells for the planned single family residences and guest houses on these subdivision lots. No adverse affects on groundwater quality are anticipated due to the placement of the drainfields and drilling of wells on this subdivision.

2.5. Profiles of soils in the proposed area of 51 new drainfields are described in Section 4.1 of this report. No percolation tests were conducted. The

average ground slope in the immediate area of drainfields does not exceed 15%.

3. Design Standards and References

Design and specifications for the individual wastewater treatment system shall conform to the following standards:

3.1. Department Circular DEQ 4, Montana Standards for On-Site Subsurface Sewage Treatment Systems, 2004 Edition.

4. Description of Soil Profiles Encountered in Inspection Pits and Result of Percolation Tests

Refer to attached Water and Sanitation Site Layout Map for locations of inspection pits within the proposed drainfield on each lot and attached log entitled "Description of Soil Profiles Encountered in Inspection Pits".

4.1. Percolation Test Results

No percolation tests were conducted.

4.2. Observations and Conclusions

Refer to Observations and Conclusions at the end of the soil inspection pit description log.

4.3. A request is hereby made for waiver from ARM that requires an inspection pit within location of each proposed drainfield.

Based on the consistency of the soil conditions encountered in the 52 inspection pits excavated over the property and reported in the attached log, and the soil types described in the NRCS soil report (refer to EA document), reasonable justification exists to grant a waiver to exempt excavation of the additional 37 inspection pits. There are 99 lots with one drainfield proposed for each. Eleven of the lots are greater than 20 acres and exempt from DEQ review. One of the inspection pits was excavated on a 20+ acre lot. Therefore, under the Rules an additional 37 inspection pits are required without approval of the requested waiver.

The methodology for sizing the drainfield on each lot is presented in the Observations and Conclusions section of the attached soil description log. In the opinion of the Engineer, reasonably conservative assumptions have been used in the sizing of these 37 drainfields proposed on lots where a soil inspection pit was not excavated.

5. Determination of Impact from Proposed Septic Systems on Groundwater in Accordance with Department of Environmental Quality Non-Degradation of Groundwater Regulations

5.1. The attached calculation sheets document results from the nitrates sensitivity analysis performed to predict the impact on groundwater from proposed drainfield on each lot intended to serve one single family residence and an additional guest house on the same lot where a guest house is allowed. Drainfields on Lots 2, 15, 16, 31, 32, 33, 61 and 63 result in one line in which 8 drainfields are assumed to be aligned along the calculated groundwater flow direction over a total distance of 3890 ft.

This alignment is analyzed in spread sheets identified by page numbers 1 through 8 of 8. All 8 of these drainfields are analyzed to serve a residence and guest house. Another assumed alignment of five drainfields on Lots 78, 79, 81, 82 and 83 spans a distance of 1980 ft. This alignment is analyzed in spread sheets identified by page numbers 1 through 5 of 5. All 5 of these drainfields are analyzed to serve only a single family residence. All other alignments of drainfields on this subdivision consist of fewer drainfields, over longer or the same distances, allow longer lengths of drainfield perpendicular to groundwater flow direction, and a regulation length mixing zone.

In addition, a generic stand alone drainfield 75 ft long perpendicular to groundwater flow serving residence and guest house was analyzed with three lengths of mixing zones: 1) typical 500 ft long mixing zone, 2) a mixing zone limited to 300 ft, and 3) a mixing zone limited to 200 ft long. The shorter mixing zones address situations where a mixing zone may overlap the zone of isolation surrounding a potable water well or extend unnecessarily onto neighboring property, as is the case on Lots 83, 84, 91, 93, 94 and 99 located along the north boundary of the subdivision. The 300 ft or 200 ft long mixing zone limits encroachment into neighboring property. Due to the size of each lot and general layout of improvements on the lot, drainfield mixing zones in general do not overlap the 100 ft radius zone of protection around a proposed well along the groundwater gradient for over 500 ft. In addition, due to the sparseness and proximity of surrounding development, low density of proposed development on this subdivision and direction of calculated flow direction, existing drainfields are located on neighboring properties such that their mixing zones do not overlap proposed drainfields or 100 ft radius zones of protection around proposed wells. Therefore, the NSA calculation sheets described above estimate the cumulative nitrates concentrations resulting from worst case alignments.

5.2. The hydraulic conductivity (K) of the groundwater aquifer was determined by plugging the required data from two pump tests conducted on wells on Lots 50 and 19 into the following equations for an unconfined aquifer: $T = 33.6[Q/(h_o - h)]^{0.67}$ and $K = T/b$. The wells are constructed with open bottom casing and no perforations or screens. An average K value of 164.7 ft/day was calculated (refer to attached calculation sheet). The average K value calculated is used in the NSA model.

5.3. The hydraulic gradient (i) and flow direction of the groundwater table under laying this area were determined to be 0.0126 ft/ft to the north northeast by using the three point solution for 5 wells located as shown approximately on the attached copy of the USGS Pray quadrangle map, and plotted accurately according to survey data on the attached plot map. The five wells used are identified as Paradise Found well on Tract B-2, Pray vacant monitoring well, and the 3 test wells drilled on this property. The data from the five wells allowed calculation of three combinations of graphic solutions, which were averaged to arrive at the gradient and flow direction used in the NSA (refer to attached calculation sheets). The

horizontal and vertical locations of all five wells were surveyed by GPS, and the SWLs were measured between 11:00 and 14:00 on June 22, 2006. The distances between these wells are approximately 4800 ft.

5.4. A typical mixing zone length of 500 ft is used for the new drainfields based on lot size being greater than 2 acres and subdivision size being greater than 10 acres. Where shorter mixing zone lengths are specified, the length is shown on the Water and Sanitation Site Layout Map.

5.5. The NSA spread sheets which calculate nitrates concentrations at the bottom of 500 ft long, 300 ft long and 200 ft long mixing zones for a 75 ft long generic drainfield that serves 2 residences predicts concentrations of 0.96 ppm, 1.10 ppm and 1.20 ppm, respectively. The cumulative nitrates concentration at the bottom of a 500 ft long mixing zone due to 8 drainfields (with the 8 drainfields serving 2 residences each) aligned over a distance of 3890 ft, and each assumed to be 85 ft long or shorter due to orientation is 3.23 ppm. The cumulative nitrates concentration at the bottom of a 200 ft long mixing zone due to 5 drainfields (with all 5 serving only 1 residence each) aligned over a distance of 1980 ft, and four assumed to be 20 ft long due to orientation, is 2.25 ppm.

5.6. The nitrates concentrations measured in a water sample taken from test wells 1 and 3 (well log attached) shows background nitrates concentrations of 0.44 ppm and 0.15 ppm, respectively. Refer to attached lab reports. A value of 0.44 ppm was used in NSA.

5.7. A nitrates concentration of 50 ppm is used for drainfield effluent in accordance with DEQ guidelines for nitrates sensitivity analysis (NSA).

5.8. The results of the NSA described herein, documented on the attached calculation sheet and shown on the Site Layout Map predict nitrates concentrations less than the maximum value of 5.0 ppm allowed for drainfield effluent without secondary treatment. Based on these results, the Engineer concludes that the drainfields proposed for this subdivision will result in a non-significant impact on the groundwater in the area.

5.9. Phosphorus break-through calculations were prepared to predict impact of drainfields described above.
Eight drainfields with each serving 2 residences were assumed to be located 3900 ft from surface water (as measured along calculated flow direction) and the dimensions of the generic drainfield modeled were 85 ft long (perpendicular to flow) by 25 ft wide (parallel to flow). The location of down gradient surface water was conservatively assumed based on the distance from drainfield 1 to drainfield 8 in this assumed alignment, which is not the actual location of surface water. The result calculated for this scenario predicts time to break through of 59 years.
Five drainfields with each serving 1 residence were assumed to be located 2000 ft from surface water (as measured along calculated flow direction) and the dimensions of the generic drainfield modeled were assumed at 20 ft wide (perpendicular to flow) by 75 ft long (parallel to flow). The location of down gradient surface water was conservatively assumed based on the distance from drainfield 1 to drainfield 5 in this assumed alignment, which is not the actual location of surface water. The result calculated for this scenario predicts time to break through of 50

years.
Two additional calculations were prepared: One for a single family drainfield 85 ft long (parallel to surface water) by 18 ft wide, and located 100 ft from surface water. Breakthrough time is calculated at 51 years. The second for a drainfield with dimensions 90 ft long by 30 ft wide serving two residences located 250 ft from surface water. Breakthrough time is calculated at 51 years. This calculation shows that an alignment of typical drainfield serving 2 residences each and positioned at least 250 ft apart on average will exceed the minimum time to breakthrough. These times to break through exceed or are equal to the minimum time of 50 years.

6. Description of Proposed Sewage Treatment Systems

6.1. One standard septic tank and drainfield system shall be designed for each lot in this subdivision. The new septic systems shall be designed, permitted, constructed and approved in accordance with Park County Health Department regulations and Department Circular DEQ 4, 2004 Edition. The drainfields are located to allow gravity flow from the septic tank to the drainfield.

6.2. The drainfield shall be constructed using non-pressurized 4" diameter perforated pipe. Each drainfield shall be sized according to the soil description as required by Department Circular DEQ 4, 2004 Edition. The drainfields are sized as described in the Observations and Conclusions section at the end of the attached soil description log entitled "Description of Soil Profiles Encountered in Inspection Pits". Nominal depth of all drainfield trenches should be approximately 24". On lots where a residence and guest house will be constructed, one drainfield sized to provide the required absorption area for each residence shall be constructed. As a viable alternative, two separate drainfields of adequate absorption area can be located immediately adjacent to each other so as to meet the specified drainfield layout.

6.3. The proposed location of the drainfield and 100% drainfield replacement area intended to serve each lot is shown on the attached Site Layout Map.

6.4. Construction equipment not needed to construct the system should be kept off the area to be utilized for the drainfield trench system to prevent undesirable compaction of the soils.

6.5. An existing septic system serves the old stone house homestead located on Lot 13. A septic system permit dated 8/14/1974 was found in the records of the PCHD for the residence of this lot. The location of system, shown on the Site Layout Map, was visually inspected by Engineer and appears to be functioning hydraulically properly. However, with no one occupying the house some years, hydraulic functioning of the existing system could not be confirmed.

7. Description of Individual Potable Water System to Serve New Residence

7.1. One new well is proposed to be constructed on each new lot at approximately the location shown on the Site Layout Map to serve the

single family residence planned to be on every lot and a guest house allowed on most lots. Construction of these wells will use materials and methods in accordance with current DNRC regulations for water wells.

7.2. A well serving one residence must produce a minimum sustained yield of 10 gpm for 1 hour of continuous pumping, 6 gpm for 2 hours or 4 gpm for 4 hours of continuous pumping. A well serving two residences must produce a minimum sustained yield of 15 gpm for 1 hour of continuous pumping or 10 gpm for 2 hours of continuous pumping. The GWIC database reports over 75 well logs in Sections 13, 14, 23, 26, 24, 25 and 35 T. 5S R. 8E which produce adequate yields to exceed the minimum requirements (refer to attached GWIC summary sheets 1 through 5 of 5). In addition, an analysis of two pump tests conducted by the Engineer in 2005 from wells drilled on this subdivision property is presented in the Summary / Conclusions section of the pump test log for these tests. A pump test was conducted by the Engineer in 2004 from a well drilled on Tract B-2 of Paradise Found. Two separate tests were conducted by MBMG and the developer of Yellowstone Trails Ranch is 2003. Both these subdivisions are contiguous to the east of this property. Continuous yields of greater than 100 gpm for periods greater than 19 hours were discharged during these five well tests. Copies of the test reports are provided. These results indicate that there is reasonable potential of drilling a well on these 99 lots near the locations indicated on the Site Layout Map which will yield adequate water to serve the single family residence, guest house and some landscape irrigation on each lot. In the event that a proposed well does not produce the required flow, adequate cistern volume must be installed to develop the maximum capacity of the well to meet the requirements of the domestic demands.

7.3. To ensure the continued quality of the well water, activities and improvements within a radius of 100 ft around each well head will be restricted to prohibit those which may have a significant potential of contaminating the groundwater, such as drainfields, underground storage tanks containing fuel or hazardous substances, and significant numbers of confined livestock, such as a feed lot.

7.4. Following the completion of the new well construction and prior to placing the water system into service, the entire system, including the well and connected supply piping should be disinfected in accordance with Section 8.0, "Well and Water Piping Disinfection Procedure". After the disinfection is complete and the entire system has been thoroughly flushed, the water should be tested for bacteriological contamination by a state approved laboratory. Acceptable test results should be received before the system is put into service.

7.5. A water samples collected from test wells #1 and #3 on this property, and tested for specific conductance report values of 283 umhos and 339 umhos, respectively, which indicate class 1 groundwater. Copies of lab test results are provided.

8. Well and Water Piping Disinfection Procedure

8.1. The wells and water lines should be disinfected following the guidelines of AWWA Standard C651 and as described below.

8.2. A sufficient volume of concentrated chlorine solution shall be poured into the well to produce an initial minimum chlorine concentration of over 50 ppm in the well casing.

8.3. The well pump should be turned on after adding the chlorine and run until the chlorine concentration of at least 50 ppm is measured at every service riser and plumbing fixture connected to the system. The pump must be shut off after this is achieved.

8.4. An additional quantity of concentrated chlorine solution should be poured into the well casing to bring the chlorine concentration in the well to at least 50 ppm. The chlorine shall remain in the system for a period of 24 hr.

8.5. After 24 hr, water samples should be taken at the pump control room and other locations throughout the system and tested for chlorine residual. The chlorine residual concentration shall be at least 10 ppm. The results of the tests shall be recorded.

8.6. The well pump should be used to flush the water system until the chlorine residual at all service risers is less than 2 ppm.

8.7. The water should also be tested to ensure that no offensive odor exists due to chlorine reactions or excess chlorine residual.

8.8. Water samples should be taken from two separate points in the system and tested by a MDEQ approved testing laboratory for coliform bacteria.

8.9. The disinfection procedure shall be repeated until bacterial counts are below levels acceptable to the water laboratory and the water is satisfactory for drinking.

8.10. The system should not be placed into service until the satisfactory bacterial results have been confirmed by the MDEQ approved testing lab.

9. Erosion Control, Reclamation and Control of Noxious Weeds

9.1. Reclamation activities shall be conducted in accordance with Park County Subdivision Regulations and these specifications.

9.2. Adequate measures shall be implemented to control erosion from disturbed areas and topsoil stockpiles, reclaim the disturbed areas of the site with topsoil and grass, and control the growth and spread of noxious and unsightly weeds. These measures shall include stripping and stock piling topsoil from areas to be disturbed by cutting and filling operations for future use in reclamation, placing barriers along the lower perimeter of a disturbed area, as required by site conditions to reduce sediment transport, preparing the surface and respreading topsoil over disturbed areas, and seeding disturbed areas with the correct blend of grass seed.

9.3. Existing trees and other vegetation shall be preserved where possible. Disturbance of the natural ground cover due to construction activities should be confined to within the areas immediately associated with that

construction in order to prevent unnecessary disturbance outside these areas.

10. Stormwater Runoff Control Provisions

10.1. The stormwater drainage and potential for stormwater runoff have been evaluated in accordance with ARM 17.36.310 (2) and Circular DEQ 8. Refer to stormwater analysis map for this major subdivision.

10.1.1. The attached 2 spread sheets entitled "Yellowstone River Ranch Estates Major Subdivision" document the results of a stormwater analysis for typical residential development on a lot and stormwater runoff from a typical 1000 ft length of subdivision road with 24 ft driving surface and 2 ft wide shoulders between drainage ditches. Because the development on each lot is assumed to be equal, including length and area of driveway, the volume of excess stormwater will be identical regardless of the size of the lots. The calculations predict a total volume of 106 cu. ft. must be detained on each lot, and 463 cu. ft. must be detained from each 1000 ft of gravel subdivision road.

10.1.2. The total area of this 99 lot major subdivision is 1158 acres. Minimum and maximum lot sizes are 3.0 acres and 45.5 acres, respectively. Each lot is accessed directly off of a private gravel surfaced subdivision road. A gravel driveway will be constructed to the single family residence and guest house on the lot. The natural ground slope over most of this property varies between <1% and approximately 8%. Some of the designated building envelopes for one single family residence on river front lots (no guest house allowed on these lots with designated building envelopes) occupy terrain with surface slopes up to 25%. The total area of unvegetated disturbance on any lot, including road surfaces, road cut and fill slopes, roofs, and driveways, is estimated to be less than 10%.

10.1.3. Drainage structures in the form of drainage ditches along subdivision access roads and each residential driveway shall be constructed. Where terrain allows on gentle ground slopes, drainage ditches should be constructed along both sides of driving surfaces, and the driving surface shall be crowned at the centerline of road. On side slopes, driving surfaces should be sloped inboard toward the cut slope and drainage ditches constructed into the inside edge. Where a driveway approaches the subdivision road, ditches shall be provided along both sides of the driveway. Ditches should be 2 ft wide at the top by approximately 1 ft deep in the center with bottoms sloping up to blend into the driving surface and natural ground surface.

Compacted earth dikes shall be placed across ditches at intervals determined by the grade of the driving surface, and no greater than 100 ft intervals where a road or driveway has a grade. Dikes must also be placed near the driveway intersection with the subdivision

road to detain stormwater runoff. Compacted earth dikes shall be placed within each drainage ditch to provide storage volume for at least 50 cu. ft of stormwater per 100 ft of length. Thereby, ditches properly constructed and maintained along roads and driveways will detain excess stormwater runoff.

10.1.4. Berms shall be constructed along the lower edge of landscaped areas around residence and guest house in positions to detain stormwater runoff without trapping water against the perimeter of the residence. Each berm shall be at least 1 ft high by at least 40 ft long blended into the finish contours of the ground. Each berm shall be capable of detaining a volume of at least 100 cu. ft of stormwater. A berm constructed to these dimensions on ground with slope of up to 4% is estimated to detain at least 300 cu. ft of stormwater.

10.1.5. The potential for erosion and sediment transport by stormwater runoff within the subdivision is low. Due to the substantial surface vegetation over this property, the ground surface is stable, no active drainage courses cross this property, and no signs of erosion exist. After the stormwater detention measures described in paragraphs 10.1.3 and .4, and specified on the stormwater drainage analysis map and Water and Sanitation Site Layout Map are in place, all disturbed areas are reclaimed in accordance with Section 9.0, and the surface vegetation is re-established, the historical (pre-development) amount of storm water runoff from the lots will not be increased.

10.1.6. The subdivision layout including driveway construction and locations of residences will not alter pre-development stormwater flow patterns.

10.1.7. Enclosed with this Engineer's Report is a copy of a portion of the Pray quadrangle USGS topo map of this area with contour intervals of 20 ft to show existing drainage patterns.

10.2. A stormwater evaluation has been prepared to predict volume of stormwater runoff from the development on each lot, including driveway to the residence on the lot, gravel turn around at the residence, paved areas and building roofs, and lawn and landscaped area. Copy of the spread sheet is attached. A volume of 106 c.f. of excess stormwater runoff must be detained on each lot. Therefore, notes have been placed on the site layout map to specify ditches along at least one side of a driveway, with dikes constructed at intervals not to exceed 100 ft in those ditches. In addition, construction of a berm at least 1 ft high by 40 ft long along the lower side of new development has been specified. Where all stormwater runoff from the developed areas on a lot cannot be captured in one location, additional detention berms should be constructed. These measures are estimated to detain a larger volume of stormwater than the excess volume predicted by the spread sheet analysis.

A second stormwater evaluation has been prepared to predict volume of stormwater runoff from a generic 1000 LF length of gravel road serving the subdivision. A copy of the spread sheet is attached. Where surface terrain allows, a volume of 46.3 c.f. of stormwater must be detained uniformly within the road-side drainage ditches along each 100 LF of road. Where surface terrain is steeper than 5%, adequately sized detention areas away from the roads shall be designated to detain excess stormwater. The gravel access roads to serve this property will run nearly level with gentle grades not exceeding 5% over the majority of the property. These roads shall be constructed to meet County subdivision standards, and ditches to meet stormwater detention requirements must be constructed as follows:

Average Road grade over length	Req'd max on-center spacing of dikes	Vol. Detained per 100 ft length of roadway
≤ 1%	200 ft	100 cu. ft
≤ 2%	100 ft	50 cu. ft
≤ 3%	90 ft	50 cu. ft
≤ 4%	50 ft	50 cu. ft
≤5%	50 ft	40 cu. ft

Therefore, notes have been placed on the water and sanitation site layout map to specify that ditches shall be constructed along both sides of all subdivision access roads, and dikes constructed within the ditches as follows:
at intervals not to exceed 200 ft where road grade is not steeper than 1%;
at intervals not to exceed 100 ft where road grade is not steeper than 2%;
at intervals not to exceed 90 ft where road grade is not steeper than 3%;
and at intervals not to exceed 50 ft where road grade is not steeper than 5%. These measures are estimated to detain a larger volume of stormwater than the excess volume predicted by the spread sheet analysis.

Description of Soil Profiles Encountered in Inspection Pits

(Refer to attached Site Layout Map for locations of inspection pit within the proposed drainfield on each lot.)

Soil Profile Description: Inspection Pits

Inspection pits were excavated to the depth shown in the table below within the proposed drainfield area for each lot.
Date of Inspection: January 31 through February 15, 2006
Inspection performed by: William E. Smith, P.E.

