

# MONTANA BUREAU OF MINES AND GEOLOGY

## Ground Water Investigation Program



In Montana, groundwater is essential for safe drinking water supplies and for economic growth. On average, approximately 272,000,000 gallons (835 acre-feet) are extracted from Montana's aquifers every day. In many areas of the State, groundwater is the only reliable year-round source of water for household use and for livestock. Groundwater is also widely used for irrigated agriculture and for lawns and gardens. In some settings, groundwater withdrawals could directly affect senior water-rights holders, stream flows, the availability of irrigation water, and the health of aquatic ecosystems. Efficient water management in these areas requires a well-founded understanding of the groundwater systems.

In 2009 the Montana State Legislature established the Ground Water Investigation Program (GWIP) within the Montana Bureau of Mines and Geology (MBMG) to conduct detailed groundwater investigations in specific areas with the most serious concerns. Over 40 projects have been nominated to date and prioritized by the Groundwater Steering Committee. Seven investigations were initiated in 2009. Five additional areas were selected to begin during 2011 and 2012. Each investigation is expected to take from 1 to 3 years to complete.

The results of each study will include a detailed report describing the hydrogeologic system of the area and a comprehensive set of data. These products are intended to provide a more detailed understanding of the groundwater system and tools which can then be used by regulators, senior water-rights holders, new water-rights applicants, and other stakeholders, to make informed water management decisions and to help anticipate hydrogeologic effects from changes in land use.

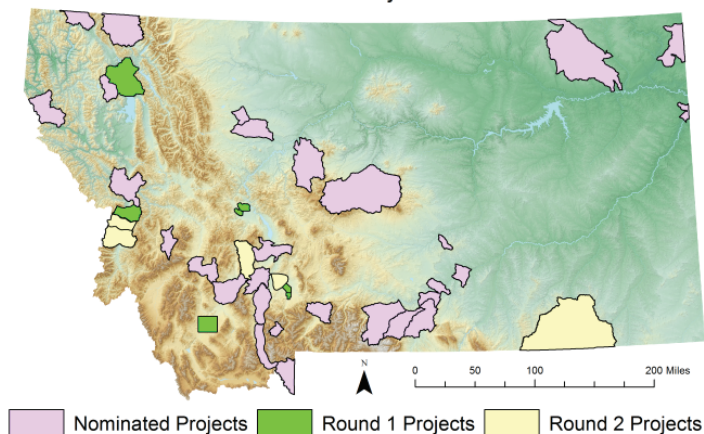
### Investigations Begun during 2009

- 1) **North Hills area, Helena**—Increased subdivision development in this area raises concerns about declining water levels, and the possibility of degraded water quality. (MBMG Open-File Report 610).
- 2) **Four Corners area, Gallatin County**—Conversion from irrigated agriculture to high-density residential land use has raised concerns about changes in water quality, water availability, and effects on surface water.
- 3) **Belgrade**—Increased development of shallow groundwater may lower the water table and impact surface water availability and quality.
- 4) **Lower Beaverhead River, Dillon**—The current increase in the number of high-volume irrigation wells has raised concerns regarding stream depletion and impacts to senior water-rights holders.
- 5) **Scratchgravel Hills, Helena**—Increased subdivision development is creating concerns about groundwater depletion and water-quality impacts.
- 6) **Florence**—Higher population density has increased the demand on the aquifer and raised the possibility of groundwater degradation.
- 7) **Flathead Valley Deep Confined Aquifer**—Increased groundwater utilization, and localized water-level declines, have raised concerns about the long-term sustainability of the aquifer and the possibility of degradation to groundwater and surface-water quality.

### Investigations Begun during 2012

- 1) **Stevensville**—The feasibility of using groundwater to supplement surface water for irrigation will be investigated.
- 2) **Boulder River Valley**—Groundwater availability for subdivision development and the potential to use the aquifer as a storage reservoir will be investigated.
- 3) **Hamilton**—Increasing population density may stress the aquifer and has raised the possibility of groundwater degradation.
- 4) **Manhattan**—Development of shallow groundwater may impact stream flow and water quality.
- 5) **Coalbed Methane (CBM)**—Development of CBM in the Powder River Basin has raised concerns regarding aquifer depletion and mobilization of salts.