Number of Stratum	Depth below natural ground surface	Description of Soil Stratum
Inspection Pit for Lot 1. Depth of pit: 11'-0"		
1	0" to 0'-8"	Sandy loam topsoil with small percent fine to medium gravel, uniform medium brown coloration.
2	0'-8" to 11'-0"	Silty sand with large percentage well-graded gravel, moderate percentage cobbles to 8" and few stones to 20", roots to ~28", non-cohesive texture, slightly damp, uniform very dark grayish brown coloration (10 YR 3/2 Munsell Color Chart).
Inspection Pit for Lot 2. Depth of pit: 11'-0"		
1	0" to 0'-8"	Sandy loam topsoil with small percent fine to medium gravel, uniform medium brown coloration.
2	0'-8" to 4'-6"	Fine sandy loam with few particles >2 mm, dry texture in-situ and slightly cohesive when wet making weak ribbon <1", roots to ~30", uniform light yellowish brown coloration (2.5 YR 6/3 to 6/4 Munsell Color Chart).
3	4'-6" to 11'-0"	Clayey well-graded sand with moderate percentage gravel, cobbles to 8" and few stones to 12", non-cohesive texture, and uniform very dark grayish brown coloration.
Inspection Pit for Lot 7. Depth of pit: 10'-6"		
1	0" to 0'-6"	Sandy loam topsoil with small percentage gravel and few cobbles to 8".
2	0'-6" to 10'-6"	Sandy loam with moderate percentage well-graded gravel and small percentage cobbles to 8", slightly cohesive texture, and uniform light olive brown coloration (2.5 Y 5/4 Munsell Color Chart).
Inspection Pit for Lot 9. Depth of pit: 10'-6",		
1	0" to 1'-0"	Sandy loam topsoil with small percentage gravel, few cobbles.
2	1'-0" to 10'-6"	Sandy loam with moderate percentage well-graded gravel and small percentage cobbles to 8", slightly cohesive texture, and uniform light olive brown coloration (2.5 Y 5/4 Munsell Color Chart).

Number of Stratum	Depth below natural ground surface	Description of Soil Stratum
Inspection Pit for Lot 12. Depth of pit: 10'-0".		
1	0" to 1'-0"	Sandy loam topsoil with small percentage gravel and few cobbles, light brown coloration.
2	1'-0" to 10'-0"	Sandy loam with small percentage well-graded gravel and few cobbles to 8", slightly cohesive texture, and uniform light olive brown coloration (2.5 Y 5/4 Munsell Color Chart).
Inspection Pit for Lot 14. Depth of pit: 11'-0".		
1	0" to 0'-6"	Sandy loam topsoil with small percent fine to medium gravel, uniform light brown coloration.
2	0'-6" to 5'-6"	Very fine sandy loam with small percentage fine gravel, dry texture in-situ and non-cohesive when wet, uniform light yellowish brown coloration.
3	5'-6" to 11'-0"	Loamy sand with well-graded gravel, small percentage cobbles to 10" and few stones to 24", non-cohesive texture, and uniform olive brown coloration (2.5 Y 4/4 Munsell Color Chart).
Inspection Pit for Lot 15. Depth of pit: 10'-6".		
1	0" to 1'-0"	Sandy loam topsoil with small percent fine to medium gravel, uniform light brown coloration.
2	1'-0" to 9'-6"	Very fine sandy loam with small percentage fine gravel, dry texture in-situ and non-cohesive when wet making weak ribbon <1", uniform light yellowish brown coloration.
3	9'-6" to 10'-6"	Loamy sand with moderate percentage fine to coarse gravel and few cobbles to 8", dry crumbly texture in-situ, uniform yellowish brown coloration.
Inspection Pit for Lot 16. Depth of pit: 11'-0".		
1	0" to 1'-0"	Sandy loam topsoil with moderate percentage gravel, uniform light brown coloration.
2	1'-0" to 11'-0"	Loamy sand and well-graded gravel with moderate percentage cobbles to 10" and few stones to 18", dry texture in-situ and non-cohesive when wet, uniform brown coloration (10 YR 5/3 Munsell Color Chart).
Inspection Pit for Lot 17. Depth of pit: 10'-6".		
1	0" to 1'-0"	Sandy loam topsoil with small percent fine to medium gravel, uniform light brown coloration.
2	1'-0" to 10'-6"	Fine sandy loam with moderate to large percentage well-graded gravel, cobbles to 10" and few stones to 24", non-cohesive texture, and uniform light yellowish brown coloration.
Inspection Pit for Lot 18. Depth of pit: 10'-0".		
1	0" to 0'-6"	Sandy loam topsoil with small percentage gravel and few cobbles to 8".

Number of stratum	Depth below natural ground surface	Description of soil stratum
2	0'-6" to 4'-0"	Fine sandy loam with few particles >2 mm, dry texture in-situ and moderately cohesive when wet making weak ribbon ~1", roots to ~30", uniform light yellowish brown coloration (2.5 YR 6/3 to 6/4 Munsell Color Chart).
3	4'-0" to 10'-0"	Sandy loam with moderate percentage well-graded gravel and small percentage cobbles to 10", slightly cohesive texture, and uniform light olive brown coloration(2.5 Y 5/4 Munsell Color Chart).
Inspection Pit for Lot 20. Depth of pit: 10'-0"		
1	0" to 1'-0"	Sandy loam topsoil with small percentage gravel and few cobbles, light brown coloration.
2	1'-0" to 10'-0"	Fine sandy loam with small percentage well-graded gravel and few cobbles to 8", slightly cohesive texture, and uniform light yellowish brown coloration (10 YR 6/4 Munsell Color Chart).
Inspection Pit for Lot 22. Depth of pit: 11'-0"		
1	0" to 0'-6"	Sandy loam topsoil with small percentage gravel, light brown coloration.
2	0'-6" to 11'-0"	Sandy loam with small percentage well-graded gravel and cobbles to 8", slightly cohesive texture, and uniform light olive brown coloration (2.5 Y 5/4 Munsell Color Chart).
Inspection Pit for Lot 26. Depth of pit: 10'-6"		
1	0" to 0'-8"	Fine sandy loam topsoil with small percent fine to medium gravel, uniform light brown coloration.
2	0'-8" to 7'-6"	Fine sandy loam with few particles >2 mm, dry texture in-situ and slightly cohesive when wet making ribbon <1", roots to ~30", uniform light yellowish brown coloration (2.5 YR 6/3 to 6/4 Munsell Color Chart).
3	7'-6" to 10'-6"	Fine sandy loam with small percentage fine to coarse gravel and cobbles to 10", dry crumbly texture in-situ, uniform yellowish brown coloration.
Inspection Pit for Lot 27. Depth of pit: 10'-0"		
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel and few cobbles to 6", uniform light brown coloration.
2	1'-0" to 10'-0"	Sandy loam with small percentage well-graded fine to coarse gravel and few cobbles to 8", dry texture in-situ and slightly cohesive when wet, uniform pale yellow coloration (2.5 Y 7/4 Munsell Color Chart).
Inspection Pit for Lot 29. Depth of pit: 10'-6"		
1	0" to 1'-4"	Sandy loam topsoil with moderate percentage gravel and few cobbles to 8", uniform light brown coloration.
2	1'-4" to 10'-6"	Loamy well-graded fine to coarse sand and gravel with moderate percentage cobbles to 10" and few stones,

Number of Stratum	Depth below natural ground surface	Description of Soil Stratum
		gravel tight packed toward bottom of pit, dry texture in-situ and non-cohesive when wet, uniform light olive brown coloration (2.5 Y 5/3 Munsell Color Chart).
Inspection Pit for Lot 30. Depth of pit: 10'-0".		
1	0" to 0'-6"	Sandy loam topsoil with small percent fine to medium gravel, uniform light brown coloration.
2	0'-6" to 5'-0"	Very fine sandy loam with small percentage fine gravel, dry texture in-situ and non-cohesive when wet making weak ribbon <1", uniform light yellowish brown coloration.
3	5'-0" to 10'-0"	Fine sandy loam with moderate percentage well-graded gravel, cobbles to 10" and few stones to 24", non-cohesive texture, and uniform light yellowish brown coloration.
Inspection Pit for Lot 31. Depth of pit: 10'-6".		
1	0" to 1'-0"	Sandy loam topsoil with small percentage of fine gravel, uniform light brown coloration.
2	1'-0" to 10'-6"	Loamy sand with well-graded gravel and moderate percentage cobbles to 10" and few stones to 18", dry texture in-situ and non-cohesive when wet, uniform yellowish brown coloration.
Inspection Pit for Lot 32. Depth of pit: 10'-0".		
1	0" to 0'-7"	Fine sandy loam topsoil with small percentage of fine gravel, uniform light brown coloration.
2	0'-7" to 3'-0"	Fine sandy loam with few particles >2 mm, dry texture in-situ and non-cohesive when wet, uniform light yellowish brown coloration (10 YR 6/3 to 6/4 Munsell Color Chart).
3	3'-0" to 10'-0"	Loamy sand with moderate percentage gravel, small percentage cobbles to 10", and few stones to 18", dry crumbly texture in-situ and non-cohesive when wet, uniform texture and yellowish brown coloration.
Inspection Pit for Lot 33. Depth of pit: 10'-0".		
1	0" to 1'-0"	Very fine sandy loam topsoil with small percentage fine gravel, uniform light brown coloration.
2	1'-0" to 10'-0"	Loamy sand with moderate percentage gravel, small percentage cobbles to 10", and few stones to 18", dry crumbly texture in-situ and non-cohesive when wet, uniform texture and yellowish brown coloration.
Inspection Pit for Lot 34. Depth of pit: 11'-0".		
1	0" to 1'-0"	Sandy loam topsoil with small percentage fine to medium gravel, uniform brown coloration (10YR 5/3 Munsell Color Chart).
2	1'-0" to 11'-0"	Loamy well-graded sand and gravel with moderate percentage cobbles to 10" and few stones to 24" toward bottom of pit, roots to ~30", dry texture in-situ and non-

Number of Stratum	Depth below natural ground surface	Description of Soil Stratum
		cohesive when wet, uniform light olive brown coloration (2.5 Y 5/3 to 5/6 Munsell Color Chart).
Inspection Pit for Lot 35. Depth of pit: 10'-0".		
1	0" to 1'-0"	Sandy loam topsoil with moderate percentage gravel and few cobbles to 8", uniform light brown coloration.
2	1'-0" to 10'-0"	Loamy well-graded fine to coarse sand and gravel with moderate percentage cobbles to 10" and few stones to 15", dry texture in-situ and non-cohesive when wet, uniform brown to light olive brown coloration (10 YR 5/3 to 2.5 Y 5/3 Munsell Color Chart).
Inspection Pit for Lot 36. Depth of pit: 10'-6".		
1	0" to 1'-2"	Sandy loam topsoil with moderate percentage gravel and few cobbles to 8", uniform light brown coloration.
2	1'-2" to 10'-6"	Loamy well-graded fine to coarse sand and gravel with large percentage cobbles to 10" and few stones to 16", dry texture in-situ and non-cohesive when wet, uniform brown to light olive brown coloration.
Inspection Pit for Lot 38. Depth of pit: 11'-0".		
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel and few cobbles to 6", uniform light yellowish brown coloration.
2	1'-0" to 3'-0"	Fine sandy loam with small percentage well-graded gravel and few cobbles >6", dry texture in-situ and moderately cohesive when wet making weak ribbon ~1" long, uniform pale yellow coloration (2.5 Y 7/4 Munsell Color Chart).
3	3'-0" to 6'-0"	Sandy loam with moderate percentage gravel and cobbles to 6", dry texture in-situ and slightly cohesive when wet, uniform light yellowish brown coloration (2.5 Y 6/4 Munsell Color Chart).
4	6'-0" to 11'-0"	Loamy sand and gravel, small percentage cobbles to 10" and few stones to 30", dry texture in-situ and non-cohesive when wet.
Inspection Pit for Lot 41. Depth of pit: 10'-6".		
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel, uniform light brown coloration.
2	1'-0" to 8'-6"	Fine sandy loam with few particles >2 mm, dry texture in-situ and slightly cohesive when wet making ribbon <1", roots to ~30", uniform light yellowish brown coloration (2.5 YR 6/3 to 6/4 Munsell Color Chart).
3	8'-6" to 10'-6"	Clayey well-graded sand and gravel, cobbles to 8" and few stones to 15", non-cohesive texture, and uniform dark grayish brown coloration.

Number of Stratum	Depth below natural ground surface	Description of Soil Stratum
Inspection Pit for Lot 44. Depth of pit: 10'-0".		
1	0" to 0'-7"	Fine sandy loam topsoil with small percentage well-graded gravel, uniform light brown coloration.
2	0'-7" to 6'-0"	Sandy loam with small percentage well-graded gravel, dry texture in-situ and slightly cohesive when wet, uniform light yellowish brown coloration (2.5 Y 6/3 to 6/4 Munsell Color Chart).
3	6'-0" to 10'-0"	Loamy well-graded sand and gravel with moderate percentage cobbles to 8", dry crumbly texture in-situ and non-cohesive when wet, uniform texture and yellowish brown coloration.
Inspection Pit for Lot 45. Depth of pit: 10'-6".		
1	0" to 1'-4"	Fine sandy loam topsoil with small percentage gravel, uniform light brown coloration.
2	1'-4" to 10'-6"	Sandy loam with small percentage well-graded fine to coarse gravel and few cobbles to 8", dry texture in-situ and slightly cohesive when wet, uniform pale yellow coloration (2.5 Y 7/4 Munsell Color Chart).
Inspection Pit for Lot 47. Depth of pit: 10'-0".		
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel and few cobbles, uniform light brown coloration.
2	1'-0" to 10'-0"	Silty sandy loam with moderate percentage well-graded gravel and few cobbles to 10", dry texture in-situ and moderately cohesive when wet, uniform light yellowish brown coloration.
Inspection Pit for Lot 48. Depth of pit: 10'-0".		
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel and few cobbles to 5", uniform light yellowish brown coloration.
2	1'-0" to 10'-0"	Fine sandy loam with small percentage well-graded gravel and few cobbles to 8", dry texture in-situ and slightly cohesive when wet making weak ribbon <1" long, uniform light yellowish brown coloration (2.5 Y 6/3 Munsell Color Chart).
Inspection Pit for Lot 49. Depth of pit: 10'-0".		
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel and few cobbles to 5", uniform light brown coloration.
2	1'-0" to 10'-0"	Sandy loam with small percentage well-graded fine to coarse gravel and few cobbles to 8", dry texture in-situ and slightly cohesive when wet, uniform pale yellow coloration (2.5 Y 7/4 Munsell Color Chart).
Inspection Pit for Lot 52. Depth of pit: 10'-0".		
1	0" to 1'-2"	Fine sandy loam topsoil with small percentage fine gravel, uniform light yellowish brown coloration.

Number of Stratum	Depth below natural ground surface	Description of Soil Stratum
2	1'-2" to 10'-0"	Fine sandy loam with small percentage well-graded fine to coarse gravel, cobbles to 10" and few stones to 16", dry texture in-situ and slightly cohesive when wet making weak ribbon ~1" long, uniform pale yellow coloration (2.5 Y 7/4 Munsell Color Chart).
Inspection Pit for Lot 54. Depth of pit: 11'-0".		
1	0" to 1'-4"	Fine sandy loam topsoil with moderate percentage gravel and few cobbles to 6", uniform light yellowish brown coloration.
2	1'-4" to 3'-0"	Sandy loam with large percentage well-graded gravel and few cobbles >6", dry texture in-situ and non-cohesive when wet, uniform light yellowish brown coloration (10 YR 6/4 Munsell Color Chart).
3	3'-0" to 4'-0"	Clean well-graded sand with few particles >2 mm, dry texture in-situ and non-cohesive when wet, uniform brown coloration (10 YR 5/3 Munsell Color Chart).
4	4'-0" to 11'-0"	Loamy sand with moderate percentage gravel and few cobbles to 10", dry texture in-situ and non-cohesive when wet, uniform yellowish brown coloration (10 YR 5/4 Munsell Color Chart).
Inspection Pit for Lot 55. Depth of pit: 10'-6".		
1	0" to 1'-4"	Sandy loam topsoil with moderate percentage gravel, uniform light yellowish brown coloration.
2	1'-4" to 10'-6"	Loamy well-graded fine to coarse sand and gravel with small percentage cobbles to 8" and few stones to 15", dry texture in-situ and non-cohesive when wet, uniform yellowish brown coloration.
Inspection Pit for Lot 59. Depth of pit: 10'-0".		
1	0" to 1'-4"	Fine sandy loam topsoil with small percentage fine gravel, uniform light brown coloration.
2	1'-4" to 10'-0"	Loamy well-graded fine to coarse sand and gravel with small percentage cobbles to 10" and few stones to 18", dry texture in-situ and non-cohesive when wet, uniform yellowish brown coloration.
Inspection Pit for Lot 60. Depth of pit: 10'-6".		
1	0" to 1'-4"	Sandy loam topsoil with small percentage gravel, uniform light brown coloration.
2	1'-4" to 4'-0"	Loamy well-graded sand and gravel and cobbles to 5", dry crumbly texture in-situ and non-cohesive when wet, roots to ~30", uniform brown coloration (10 YR 5/3 to 4/3 Munsell Color Chart).
3	4'-0" to 10'-6"	Sandy loam with well-graded fine to coarse gravel and moderate percentage cobbles to 10", dry texture in-situ and

Number of Stratum	Depth below natural ground surface	Description of Soil Stratum
		slightly cohesive when wet, uniform brown to light olive brown coloration (10 YR 5/3 to 2.5 Y 5/3 Munsell Color Chart).
Inspection Pit for Lot 61. Depth of pit: 10'-6".		
1	0" to 1'-4"	Silty fine sandy loam topsoil with few particles >2 mm, uniform light brown coloration.
2	1'-4" to 3'-0"	Silty fine sandy loam with few particles >2 mm, dry texture in-situ and slightly cohesive when wet making ribbon <1", roots to ~30", uniform light yellowish brown coloration (2.5 YR 6/3 to 6/4 Munsell Color Chart).
3	3'-0" to 10'-6"	Sandy loam with large percentage well-graded fine to coarse gravel, cobbles to 10", and few stones to 15", uniform texture and coloration. Content of silt, clay and fine sand decreased toward bottom of pit, cleaner coarse sand appeared to increase.
Inspection Pit for Lot 62. Depth of pit: 10'-0".		
1	0" to 0'-8"	Fine sandy loam topsoil with small percentage gravel and few cobbles to 6", uniform light brown coloration.
2	0'-8" to 10'-0"	Sandy loam with large percentage well-graded fine to coarse gravel, cobbles to 10", and few stones to 18", dry texture in-situ and slightly cohesive when wet making ribbon <1", uniform texture and coloration.
Inspection Pit for Lot 66. Depth of pit: 10'-0".		
1	0" to 1'-0"	Silty fine sandy loam topsoil with few particles >2 mm, uniform light brown coloration.
2	1'-0" to 4'-0"	Silty sandy loam with small percentage gravel, dry texture in-situ and slightly cohesive when wet making ribbon ~1", roots to ~30", uniform light yellowish brown coloration.
3	4'-0" to 10'-0"	Sandy loam with large percentage well-graded fine to coarse gravel, cobbles to 10", and few stones to 18", dry texture and non-cohesive when wet, uniform texture and coloration.
Inspection Pit for Lot 68. Depth of pit: 10'-0".		
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel, uniform light brown coloration.
2	1'-0" to 4'-0"	Loamy sand and gravel, dry texture in-situ and non-cohesive when wet, roots to ~30", uniform light yellowish brown coloration.
3	4'-0" to 10'-0"	Sandy loam with large percentage well-graded fine to coarse gravel, cobbles to 10", and few stones to 18", dry texture and non-cohesive when wet, uniform texture and coloration.

Number of Stratum	Depth below natural ground surface	Description of Soil Stratum
Inspection Pit for Lot 70. Depth of pit: 10'-6".		
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel, uniform light brown coloration.
2	1'-0" to 3'-0"	Sandy loam with moderate percentage well-graded gravel and cobbles to 5", dry crumbly texture in-situ and slightly cohesive when wet making weak ribbon <1" long, roots to ~30", uniform light olive brown coloration.
3	3'-0" to 10'-6"	Loamy sand with well-graded fine to coarse gravel and moderate percentage cobbles to 10" and few stones to 24", dry texture in-situ and non-cohesive when wet, uniform brown to light olive brown coloration.
Inspection Pit for Lot 72. Depth of pit: 10'-0".		
1	0" to 1'-4"	Fine sandy loam topsoil with small percentage gravel, uniform light brown coloration.
2	1'-4" to 3'-0"	Sandy loam with small percentage well-graded gravel and cobbles to 5", dry crumbly texture in-situ and slightly cohesive when wet making weak ribbon <1" long, uniform pale yellow coloration (2.5 Y 7/4 Munsell Color Chart).
3	3'-0" to 10'-0"	Sandy loam with large percentage well-graded gravel and few cobbles to 8" and small percentage stones to 18" occurring toward bottom of pit, dry texture in-situ and non-cohesive when wet, uniform olive brown coloration.
Inspection Pit for Lot 74. Depth of pit: 10'-0".		
1	0" to 1'-4"	Sandy loam topsoil with moderate percentage gravel, uniform light brown coloration.
2	1'-4" to 10'-0"	Sandy loam with large percentage well-graded fine to coarse gravel, and small percentage cobbles to 10", dry texture in-situ and slightly cohesive when wet, uniform texture and coloration.
Inspection Pit for Lot 76. Depth of pit: 10'-0".		
1	0" to 1'-0"	Sandy loam topsoil with small percentage gravel and cobbles to 6", uniform light brown coloration.
2	1'-0" to 5'-0"	Sandy loam with large percentage gravel, moderate percentage cobbles to 10" and few stones to 24", dry texture in-situ and non-cohesive when wet, uniform yellowish brown coloration.
3	5'-0" to 10'-0"	Loamy well-graded sand and gravel with moderate percentage cobbles to 10", dry texture and non-cohesive when wet, uniform texture and coloration.
Inspection Pit for Lot 77. Depth of pit: 10'-0".		
1	0" to 1'-4"	Fine sandy loam topsoil with moderate percentage well-graded gravel and few cobbles to 6", uniform light yellowish brown coloration.

Number of Stratum	Depth below natural ground surface	Description of Soil Stratum
2	1'-4" to 6'-0"	Sandy loam with large percentage gravel, moderate percentage cobbles to 8" and few stones, dry texture in-situ and non-cohesive when wet, uniform yellowish brown coloration.
3	6'-0" to 10'-0"	Silty sand and well-graded gravel and moderate percentage cobbles to 10", dry texture in-situ and non-cohesive when wet, uniform light yellowish brown coloration.
Inspection Pit for Lot 79. Depth of pit: 10'-0".		
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel and few cobbles, uniform light yellowish brown coloration.
2	1'-0" to 10'-0"	Silty sandy loam with small percentage well-graded gravel and few cobbles, dry texture in-situ and moderately cohesive when wet making weak ribbon ~1" long, uniform light yellowish brown coloration (2.5 Y 6/4 Munsell Color Chart).
Inspection Pit for Lot 82. Depth of pit: 10'-0".		
1	0" to 1'-0"	Fine sandy loam topsoil with moderate percentage well-graded gravel and few cobbles, uniform light yellowish brown coloration.
2	1'-0" to 10'-0"	Silty loam with large percentage well-graded gravel and moderate percentage cobbles to 10", dry texture in-situ and slightly cohesive when wet making weak ribbon <1" long, uniform light olive brown coloration (2.5 Y 5/4 Munsell Color Chart).
Inspection Pit for Lot 84. Depth of pit: 10'-0".		
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel and few cobbles, uniform light yellowish brown coloration.
2	1'-0" to 10'-0"	Silty sandy loam with small percentage well-graded gravel and few cobbles, dry texture in-situ and moderately cohesive when wet making weak ribbon ~1" long, uniform light olive brown coloration (2.5 Y 5/4 Munsell Color Chart).
Inspection Pit for Lot 85. Depth of pit: 10'-0".		
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel and few cobbles, uniform light yellowish brown coloration.
2	1'-0" to 10'-0"	Fine sandy loam with small percentage well-graded gravel and few cobbles to 8", dry texture in-situ and slightly cohesive when wet making weak ribbon <1" long, uniform light yellowish brown coloration (2.5 Y 6/3 Munsell Color Chart).
Inspection Pit for Lot 87. Depth of pit: 10'-0".		
1	0" to 1'-0"	Sandy loam topsoil with moderate percentage well-graded gravel and few cobbles, uniform light yellowish brown color.

Number of Stratum	Depth below natural ground surface	Description of Soil Stratum
2	1'-0" to 6'-0"	Sandy loam with large percentage gravel, moderate percentage cobbles to 8", dry texture in-situ and non-cohesive when wet, uniform yellowish brown coloration.
3	6'-0" to 10'-0"	Sandy loam with well-graded gravel as above with small percentage stones to 20".
Inspection Pit for Lot 91	Depth of pit: 10'-0"	
1	0" to 1'-4"	Fine sandy loam topsoil with small percentage gravel, uniform light yellowish brown coloration.
2	1'-4" to 3'-0"	Silty sandy loam with small percentage gravel and few cobbles to 8", dry texture in-situ and slightly cohesive when wet, uniform yellowish brown coloration.
3	3'-0" to 10'-0"	Sandy loam with moderate percentage well-graded gravel and few cobbles to 10", dry texture in-situ and slightly cohesive when wet, uniform grayish brown coloration.
Inspection Pit for Lot 93	Depth of pit: 10'-0"	
1	0" to 1'-0"	Fine sandy loam topsoil with small percentage gravel, uniform light yellowish brown coloration.
2	1'-0" to 4'-0"	Silty sandy loam with small percentage gravel and cobbles, dry texture in-situ and slightly cohesive when wet, uniform yellowish brown coloration.
3	4'-0" to 10'-0"	Loamy well-graded sand and gravel with small percentage cobbles to 10", few stones to 16" toward bottom of pit and tightness of gravel pack increased toward bottom of pit, dry texture in-situ and non-cohesive when wet, uniform light olive brown coloration.
Inspection Pit for Lot 98	Depth of pit: 10'-0"	
1	0" to 1'-4"	Fine sandy loam topsoil with small percentage gravel, uniform light brown coloration.
2	1'-4" to 5'-0"	Loamy well-graded sand and gravel with few cobbles to 10", dry texture in-situ and non-cohesive when wet, uniform yellowish brown coloration.
3	5'-0" to 10'-0"	Silty sand and well-graded gravel and small percentage cobbles to 10" and stones to 16", dry texture in-situ and non-cohesive when wet, uniform light olive brown coloration.
Inspection Pit for Lot 99	Depth of pit: 10'-0"	
1	0" to 2'-0"	Fine sandy loam topsoil with small percentage gravel, uniform light brown coloration.
2	2'-0" to 6'-0"	Sandy loam with large percentage gravel, moderate percentage cobbles to 10" and few stones, dry texture in-situ and non-cohesive when wet, uniform yellowish brown coloration.

Number of Stratum	Depth below natural ground surface	Description of Soil Stratum
3	6'-0" to 10'-0"	Silty sand and well-graded gravel and moderate percentage cobbles to 10", dry texture in-situ and non-cohesive when wet, uniform light olive brown coloration.

Percolation Test Results

No percolation tests were conducted.

Observations and conclusions

Of the 99 lots proposed by this subdivision, 11 lots are greater than 20 acres leaving 88 lots on which site evaluation and DEQ approval are required. A total of 51 soil inspection pits were excavated on lots less than 20 acres in size, and 1 inspection pit was excavated on Lot 7 which is larger than 20 acres. Soil inspection pits were not excavated on 37 lots less than 20 acres. By comparing the drainfield sizes proposed for neighboring lots on which soil inspection evaluation was conducted, and making conservative assumptions, the Engineer believes these drainfields can be properly sized.

No soil conditions which would prevent proper treatment or percolation of septic tank effluent, signs of seasonal high ground water (mottling), groundwater table or questionably moist soil were observed within the depth of the inspection pits. Due to the varying content of loam, silt, sand and gravel observed in the soil profiles, drainfields have been sized as follows:

Drainfields requiring a minimum of 500 sf of absorption area for each 3 bedroom residence or guest house on the lot due to medium sand and/or sandy loam soil conditions, and sand lined trenches due to coarseness of sand and gravel in accordance with Circular DEQ4 and the attached detail:
Lots 1, 16, 29, 31, 33, 34, 35, 36, 55, 59, 60, 68, 74, 76, 77, 87, 98 and 99.

Drainfields requiring a minimum of 500 sf of absorption area for each 3 bedroom residence or guest house on the lot due to sandy loam soil conditions but not requiring sand lined trenches:
Lots 9, 12, 22, 27, 44, 45, 49, 54, 62, 70 and 72.

Drainfields requiring a minimum of 600 sf of absorption area for each 3 bedroom residence or guest house on the lot due to fine sandy loam soil conditions:
Lots 2, 17, 18, 20, 26, 32, 38, 41, 48, 52 and 85.

Drainfields requiring a minimum of 750 sf of absorption area for each 3 bedroom residence or guest house on the lot due to very fine sandy

loam or silty sandy loam soil conditions:
Lots 14, 15, 30, 47, 61, 66, 79, 82, 84, 91 and 93.

Required drainfield size must be estimated on lots on which no soil inspection pit was excavated. Although no clear pattern of soil conditions is apparent from the soil inspection pits excavated on this property, reasonably conservative assumptions can be used.

Drainfields requiring 500 sf of absorption area with sand lined trenches for each 3 bedroom residence or guest house on the lot are assigned to Lots 56, 57, 58, 71, 73, 75 and 97.

Drainfields requiring 600 sf of absorption area for each 3 bedroom residence or guest house on the lot are assigned to Lots 21, 23, 24, 28, 37, 39, 40, 42, 43, 46, 50, 51, 53, 63, 64, 65, 67, 69, 78, 86, 88, 89, 90, 95 and 96.

Drainfields requiring 750 sf of absorption area for each 3 bedroom residence or guest house on the lot are assigned to Lots 80, 81, 83, 92 and 94.

The entire area of each proposed drainfield and 100% replacement should perc at an average rate as identified by the soil descriptions identified or conservatively assumed on each lot.

Due to limitations imposed by terrain, proximity to the Yellowstone River and lot size, the following river front lots are entitled to construct one primary residence within applicable restrictions being imposed by the Developer and Land Owner, but may not have a guest house:
Lot 44, 47, 48, 51, 52, 53, 77, 78, 79, 80, 81, 82 and 83.
This restriction of not allowing a guest house on these lots supersedes any reference to a guest house in the above drainfield sizing sections in which the lot numbers are included.

YRR

'COMBINATION #1 GROUND WATER GRADIENT & FLOW DIRECTION

HSWE	4832.50	Well #1
LSWE	4777.99	PF well
ISWE	4783.04	Well #2

CALCULATIONS

HSWE − LSWE = 4832.50 − 4777.99 = 54.51'

DISTANCE BTWN Well #1 & PF Well = 6345'

6345/54.51 = 116.40'/ft.

HSWE − ISWE = 4832.50 − 4783.04 = 49.46'

DIST. BTWN Well #1 & PF Well = to ISWE

116.40 × 49.46 = 5757.18'

DIST BTWN ISWE CONTOUR & HSWE WELL = 3810'

HYDRAULIC GRADIENT = $\frac{49.46}{3810}$ = 0.0130 ft/ft.

FLOW DIRECTION N 4.0° E

YRR

COMBINATION #2 GROUND WATER GRADIENT & FLOW DIRECTION

HSWE	4832.50	Well #1
LSWE	4778.53	Pray Well
ISWE	4785.25	Well #3

CALCULATIONS

HSWE - LSWE = 4832.50 - 4778.53 = 53.97'

DIST. BTWN Well #1 & Pray Well = 6975'

6975/53.97 = 129.24 Horiz ft to Drop 1 ft

HSWE - ISWE = 4832.50 - 4785.25 = 47.25'

DIST. BTWN Well #1 & PRAY WELL = to ISWE

129.24 x 47.25 = 6106.52'

DIST BTWN ISWE CONTOUR & HSWE WELL = 4062'

HYDRAULIC GRADIENT = $\frac{47.25'}{4062'}$ = 0.0116 ft/ft

FLOW DIRECTION N 16.0° E

YRR

COMBINATION GROUNDWATER GRADIENT & FLOW DIRECTION #3

HSWE 4832.50 Well #1

LSWE 4778.53 PRAY Well

ISWE 4783.04 Well #2

CALCULATIONS

HSWE - LSWE = 4832.50 - 4778.53 = 53.97'

DIST BTWN WELL #1 & PRAY WELL = 6975'

6975/53.97 = 129.24'/ft HORIZ DIST TO DROP 1F

HSWE - ISWE = 4832.50 - 4783.04 = 49.46'

DIST BTWN WELL #1 & PRAY WELL = to ISWE

129.24 x 49.46 = 6392.2'

DIST BTWN ISWE CONTOUR & HSWE WELL = 3778'

HYDRAULIC GRADIENT = 49.46/3778' = 0.0131'/ft.

FLOW DIRECTION : N 11.0° E

AVERAGE

GRADIENT = 0.0126

FLOW DIRECTION : N 10° E

Yellowstone River Ranch Estates Major Subdivision

Pump Testing Log #1

Well tested: Well Located on Lot 50

(Labeled Test Well #3 on attached map)

Date of Test: Friday July 22 and Saturday July 23, 2005

Pump Testing Monitored by: William E. Smith, P.E.

Static Water Level at Start of Test: 202.66 (from top of well casing)

Time	Depth to Water Level below Top of Casing	Pumping Rate (gpm)
	Friday 7/22/05	
09:40	static 202.66	0
09:44	Start pumping	115
09:45	268.44	115
09:50	272.69	135
09:51	272.69	135
09:52	272.69	135
09:53	272.69	135
09:54	272.69	135
10:00	272.83	138
10:05	272.81	138
10:15	272.79	138
10:23	272.76	138
10:35	272.70	138
10:55	272.48	138
11:15	272.55	138
11:40	272.55	138
12:10	273.37	138
12:40	273.44	138
13:10	273.55	138
13:40	273.47	138
14:10	273.50	138
14:40	273.25	138
15:00	273.53	138
15:10	273.53	138
15:45	273.32	138
16:30	273.37	138
17:15	273.38	136
18:15	273.38	136
19:15	273.45	138
20:30	273.52	138
21:30	273.57	138
22:25	273.65	138
22:55	273.69	137
23:40	273.74	136
	Saturday 7/23/05	
00:45	273.94	136
06:30	274.09	137

Time	Depth to Water Level below Top of Casing	Pumping Rate (gpm)
07:30	274.09	137
08:30	274.10	137
09:10	274.07	138
09:35	274.06	138
09:37	End pumping	0
09:37	Rising too fast to measure	0
09:37+	208	0
09:37+	205	0
09:38	204.1	0
09:38+	203.4	0
09:38+	203.2	0
09:38+	203.1	0
09:40+	202.9	0
09:48	202.85	0
10:17	202.80	0
10:42	202.80	0
10:47	202.80	0
	Sunday 7/24/05	0
06:55	202.76	

Yellowstone River Ranch Estates Major Subdivision

Pump Testing Log #2

Well tested: Well Located on Lot 19

(Labeled Test Well #1 on attached map)

Date of Test: Sunday July 24 and Monday July 25, 2005

Pump Testing Monitored by: William E. Smith, P.E.

Static Water Level at Start of Test: 195.04 (from top of well casing)

Time	Depth to Water Level below Top of Casing	Pumping Rate (gpm)
	Sunday 7/24/05	
07:25	static 195.04	0
07:29	Start pumping	110
07:30	258.83	110
07:31	259.63	110
07:32	259.74	110
07:33	259.83	110
07:34	259.78	110
07:35	277.68	129
07:36	277.60	129
07:37	277.67	129
07:38	277.76	129
07:39	277.70	129
07:45	277.69	129
07:50	277.79	129
08:00	277.95	129
08:15	278.09	129
08:45	278.39	129
09:00	278.38	129
09:20	278.49	129
10:00	278.55	129
10:40	278.63	129
11:10	278.63	129
12:00	278.66	129
13:00	278.76	129
14:00	278.75	129
15:00	278.52	129
16:00	278.62	129
17:00	278.60	129
18:00	278.64	129
19:00	278.63	129
20:00	278.62	129
21:00	278.69	129
22:00	278.72	129
23:00	278.88	129
	Monday 7/25/05	
01:00	278.89	129
03:00	278.90	129

Time	Depth to Water Level below Top of Casing	Pumping Rate (gpm)
05:00	278.85	129
06:00	278.87	129
07:00	278.91	129
07:30	278.90	129
07:40	278.90	129
07:45	278.90	129
07:47	End pumping	0
07:47	Rising too fast to measure	0
07:48+	198.10	0
07:49	197.2	0
07:49+	196.8	0
07:50	196.6	0
07:51	196.40	0
07:51+	196.33	0
07:52	196.23	0
07:53	196.13	0
07:55	196.03	0
07:57	195.93	0
07:59	195.83	0
08:03	195.72	0
08:08	195.63	0
08:16	195.55	0
08:36	195.42	0
09:28	195.36	0
21:30	195.31	0

Yellowstone River Ranch Estates Major Subdivision

Well Monitoring Log

Well #2: Located on Lot 56 1035 ft southeast of Test Well #3
Top of well casing Elevation 4984.69
(Labeled Test #2 on attached map showing graphic determination of groundwater gradient and flow direction)

Well #1: Located on Lot 19 3800 ft south of Well #2
Top of well casing Elevation 5028.24
(Labeled Test #1 on attached map showing graphic determination of groundwater gradient and flow direction)

Stone House Well: Located on Lot 13 565 ft east of Test Well #1
Top of well casing Elevation 5009.64
(Labeled House on attached map showing graphic determination of groundwater gradient and flow direction)

Dates of Pump Testing and Monitoring:
Friday July 22 through Monday July 25, 2005
Pump Testing Monitored by: William E. Smith, P.E.
(Measurements of Static Water Level (SWL) made at top of well casing)

Time	Well #2	Well #1	Stone House Well
	Thursday 07/21/05		
20:05	199.80		
22:10		195.02	
	Friday 07/22/05		
08:25		194.98	
09:15	199.76		
09:45	Start Pumping Well #3		
11:30	199.79		
11:50		194.91	
14:30		194.97	
14:50	199.81		
17:00	199.81		
17:25		195.11	
23:00	199.75		
23:35		195.05	
	Saturday 07/23/05		
08:45		194.96	
09:00	199.75		
09:37	End Pumping Well #3		
09:55	199.79		
11:07	199.78		
11:48		194.96	
12:55		195.04	
14:00			175.72

Time	Well #2	Well #1	Stone House Well
14:40	199.79		
17:05		195.08	
17:30	199.79		
22:45	199.80		
23:20		195.04	
	Sunday 07/24/05		
06:45	199.80		
07:15			175.65
07:25		195.04	
07:29		Start Pumping Well #1	
09:30			175.44
10:50			175.44
11:13	199.80		
18:30			175.44
20:25	199.82		
20:40			175.38
	Monday 07/25/05		
06:20			175.20
06:45	199.87		
07:40			175.20
07:47		End Pumping Well #1	
08:42			175.36
09:55			175.43
10:15	199.87		
21:30		195.31	
21:55			175.45
	Tuesday 07/26/05		
07:45			175.66
21:35			175.66

Summary/Conclusion:

Test Well #1 was drilled on Lot 19 to a total depth of 300 ft, and static water level (SWL) was measured at 195.04 ft below top of casing immediately before commencing pumping. An existing well which servers the stone house is located 565 ft to the east of Well #1 on Lot 13. This well was used to monitor the drawdown of static level on the groundwater aquifer during the pump test of Well #1. The SWL in this well was measured at 175.65 ft below top of cap immediately before pump test of Well #1 began. Static water level in Test Well #2 was also monitored during this test.

Test well #3 was drilled to a total depth of 300 ft on Lot 50 4,450 ft to the north of Test Well #1. Static water level was measured at 202.66 ft below top of casing immediately before commencing pumping. Test Well #2 was drilled 1035 ft to the southeast of Well #3 on Lot 56 for the purpose of monitoring the affect on groundwater aquifer static level during pumping of Test Well #3. The static water level was measured in this well at 199.76 ft thirty minutes prior to starting the test. The SWL was also monitored in Test Well #2 during the test pumping of Well #1. These four wells are plotted on the attached site layout map and on the map used to calculate groundwater gradient and flow direction.

A 6 inch nominal 10 horsepower 3Ø submersible pump was set at a depth of approximately 286 ft in the test well for the test. Water samples collected from the test wells during pumping and analyzed for nitrates concentration and specific conductance produced results of 0.44 ppm and 0.15 ppm nitrates in Wells 1 and 3, respectively, and 283 umhos/cm and 283 umhos/cm specific conductance in Wells 1 and 3, respectively. These results show the groundwater in these wells to be class 1.

During the pump test of Test Well #1 (as documented in the attached Test Log #2), PWL in the test well initially dropped 63.79 ft at start of pumping at 110 gpm, dropped 0.95 ft over the first 5 min. of pumping, dropped an additional 17.90 ft when pumping rate was increased by 19 gpm to 129 gpm, dropped 0.95 ft steadily over the next 3 hr-5 min., and then gradually and steadily dropped 0.27 ft over the next 21 hr-7 min. until pumping was terminated. The water level in Test Well #1 reached a maximum drawdown of 278.90 ft below top of casing due to constant pumping at a rate of 129 gpm over the 24 hour test. PWL returned to 0.89 ft below initial SWL of 195.04 (measured immediately prior to test) in 10 min., recovered to 0.68 ft below initial static level within 15 minutes of termination of pumping, and to 0.32 ft below initial SWL within 100 minutes. PWL rose another 0.05 ft over the next 12 hrs. Most of the 83.86 ft of drawdown in the casing of the test well is a result of inefficiencies in the construction of a 6 inch open bottom steel casing delivering 129 gpm. As of 21:30 (12 hours after this last measurement) SWL had come up only an additional 0.05 ft. The existing Stone House well, located 565 ft east of Test Well #1, was monitored for change in static water level during pumping. The maximum drawdown in static water level in the monitoring well was measured at 0.45 ft. However, these SWLs were not

corrected for barometric pressure, therefore small changes in water level could occur due to changes in atmospheric pressure.