GWIP Projects



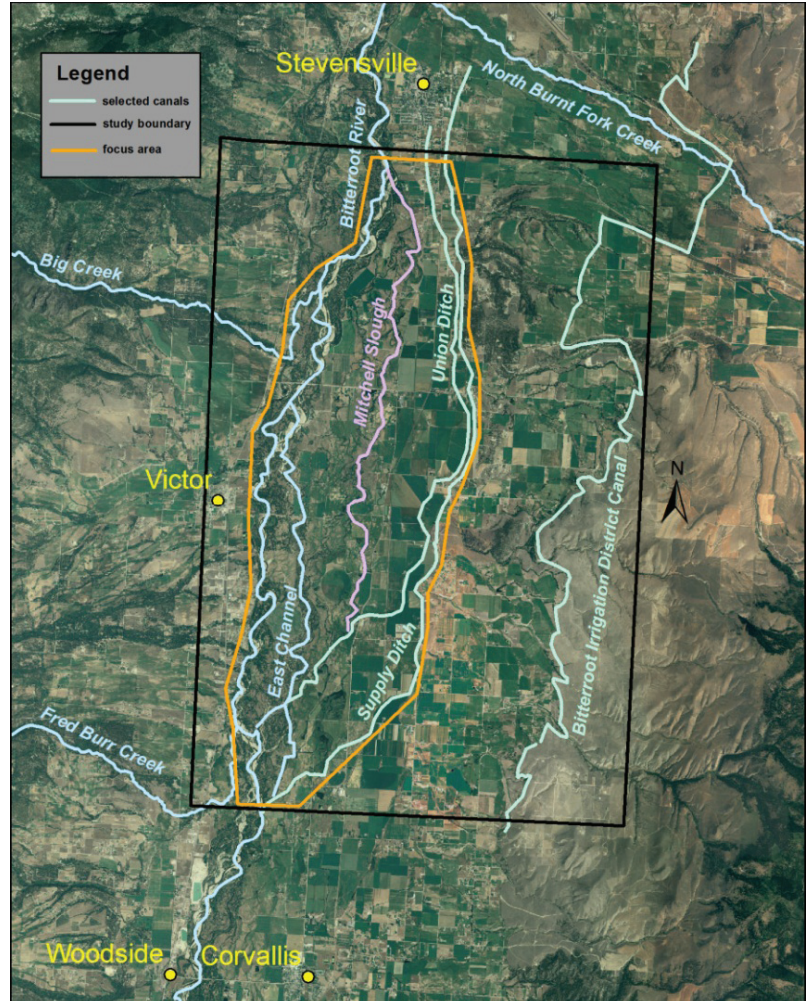


# GWIP PROJECT AREA: STEVENSVILLE SHALLOW AQUIFER INVESTIGATION, RAVALLI COUNTY

The Stevensville Shallow Aquifer Investigation area, located in the Bitterroot Valley, will address concerns raised by irrigators about the expense and practicality of maintaining current diversion and distribution. One option the irrigators may consider in the future is moving some water diversions from surface water to groundwater wells. This investigation will provide them with the information needed to consider this option. Six irrigation canals divert water from a reach of the Bitterroot River locally called the East Channel. Approximately 3,500 acres, including some of the most productive farmland in the Bitterroot Valley, are irrigated from this source. During the past several decades, irrigators have maintained flow into the channel by excavating a canal from the main Bitterroot River to the East Channel. Construction and regular maintenance of the canal is necessary because the main river channel is migrating westward, away from the canal intake. The canal is presently about 3,000 feet in length and is being extended each year. There is significant concern among irrigators that maintenance of the canal will not be technically or economically feasible in the near future.