During the pump test of Test Well #3 (as documented in the attached Test Log #1), pumping water level (PWL) in the test well initially dropped 65.78 ft at start of pumping at 115 gpm, dropped an additional 4.25 ft when pumping rate was increased to 135 gpm, held stable with small fluctuation for 1 hr-50 minutes, dropped 0.82 ft over the next 30 min., and then gradually and steadily dropped 0.69 ft over the next 21 hr-27 min. until pumping was terminated. The water level in Test Well #3 reached a maximum drawdown of 274.06 ft below top of casing due to constant pumping at a rate of 138 gpm over the 24 hour test. PWL returned to 0.24 ft below SWL of 202.66 (measured immediately prior to test) in 4 min., recovered to 0.19 ft below initial static level within 11 minutes of termination of pumping, and to 0.14 ft below initial SWL within 40 minutes. Most of the 71.40 ft of drawdown in the casing of the test well is a result of inefficiencies in the construction of a 6 inch open bottom steel casing delivering 138 gpm. As of 06:55 Sunday morning (20 hours after this last measurement) SWL had come up only an additional 0.04 ft. Test Well #2 located 1035 ft southeast of Test Well #3 was monitored for change in static water level during pumping. The SWL in the observation well showed no effect as the SWL remained constant. The SWL in this well did not show measurable drop beyond what could have been produced by changes in atmospheric barometric pressure.

The responses of the test wells and monitoring wells during pumping were stable and the data collected during the pump tests are viable to verify the adequacy of the underlying aquifer to supply potable water to the residences in Yellowstone River Ranch Estates major subdivision, and to calculate hydraulic conductivity on the groundwater aquifer.

The hydraulic conductivity (k) of this aquifer is calculated using Fetter equations for an unconfined gravel aquifer: $T = 33.6[Q/(h_o - h)]^{0.67}$ and $K = T/b$. A discharge rate (Q) of 129 gpm for Test Well #1 and 138 gpm for Test Well #3 (converted to cf/day by multiplying gpm by 192.49), a drawdown ($h_o - h$) of 83.86 ft for Test Well #1 and 71.40 ft for Test Well #3, and an aquifer thickness (b) of 10 ft for both wells based on the open bottom steel casings (which attempts to address inefficiencies of moving 130 gpm past a 6 inch nominal pump motor in a 6 inch casing) are plugged into the equations. The calculated values of k indicate that groundwater is moving through the aquifer at 152 ft per day for Test Well #1 and 177 ft/day for Test Well #3, which are reasonably similar in value, and produce an average value of 165 ft/day.

Partial penetration of the aquifer and inefficiencies of pumping 100+ gpm from an open bottom 6 inch well affect analysis results. The minimum width of the property is 3000 ft, and the length is 12,000 ft. Records from a petroleum exploration test well drilled approximately 5 miles to the northeast of this site (MPC1984) indicate an aquifer saturated thickness of approximately 650 ft at

that location. Based on previous geophysical work in the area (Wu, 1995), 400 ft is a reasonable estimate for saturated aquifer thickness.

Total volumes of approximately 185,700 gallons of water from Test Well #1 and 198,700 gallons from Test Well #3 were discharged from the underlying aquifer in two 24+ hour pump tests without significant drawdown in either test well or associated monitoring well. This is a total of 384,400 gallons discharged from the groundwater aquifer underlying this property over a period of 72 hours. Assuming 99 single family residences occupied full time and 51 guest houses occupied part time through the year, 150 residences will be drawing water from wells distributed uniformly over more than 1100 acres. Assuming a domestic water use of 400 gallons per day per residence continuously every day by all residences in the subdivision, a total of 60,000 gallons of water will be withdrawn from the aquifer per day. At this rate, 6.4 days (or 154 hours) would be required to withdraw a volume of water equal to the volume discharged from two wells in the aquifer during the two 24 hour pump tests which occurred over 72 hours.

During the growing season of approximately 6 months per year, an additional volume of water will be withdrawn for irrigating lawn and landscape plants. Assuming that each residence (permanent and guest house) is surrounded by 10,000 sf of lawn and landscaping and that irrigation water is applied at an average rate of 1.25 inches per week over the entire area, an average daily volume of 2230 gallons of ground water per lot (1113 gallons per residence) will be withdrawn for irrigation. Assuming all homes and guest houses irrigate at this level, the 150 residences in the subdivision would pump a total average daily volume of 167,000 gallons.

For purposes of comparison, the combined total daily volume of water pumped per residence for domestic and irrigation purposes, as described above, would result in a total annual volume of 346,340 gallons per year per residence. This is a volume of 1.06 acre-ft per year. This volume pumped from a well serving one residence on a lot is less than 11% of the maximum volume an individual well can discharge per year without the requirement of obtaining a water right under Montana state law. On lots where one residence and one guest house are constructed, the volume pumped is approximately 21% of the maximum volume a well can discharge per year without the requirement of obtaining a water right under Montana state law.

The drawdown and recovery of SWLs in the test wells and monitoring wells, sustained pumping rates for 24 continuous hours, total volume of water pumped and estimated total saturated depth of the aquifer in this area combine to show this aquifer has significant reserve capacity to handle the residences in this subdivision. In addition, results of water quality testing on samples obtained from wells on this property show the quality of groundwater is high.

Calculation of Hydraulic Conductivity
by Fetters Equation
(k = ft/day)
Yellowstone River Ranch Estates Major Subdivision

Well ID	Well Yield Q (gpm)	Well Yield Q (cf/day)	Static level h (ft)	Pump leve h0 (ft)	Drawdown (ft)	Aqu depth b (ft)	Conductiv k (ft/day)
Test Well 1	129.0	24,834	195.04	278.90	83.86	10.0	152.14
Test Well 3	138.0	26,566	202.66	274.06	71.40	10.0	177.28
Average K value							164.71

ENERGY LABORATORIES, INC. • P.O. Box 30916 • 1120 South 27th Street • Billings, MT 59107-0916
800-735-4489 • 406-[redacted]-6325 • 406-252-6069 fax • eli@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Octagon Consulting Engineers
Project: Yellowstone River Ranch
Lab ID: B05072070-002
Client Sample ID: YRR Test Well #1

Report Date: 08/03/05
Collection Date: 07/24/05 19:00
Date Received: 07/29/05
Matrix: Aqueous

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Conductivity	283	umhos/cm		1		A2510 B	08/01/05 08:51 / qed
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.44	mg/L		0.05		E353.2	08/02/05 12:25 / bls

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: Octagon Consulting Engineers
Project: Yellowstone River Ranch
Lab ID: B05072070-001
Client Sample ID: YRR Test Well #3

Report Date: 08/03/05
Collection Date: 07/23/05 10:05
Date Received: 07/29/05
Matrix: Aqueous

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Conductivity	339	umhos/cm		1		A2510 B	08/01/05 08:50 / qed
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.15	mg/L		0.05		E353.2	08/02/05 12:23 / bls

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

STONE HOUSE WELL

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
WEETER BRUCE AND DIANE

Plot this site on a topographic map

Location Information

GWIC Id:	36914	Source of Data:	LOG
Location (TRS):	05S 08E 26 DBB	Latitude (dd):	45.3721
County (MT):	PARK	Longitude (dd):	-110.7005
DNRC Water Right:	C007471-00	Geomethod:	TRS-TWN
PWS Id:		Datum:	NAD27
Block:		Altitude (feet):	
Lot:		Certificate of Survey:	
Addition:		Type of Site:	WELL

Well Construction and Performance Data

Total Depth (ft):	192.00	How Drilled:	CABLE
Static Water Level (ft):	157.00	Driller's Name:	VAN DYKEN
Pumping Water Level (ft):	184.00	Driller License:	WWC1
Yield (gpm):	15.00	Completion Date (m/d/y):	8/2/1974
Test Type:	BAILER	Special Conditions:	
Test Duration:	2.00	Is Well Flowing?:	
Drill Stem Setting (ft):		Shut-In Pressure:	
Recovery Water Level (ft):		Geology/Aquifer:	112DRFT
Recovery Time (hrs):		Well/Water Use:	DOMESTIC STOCKWATER
Well Notes:			

Hole Diameter Information

From	To	Diameter
0.0	192.0	6.0

Annular Seal Information

No Seal Records currently in GWIC.

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
0.0	192.0	6.0				STEEL

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
192.0	192.0	6.0			OPEN BOTTOM *

Lithology Information

From	To	Description
0.0	11.0	BOULDERS
11.0	37.0	CLAYBOUND GRAVELS
37.0	41.0	CLAY
41.0	184.0	CLAYBOUND GRAVELS. WET AT 186'
184.0	192.0	CLEANER GRAVELS. WATER

[1] - All diameters reported are **inside** diameter of the casing.

MONTANA WELL LOG REPORT

Form No. 603 R2-99 — Well ID# 927

This log reports the activities of a licensed Montana well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered. This form is to be completed by the driller and filed with DNRC within 60 days of completion of the work. Acquiring Water Rights is the well owner's responsibility and is not accomplished by the filing of this report.

Well log information is stored in the Groundwater Information Center at the Montana Bureau of Mines and Geology (Butte) and water right information is stored in the Water Rights Bureau records (Helena).

For fields that are not applicable, enter NA. Optional fields have a grayed background. Record additional information in the REMARKS section.

1. WELL OWNER:
Name Yellowstone River Ranch, LLC
MAILING ADDRESS 104 W. Superior St.
Duluth, MN 55802

2. WELL LOCATION: List ¼ from smallest to largest
SE ¼ NE ¼ NE ¼ SW ¼, Section 26
Township 5S N/S Range 8E E/W County Park
Lot ____, Tract/Blk ____ Subdivision Name ____
Well Address ____
GPS [X] Yes [ ] No
Latitude 0523381 Longitude 5024098
Error as reported by GPS locator (± feet) 16
Horizontal datum [X] NAD27 [ ] WGS84

3. PROPOSED USE: [ ] Domestic [ ] Stock [ ] Irrigation
[ ] Public Water Supply [ ] Monitoring Well [X] Other: Test Well #1

4. TYPE OF WORK:
[X] New well [ ] Deepen existing well [ ] Abandon existing well
Method: [ ] Cable [X] Rotary [ ] Other: ____

5. WELL CONSTRUCTION DETAIL:
Borehole:
Dia. 6 in. from 0 ft. to 300 ft.
Dia. ____ in. from ____ ft. to ____ ft.
Dia. ____ in. from ____ ft. to ____ ft.

Casing:
Steel: Wall thickness .250 [ ] Threaded [X] Welded
Dia. 6 in. from +1.5 ft. to 299 ft.
Dia. ____ in. from ____ ft. to ____ ft.

Plastic: Pressure Rating ____ lbs. [ ] Threaded [ ] Welded
Dia. ____ in. from ____ ft. to ____ ft.

Perforations/Slotted Pipe:
Type of perforator used ____
Size of perforations/slots ____ in. by ____ in.
____ no. of perforations/slots from ____ ft. to ____ ft.
____ no. of perforations/slots from ____ ft. to ____ ft.

Screens: [ ] Yes [X] No
Material ____
Dia. ____ Slot size ____ from ____ ft. to ____ ft.
Dia. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel Packed: [ ] Yes [X] No
Size of gravel ____
Gravel placed from ____ ft. to ____ ft.

Packer: [ ] Yes [X] No
Type ____ Depth(s) ____

Grout: Material used Bentonite
Depth from 0 ft. to 20+ ft. OR [ ] Continuous feed

6. WELL TEST DATA:
A well test is required for all wells. (See details on well log report cover.)

[X] Static water level 196 ft. below top of casing or
[ ] Closed-in artesian pressure ____ psi.

How was test flow measured:
Bucket/stopwatch, weir, flume, flowmeter, etc Bucket/Stopwatch
Yellowstone groundwater closure area only - Water Temperature ____ °F

[ ] AQUIFER TEST DATA FORM ATTACHED

Test - 1 hour minimum
Drawdown is the amount water level is lowered below static level.
All depth measurements shall be from the top of the well casing.
Time of recovery is hours/minutes since pumping stopped.

Air test*
50 gpm with drill stem set at 295 ft. for 2.5 hours
Time of recovery 1 hr. hrs/min. Recovery water level 196 ft.

OR Bailer test*
____ gpm with ____ ft. of drawdown after ____ hours
Time of recovery ____ hrs/min Recovery water level ____ ft.

OR Pump test*
Depth pump set for test ____ ft.
____ gpm pump rate with ____ ft. of drawdown after ____ hrs pumping
Time of recovery ____ hrs/min. Recovery water level ____ ft.

OR Flowing Artesian*
____ gpm for ____ hours
Flow controlled by ____

*During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.

7. WELL LOG:

Depth, Feet From	Depth, Feet To	Material: color/rock and type/descriptor (example: blue/shale/hard, or brown/gravel/water, or brown/sand/heaving)
0	2	Soft clays & gravel
2	6	Dry loomy clay & some gravel
6	105	Sand, gravel & boulders; clay lenses
105	124	Heavy orange clays & gravel
124	220	Sand, gravel & cobbles - some clay
220	270	Cemented & claybound gravels & cobbles
270	300	Sand, gravel & boulders
I.R. Drive Shoe used		

[ ] ADDITIONAL SHEETS ATTACHED

8. DATE WELL COMPLETED: 5/23/2005

9. REMARKS: ____

10. DRILLER/CONTRACTOR'S CERTIFICATION:
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.
Name, firm, or corporation (print) Hayes Drilling Co
Address 2403 Par Court - Bozeman, MT 59715
Signature ____
Date 6/18/2005 License no. 361/074

MBMG ID#

MONTANA WELL LOG REPORT

Form No. 603 R2-99 — Well ID# 928

This log reports the activities of a licensed Montana well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered. **This form is to be completed by the driller and filed with DNRC within 60 days of completion of the work.** Acquiring Water Rights is the well owner's responsibility and is not accomplished by the filing of this report.

This log information is stored in the Groundwater Information Center at the Montana Bureau of Mines and Geology (Butte) and water right information is stored in the Water Rights Bureau records (Helena).

For fields that are not applicable, enter NA. Optional fields have a grayed background. Record additional information in the REMARKS section.

1. WELL OWNER:
Name Yellowstone River Ranch, LLC
MAILING ADDRESS 104 W. Superior St.
Duluth, MN 55802

2. WELL LOCATION: List ¼ from smallest to largest
NW ¼ SW ¼ SW ¼ SE ¼, Section 23
Township 5S N/S Range 8E E/W County Park
Lot ____, Tract/Blk ____ Subdivision Name ____
Well Address ____
GPS [X] Yes [ ] No
Latitude 0523448 Longitude 5025246
Error as reported by GPS locator (± feet) 18
Horizontal datum [X] NAD27 [ ] WGS84

3. PROPOSED USE: [ ] Domestic [ ] Stock [ ] Irrigation
[ ] Public Water Supply [ ] Monitoring Well [X] Other: Test Well #2

4. TYPE OF WORK:
[X] New well [ ] Deepen existing well [ ] Abandon existing well
Method: [ ] Cable [X] Rotary [ ] Other: ____

5. WELL CONSTRUCTION DETAIL:

Borehole:
Dia. 6 in. from 0 ft. to 279.5 ft.
Dia. ____ in. from ____ ft. to ____ ft.
Dia. ____ in. from ____ ft. to ____ ft.

Casing:
Steel Wall thickness .250 [ ] Threaded [X] Welded
Dia. 6 in. from +2 ft. to 279 ft.
Dia. ____ in. from ____ ft. to ____ ft.

Plastic: Pressure Rating ____ lbs. [ ] Threaded [ ] Welded
Dia. ____ in. from ____ ft. to ____ ft.

Perforations/Slotted Pipe:
Type of perforator used ____
Size of perforations/slots ____ in. by ____ in.
____ no. of perforations/slots from ____ ft. to ____ ft.
____ no. of perforations/slots from ____ ft. to ____ ft.

Screens: [ ] Yes [X] No
Material ____
Dia. ____ Slot size ____ from ____ ft. to ____ ft.
Dia. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel Packed: [ ] Yes [X] No
Size of gravel ____
Gravel placed from ____ ft. to ____ ft.

Packer: [ ] Yes [X] No
Type ____ Depth(s) ____

Grout: Material used Bentonite
Depth from 0 ft. to 20+ ft. OR [ ] Continuous feed

6. WELL TEST DATA:
A well test is required for all wells. (See details on well log report cover.)

[X] Static water level 201 ft. below top of casing or
[ ] Closed-in artesian pressure ____ psi.

How was test flow measured:
bucket/stopwatch, weir, flume, flowmeter, etc: Bucket/Stopwatch
Yellowstone groundwater closure area only - Water Temperature ____ °F

[ ] AQUIFER TEST DATA FORM ATTACHED

Test - 1 hour minimum
Drawdown is the amount water level is lowered below static level.
All depth measurements shall be from the top of the well casing
Time of recovery is hours/minutes since pumping stopped.

Air test*
45 gpm with drill stem set at 275 ft. for 1.5 hours
Time of recovery 1 hr. hrs/min. Recovery water level 201 ft.

OR Bailer test*
____ gpm with ____ ft. of drawdown after ____ hours
Time of recovery ____ hrs/min. Recovery water level ____ ft.

OR Pump test*
Depth pump set for test ____ ft.
____ gpm pump rate with ____ ft. of drawdown after ____ hrs pumping
Time of recovery ____ hrs/min. Recovery water level ____ ft.

OR Flowing Artesian*
____ gpm for ____ hours
Flow controlled by ____

*During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the resevoir of the well casing.

7. WELL LOG:

Depth, Feet From	Depth, Feet To	Material: color/rock and type/descriptor (example: blue/shale/hard, or brown/gravel/water, or brown/sand/heaving)
0		Sand, gravel, cobbles & few small
	108	boulders
108		Same with intermittant sand beds 1-2'
	154	thick
154	180	Slightly claybound gravels & boulders
180	279	Same - large & more boulders
I.R. Drive Shoe used		

[ ] ADDITIONAL SHEETS ATTACHED

8. DATE WELL COMPLETED: 6/2/2005

9. REMARKS: ____

10. DRILLER/CONTRACTOR'S CERTIFICATION:
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name, firm, or corporation (print)
Hayes Drilling Co
Address 2403 Par Court - Bozeman, MT 59715
Signature ____
Date 6/23/2005 License no. 361/074

MBMG ID#

Montana DNRC P.O. BOX 201601 HELENA, MT 59620-1601 444-6610

Well Owner's Copy

Form No. 603 R2-99

MONTANA WELL LOG REPORT

Well ID# 929

This log reports the activities of a licensed Montana well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered. This form is to be completed by the driller and filed with DNRC within 60 days of completion of the work. Acquiring Water Rights is the well owner's responsibility and is not accomplished by the filing of this report.

The log information is stored in the Groundwater Information Center at the Montana Bureau of Mines and Geology (Butte) and water right information is stored in the Water Rights Bureau records (Helena).

For fields that are not applicable, enter NA. Optional fields have a grayed background. Record additional information in the REMARKS section.

1. WELL OWNER:
Name Yellowstone River Ranch, LLC
MAILING ADDRESS 104 W. Superior St.
Duluth, MN 55802

2. WELL LOCATION: List ¼ from smallest to largest
NW ¼ NE ¼ SE ¼ SW ¼, Section 23
Township 5S N/S Range 8E E/W County Park
Lot ____, Tract/Blk ____ Subdivision Name ____
Well Address ____
GPS [X] Yes [ ] No
Latitude 0523190 Longitude 5025437
Error as reported by GPS locator (± feet) 15
Horizontal datum [X] NAD27 [ ] WGS84

3. PROPOSED USE: [ ] Domestic [ ] Stock [ ] Irrigation
[ ] Public Water Supply [ ] Monitoring Well [X] Other: Test Well #3

4. TYPE OF WORK:
[X] New well [ ] Deepen existing well [ ] Abandon existing well
Method: [ ] Cable [X] Rotary [ ] Other: ____

5. WELL CONSTRUCTION DETAIL:
Borehole:
Dia. 6 in. from 0 ft. to 300 ft.
Dia. ____ in. from ____ ft. to ____ ft.
Dia. ____ in. from ____ ft. to ____ ft.

Casing:
Steel: Wall thickness .250 [ ] Threaded [X] Welded
Dia. 6 in. from +1.5 ft. to 299 ft.
Dia. ____ in. from ____ ft. to ____ ft.

Plastic: Pressure Rating ____ lbs. [ ] Threaded [ ] Welded
Dia. ____ in. from ____ ft. to ____ ft.

Perforations/Slotted Pipe:
Type of perforator used ____
Size of perforations/slots ____ in. by ____ in.
____ no. of perforations/slots from ____ ft. to ____ ft.
____ no. of perforations/slots from ____ ft. to ____ ft.

Screens: [ ] Yes [X] No
Material ____
Dia. ____ Slot size ____ from ____ ft. to ____ ft.
Dia. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel Packed: [ ] Yes [X] No
Size of gravel ____
Gravel placed from ____ ft. to ____ ft.

Packer: [ ] Yes [X] No
Type ____ Depth(s) ____

Grout: Material used Bentonite
Depth from 0 ft. to 20+ ft. OR [ ] Continuous feed

6. WELL TEST DATA:
A well test is required for all wells. (See details on well log report cover.)

[X] Static water level 205 ft. below top of casing or
[ ] Closed-in artesian pressure ____ psi.

How was test flow measured:
bucket/stopwatch, weir, flume, flowmeter, etc Bucket/Stopwatch

Yellowstone groundwater closure area only - Water Temperature ____ °F

[ ] AQUIFER TEST DATA FORM ATTACHED

Test - 1 hour minimum
Drawdown is the amount water level is lowered below static level.
All depth measurements shall be from the top of the well casing.
Time of recovery is hours/minutes since pumping stopped.

Air test*
50 gpm with drill stem set at 295 ft. for 2 hours
Time of recovery 1 hr. hrs/min. Recovery water level 205 ft.

OR Bailer test*
____ gpm with ____ ft. of drawdown after ____ hours
Time of recovery ____ hrs/min. Recovery water level ____ ft.