The study will focus on the area lying between the Union Ditch and the main channel of the Bitterroot River beginning at the headgate and extending north (downstream) to near the town of Stevensville. Two large irrigation systems, the Supply and the Bitterroot Irrigation District, are located above the Union Ditch. This project will evaluate the scientific feasibility of using groundwater to supplement or replace irrigation water that is currently supplied by water diverted from the East Channel. Irrigation needs supplemented by groundwater may provide a more reliable source of irrigation water, particularly during droughts, and leave more surface water in the streams during periods when low flows are detrimental to fish and wildlife. A numerical groundwater model will be developed and used to evaluate various scenarios of groundwater use. This project is nearly ideal in terms of gaining a better understanding of groundwater—surface water interactions, a major goal of GWIP.

The products of this investigation will include an interpretive report and a groundwater flow model. These publicly available products will provide landowners and public agencies with scientific information to help make data-driven water management decisions about how proposed changes in irrigation activities may affect groundwater and surface water in the area.



Current MBMG personnel assigned to this project:

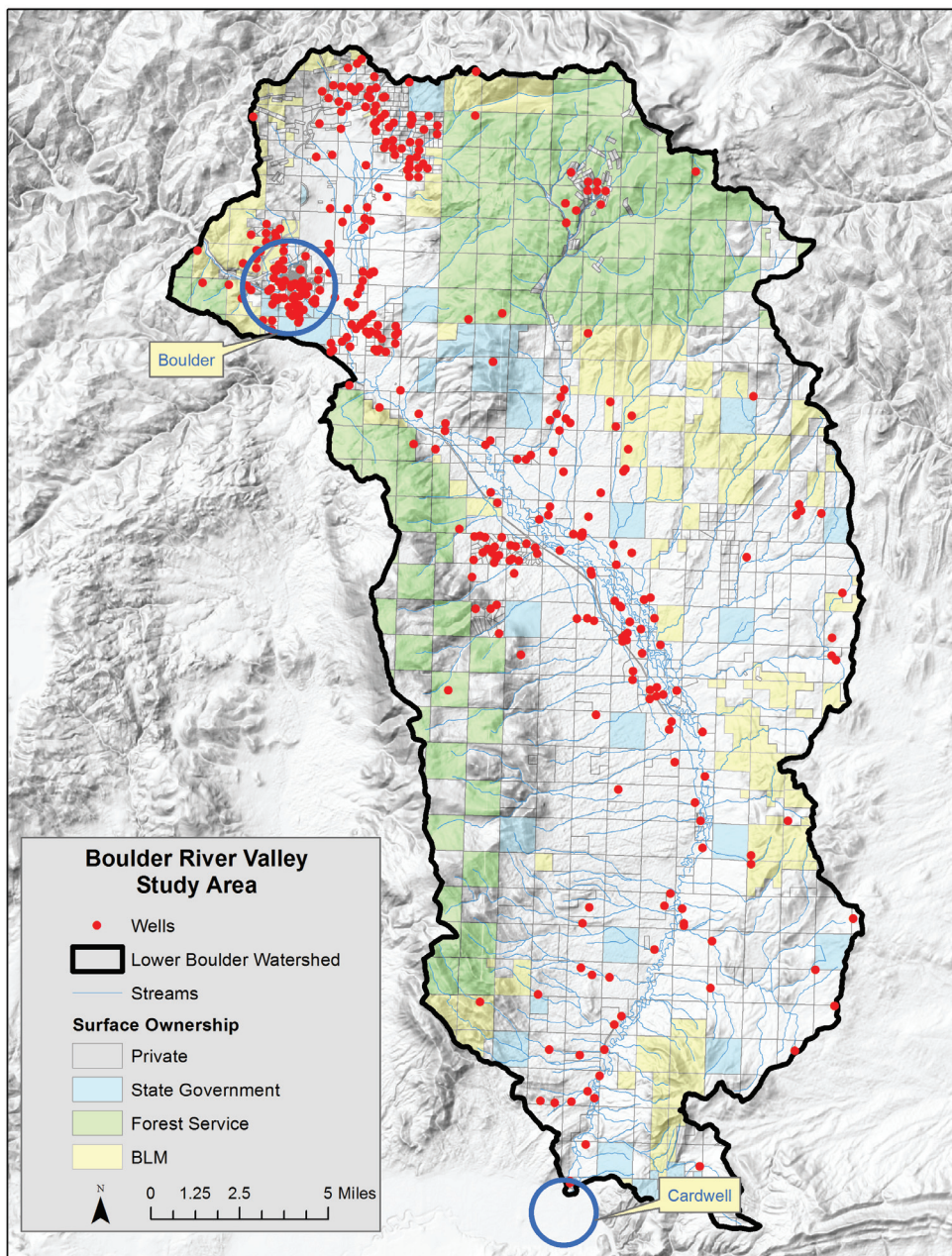
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# GWIP PROJECT AREA: BOULDER RIVER VALLEY