OR Pump test*
Depth pump set for test ____ ft.
____ gpm pump rate with ____ ft. of drawdown after ____ hrs pumping
Time of recovery ____ hrs/min. Recovery water level ____ ft.

OR Flowing Artesian*
____ gpm for ____ hours
Flow controlled by ____

*During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the resevoir of the well casing.

7. WELL LOG:

Depth, Feet From	Depth, Feet To	Material: color/rock and type/descriptor (example: blue/shale/hard, or brown/gravel/water, or brown/sand/heaving)
0	24	Sandy clay with some gravel
24	40	Loose sands & gravel - some clay lenses
40	165	Sand, gravel, cobbles & few boulders
165	260	Same - slightly claybound
260	300	Same with numerous boulders
I.R. Drive Shoe used		

[ ] ADDITIONAL SHEETS ATTACHED

8. DATE WELL COMPLETED: 6/6/2005

9. REMARKS: ____

10. DRILLER/CONTRACTOR'S CERTIFICATION:
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name, firm, or corporation (print)
Hayes Drilling Co
Address 2403 Par Court - Bozeman, MT 59715
Signature ____
Date 6/23/2005 License no. 361/074

MBMG ID#

PARADISE FOUND TR. B-2

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
GOULD TOM

Plot this site on a topographic map

Location Information

GWIC Id: 212415
Location (TRS): 05S 08E 24 CD
County (MT): PARK
DNRC Water Right:
PWS Id:
Block:
Lot:
Addition:

Source of Data: LOG
Latitude (dd): 45.3825
Longitude (dd): -110.6828
Geomethod: NAV-GPS
Datum: WGS84
Altitude (feet):
Certificate of Survey:
Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 284.00
Static Water Level (ft): 200.00
Pumping Water Level (ft):
Yield (gpm): 58.00
Test Type: AIR LIFT
Test Duration: 1.00
Drill Stem Setting (ft): 280.00
Recovery Water Level (ft): 200.00
Recovery Time (hrs): 0.50
Well Notes:

How Drilled: ROTARY
Driller's Name: RED TIGER
Driller License: WWC598
Completion Date (m/d/y): 5/28/2004
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: Not Reported
Well/Water Use: DOMESTIC

Hole Diameter Information

From	To	Diameter
0.0	284.0	7.0

Annular Seal Information

From	To	Description	Cont. Feed
0.0	0.0	BENTONITE	Y

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-2.0	284.0	6.0	0.250		WELDED	STEEL

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
284.0	284.0	6.0			OPEN BOTTOM

Lithology Information

From	To	Description
0.0	1.0	TOP SOIL GRAVEL
1.0	284.0	FINE SAND GRAVEL BOULDERS

[1] - All diameters reported are **inside** diameter of the casing.

PRAY WELL

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
MONTANA CUSTOM HOMES *WELL #1

Plot this site on a topographic map

Location Information

GWIC Id: 160120
Location (TRS): 05S 08E 25 ABA
County (MT): PARK
DNRC Water Right:
PWS Id:
Block:
Lot:
Addition:

Source of Data: LOG
Latitude (dd): 45.3796
Longitude (dd): -110.6774
Geomethod: TRS-TWN
Datum: NAD27
Altitude (feet):
Certificate of Survey:
Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 219.00
Static Water Level (ft): 180.00
Pumping Water Level (ft): 189.00
Yield (gpm): 50.00
Test Type: PUMP
Test Duration: 13.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):

Well Notes:

How Drilled: ROTARY
Driller's Name: HAYES
Driller License: WWC361
Completion Date (m/d/y): 1/28/1997
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: Not Reported
Well/Water Use: DOMESTIC
TEST WELL

Hole Diameter Information

From	To	Diameter
0.0	221.0	6.0

Annular Seal Information

From	To	Description	Cont. Feed
0.0	20.0	BENTONITE	

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-2.0	219.0	6.0			WELDED	STEEL

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
206.0	218.0	6.0		1/8X1	HOLTE PERFORATOR SLOTS

Lithology Information

From	To	Description
0.0	13.0	SOFT CLAY
13.0	15.0	CLAYBOUND GRAVELS AND COBBLES
15.0	70.0	LOOSE SAND GRAVEL COBBLES AND A FEW SMALL BOULDERS
70.0	115.0	CLAYBOUND GRAVELS COBBLES
115.0	119.0	SANDY CLAY
119.0	130.0	CLAYBOUND GRAVEL COBBLES AND BOULDERS
130.0	148.0	SAME-HEAVY CLAYS
148.0	180.0	CLEANER SAND AND GRAVELS-VERY LITTLE CLAY
180.0	216.0	CLAYBOUND GRAVEL COBBLES 200-216 FT 15-20GPM

216.0	221.0	SAME MORE CLAY LESS WATER

[1] - All diameters reported are **inside** diameter of the casing.

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	200	ft

Date of Analysis: June 25, 2006

Concentration of nitrates in groundwater at bottom of Lot 15 drainfield mixing zone due to new drainfield on Lot 2

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	700	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	85	ft
w =	Width of mixing zone perpendicular to grdw. flow	207.48	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	3,112	sf
As =	Surface area of mixing zone (= L*w)	145,238	sf
Ng =	Background nitrates from lab report	0.44	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	2	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	6,458.61	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	109.43	cf/day
Qe =	Volume of effluent (= F# * Qf)	53.47	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	6,621.50	cf/day

Nt = **Resulting Nitrates Concentration =** 0.85 ppm

(NgQg + NrQr + NeQe)/Qt

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	750	ft

Date of Analysis: June 25, 2006

Concentration of nitrates in groundwater at bottom of Lot 16 drainfield mixing zone due to new drainfield on Lot 15

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	1250	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	85	ft
w =	Width of mixing zone perpendicular to grdw. flow	303.72	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	4,556	sf
As =	Surface area of mixing zone (= L*w)	379,651	sf
Ng =	Background nitrates in groundwater from sheet 2 of 7	0.85	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	2	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	9,454.30	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	286.04	cf/day
Qe =	Volume of effluent (= F# * Qf)	53.47	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	9,793.81	cf/day

Nt =	**Resulting Nitrates Concentration =** (NgQg + NrQr + NeQe)/Qt	1.12	ppm

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	400	ft

Date of Analysis: June 25, 2006

Cumulative concentration of nitrates in groundwater at bottom of Lot 31 drainfield mixing zone due to new drainfield on Lot 16

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	900	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	85	ft
w =	Width of mixing zone perpendicular to grdw. flow	242.48	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	3,637	sf
As =	Surface area of mixing zone (= L*w)	218,231	sf
Ng =	Background nitrates in groundwater from sheet 2 of 7	1.12	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	2	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	7,547.95	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	164.42	cf/day
Qe =	Volume of effluent (= F# * Qf)	53.47	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	7,765.84	cf/day

Nt =	**Resulting Nitrates Concentration =** (NgQg + NrQr + NeQe)/Qt	1.46	ppm

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	300	ft

Date of Analysis: June 25, 2006

Cumulative concentration of nitrates in groundwater at bottom of Lot 32 drainfield mixing zone due to new drainfield on Lot 31

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	800	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	85	ft
w =	Width of mixing zone perpendicular to grdw. flow	224.98	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	3,375	sf
As =	Surface area of mixing zone (= L*w)	179,985	sf
Ng =	Background nitrates in groundwater from sheet 3 of 7	1.46	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	2	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	7,003.28	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	135.61	cf/day
Qe =	Volume of effluent (= F# * Qf)	53.47	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	7,192.35	cf/day

Nt = **Resulting Nitrates Concentration =** 1.81 ppm

(NgQg + NrQr + NeQe)/Qt

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	400	ft

Date of Analysis: June 25, 2006

Cumulative concentration of nitrates in groundwater at bottom of Lot 33 drainfield mixing zone due to new drainfield on Lot 32

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	900	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	85	ft
w =	Width of mixing zone perpendicular to grdw. flow	242.48	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	3,637	sf
As =	Surface area of mixing zone (= L*w)	218,231	sf
Ng =	Background nitrates in groundwater from sheet 4 of 7	1.81	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	2	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	7,547.95	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	164.42	cf/day
Qe =	Volume of effluent (= F# * Qf)	53.47	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	7,765.84	cf/day

Nt =	**Resulting Nitrates Concentration =** (NgQg + NrQr + NeQe)/Qt	2.12	ppm

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	500	ft

Date of Analysis: June 25, 2006

Cumulative concentration of nitrates in groundwater at bottom of Lot 61 drainfield mixing zone due to new drainfield on Lot 33

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	1000	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	85	ft
w =	Width of mixing zone perpendicular to grdw. flow	259.98	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	3,900	sf
As =	Surface area of mixing zone (= L*w)	259,976	sf
Ng =	Background nitrates in groundwater from sheet 5 of 7	2.12	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	2	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	8,092.62	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	195.87	cf/day
Qe =	Volume of effluent (= F# * Qf)	53.47	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	8,341.96	cf/day

Nt = **Resulting Nitrates Concentration =** 2.40 ppm

(NgQg + NrQr + NeQe)/Qt

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	500	ft

Date of Analysis: June 25, 2006

Cumulative concentration of nitrates in groundwater at bottom of Lot 63 drainfield mixing zone due to new drainfield on Lot 61

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	1000	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	55	ft
w =	Width of mixing zone perpendicular to grdw. flow	229.98	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	3,450	sf
As =	Surface area of mixing zone (= L*w)	229,976	sf
Ng =	Background nitrates in groundwater from sheet 5 of 7	2.40	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	2	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	7,158.77	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	173.27	cf/day
Qe =	Volume of effluent (= F# * Qf)	53.47	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	7,385.51	cf/day

Nt = **Resulting Nitrates Concentration =** 2.72 ppm

(NgQg + NrQr + NeQe)/Qt

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	0	ft

Date of Analysis: June 25, 2006

Cumulative concentration of nitrates in groundwater at bottom of drainfield mixing zone due to new drainfield on Lot 63

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	500	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	60	ft
w =	Width of mixing zone perpendicular to grdw. flow	147.49	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	2,212	sf
As =	Surface area of mixing zone (= L*w)	73,744	sf
Ng =	Background nitrates in groundwater from sheet 6 of 7	2.72	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	2	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	4,591.06	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	55.56	cf/day
Qe =	Volume of effluent (= F# * Qf)	53.47	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	4,700.09	cf/day

Nt = **Resulting Nitrates Concentration =** 3.23 ppm

(NgQg + NrQr + NeQe)/Qt

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	330	ft

Date of Analysis: July 7, 2006

Concentration of nitrates in groundwater at bottom of Lot 79 drainfield mixing zone due to new drainfield on Lot 78

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	830	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	20	ft
w =	Width of mixing zone perpendicular to grdw. flow	165.23	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	2,478	sf
As =	Surface area of mixing zone (= L*w)	137,141	sf
Ng =	Background nitrates from lab report	0.44	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	1	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	5,143.34	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	103.33	cf/day
Qe =	Volume of effluent (= F# * Qf)	26.73	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	5,273.40	cf/day

Nt = **Resulting Nitrates Concentration =** 0.70 ppm

(NgQg + NrQr + NeQe)/Qt

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	780	ft

Date of Analysis: July 7, 2006

Cumulative concentration of nitrates in groundwater at bottom of Lot 81 drainfield mixing zone due to new drainfield on Lot 79

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	1280	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	20	ft
w =	Width of mixing zone perpendicular to grdw. flow	243.97	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	3,660	sf
As =	Surface area of mixing zone (= L*w)	312,281	sf
Ng =	Background nitrates in groundwater from sheet 1 of 5	0.70	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	1	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	7,594.36	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	235.28	cf/day
Qe =	Volume of effluent (= F# * Qf)	26.73	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	7,856.38	cf/day

Nt = **Resulting Nitrates Concentration =** 0.88 ppm

(NgQg + NrQr + NeQe)/Qt

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	200	ft

Date of Analysis: July 7, 2006

Cumulative concentration of nitrates in groundwater at bottom of Lot 82 drainfield mixing zone due to new drainfield on Lot 81

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	700	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	50	ft
w =	Width of mixing zone perpendicular to grdw. flow	172.48	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	2,587	sf
As =	Surface area of mixing zone (= L*w)	120,738	sf
Ng =	Background nitrates in groundwater from sheet 2 of 5	0.88	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	1	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	5,369.12	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	90.97	cf/day
Qe =	Volume of effluent (= F# * Qf)	26.73	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	5,486.82	cf/day

Nt = **Resulting Nitrates Concentration =** 1.12 ppm

(NgQg + NrQr + NeQe)/Qt

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	200	ft
Min. Distance to next drainfield downstream =	280	ft

Date of Analysis: July 7, 2006

Cumulative concentration of nitrates in groundwater at bottom of Lot 83 drainfield mixing zone due to new drainfield on Lot 82

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	480	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	20	ft
w =	Width of mixing zone perpendicular to grdw. flow	103.99	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	1,560	sf
As =	Surface area of mixing zone (= L*w)	49,915	sf
Ng =	Background nitrates in groundwater from sheet 3 of 5	1.12	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	1	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	3,236.99	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	37.61	cf/day
Qe =	Volume of effluent (= F# * Qf)	26.73	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	3,301.33	cf/day

Nt =	**Resulting Nitrates Concentration =** (NgQg + NrQr + NeQe)/Qt	1.51	ppm

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 4

Mixing Zone Length =	200	ft
Min. Distance to next drainfield downstream =	0	ft

Date of Analysis: July 7, 2006

Cumulative concentration of nitrates in groundwater at bottom of drainfield mixing zone due to new drainfield on Lot 83

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	200	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	20	ft
w =	Width of mixing zone perpendicular to grdw. flow	55.00	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	825	sf
As =	Surface area of mixing zone (= L*w)	10,999	sf
Ng =	Background nitrates in groundwater from sheet 4 of 5	1.51	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	1	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	1,711.91	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	8.29	cf/day
Qe =	Volume of effluent (= F# * Qf)	26.73	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	1,746.93	cf/day

Nt =	**Resulting Nitrates Concentration =** (NgQg + NrQr + NeQe)/Qt	2.25	ppm

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = **I**

Mixing Zone Length =	500	ft
Min. Distance to next drainfield downstream =	0	ft

Date of Analysis: June 25, 2006

Concentration of nitrates in groundwater at bottom of drainfield mixing zone due to new drainfield on any lot with unobstructed 500 ft long MZ

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	500	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	75	ft
w =	Width of mixing zone perpendicular to grdw. flow	162.49	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	2,437	sf
As =	Surface area of mixing zone (= L*w)	81,244	sf
Ng =	Background nitrates in groundwater from lab report	0.44	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	2	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	5,057.98	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	61.21	cf/day
Qe =	Volume of effluent (= F# * Qf)	53.47	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	5,172.66	cf/day

Nt = **Resulting Nitrates Concentration =** 0.96 ppm

(NgQg + NrQr + NeQe)/Qt

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = I

Mixing Zone Length =	300	ft
Min. Distance to next drainfield downstream =	0	ft

Date of Analysis: June 25, 2006

Concentration of nitrates in groundwater at bottom of drainfield mixing zone due to new drainfield on any lot where MZ is obstructed at 300 ft long

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	300	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	75	ft
w =	Width of mixing zone perpendicular to grdw. flow	127.49	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	1,912	sf
As =	Surface area of mixing zone (= L*w)	38,248	sf
Ng =	Background nitrates in groundwater from lab report	0.44	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	2	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	3,968.64	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	28.82	cf/day
Qe =	Volume of effluent (= F# * Qf)	53.47	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	4,050.92	cf/day
Nt =	**Resulting Nitrates Concentration =** (NgQg + NrQr + NeQe)/Qt	1.10	ppm

Nitrates Sensitivity Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 1

Mixing Zone Length =	200	ft
Min. Distance to next drainfield downstream =	0	ft

Date of Analysis: June 25, 2006

Concentration of nitrates in groundwater at bottom of drainfield mixing zone due to new drainfield on any lot where MZ is obstructed at 200 ft long

K =	Hydraulic Conductivity	164.7	ft/day
i =	Hydraulic Gradient	0.0126	ft/ft
d =	Depth of aquifer	15.0	ft
L =	Distance to length of mixing zone	200	ft
Ld =	Length of drainfield perpendicular to shallow grdw. flow	75	ft
w =	Width of mixing zone perpendicular to grdw. flow	110.00	ft
Am =	Cross sectional area of aquifer mixing zone (= w*d)	1,650	sf
As =	Surface area of mixing zone (= L*w)	21,999	sf
Ng =	Background nitrates in groundwater from lab report	0.44	ppm
Nr =	Naturally occurring nitrates in rainwater	1	ppm
Ne =	Nitrates in domestic sewage effluent	50	ppm
F# =	Number of dwelling units connected to drainfield	2	ea.
Qf =	Volume of effluent per dwelling unit	200	gal/day
p =	Precipitation for area	16.50	in./yr.
I =	Recharge Percentage (constant)	20	%
Qg =	Volume of groundwater through mixing zone (= K*i*Am	3,423.97	cf/day
Qr =	Volume of recharge from precipitation (= As*p*I)	16.57	cf/day
Qe =	Volume of effluent (= F# * Qf)	53.47	cf/day
Qt =	Total volume (= Qg + Qr + Qe)	3,494.01	cf/day

Nt = **Resulting Nitrates Concentration =** 1.20 ppm

(NgQg + NrQr + NeQe)/Qt

Phosphorus Breakthrough Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 8
Min. Distance down gradient to surface water from new drainfields = 3900 ft
Date of Analysis: July 7, 2006

Time to breakthrough due to 8 single drainfields aligned along calculated flow direction to assumed surface water 3900 ft down gradient

D# =	Number of residences connected to drainfield	16	each
Pe =	Quantity of phosphorus produced / household / yr.	6.44	lbs/yr.
Swt =	Unit weight of soil	100	lbs/cf
Dw =	Depth below ground surface to first water table	8	ft
Ld =	Width of drainfield perpendicular to grdw. flow	85	ft
Wd =	Length of drainfield parallel to grdw. flow (8 fields each 25 ft wide)	200	ft
De =	Min. downgradi. dist. to surface water	3,900	ft
Tke =	Thickness of effluent plume in soil above water table	0.5	ft
Adp =	Phosphorus adsorption rate of soil	200	ppm
Wtd =	Weight of soil under drainfield to shallow water table	13,600	K-lbs
WtP1 =	Weight of phosphorus adsorbed by soil under drainfiel	2,720.0	lbs
Wte =	Weight of soil above water table	16,575	K-lbs
WtP2 =	Weight of phosphorus adsorbed by soil at water tbl.	3,315.0	lbs
WtPT =	Total weight of phosphorus adsorbed by soil	6,035.0	lbs
Time =	**Time to phosphorus breakthrough**	58.6	yrs.

Phosphorus Breakthrough Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 5
Min. Distance down gradient to surface water from new drainfields = 2000 ft
Date of Analysis: July 7, 2006

Time to breakthrough due to 5 single drainfields aligned along calculated flow direction to assumed surface water 2000 ft down gradient

D# =	Number of residences connected to drainfield	5	each
Pe =	Quantity of phosphorus produced / household / yr.	6.44	lbs/yr.
Swt =	Unit weight of soil	100	lbs/cf
Dw =	Depth below ground surface to first water table	8	ft
Ld =	Width of drainfield perpendicular to grdw. flow	20	ft
Wd =	Length of drainfield parallel to grdw. flow (5 fields each 75 ft long oriented end to end)	375	ft
De =	Min. downgradi. dist. to surface water	2,050	ft
Tke =	Thickness of effluent plume in soil above water table	0.5	ft
Adp =	Phosphorus adsorption rate of soil	200	ppm
Wtd =	Weight of soil under drainfield to shallow water table	6,000	K-lbs
WtP1 =	Weight of phosphorus adsorbed by soil under drainfiel	1,200.0	lbs
Wte =	Weight of soil above water table	2,050	K-lbs
WtP2 =	Weight of phosphorus adsorbed by soil at water tbl.	410.0	lbs
WtPT =	Total weight of phosphorus adsorbed by soil	1,610.0	lbs
Time =	**Time to phosphorus breakthrough**	50.0	yrs.

Phosphorus Breakthrough Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 1
Min. Distance down gradient to surface water from new drainfield = 100 ft
Date of Analysis: July 7, 2006

Time to breakthrough due to 1 single drainfield (no guest house) to assumed surface water 100 ft down gradient

D# =	Number of drainfields in line parallel to grdw. flow	1	each
Pe =	Quantity of phosphorus produced / household / yr.	6.44	lbs/yr.
Swt =	Unit weight of soil	100	lbs/cf
Dw =	Depth below ground surface to first water table	8	ft
Ld =	Width of drainfield perpendicular to grdw. flow	85	ft
Wd =	Length of drainfield parallel to grdw. flow	18	ft
De =	Min. downgradi. dist. to surface water	100	ft
Tke =	Thickness of effluent plume in soil above water table	0.5	ft
Adp =	Phosphorus adsorption rate of soil	200	ppm
Wtd =	Weight of soil under drainfield to shallow water table	1,224	K-lbs
WtP1 =	Weight of phosphorus adsorbed by soil under drainfiel	244.8	lbs
Wte =	Weight of soil above water table	425	K-lbs
WtP2 =	Weight of phosphorus adsorbed by soil at water tbl.	85.0	lbs
WtPT =	Total weight of phosphorus adsorbed by soil	329.8	lbs
Time =	**Time to phosphorus breakthrough**	51.2	yrs.

Phosphorus Breakthrough Analysis
Prepared by William E. Smith, P.E.

Subdivision: Yellowstone River Ranch Estates, Park County
Type of Subdivision: 99 Lot major
Number/Acreage of Tracts = 99 lots / 3 to 20+ acres
Number / Type of Dwellings: 1 new Single Family residence + Guest House per lot
Drainfields in line parallel to grdw. flow = 1
Min. Distance down gradient to surface water from new drainfield = 250 ft
Date of Analysis: July 7, 2006

Time to breakthrough due to residence and guest house on single drainfield aligned along calculated flow direction
Surface water or next drainfield minimum of 250 ft down gradient

D# =	Number of residences connected to drainfield	2	each
Pe =	Quantity of phosphorus produced / household / yr.	6.44	lbs/yr.
Swt =	Unit weight of soil	100	lbs/cf
Dw =	Depth below ground surface to first water table	8	ft
Ld =	Width of drainfield perpendicular to grdw. flow	90	ft
Wd =	Length of drainfield parallel to grdw. flow	30	ft
De =	Min. downgradi. dist. to surface water	250	ft
Tke =	Thickness of effluent plume in soil above water table	0.5	ft
Adp =	Phosphorus adsorption rate of soil	200	ppm
Wtd =	Weight of soil under drainfield to shallow water table	2,160	K-lbs
WtP1 =	Weight of phosphorus adsorbed by soil under drainfiel	432.0	lbs
Wte =	Weight of soil above water table	1,125	K-lbs
WtP2 =	Weight of phosphorus adsorbed by soil at water tbl.	225.0	lbs
WtPT =	Total weight of phosphorus adsorbed by soil	657.0	lbs
Time =	**Time to phosphorus breakthrough**	51.0	yrs.

01/04/2026 02:35 3024526 ELLEN PAGE 01

6833000 LOT 13

APPLICATION FOR INDIVIDUAL SEWAGE DISPOSAL INSTALLATION PERMIT

Park City-County Health Department. Date 8/14/74

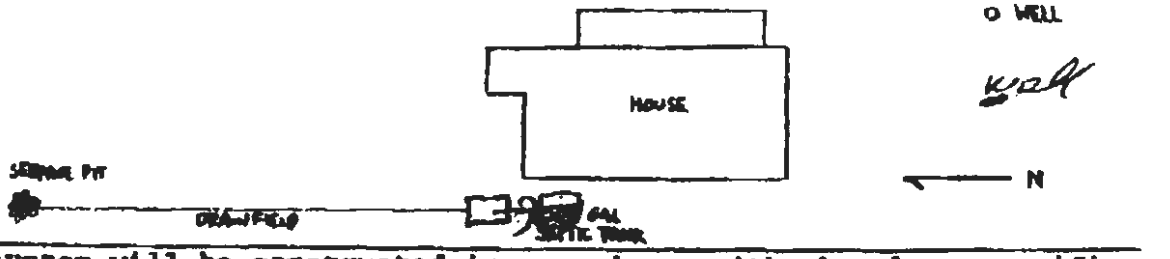
Owner Bruce Weeter at _____ (location, lot, block, etc.)

Address Pray, Montana 59065

New X Existing ____ Installer Archie Mann

living units 1, bedrooms 4, people served 5, water supply Well garbage disposal No, size of septic tank 1500 gallons, drain field ____, modified drain field ____, seppage pit ____, make or dimensions of septic tank ____, footage effective area ____, all disposal into septic tank Yes, bypass na, distance from septic tank to: foundation 20', well 150', canal, stream, lake, etc. 1 mi., distance from drainfield or seepage pit to: well 200', nearest property line 0.5 mi., canal, stream, lake, etc. 1 mi., percolation test ____, soil type ____, maximum ground water depth during high water ____ from surface.

Sketch house, proposed sewage disposal layout and all adjacent wells within 200 feet of streams, lakes, etc.



This system will be constructed in accordance with the above specification and regulation governing sewage systems with the county and state. Final inspection must be made before backfill.

Applicant _____ Address _____

Paid by ____ Permit No. 491 Bill ____ No Fee ____ Date of Installation ____

Approved ____ Not Approved ____

Date of Inspection 20 Aug 74

By: Ray Hedrick
City-County Sanitarian -or-
Health Officer

Please let us know when the septic tank system is ready for inspection. Ed.

mbmggwic

Ground-Water Information Center
Montana Bureau of Mines and Geology
Montana Tech of The University of Montana
1300 West Park Street - Main Hall 314
Butte Montana 59701-8997

7/10/2006
Sign Out

Ground Water Information Center
Wells Report

The following data were returned from the GWIC databases for the area you requested. For a more detailed description of the data view the GWIC Metadata report. If you notice data entry errors or have questions please let us know by clicking here to leave us a message. If you wish to view a one page report for a particular site, click the hyperlinked **Gwic Id** for that well. Scroll to the right of your screen to view all the data.

Retrieval Statistics *

Field	Max	Min	Count	Avg
Total Depth	300.00	28.00	96	175.84
Pumping Water Level	280.00	4.00	51	117.21
Static Water Level	220.00	10.00	94	110.25
Yield (gpm)	600.00	8.00	91	46.63

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

Filter Options

Td >=

filter report

Gwic Id	PDF	DNRC WR	Site Name	Location	Ver?	Type	Td	Pwl	Swl	Yield	Date	Prim Water
206318			YELLOWSTONE TRAILS RANCH TEST WELL # 1	05S08E13	NO	WELL						
206319			YELLOWSTONE TRAILS RANCH TEST WELL # 2	05S08E13	NO	WELL						
206316			YELLOWSTONE TRAILS RANCH TEST WELL #4	05S08E13	NO	WELL						
102470			HOBBS HARRY B.	05S08E13A	NO	WELL	180.00		160.00	500.00	1/1/1900	STOCKWATE
221801	✓		IBES GALEN	05S08E13AADC	NO	WELL	240.00		161.00	40.00	5/5/2005	DOMESTIC
205557			AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL 2	05S08E13ABAD	YES	WELL	239.00		168.00	40.00	6/25/2003	DOMESTIC
205595			AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE*TEST WELL 1	05S08E13ABDA	YES	WELL	239.00		174.00	40.00	6/24/2003	DOMESTIC
212142			DENNY GARY	05S08E13CBB	NO	WELL	160.00		120.00	30.00	6/21/2004	DOMESTIC
162941		P100729-00	ARROWHEAD SCHOOL DISTRICT 75	05S08E13DDDD	YES	WELL	248.00	162.30	158.30	72.00	8/19/1996	PUBLIC WAT
167776			BURGFECHTEL STEVE	05S08E14	NO	WELL	134.00	120.00	38.50	12.00	4/18/1998	DOMESTIC
153651			HART EDWARD N AND ENSTROM AND EILEEN	05S08E14	NO	WELL	173.50	102.50	97.50	10.00	9/7/1995	DOMESTIC

PUMP TEST CONDUCTED BY MBMG. REFER TO ATTACHED REPORT.

REFER REPORT ABOVE

102472		JERLA RALPH	05S08E14	NO	WELL	205.00	205.00	66.00	30.00	5/24/1982	DOMESTIC
102473		MCCARTHY VESTA #1	05S08E14	NO	WELL	28.00		28.00		1/1/1900	DOMESTIC
102474		MCCARTY VESTA "WELL #2	05S08E14	NO	WELL	28.00		28.00		1/1/1900	DOMESTIC
155018		STOUFFER MARSHALL	05S08E14	NO	WELL	139.50	41.50	38.00	15.00	10/15/1995	DOMESTIC
102471		VANCE DUANE	05S08E14	NO	WELL	86.00	80.00	34.00	25.00	4/16/1984	DOMESTIC
206317		YELLOWSTONE TRAILS RANCH TEST WELL #3	05S08E14	NO	WELL						
155015		BIGENHO ED & CARYL	05S08E14	NO	WELL	109.50	41.50	39.00	15.00	9/17/1995	DOMESTIC
205550		AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE	05S08E14AADA	YES	WELL	98.50		53.00	80.00	7/3/2003	DOMESTIC
205551		AINSWORTH B NEAL/GALLATIN VALLEY REAL ESTATE"TEST WELL 3	05S08E14AADB	YES	WELL	98.50		52.00	80.00	7/1/2003	DOMESTIC
102475	C095458-00	DELOREY BRUCE	05S08E14ABD	NO	WELL	175.00	170.00	135.00	8.00	7/27/1979	DOMESTIC
147735	C089711-00	REINHARDT CARL	05S08E14ACB	NO	WELL	93.00	90.00	10.00	35.00	11/10/1993	FIRE PROTE
206290		SACKETTES	05S08E14ACBA	YES	WELL						
159750	C097936-00	SACKETT GARY AND SHANNON	05S08E14ACBD	YES	WELL	43.50	30.00	26.00	15.00	4/15/1996	DOMESTIC
134019		HENNESSEY MIKE	05S08E14ACC	NO	WELL	74.00	70.00	14.00	35.00	8/6/1992	DOMESTIC
133368		LAY BRUCE	05S08E14ACC	NO	WELL	86.00	83.00	33.00	35.00	8/8/1992	DOMESTIC
169348		DEYOUNG BRET	05S08E14ACD	NO	WELL	139.00	47.00	44.00	12.00	6/13/1998	DOMESTIC
169349		EDDINGTON TERESA D.	05S08E14ACD	NO	WELL	139.00	55.00	48.00	12.00	5/31/1998	DOMESTIC
169350	C104672-00	BURGFECHTEL STEVE	05S08E14BBD	NO	WELL	134.00	46.00	38.50	12.00	4/18/1998	DOMESTIC
102477	C007666-00	ANGLE BOB	05S08E14D	NO	WELL	162.00	157.00	149.00	12.00	8/13/1975	DOMESTIC
155016		BIGENHO ED & CARYL	05S08E14D	NO	WELL	121.50	39.00	38.00	15.00	10/1/1995	DOMESTIC
102478		D'ANGELO RON	05S08E14D	NO	WELL	148.50		110.00	25.00	4/4/1990	DOMESTIC
176956		DEWALT FREDERIC G. & PATRICA G.	05S08E14D	NO	WELL	162.00	66.00	39.00	15.00	10/24/1999	DOMESTIC
170790	C106158-00	DEYOUNG BRET	05S08E14D	NO	WELL	139.00	47.00	44.00	12.00	6/13/1998	DOMESTIC
183230	C30009393	MACKAY GREG & TERESA	05S08E14D	NO	WELL	118.50		63.00	30.00	5/18/2000	DOMESTIC
102476	C061505-00	NAGEL WALTER	05S08E14D	NO	WELL	202.00	190.00	164.00	18.00	4/28/1986	DOMESTIC
147736		O'BRIEN JAMES R	05S08E14D	NO	WELL	149.00	39.50	34.00	13.00	7/2/1994	DOMESTIC
143113	C088952-00	GRINDINGER LEE & RUTH	05S08E14DA	NO	WELL	118.00	115.00	90.00	20.00	5/24/1993	DOMESTIC
160118	C099513-00	QUESENBERRY NELSON	05S08E14DA	NO	WELL	118.00	115.00	91.00	20.00	6/25/1996	DOMESTIC
143112	C091506-00	BUSBY MIKE AND SUSAN	05S08E14DAA	NO	WELL	67.00	60.00	45.00	15.00	5/25/1993	DOMESTIC
200132		BIGENHO ED	05S08E14DAC	NO	WELL	131.50	91.00	87.00	14.00	9/22/2002	DOMESTIC

		CARYL AND CHRISTOPHER										
218446	B30014837	HILLMAN JIM	05S08E14DAC	NO	WELL	110.00		61.00	30.00	3/9/2005	DOMESTIC	
165017		PHILLIPS MATT	05S08E14DAC	NO	WELL	127.50	81.00	76.00	12.00	10/12/1995	DOMESTIC	
213658		SPANNRING BOB	05S08E14DACC	NO	WELL	181.00		98.00	80.00	5/26/2004	DOMESTIC	
200141		BIGENHO ED CARYL AND CHRISTOPHER	05S08E14DBA	NO	WELL	113.50	48.50	45.50	14.00	10/10/2002	DOMESTIC	
142905	C089621-00	KNOLL AMY	05S08E14DBC	NO	WELL	95.00	90.00	34.00	35.00	11/2/1993	DOMESTIC	
147211	C092490-00	JURACK ROGER OR CAROLYN	05S08E14DBD	NO	WELL	109.00	45.00	40.00	13.00	7/17/1994	DOMESTIC	
181688		FATAUROS JOSH	05S08E14DBDD	NO	WELL	158.00		41.00	100.00	9/11/1997	DOMESTIC	
134021	C093756-00	HENNESSEY MIKE	05S08E14DC	NO	WELL	63.00	60.00	15.00	35.00	8/7/1992	DOMESTIC	
159751		TATUM JEANNIE	05S08E14DC	NO	WELL	149.00	144.00	80.00	25.00	4/1/1996	DOMESTIC	
169852		HANLON KEVIN	05S08E14DCA	NO	WELL	155.00			100.00	9/16/1998	DOMESTIC	
133369	C083301-00	ROBEY PATRICIA	05S08E14DCAD	YES	WELL	135.00	117.00	81.00	10.00	4/21/1992	DOMESTIC	
192471		DAVIS DAN AND VIVIAN	05S08E14DCB	NO	WELL	99.00		67.00	15.00	6/14/2001	DOMESTIC	
147740	C089710-00	REINHARDT CARL	05S08E14DCB	NO	WELL	78.00	75.00	12.00	35.00	11/10/1993	DOMESTIC	
144004	C092574-00	REINHART CARL	05S08E14DCB	NO	WELL	141.00	135.00	31.00	30.00	9/15/1993	DOMESTIC	
221803		HENNESSEY MIKE	05S08E14DCBA	NO	WELL	140.00		47.00	100.00	12/28/2004	DOMESTIC	
147738	C095530-00	MOFFO LEONARD	05S08E14DCC	NO	WELL	177.00	161.00	162.00	10.00	5/20/1994	DOMESTIC	
221524		MOROFF RON	05S08E14DCCB	NO	WELL	236.00		72.00	100.00	8/8/2005	DOMESTIC	
218733		CHADWICK KIRK	05S08E14DCDA	NO	WELL	200.00		135.00	40.00	2/11/2005	DOMESTIC	
213595		BUSCHER CRAIG	05S08E14DD	NO	WELL	142.00		47.00	30.00	8/3/2004	DOMESTIC	
210808	C30008681	CHADWICK KIRK	05S08E14DDA	NO	WELL	181.00		115.00	8.00	9/28/1997	DOMESTIC	
166310	C30008681	CHADWICK KIRK	05S08E14DDA	NO	WELL	181.00	118.00	115.00	8.00	9/28/1997	DOMESTIC	
204071		DELOREY ELMER	05S08E14DDAD	NO	WELL	219.00		173.00	20.00	5/21/2003	DOMESTIC	
142906	C092444-00	KENNARD CHRIS	05S08E14DDB	NO	WELL	178.00	155.00	140.00	20.00	7/6/1993	DOMESTIC	
222632		PURLEE JOHN	05S08E14DDB	NO	WELL	157.00		120.00	20.00	4/21/2005	DOMESTIC	
221576	YRR TEST Well 3	YELLOWSTONE RIVER RANCH, LLC *TEST WELL 3	05S08E23CDAB	NO	WELL	300.00		205.00	50.00	6/6/2005	TEST WELL	
221577		YELLOWSTONE RIVER RANCH, LLC *TEST WELL 2	05S08E23DCCB	NO	WELL	279.00		201.00	45.00	6/2/2005	TEST WELL	
102481		BUSBY LESLIE	05S08E24A	NO	WELL	207.00		47.00	600.00	2/1/1949	DOMESTIC	
102482		ANDERSON ARNOLD J	05S08E24AD	NO	WELL	200.00	197.00	170.00	25.00	2/27/1979	DOMESTIC	
218735		MILAM RAY	05S08E24ADDB	NO	WELL	240.00		177.00	30.00	3/23/2005	DOMESTIC	
102483		HOBBS HARRY	05S08E24B	NO	WELL	180.00		160.00	500.00	1/1/1900	STOCKWATE	

		H.									
213660		B. NEAL AINSWORTH / LLOYD MANDEVILLE	05S08E24BCAA	NO	WELL	259.00		191.00	40.00	5/20/2004	OTHER
215806	C30020140	HARDIN DORTHY L. OR W. EDWARD	05S08E24CCD	NO	WELL	260.00		184.00	42.00	12/7/2004	DOMESTIC
212415	PARADISE Ford WELL	GOULD TOM	05S08E24CD	NO	WELL	284.00		200.00	58.00	5/28/2004	DOMESTIC
102484	C015198-00	BALAVAGE JERRY	05S08E24D	NO	WELL	175.00	157.00	140.00	15.00	10/13/1976	DOMESTIC
102485		QUESENBERRY MARVIN	05S08E24D	NO	WELL	195.00	195.00	165.00	10.00	12/11/1986	DOMESTIC
196500	C30005478	BIG SKY HOLDINGS LLC	05S08E24DBAD	NO	WELL	239.00		191.00	18.00	5/31/2002	DOMESTIC
183947		HALL NORMAN	05S08E24DBCA	NO	WELL	239.00		187.00	15.00	7/25/2000	DOMESTIC
212476		DILMORE VINCE AND TARA	05S08E24DC	NO	WELL	241.00		190.00	20.00	6/28/2001	DOMESTIC
175958		TUBRE TERRY	05S08E25	NO	WELL	278.50		209.00		5/4/1999	DOMESTIC
192472		HOLLAND GARY	05S08E25AB	NO	WELL	258.00		195.00	20.00	6/26/2001	DOMESTIC
187187		LANEY HARRY E. OR JODI E.	05S08E25AB	NO	WELL	238.50		200.00	15.00	6/26/1997	DOMESTIC
102487		TAYLOR ROBERT E. AND URMA O.	05S08E25AB	NO	WELL	202.00	4.00	40.00		1/1/1938	COMMERCIA
160120	PRAY MONITORING WELL	MONTANA CUSTOM HOMES *WELL #1	05S08E25ABA	NO	WELL	219.00	189.00	180.00	50.00	1/28/1997	DOMESTIC
160122		MONTANA CUSTOM HOMES *WELL #2	05S08E25ACA	NO	WELL	259.00	207.00	180.00	50.00	1/31/1997	DOMESTIC
183891		TAYLOR JACK	05S08E25ADDA	YES	WELL	287.00					DOMESTIC
222606		STANDISH CHAD	05S08E25BBA	NO	WELL	240.00		151.00	60.00	9/30/2005	DOMESTIC
153652	C096630-00	STANDISH CHAD	05S08E25BC	NO	WELL	149.00	127.00	125.00	10.00	6/3/1995	DOMESTIC
102488		ROMEY BLAKE	05S08E25BCC	NO	WELL	158.00	108.00	102.00	20.00	4/11/1983	DOMESTIC
159752		ROMEY BLAKE & CATHY	05S08E25BCC	NO	WELL	168.00	134.00	124.00	12.00	9/28/1996	DOMESTIC
102489	C020122-00	MORRIS PATTY	05S08E25BDA	NO	WELL	225.00	205.00	193.00	10.00	7/27/1993	DOMESTIC
195465		MILLER AMY AND STANDISH CORDELL	05S08E25BDBD	NO	WELL	238.00		195.00	10.00	3/4/2002	DOMESTIC
102486	C060785-00	STANDISH CHAD AND MORLEY PAT	05S08E25BDBD	YES	WELL	220.00	218.00	155.00	16.00	12/6/1985	DOMESTIC
208396		TERRY HOMER	05S08E25BDC	NO	WELL	240.00		190.00	15.00	12/2/2003	DOMESTIC
102490		PIRTZ RICHARD	05S08E25CA	NO	WELL	200.00		40.00	45.00	1/1/1947	DOMESTIC
221578	YRRTEST well 1	YELLOWSTONE RIVER RANCH, LLC *TEST WELL 1	05S08E26CAAD	NO	WELL	300.00		196.00	50.00	5/23/2005	TEST WELL
36914	C007471-00 STONEHOUSE	WEETER BRUCE AND DIANE	05S08E26DBB	NO	WELL	192.00	184.00	157.00	15.00	8/2/1974	DOMESTIC
175964	C110124-00	MCCULLEY MARK	05S08E35ADAD	YES	WELL	240.00		190.00	35.00	10/29/1999	DOMESTIC

196503	HERMANN MATT	05S08E35ADCD	NO	WELL	259.00		185.00	25.00	6/10/2002	DOMESTIC
153663	PERKY SCOTT	05S08E35DAC	NO	WELL	280.00	280.00	203.00	35.00	6/1/1995	DOMESTIC
150163	TRAINER HANDELL LESLIE	05S08E35DDA	NO	WELL	280.00	280.00	220.00	30.00	4/29/1995	DOMESTIC

End of Report.
101 record(s) listed.

This report is restricted to site types of **WELL**, **BOREHOLE**, **SPRING**, and **COAL BED METHANE WELL**.

Explanation of Columns:
PDF = Is a scanned version of the well log available in PDF format?

- = Yes
- = No, well was submitted electronically. No paper record exists.

Td = Total depth of well in feet below ground
Pwl = Pumping water level in feet below ground
Swl = Static water level in feet above/below ground - Negative values are reported for water levels that are above land surface.
Yield = Yield in gallons per minute
Date = Completion date of well/borehole
Use = Reported use of water
Ver? = Was location verified?