The MBMG Groundwater Investigations Program is conducting a groundwater study of the Boulder River Valley. It is believed that the alluvial aquifer of the Boulder River provides baseflow to the Boulder River. In its current state, the Boulder River often runs dry in the late summer, eliminating the ability to irrigate, even for senior water-rights holders. As such, there are concerns that continued groundwater development in the watershed will adversely impact senior water-rights holders. This GWIP study examines the flux of water between the alluvium and the river, the magnitude of impacts that would be expected from existing and potential future housing developments in the watershed, and the potential for increasing water availability throughout the year through enhanced aquifer storage. Water-quality samples will also be collected from groundwater and surface waters in the study area. This is a 2-year study, running from July 1, 2011 to June 30, 2013. The area of study is the Lower Boulder River Watershed from Boulder to Cardwell (USGS Watershed 1002000605), with the focus being on the alluvial aquifer along the Boulder River. In the initial phase of the project, wells were inventoried and surface-water sites (including irrigation ditches) were established as part of a monitoring network. Additional wells are being installed where more data are needed, such as upland bedrock areas and alongside the Boulder River.

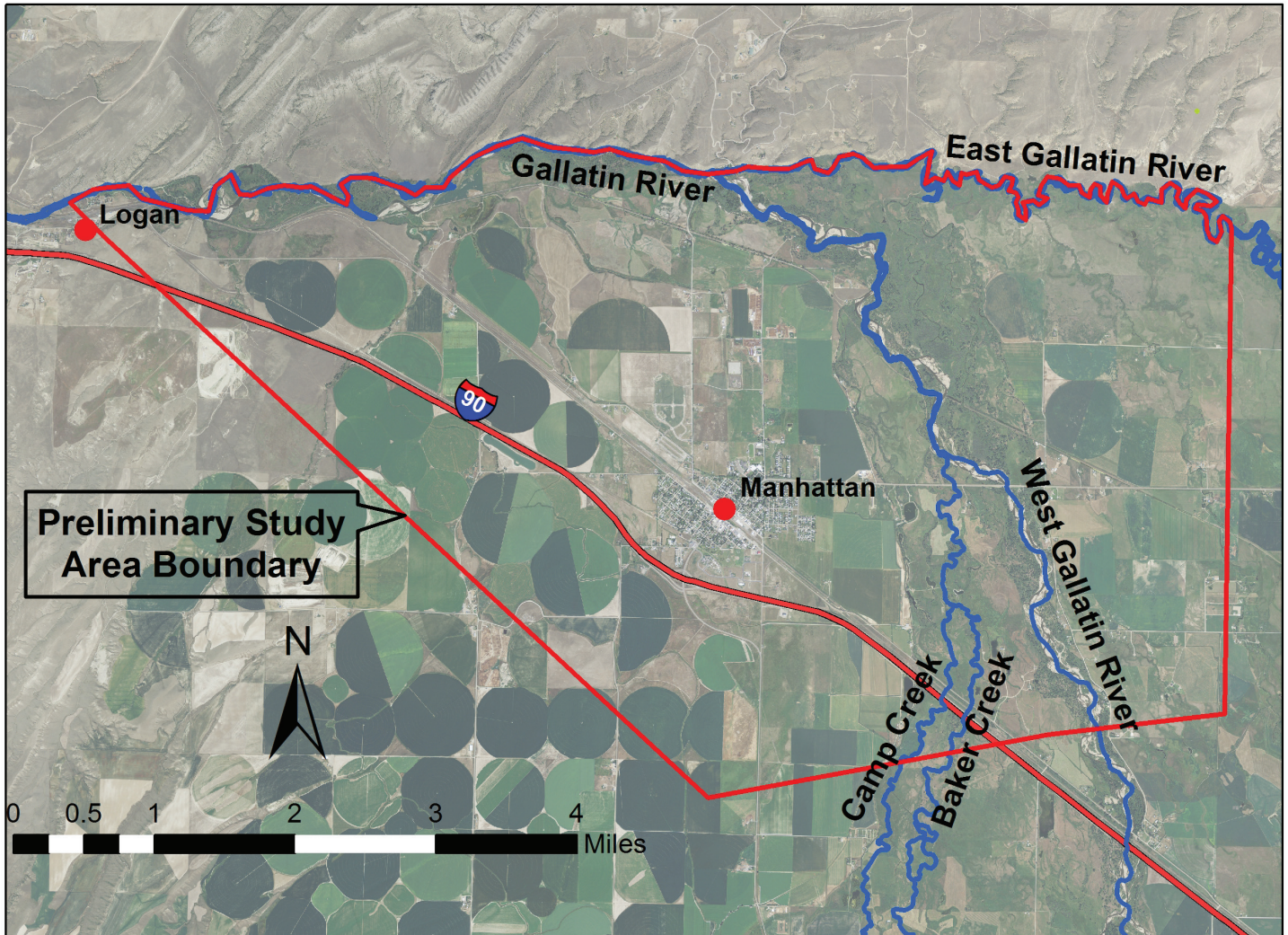
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# GWIP PROJECT AREA: MANHATTAN