Yellowstone River Ranch Estates Major Subdivision

Pray Area Subdivision Roads 24 ft wide x 1000 ft (unit length)

REQUIRED STORMWATER DETENTION VOLUME:

RELATIVE IMPERVIOUSNESS FACTORS:		**(C Range)**	**(C Used)**
PAVED AREAS/STRUCTURES	=	(0.8-0.9)	0.9
GRAVELED AREAS	=	(0.35-0.8)	0.8
UNIMPROVED RANGELAND	=	(0.15-0.4)	0.3
LANDSCAPED (lawn, shurbs,trees)	=	(0.1-0.3)	0.1

2 YEAR -1HOUR STORM EVENT: **i** **0.40** in\hr **(Input Site Rainfall Intensity 2-yr 1-hr**
T 3600 sec/hr **for Livingston, Montana)**

		NEW SITE LAYOUT		**EXISTING SITE LAYOUT**	
AREAS:		**AREA (Ft2)**		**AREA (Ft2)**	
TOTAL AREA OF WATERSHED	=	**28,000** sq. ft.	0.64 acres		
		Input Only		**Input Only**	
PAVED AREAS/STRUCTURES	=	**0.00** sq. ft.	0.00 acres	**0.00** sq. ft.	0.00 acres
GRAVELED AREAS	=	**28,000.00** sq. ft.	0.64 acres	**0.00** sq. ft.	0.00 acres
UNIMPROVED	=	**0.00** sq. ft.	0.00 acres	**28,000** sq. ft.	0.64 acres
LANDSCAPED	=	**0.00** sq. ft.	0.00 acres	**0.00** sq. ft.	0.00 acres
TOTAL	=	**28,000** sq. ft.	0.64 acres	**28,000** sq. ft.	0.64 acres

VOLUMES REQUIRED: Volume of runoff = (C*I*A)*T
Total Volume Difference = New Volume - Existing Volume

PAVED AREAS/STRUCTURES	=	0.00 C.F.	0.00 C.Y.	0.00 C.F.	0.00 C.Y.
GRAVELED AREAS	=	740.49 C.F.	27.43 C.Y.	0.00 C.F.	0.00 C.Y.
UNIMPROVED	=	0.00 C.F.	0.00 C.Y.	277.68 C.F.	10.28 C.Y.
LANDSCAPED	=	0.00 C.F.	0.00 C.Y.	0.00 C.F.	0.00 C.Y.
TOTAL VOLUME	=	740.49 C.F.	27.43 C.Y.	277.68 C.F.	10.28 C.Y.
FLOW IN C.F.S.	=	0.21 C.F.S.		0.08 C.F.S.	

TOTAL VOLUME DIFFERENCE	=	**463 C.F.**	**17 C.Y.**
TOTAL FLOW IN C.F.S.	=	0.13 C.F.S.	

Yellowstone River Ranch Estates Major Subdivision

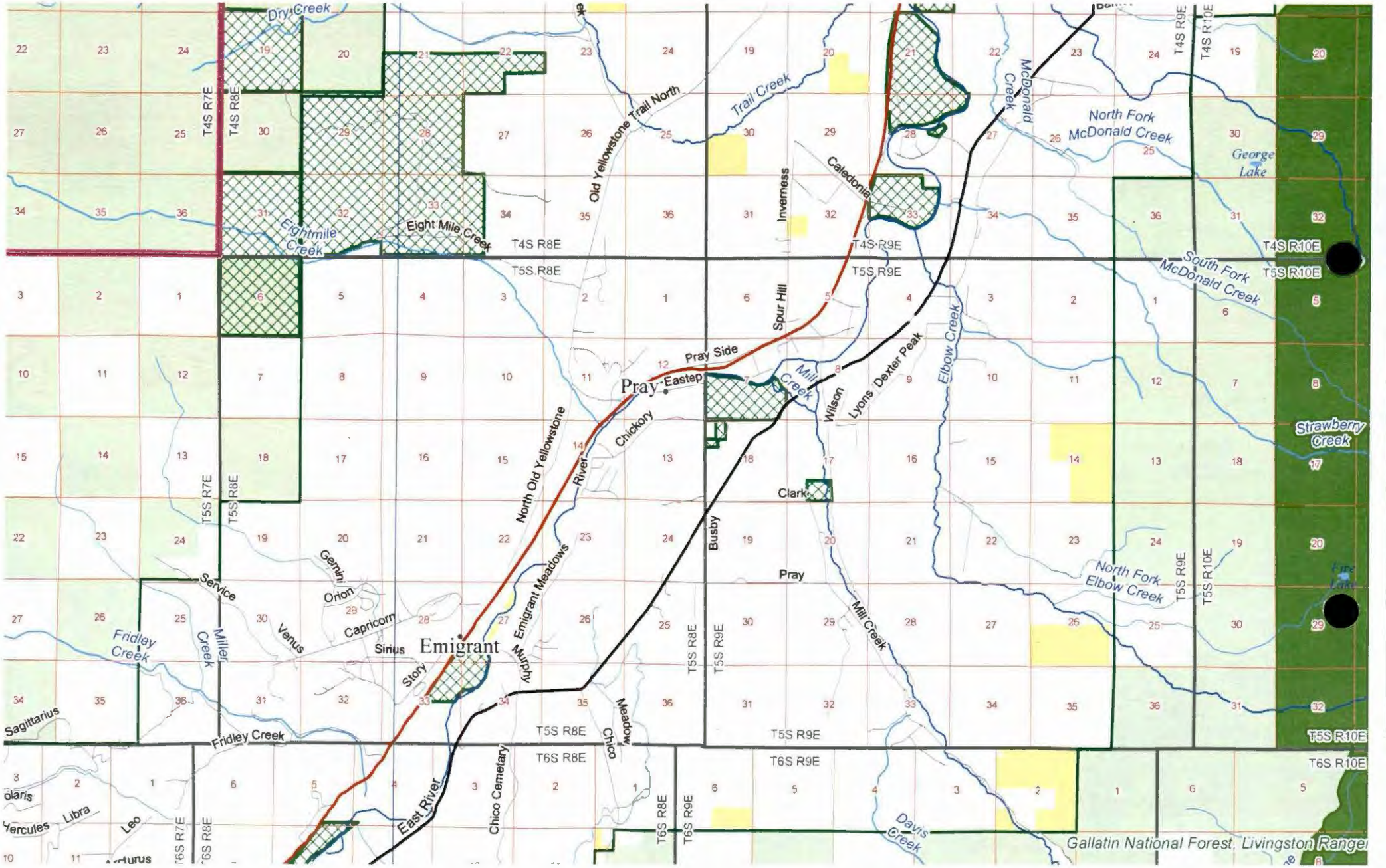
Pray Area Single Family Home on 5 Acres

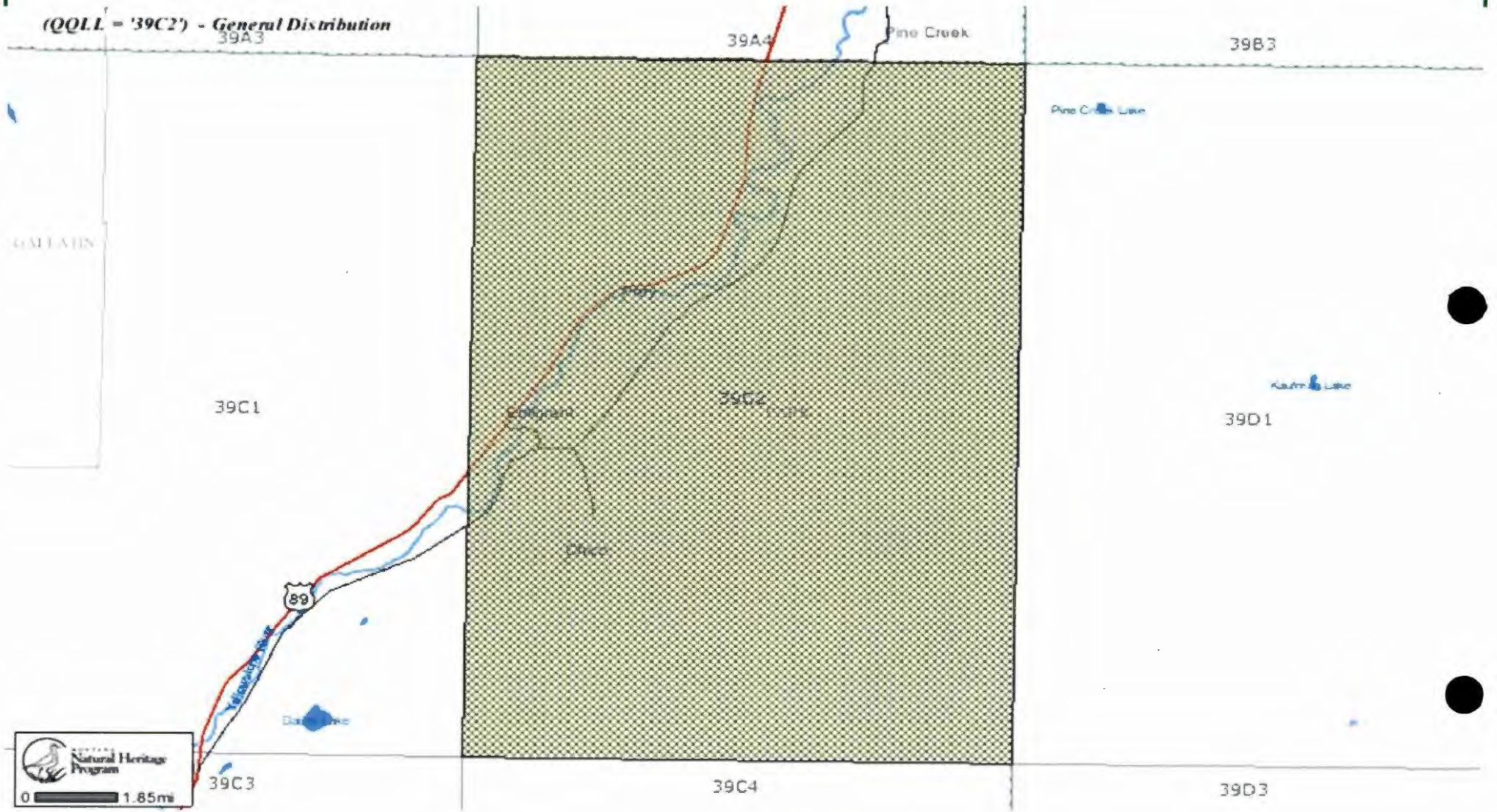
REQUIRED STORMWATER DETENTION VOLUME:

RELATIVE IMPERVIOUSNESS FACTORS:		**(C Range)**	**(C Used)**
PAVED AREAS/STRUCTURES	=	(0.8-0.9)	0.9
GRAVELED AREAS	=	(0.35-0.8)	0.8
UNIMPROVED RANGELAND	=	(0.15-0.4)	0.3
LANDSCAPED (lawn, shurbs,trees)	=	(0.1-0.3)	0.1

2 YEAR -1HOUR STORM EVENT: **i** **0.40** in\hr **(Input Site Rainfall Intensity 2-yr 1-hr**
T 3600 sec/hr **for Livingston, Montana)**

		NEW SITE LAYOUT		**EXISTING SITE LAYOUT**	
AREAS:		**AREA (Ft2)**		**AREA (Ft2)**	
TOTAL AREA OF WATERSHED	=	**217,800** sq. ft.	5.00 acres		
		Input Only		**Input Only**	
PAVED AREAS/STRUCTURES	=	**4,500.00** sq. ft.	0.10 acres	**0.00** sq. ft.	0.00 acres
GRAVELED AREAS	=	**5,000.00** sq. ft.	0.11 acres	**0.00** sq. ft.	0.00 acres
UNIMPROVED	=	**198,300.00** sq. ft.	4.55 acres	**217,800** sq. ft.	5.00 acres
LANDSCAPED	=	**10,000.00** sq. ft.	0.23 acres	**0.00** sq. ft.	0.00 acres
TOTAL	=	**217,800** sq. ft.	5.00 acres	**217,800** sq. ft.	5.00 acres
VOLUMES REQUIRED:		Volume of runoff = (C*I*A)*T			
		Total Volume Difference = New Volume - Existing Volume			
PAVED AREAS/STRUCTURES	=	133.88 C.F.	4.96 C.Y.	0.00 C.F.	0.00 C.Y.
GRAVELED AREAS	=	132.23 C.F.	4.90 C.Y.	0.00 C.F.	0.00 C.Y.
UNIMPROVED	=	1966.60 C.F.	72.84 C.Y.	2159.99 C.F.	80.00 C.Y.
LANDSCAPED	=	33.06 C.F.	1.22 C.Y.	0.00 C.F.	0.00 C.Y.
TOTAL VOLUME	=	2265.78 C.F.	83.92 C.Y.	2159.99 C.F.	80.00 C.Y.
FLOW IN C.F.S.	=	0.63 C.F.S.		0.60 C.F.S.	
TOTAL VOLUME DIFFERENCE	=	**106 C.F.**	**4 C.Y.**		
TOTAL FLOW IN C.F.S.	=	0.03 C.F.S.			


Dry Creek
T4S R7E
T4S R8E
T4S R9E
T4S R10E
Old Yellowstone Trail North
Trail Creek
McDonald Creek
North Fork McDonald Creek
George Lake
Eightmile Creek
Eight Mile Creek
Inverness
Caledonia
T5S R8E
T5S R9E
T5S R10E
South Fork McDonald Creek
Spur Hill
Pray Side
Pray-Eastep
Mill Creek
Wilson
Lyons
Dexter Peak
Elbow Creek
Strawberry Creek
Chickory
North Old Yellowstone
River
Clark
Busby
Pray
Gemini
Orion
Service
Capricorn
Venus
Sirius
Emigrant
Emigrant Meadows
Murphy
Story
Fridley Creek
Miller Creek
Sagittarius
Meadow
Chico
T6S R8E
T6S R9E
T6S R10E
East River
Chico Cemetary
Olaris
Hercules
Libra
Leo
Arcturus
Davis Creek
North Fork Elbow Creek
Gallatin National Forest, Livingston Ranger



Expand All Collapse All

(QQLL = '39C2') - General Distribution

- Charts and Graphs
- Species List
- Observation Details
- Other Visible Map Layers

Plant Species of Concern

Species List Last Updated **04/22/2011**

4 Species of Concern

Filtered by the following criteria:

Heritage State Rank = S1, S2

QQLL = 39C2

MONTANA Natural Heritage Program

A program of the University of Montana and Natural Resource Information Systems, Montana State Library

Introduction

The Montana Natural Heritage Program (MTNHP) serves as the state's information source for Species of Concern (SOC) -- plants and animals that are rare, threatened, and/or have declining populations and as a result are at risk or potentially at risk of extirpation in Montana. This report is based on information gathered from field inventories, publications, reports, herbaria specimens, and the knowledge of botanists and other taxonomic experts. Taxa in the SOC category generally include all vascular plant taxa ranked S1, S2, S3 or SH. Nonvascular taxa (bryophytes and lichens) which are not as well documented or studied as vascular plant taxa in the state, are listed as SOC using similar criteria as vascular taxa but are more strictly limited to those taxa which are believed to be the rarest or most vulnerable to extirpation based on current information.

Designation as a Species of Concern is not a statutory or regulatory classification. Instead, these designations provide a basis for resource managers and decision-makers to make proactive decisions regarding species conservation and data collection priorities in order to maintain viable populations and avoid extirpation of species from the state. MTNHP may designate additional taxa as Potential Species of Concern (PSOC). Taxa in this designation include species or subspecies which may be rare, have a restricted range in the state or are otherwise vulnerable to extirpation in at least part of their range but otherwise do not meet the criteria for inclusion as a SOC. An additional designation of Status Under Review is used for those taxa for which additional information is needed to accurately assign a status rank or for which conflicting information exists. Taxa designated as Status Under Review are not included in this document but can be found in the on-line **Fieldguide (http://fieldguide.mt.gov/)**.

This web-based report, which replaces the 2006 Plant Species of Concern publication, identifies vascular plant Species of Concern (SOC), bryophyte SOC and lichen SOC in Montana. The MTNHP continuously reviews and updates status ranks as new information and data become available through field surveys, research, and submitted observations. Status ranks and information supporting them are reviewed by botanists and resource specialists. If you wish to comment or contribute information to this process please contact the MTNHP Botanist. The information we receive from botanists and others throughout the state is essential in this process, and contributes to more accurate assessments of species' status. We continue to ask that all observations for SOC, PSOC and Review Status plants be reported to the Heritage Program. A copy of the field survey form specifying the information that should be submitted is available on our **website (http://mtnhp.org/)**.

Information concerning plant species contained on the SOC, PSOC or Review lists may be viewed on the MTNHP's on-line Montana Plant Field Guide. The Field Guide provides information for vascular and non-vascular plants, including species' characteristics, identification, habitat, distribution, state rank reasons and references, as well as technical illustrations and photographs of the plants and their habitats. For each species, a link to the NatureServe website (http://www.natureserve.org/) provides access to information on the status of the species throughout North America, assembled from state and provincial Natural Heritage databases. Information in the Montana Field Guide is continuously updated and expanded, so please check it often for current species' information. If you have questions concerning the field guide or find errors or omissions please contact the MTNHP.

Status lists of SOC plants may be queried on-line by county and/or township; taxonomic group or one of several rank/status criteria. More detailed information or additional assistance can be requested from MTNHP using the Information Request function on our website, or by phone, e-mail or mail.

How to Read the Lists

The SOC list is organized alphabetically by scientific name (Genus and specific epithet followed by subspecific epithet if any) within the major groups of Vascular Plants, Bryophytes (Mosses and Liverworts) and Lichens. Vascular plants are further sorted by the subgroups: Ferns and Fern Allies, Gymnosperms (if any), Flowering Plants-Dicots and Flowering Plants-Monocots. The list can also be sorted alphabetically by the common name. Additional scientific names as well as the Family name are included in adjacent columns for each species. The nomenclature and taxonomy for many groups of plants continues to change as new research is conducted and published, and as a result no one nomenclatural reference is followed. Publications and web resources which are most relevant to Montana plants include Vascular Plants of Montana (Dorn 1984), NatureServe Explorer, The USDA PLANTS database, Flora of North America (1993-), Grasses of Montana (Lavin and Seibert 2011) and Flora of the Pacific Northwest (Hitchcock and Cronquist 1973). Additionally, an abundance of scientific literature pertinent to Montana plants is available and indispensable in the process of determining the nomenclature and taxonomic concepts used in this report.

Species that have been added to or deleted from the SOC list due to changes in their global or state rank are reported in separate sections below. These changes are also reflected in the date displayed at the top of the report which shows when an addition or deletion to the list last occurred.

County Distribution

Montana counties of record are listed alphabetically with each species. County records of occurrence are determined directly from mapped species occurrences (SO's) in MTNHP databases. A record of occurrence for a particular county may be based on a historical observation which may no longer be extant. Additionally, some plant observations with vague locality information are not mapped in MTNHP databases and as result would not be included in the county distribution for that particular species.

Heritage Program Ranks

The international network of Natural Heritage Programs employs a standardized ranking system to denote **global** (range-wide) and **state** status (NatureServe 2006). Species are assigned numeric ranks ranging from 1 (highest risk, greatest concern) to 5 (demonstrably secure, least concern), reflecting the relative degree of risk to the species' viability, based upon available information. Global ranks are assigned by biologists at NatureServe (the international affiliate organization for the heritage network) in consultation with biologists in the natural heritage programs and other taxonomic experts, or by the MTNHP Botanist, who has the responsibility for reviewing and assigning global ranks for approximately 50 plant species that are either endemic to Montana or in which a large portion of the species' global range or population is within the state.

A number of factors are considered in assigning state ranks — the number, size and quality of known occurrences or populations, distribution, trends (if known), life history traits, habitat specificity, and definable threats. The process of assigning state ranks for each taxon relies heavily on factors of abundance (# of occurrences, population size and area of occupancy), viability of occurrences, threats to viability and trends in population size. The "State Rank Reason" field in the *Montana Field Guide* provides additional information on the reasons for a particular species' rank. The ranking process being used by MTNHP for plant species relies heavily on IUCN (2001) methodology and NatureServe/Heritage Network methodology presented in Master et al (2009), Faber-Langendoen et al (2009) and previously in Regan, Master and Hammerson (2004).

Rank definitions given below reflect some changes in terminology from that used by NatureServe. However, the meaning and criteria for ranks remain unchanged, to maintain consistency with international standards.

Rank		Definition
G1	**S1**	At very high risk of extinction or extirpation in the state due to **extremely limited** and/or **rapidly declining** population numbers, range and/or habitat. or extirpation in the state.
G2	**S2**	At high risk of extinction or extirpation in the state due to **very limited** and/or **declining** population numbers, range and/or habitat. or extirpation in the state.
G3	**S3**	At risk of extinction or extirpation in the state due to **limited** and/or **declining** numbers, range and/or habitat, even though it may be abundant in some areas.
G4	**S4**	Apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining.
G5	**S5**	Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range.
GX	**SX**	Presumed Extinct or Extirpated - Species is believed to be extinct throughout its range or extirpated in Montana. Not located despite intensive searches of historical sites and other appropriate habitat, and small likelihood that it will ever be rediscovered.
GH	**SH**	Historical, known only from records usually 40 or more years old; may be rediscovered.
GNR	**SNR**	Not Ranked as of yet.
GU	**SU**	Unrankable - Species currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
GNA	**SNA**	A conservation status rank is not applicable for one of the following reasons: 1) The taxa is of Hybrid Origin; is Exotic or Introduced; is Accidental or 2) is Not Confidently Present in the state. (see other codes below)

Combination or Range Ranks

G#G# or **S#S#** Indicates a range of uncertainty about the status of the species.
e.g. G1G3 = Global Rank ranges between G1 and G3 inclusive

Sub-rank

T# Rank of a subspecies or variety. Appended to the global rank of the full species, *e.g. G4T3*

Qualifiers

Q **Questionable** taxonomy that may reduce conservation priority-Distinctiveness of this entity as a taxon at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority (numerically higher) conservation status rank. Appended to the global rank, *e.g. G3Q*

? **Inexact Numeric Rank** - Denotes uncertainty; inexactness.