New subdivisions have been developed in areas north and west of Manhattan. In addition, significant new irrigation from groundwater has been added. Some rural residents report decreased flows in spring-fed streams that are tributaries of the East Gallatin River. In this area, near the hydrologic outlet for the Gallatin Valley, more information is needed to address certain issues:

- Can the groundwater resource support increased municipal and agricultural use?
- Has development upstream and upgradient of Manhattan caused changes in local hydrology?

Intensive irrigation and new subdivision development north and west of Manhattan are increasing the demand on groundwater resources. Some rural residents report decreased flows in spring-fed streams that are tributaries of the East Gallatin River.

**Project Elements:** This area warrants an intense groundwater modeling effort to evaluate the many potential changes in land use. Test wells will be installed throughout the area to evaluate aquifer properties and extent. The model will be constructed based on existing irrigation canals and wells, with an emphasis on stream depletion/accretion.

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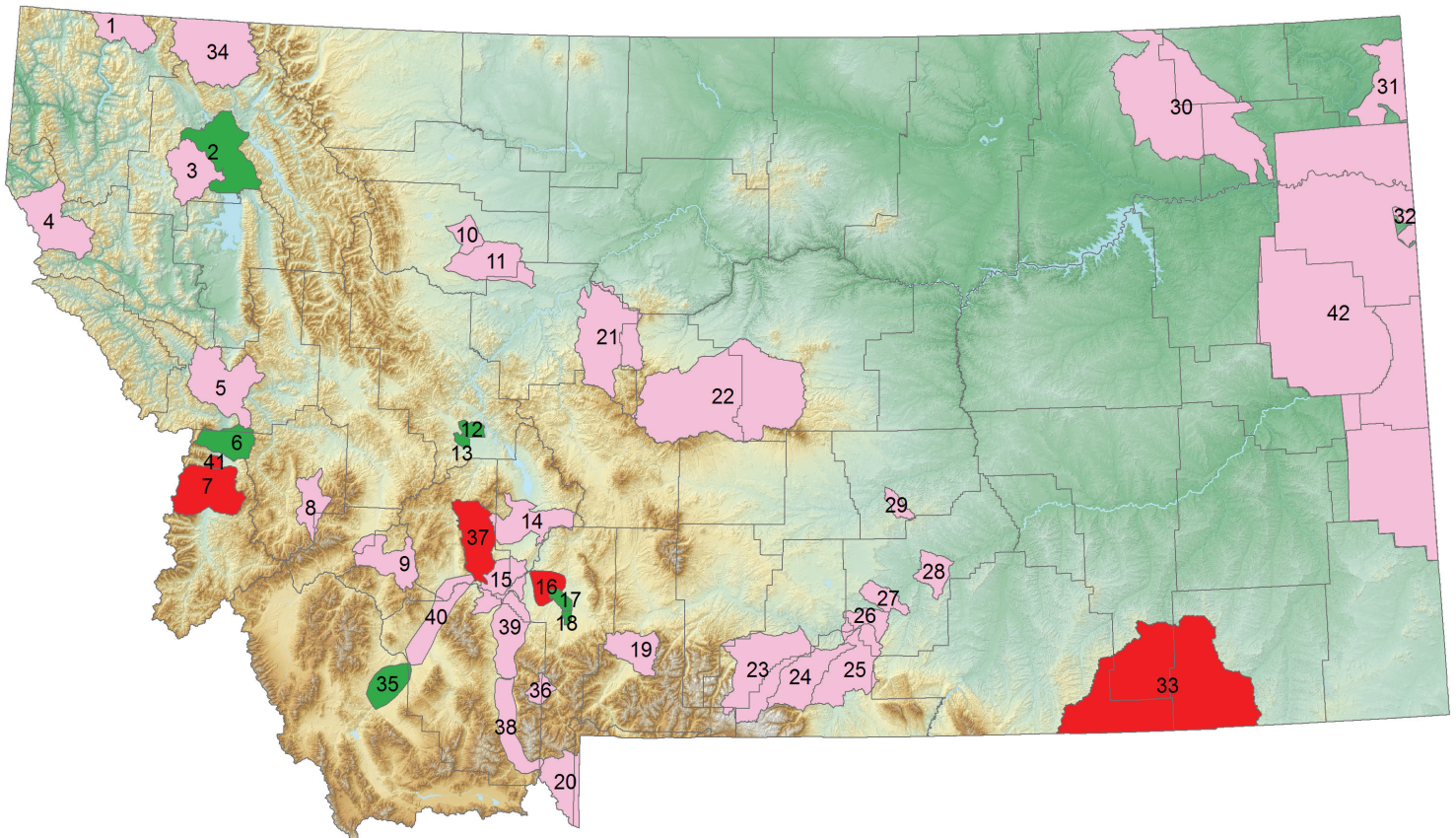
# STATUS AND FUTURE DIRECTIONS:

## MAP OF PROJECT AREAS:

**Green**, projects for 2009–2011

**Red**, planned projects for 2011–2013;

**Pink**, proposed future GWIP projects.



**2 Flathead Valley**

**6 Florence**

**12 North Hills**

**13 Scratchgravel Hills**

**17 Belgrade**

**18 Four Corners**

**35 Lower Beaverhead W.**

**7 Hamilton**

**16 Manhattan**

**33 Coalbed methane**

**37 Boulder River**

**41 Stevensville**

1 Eureka

3 Smith Valley

4 Noxon

5 Missoula Valley

8 Georgetown Lake,  
Philipsburg

9 Summit Valley

10 Priest Butte Lk

11 Greenfield Bench

14 Townsend, Toston

15 Three Forks

19 Pine Creek

20 W.Yellowstone

21 Belt, Monarch

22 Little Belt Mts

23 Stillwater Valley

24 Rock Creek

25 Pryor Mts

26 Park City

27 West Billings

28 East Billings

29 Roundup

30 Flaxville Gravels

31 Clear Lake

32 Sidney

34 North Fork Flathead

36 Big Sky

38 Madison Valley Quake  
Lake to Ennis

39 Madison Valley Ennis to  
Three Forks

40 Jefferson Valley

42 Fox Hills—Bakken





### Program Status:

Forty-two projects have been nominated and prioritized by the Ground Water Assessment Steering Committee. Prioritization was based on land-use changes, anticipated growth in housing, agricultural, industrial, and commercial activities. Seven sites were selected for the 2010–2011 biennium; those projects are in final reporting stage and nearing completion. Four of five projects selected for 2011–2012 biennium are underway.