Federal Status

Designations in these columns reflect the status of a species under the U.S. Endangered Species Act (ESA), or as "sensitive" by the U.S. Forest Service (USFS) or the Bureau of Land Management (BLM).

U.S. Fish and Wildlife Service (Endangered Species Act)

Status, if any of a taxon under the federal Endangered Species Act of 1973 (16 U.S.C.A. § 1531-1543 (Supp. 1996)) is noted. Regulatory aspects of the Endangered Species Act affect plants only when they occur on federal lands or may be affected by federal actions. Currently, 3 plants in Montana have designations under the U.S. Endangered Species Act.

Designation Descriptions

LE	**Listed endangered:** Any species in danger of extinction throughout all or a significant portion of its range (16 U.S.C. 1532(6)).
LT	**Listed threatened:** Any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (16 U.S.C. 1532(20)).
PE	**Proposed endangered:** Any species for which a proposed rule to list the species as endangered has been published in the Federal Register.
PT	**Proposed threatened:** Any species for which a proposed rule to list the species as threatened has been published in the Federal Register.
E(S/A) or **T(S/A)**	Any species listed endangered or threatened because of similarity of appearance.
C	**Candidate:** Those taxa for which sufficient information on biological status and threats exists to propose to list them as threatened or endangered. We encourage their consideration in environmental planning and partnerships; however, none of the substantive or procedural provisions of the Act apply to candidate species.
PDL	**Proposed for delisting** - Typically combined with another designation code, where a species has one status currently, but a more recent proposal has been made to change that status with no final action yet published. For example, "**LE, PDL**" indicates that the species is currently listed as endangered, but has been proposed for delisting.
DM	**Recovered, delisted, and being monitored** - Any previously listed species that is now recovered, has been delisted, and is being monitored.

Bureau of Land Management

BLM Sensitive Species are defined by the BLM 6840 Manual as those that normally occur on Bureau administered lands for which BLM has the capability to significantly affect the conservation status of the species through management. The State Director may designate additional categories of special status species as appropriate and applicable to his or her state's needs. The sensitive species designation, for species other than federally listed, proposed, or candidate species, may include such native species as those that:

1. could become endangered in or extirpated from a state, or within a significant portion of its distribution in the foreseeable future,
2. are under status review by FWS and/or NMFS,
3. are undergoing significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution,
4. are undergoing significant current or predicted downward trends in population or density such that federally listed, proposed, candidate, or State listed status may become necessary,
5. have typically small and widely dispersed populations,
6. are inhabiting ecological refugia, specialized or unique habitats, or
7. are State listed but which may be better conserved through application of BLM sensitive species status. Such species should be managed to the level of protection required by State laws or under the BLM policy for candidate species, whichever would provide better opportunity for its conservation.

Designation Descriptions

Sensitive	Denotes species listed as sensitive on BLM lands
Special Status	Denotes species that are listed as Endangered or Threatened under the Endangered Species Act

U.S. Forest Service

U.S. Forest Service Manual (2670.22) defines Sensitive Species on Forest Service lands as those for which population viability is a concern as evidenced by a significant downward trend in population or a significant downward trend in habitat capacity. The Regional Forester (Northern Region) designates Sensitive species on National Forests in Montana. These designations were last updated in 2007 and they apply only on USFS-administered lands.

Designation Descriptions

Endangered	Listed as Endangered (LE) under the U.S. Endangered Species Act.
Threatened	Listed as Threatened (LT) under the U.S. Endangered Species Act.
Sensitive	Listed as a Sensitive Species by USFS Northern Region (R1).

Acknowledgements

We would like to gratefully acknowledge the many people who contributed information on plant species' occurrences and distribution throughout Montana over the years -- those contributions are the building blocks of the MTNHP databases and this publication. We encourage you to continue submitting data for SOC, PSOC and Under Review taxa so that status ranks and this document are as accurate and comprehensive as possible.

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Species of Concern
4 Species
Filtered by the following criteria:
Heritage State Rank = S1, S2
QQLL = 39C2

FLOWERING PLANTS - DICOTS (MAGNOLIOPSIDA)

3 SPECIES
FILTERED BY THE FOLLOWING CRITERIA:
HERITAGE STATE RANK = S1, S2
QQLL = 39C2

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Atriplex truncata Wedge-leaved Saltbush		**Amaranthaceae** Amaranth (Pigweed) Family	G5	S1				3	Wetland/Riparian
			Species verified in these Counties: Beaverhead, Deer Lodge, Jefferson, Lake, Lewis and Clark, Park **State Rank Reason:** Known from two extent occurrences; one in the Centennial Valley and the other near Warm Springs. Also, known historically from four collections in the western half of the state.						
Erigeron formosissimus Beautiful Fleabane		**Asteraceae** Aster / Sunflowers	G5	S1S3					Meadows (Montane/subalpine)
			Species verified in these Counties: Madison, Park **State Rank Reason:** Species has been documented for southern Montana from a few collections. Additional data are needed for this species to more precisely determine its conservation status and need.						
Polygonum austiniae Austin's Knotweed	**Polygonum douglasii ssp. austiniae**	**Polygonaceae** Buckwheat Family	G5T4	S2S3		SENSITIVE	SENSITIVE	2	Rock/Talus
			Species verified in these Counties: Broadwater, Flathead, Glacier, Granite, Lewis and Clark, Madison, Meagher, Park, Pondera, Powell, Teton **State Rank Reason:** This annual knotweed is sparsely distributed in mountainous areas of Montana from the Rocky Mountain Front to the Madison and Gallatin Ranges. Sites are usually on open, gravelly, sparsely-vegetated slopes with shale-derived soils and as such are not generally impacted by human activity. Some sites however, are along forest roads and are susceptible to weed invasion and other disturbances. The probability of finding additional occurrences appears to be good since large areas of suitable habitat across western and central Montana remain unsurveyed for the species. Threats: Low Short- and Long-Term Trends: Unknown though Probably Stable. Intrinsic Vulnerability: Low						

FLOWERING PLANTS - MONOCOTS (LILIOPSIDA)

1 SPECIES
FILTERED BY THE FOLLOWING CRITERIA:
HERITAGE STATE RANK = S1, S2
QQLL = 39C2

SCIENTIFIC NAME COMMON NAME TAXA SORT	OTHER NAMES	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	MNPS THREAT CATEGORY	HABITAT
Carex multicostata Many-ribbed Sedge		**Cyperaceae** Sedges	G5	S2S3					Grasslands (Montane)
			Species verified in these Counties: Beaverhead, Gallatin, Park **State Rank Reason:** A rare species in Montana, scattered in the mountains of the southwest and south-central portions of the state. Very little data are available for the species in Montana. However, the potential for negative impacts to the popoulations appears to be low.						

Animal Species of Concern

Species List Last Updated **05/05/2011**

3 Species of Concern
Filtered by the following criteria:
Heritage State Rank = S1, S2
QQLL = 39C2

MONTANA Natural Heritage Program

A program of the University of Montana and Natural Resource Information Systems, Montana State Library

Introduction

The Montana Natural Heritage Program (MTNHP) serves as the state's information source for animals, plants, and plant communities with a focus on species and communities that are rare, threatened, and/or have declining trends and as a result are at risk or potentially at risk of extirpation in Montana. This report on **Montana Animal Species of Concern** is produced jointly by the Montana Natural Heritage Program (MTNHP) and Montana Department of Fish, Wildlife, and Parks (MFWP). Montana Animal Species of Concern are native Montana animals that are considered to be "at risk" due to declining population trends, threats to their habitats, and/or restricted distribution. Also included in this report are **Potential Animal Species of Concern** -- animals for which current, often limited, information suggests potential vulnerability or for which additional data are needed before an accurate status assessment can be made. Over the last 200 years, 5 species with historic breeding ranges in Montana have been extirpated from the state; Woodland Caribou (*Rangifer tarandus*), Greater Prairie-Chicken (*Tympanuchus cupido*), Passenger Pigeon (*Ectopistes migratorius*), Pilose Crayfish (*Pacifastacus gambelii*), and Rocky Mountain Locust (*Melanoplus spretus*). Designation as a Montana Animal Species of Concern or Potential Animal Species of Concern is not a statutory or regulatory classification. Instead, these designations provide a basis for resource managers and decision-makers to make proactive decisions regarding species conservation and data collection priorities in order to avoid additional extirpations.

Status determinations are made by MTNHP and MFWP biolgists in consultation with representatives of the Montana Chapter of the Wildlife Society, the Montana Chapter of the American Fisheries Society, and other experts. The process for evaluating and assigning status designations uses the Natural Heritage Program ranking system, described below, which forms the basis for identifying Montana Species of Concern.

How to Read the Lists

What Species are Included in this Report

Montana Species of Concern are defined as vertebrate animals with a state rank of S1, S2, or S3. Vertebrate species with a rank indicating uncertainty (SU), a "range rank" extending below the S3 cutoff (e.g., S3S4), or those ranked S4 for which their is limited baseline information on status are considered Potential Species of Concern. Because documentation for invertebrates is typically less complete than for vertebrates, only those ranked S1 or S2 are included as SOC. Invertebrates with a range rank extending below S2 (e.g., S2S3) are included as SOC only if their global ranks are G2G3 or G3, or if experts agree their occurrence in Montana has been adequately documented. Other invertebrates of concern with global ranks other than G1, G2, or G3 and with state ranks below S2 or range ranks extending below S2 (e.g., S3S4) are treated as Potential Species of Concern.

Organization of List

Both the list of Species of Concern and the list of Potential Species of Concern are grouped taxonomically in the following order: mammals, birds, reptiles, amphibians, fish, and various invertebrates. Within each taxonomic group you can sort species by common name or scientific name.

County Distribution

This column lists the documented county distribution for each species, including extant and historical occurrences. Any occurrences that cross county boundaries are counted for each county. Many older occurrence records and specimen collections are only known from vague location information and the area mapped as the potential area of observation may be quite large, leading to more than one county being counted.

Additions and Deletions

Species that have been added to or deleted from the SOC list due to changes in their state rank are reported in separate sections below; changes in global ranks are not tracked in this report.

Heritage Program Ranks

The international network of Natural Heritage Programs employs a standardized ranking system to denote **global** (range-wide) and **state** status (NatureServe 2006). Species are assigned numeric ranks ranging from 1 (highest risk, greatest concern) to 5 (demonstrably secure, least concern), reflecting the relative degree of risk to the species' viability, based upon available information. Global ranks are assigned by scientists at NatureServe (the international affiliate organization for the heritage network) in consultation with biologists in the natural heritage programs and other taxonomic experts.

A number of factors are considered in assigning state ranks — population size, area of occupancy in Montana, short and long-term population trends, threats, intrinsic vulnerability, and specificity to environment. Based on these factors, a preliminary rank is calculated and is reviewed by members of the Montana Chapter of the Wildlife Society and Montana Chapter of the American Fisheries Society or other key experts. A committee of biologists from MNHP and MFWP then review these rankings for consistent documentation and application of the criteria. Detailed documentation of the criteria and assessment process are available on the MTNHP website at: http://mtnhp.org/animal/2004_SOC_Criteria.pdf

Among other things, the combination of global and state ranks often helps describe the proportion of a species' range and/or total population occurring in Montana. For instance, a rank of G3 S3 often indicates that Montana comprises most or a very significant portion of an animal's total population. In contrast, an animal ranked G5 S1 often occurs in Montana at the periphery of its much larger range; thus, the state supports a relatively small portion of its total population.

Rank		Definition
G1	**S1**	At high risk because of **extremely limited** and/or **rapidly declining** population numbers, range and/or habitat, making it highly vulnerable to global extinction or extirpation in the state.
G2	**S2**	At risk because of **very limited** and/or **potentially declining** population numbers, range and/or habitat, making it vulnerable to global extinction or extirpation in the state.
G3	**S3**	Potentially at risk because of **limited** and/or **declining** numbers, range and/or habitat, even though it may be abundant in some areas.
G4	**S4**	Apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining.
G5	**S5**	Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range.
GX	**SX**	Presumed Extinct or Extirpated - Species is believed to be extinct throughout its range or extirpated in Montana. Not located despite intensive searches of historical sites and other appropriate habitat, and small likelihood that it will ever be rediscovered.
GH	**SH**	Historical, known only from records usually 40 or more years old; may be rediscovered.
GNR	**SNR**	Not Ranked as of yet.
GU	**SU**	Unrankable - Species currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
GNA	**SNA**	A conservation status rank is not applicable for one of the following reasons: 1) The taxa is of Hybrid Origin; is Exotic or Introduced; is Accidental or 2) is Not Confidently Present in the state. (see other codes below)

Combination or Range Ranks

G#G# or **S#S#** Indicates a range of uncertainty about the status of the species.
e.g. *G1G3 = Global Rank ranges between G1 and G3 inclusive*

Sub-rank

T# Rank of a subspecies or variety. Appended to the global rank of the full species, e.g. *G4T3*

Qualifiers

Q **Questionable** taxonomy that may reduce conservation priority-Distinctiveness of this entity as a taxon at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority (numerically higher) conservation status rank. Appended to the global rank, e.g. *G3Q*

? **Inexact Numeric Rank** - Denotes uncertainty; inexactness.

A **Accidental** - Species is accidental or casual in Montana, in other words, infrequent and outside usual range. Includes species (usually birds or butterflies) recorded once or only a few times at a location. A few of these species may have bred on the few occasions they were recorded.

B **Breeding** - Rank refers to the breeding population of the species in Montana. Appended to the state rank, e.g. *S2**B**,S5N = At risk during breeding season, but common in the winter*

N **Nonbreeding** - Rank refers to the non-breeding population of the species in Montana. Appended to the state rank, e.g. *S5B,S2**N** = Common during breeding season, but at risk in the winter*

M **Migratory** - Species occurs in Montana only during migration.

Federal Status

Designations in this column reflect the status of a species under the U.S. Endangered Species Act (ESA), or as "sensitive" by the U.S. Forest Service (USFS) or Bureau of Land Management (BLM).

U.S. Fish and Wildlife Service (Endangered Species Act)

Status, if any, of a taxon under the federal Endangered Species Act of 1973 (16 U.S.C.A. § 1531-1543 (Supp. 1996)) is noted.

Designation Descriptions

LE	**Listed endangered:** Any species in danger of extinction throughout all or a significant portion of its range (16 U.S.C. 1532(6)).
LT	**Listed threatened:** Any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (16 U.S.C. 1532(20)).
PE	**Proposed endangered:** Any species for which a proposed rule to list the species as endangered has been published in the Federal Register.
PT	**Proposed threatened:** Any species for which a proposed rule to list the species as threatened has been published in the Federal Register.
C	**Candidate:** Those taxa for which sufficient information on biological status and threats exists to propose to list them as threatened or endangered. We encourage their consideration in environmental planning and partnerships; however, none of the substantive or procedural provisions of the Act apply to candidate species.
DM	**Recovered, delisted, and being monitored** - Any previously listed species that is now recovered, has been delisted, and is being monitored.
NL	**Not listed** - No designation.
XE	**Experimental - Essential population** - An experimental population whose loss would be likely to appreciably reduce the likelihood of the survival of the species in the wild.
XN	**Experimental - Nonessential population** - An experimental population of a listed species reintroduced into a specific area that receives more flexible management under the Act.
CH	**Critical Habitat** - The specific areas (I) within the geographic area occupied by a species, at the time it is listed, on which are found those physical or biological features (I) essential to conserve the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by the species at the time it is listed upon determination that such areas are essential to conserve the species.
PS	**Partial status** - status in only a portion of the species' range. Typically indicated in a "full" species record where an infraspecific taxon or population, that has a record in the database has USESA status, but the entire species does not.
PS:value	**Partial status** - status in only a portion of the species' range. The value of that status appears in parentheses because the entity with status is not recognized as a valid taxon by Central Sciences (usually a population defined by geopolitical boundaries or defined administratively, such as experimental populations.) For example, Yellow-billed Cuckoo (*Coccyzus americanus*) is ranked **PS:C**. Partial Status - Candidate. Designated as a Candidate in the Western U.S. Distinct Population Segment (DPS) (subspecies *occidentalis*)

Bureau of Land Management

BLM Sensitive Species are defined by the BLM 6840 Manual as those that normally occur on BLM administered lands for which BLM has the capability to significantly affect the conservation status of the species through management. Such species should be managed to the level of protection required by State laws or under the BLM policy for candidate species, whichever would provide better opportunity for its conservation. The State Director may designate additional categories of special status species as appropriate and applicable to his or her state's needs. The sensitive species designation, for species other than federally listed, proposed, or candidate species, may include such native species as those that:

1. could become endangered in or extirpated from a state, or within a significant portion of its distribution in the foreseeable future.
2. are under status review by the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service,
3. are undergoing significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution,
4. are undergoing significant current or predicted downward trends in population or density such that federally listed, proposed, candidate, or State listed status may become necessary,
5. have typically small and widely dispersed populations,
6. are inhabiting ecological refugia, specialized or unique habitats, or
7. are State listed but which may be better conserved through application of BLM sensitive species status.

Designation Descriptions

Sensitive	Denotes species listed as sensitive on BLM lands
Special Status	Denotes species that are listed as Endangered or Threatened under the Endangered Species Act

U.S. Forest Service

U.S. Forest Service Manual (2670.22) defines Sensitive Species on Forest Service lands as those for which population viability is a concern as evidenced by a significant downward trend in population or a significant downward trend in habitat capacity. The Regional Forester (Northern Region) designates Sensitive species on National Forests in Montana. These designations were last updated in 2007 and they apply only on USFS-administered lands.

Designation Descriptions

Sensitive	Listed as a Sensitive Species by USFS Northern Region (R1)
Endangered	Listed as Endangered under the Endangered Species Act
Threatened	Listed as Threatened under the Endangered Species Act

Acknowledgements

MTNHP and MFWP staff work together on a daily basis to manage information used to evaluate the status of Montana's animal species. We extend our thanks to these individuals and professional biologists that study and work to conserve species across Montana. We also thank a number of private citizens that spend a great deal of their free time contributing valuable information to statewide databases so that species can be better understood and managed.

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Species of Concern
3 Species
Filtered by the following criteria:
Heritage State Rank = S1, S2
QQLL = 39C2

MAMMALS (MAMMALIA)

1 SPECIES
FILTERED BY THE FOLLOWING CRITERIA:
HERITAGE STATE RANK = S1, S2
QQLL = 39C2

SCIENTIFIC NAME COMMON NAME TAXA SORT	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	CFWCS TIER ID	% OF GLOBAL BREEDING RANGE IN MT	% OF MT THAT IS BREEDING RANGE	HABITAT
Ursus arctos Grizzly Bear	**Ursidae** Bears	G4	S2S3	LT,XN	THREATENED	SENSITIVE	1	1%	22%	Conifer forest
		Species verified in these Counties: Beaverhead, Carbon, Flathead, Gallatin, Glacier, Lake, Lewis and Clark, Lincoln, Madison, Missoula, Park, Pondera, Powell, Ravalli, Sanders, Stillwater, Sweet Grass, Teton								

FISH (ACTINOPTERYGII)

1 SPECIES
FILTERED BY THE FOLLOWING CRITERIA:
HERITAGE STATE RANK = S1, S2
QQLL = 39C2

SCIENTIFIC NAME COMMON NAME TAXA SORT	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	CFWCS TIER ID	% OF GLOBAL BREEDING RANGE IN MT	% OF MT THAT IS BREEDING RANGE	HABITAT
Oncorhynchus clarkii bouvieri Yellowstone Cutthroat Trout	**Salmonidae** Trout	G4T2	S2		SENSITIVE	SENSITIVE	1		12%	Mountain streams, rivers, lakes
		Species verified in these Counties: Beaverhead, Big Horn, Blaine, Carbon, Dawson, Deer Lodge, Flathead, Gallatin, Glacier, Granite, Hill, Jefferson, Judith Basin, Lake, Lewis and Clark, Madison, Meagher, Mineral, Missoula, Park, Pondera, Powell, Ravalli, Richland, Rosebud, Sanders, Silver Bow, Stillwater, Sweet Grass, Teton, Wheatland, Wibaux, Yellowstone								

INVERTEBRATES - MOLLUSKS

1 SPECIES
FILTERED BY THE FOLLOWING CRITERIA:
HERITAGE STATE RANK = S1, S2
QQLL = 39C2

SCIENTIFIC NAME COMMON NAME TAXA SORT	FAMILY (SCIENTIFIC) FAMILY (COMMON)	GLOBAL RANK	STATE RANK	USFWS	USFS	BLM	CFWCS TIER ID	% OF GLOBAL BREEDING RANGE IN MT	% OF MT THAT IS BREEDING RANGE	HABITAT
Oreohelix strigosa berryi Berry's Mountainsnail	**Oreohelicidae** Mountain Snails	G5T2	S1S2					67%	1%	Limestone talus
		Species verified in these Counties: Broadwater, Carbon, Fergus, Golden Valley, Meagher, Park								