### Program Products:

Every GWIP investigation is expected to produce: (1) a detailed report on the hydrogeologic system and stresses; (2) a computer model that simulates specific hydrogeologic features and future stresses; and (3) a comprehensive set of hydrogeologic data available online through the Ground Water Information Center.

Montana water utilization will be supported by these products, used by scientists and engineers representing agencies, senior water-rights holders, new applicants, and other stakeholders. All data that have been collected are currently available to the public at <http://mbmggwic.mtech.edu/>.





Ground Water Investigation Program project prioritization matrix - Ranking by the Ground Water Assessment Steering Committee, September 9, 2010																					
Map Location Number	Name	County	RANKING	Subdivision 2010	New wells 2010	Closed Basin 2010	Water quality 2010	Industrial 2010	Agricultural 2010	Population 2010	Water class 2010	Information 2010	Complexity 2010	Ecological	Aquifer systems 2010	Efficiency 2010	Diversity 2010	Controlled area 2010	Match Funds committed 2010	Matching funds requested 2010	TOTAL SCORE 2010
				rank 1-5	rank 1-5	5=Yes 1=No	5=Yes 0=No	rank 1-5	rank 1-5	rank 1-5	rank 1-3	rank 1-3	rank 1-4	rank 1-4	basin=1 bedrock=2 both=3	No score (+ or - for tie break)	Complex simple=1	5=Yes 0=No	match=5 ,no=0	2=Yes 0=No	
			0																		
Project Priority for FY2012-FY2013																					
41	Stevensville Bitterroot River	Ravalli	1	3	5	5	5	2	5	2	4	3	2	1	1		3	0	0	0	41
37	Boulder River Valley	Jefferson	2	1	2	5	5	1	5	1	4	2	2	3	1		2	0	5	2	41
7	Hamilton	Ravalli	3	3	5	5	5	2	5	2	4	3	1	3	1		1	0	0	0	40
16	Manhattan	Gallatin	4	4	5	5	0	3	5	4	4	1	2	1	3		3	0	0	0	40
33	Coalbed Methane	Big Horn/Rosebud/Powder River	5	1	1	0	5	5	5	1	3.5	3	3	2.5	2		2	5	0	0	39
39	Madison Valley Ennis to Three Forks	Gallatin/Madison	6	3	3.5	5	5	1	5	2.5	4	2	1	2	1		3	0	0	0	38
34	North Fork Flathead River	Flathead	7	5	5	0	2	0	4	5	1	2	4	2	2		2	0	5	0	37
27	West Billings	Yellowstone	8	3	4	0	5	1	0	5	4	3	2	1	1		2	0	5	0	36
14	Townsend, Toston	Lewis&Clark/Broadwater	9	3	3.5	5	5	1	5	2	4	1	2	2.5	1		1	0	0	0	36
36	Big Sky	Gallatin/Madison	10	4	3.5	5	5	1	0	2.5	4	1	3	2.5	2		2	0	0	0	35.5
Project for future evaluation																					
21	Belt, Monarch	Cascade		1	2	0	5	1	0	3	3	1	2	3	3		1	0	0	0	
32	Buried river channel aquifer	Richland		1	1	0	5	3	5	1	4	2	2	1.5	3		2	0	0	2	
31	Clear Lake aquifer	Sheridan		1	1	0	5	2	5	1	3	3	2	1.5	3		2	0	5	0	
28	East Billings	Yellowstone		3	4	0	0	1	0	5	4	3	2	2	1		2	0	0	0	
1	Eureka	Lincoln		3	3	0	0	2	0	1	4	1	2	2.5	3		1	0	0	0	
30	Flawille Gravels	Valley/Roosevelt		1	1	0	0	1	5	1	4	2	2	2.5	1		1	0	0	0	
8	Georgetown Lake	Granite/Deerlodge		1	1	5	5	1	0	1	4.5	1	2	2	3		1	0	0	0	
11	Greenfield Bench	Teton		1	1	5	5	1	5	1	4	3	2	1.5	2		3	0	0	0	
40	Jefferson River groundwater	Jefferson/Madison		1.5	2	5	5	1	5	1	4	2	1	2	1		1	0	0	0	
22	Little Belt Mountains	Judith Basin/Fergus		1	1	0	0	1	0	1	3.5	1	2	2	2		1	0	5	0	
38	Madison Valley, Quake Lake to Ennis Lake	Madison		2	2	5	5	1	5	1	4	2	1	3	1		1	0	0	0	
5	Missoula Valley	Missoula		2	4	5	0	3	0	4	4	3	3	1.5	1		2	0	0	0	
4	Noxon	Sanders		2	2	0	0	1	0	1	4	1	1	2	3		1	0	0	0	
26	Park City	Stillwater		1	2	0	0	1	0	1	4	1	2	1	3		1	0	0	0	
19	Pine Creek	Park		1	2	0	0	1	0	1	4	1	2	2.5	3		1	0	0	0	
10	Priest Butte Lake	Teton		1	1	5	5	1	5	1	4	1	2	1.5	1		1	0	0	0	
25	Pryor Mountains	Carbon		1	2	0	0	1	5	1	4	1	2	2	3		1	0	0	0	
24	Rock Creek terrace aquifer	Carbon		1	2	5	0	1	0	1	4.5	2	2	1.5	1		1	0	0	0	
29	Roundup	Musselshell		1	1	5	5	1	0	1	3	1	2	1.5	3		1	0	0	0	
	Shields Valley	Park																			
3	Smith Valley	Flathead		5	5	0	0	1	0	4	3.5	2	2	2	1		1	0	0	0	
23	Stillwater Valley	Stillwater		1	2	0	5	1	5	1	4	2	2	2.5	3		2	0	0	0	
9	Summit Valley	Silver Bow		1	2	5	5	2	0	2	4.5	2	1	1.5	3		2	0	0	0	
15	Three Forks	Broadwater		2	2	5	5	1	0	1	4	1	2	2	1		1	0	0	0	
20	West Yellowstone	Madison		2	2	5	5	1	0	1	4	1	2	3	3		1	5	0	0	
	Yellowstone Park Madison	Gallatin/Park																			



For more detailed and up-to-date information, please see our website:

<http://www.mbmrg.mtech.edu/gwip/gwip.asp>



#### Governing Documents/Committee

- [House Bill 52 \(section 61\)](#)
- [House Bill 831 \(section 60\)](#)
- [Water Policy Committee Website](#)

#### Products

- [Final Case Study](#)
- [Project Prioritization Matrix](#)
- [GWIP Fact Sheet —April 2010](#)

#### Online Data Access

#### Nominated Projects

#### 2011-2013 Biennium Projects

**GWIP goes to the Legislature**  
—September 8, 2010

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### HB 52 —Ground Water Investigation Program

The 2007/2008 Water Policy Interim Committee (WPIC) recognized that competition for water resources and the lack of detailed information on groundwater/surface water interaction has challenged informed water-resource management and development in Montana. The WPIC found that "continued and expanded study of groundwater resources is vital to shaping statewide policy as well as providing the data necessary for local decisions regarding water." HB 52 was drafted by the WPIC in response to this finding.

The 61st Montana Legislature passed HB 52 with a first biennium appropriation of \$4.2 million; based on the program design, this will provide funding for 6 to 8 projects lasting 1 to 3 years.

The Ground Water Investigations Program (GWIP) established by HB 52 will add to Montana's capability to deal with important water-resource issues including:

- stream depletion from groundwater development by subdivisions or changes in irrigation projects,
- cumulative effects of existing and proposed water development on stream flow,
- impacts to groundwater and surface water from changes in irrigation practices or land use,
- implementation of aquifer storage and recovery (ASR) in Montana, and
- evaluating the success of mitigation/offset plans in closed basins.

The Ground Water Investigation Program is in its inaugural stage and will be rapidly evolving over the coming months. The Steering Committee will continue to develop selection criteria and procedures as well as encourage ideas for potential projects from stakeholders and water management agencies.

*This website will be updated frequently  
with new information about the  
program and individual projects.*